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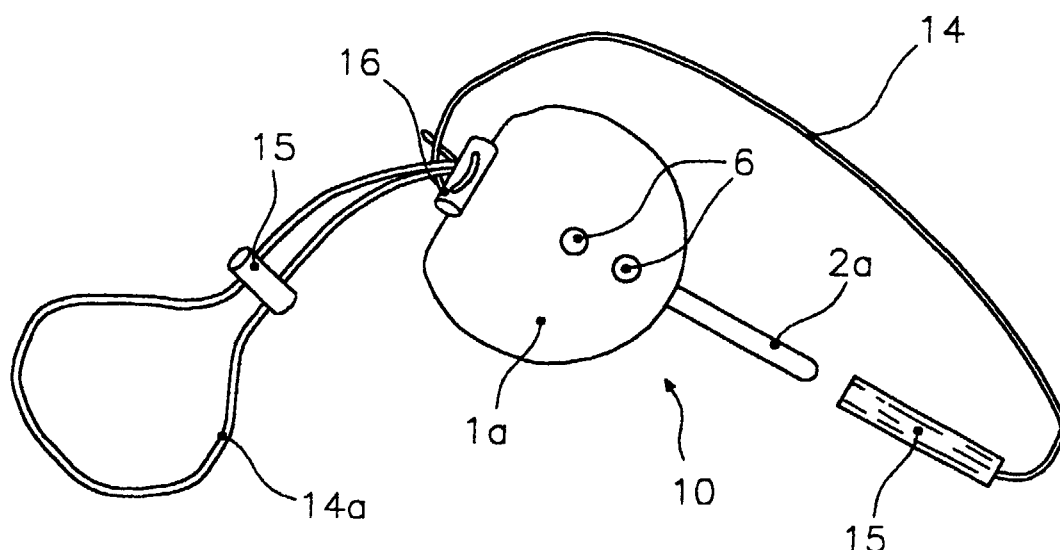
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(54) Title: AUXILIARY FORCEPS FOR HAND-ASSISTED LAPAROSCOPIC SURGERY (HALS)



(57) Abstract: An auxiliary forceps for video-assisted minimally-invasive surgery, such as the hand-assisted laparoscopic surgery, intended to be operated by the surgeon's non-dominant hand inserted in an incision for entering a patient body natural cavity, comprising: two actuating plates (1a, 1b) elastically hinged to each other and having a shape and size suitable for being operated by holding them with the tips of two fingers: two jaws (2a, b; 20a, b) each extending from a respective of the actuating plates; means (14) for temporarily connecting the forceps to the surgeon's hand for maintaining the forceps at an adjustable distance from the hand not greater than a prefixed value; means (15, 22) for housing the jaws close to each other, within which the jaws are engaged when, during operation, said forceps is not used.



WO 02/100281 A1

TITLE

AUXILIARY FORCEPS FOR HAND-ASSISTED LAPAROSCOPIC SURGERY
(HALS)

DESCRIPTION5 Field of the invention

The present invention relates to the field of the surgical instruments, particularly for the minimally invasive, video-assisted surgery (laparoscopic and toracoscopic surgery), and more precisely it relates to an
10 auxiliary forceps for use in the surgical interventions carried out according to the hand-assisted laparoscopic surgery (HALS) technique.

Background art

The technique of the hand-assisted laparoscopic
15 surgery (HALS) uses the approach typical of the minimally invasive laparoscopic surgery combined with the classical approach of the open field surgery. As a matter of fact, according to the laparoscopic technique the access to the surgical field is carried out through applications of
20 trocars (generally three accesses are sufficient) for the introduction of the instruments used during the intervention and of the laparoscope, of the optical fiber type or equipped with a CCD camera, by means of which the surgeon can visually control the involved inner part of the
25 abdomen. The diameter of the incisions is comprised between 5 and 25 mm. A working space, called pneumoperitoneum, is created in the abdomen by insufflating an inert gas to enable the surgeon to operate without significant hindrances due to the lack of suitable space. In addition
30 to the above described incisions, in the hand-assisted laparoscopic surgery a further incision 5-7 cm long is made near them, through which the surgeon introduces his/her,

generally non-dominant, hand in the abdomen to perform support operations (tissue displacement, retraction of the organs to be operated, palpation, interaction with other instruments, etc.).

5 In order to prevent the pneumoperitoneum to be lost through this incision, several types of sealing devices are available, intended to be applied to the incision to allow the passage of the surgeon's hand, while preventing the gas from escaping therethrough. The presently available sealing
10 devices are of several types, in particular of the type comprising an adhesive flange to be fixed to the abdominal wall or of the inflatable type. A sealing device of the inflatable type especially easy and comfortable in use is disclosed in WO00/32117. It consists of a substantially
15 tubular inflatable sleeve with a twisted inner cross section, to provide sealing against the surgeon's arm once her/his hand has been inserted through it, and a pair of sealing rings to provide a sealing from the innerside and the outside of the abdominal wall in correspondence to
20 the incision.

Hand-assisted laparoscopic surgery has been successfully applied to a wide range of surgical procedures for example gastric resection, gastric by-pass, transhiatal esophagectomy, pancreatic and hepatic surgery, nephrectomy,
25 colorectal surgery, aortic aneurysm repairs, etc. The main advantages of this technique with respect to the conventional laparoscopic surgery, consist, as well known, in that the surgeon regains direct tactile sensation, not allowed when remotely controlled instruments are used, and
30 hand-eye coordination which is lost when procedures are followed through a monitor. Furthermore the presence of the surgeon's hand in the surgical field allows for an easier

and atraumatic displacement of the organs, an immediate control of dangerous situations and the possibility of performing blunt dissections. In addition, the possibility of using an assisting hand makes easier the surgeon task
5 reducing the high level of training and experience usually required by the laparoscopic surgery technique.

However, in the course of hand-assisted laparoscopic surgery procedures situations often occur wherein the surgeon's hand ability is no longer adequate to perform
10 fine operations such as fine dissections, vascular peduncula isolation, lymphadenectomy, etc. In the conventional open field surgery, when a tissue to be grasped has a size of few millimeters, such that the surgeon's finger tips would be ineffective, the use of a
15 forceps, generally operated by the non-dominant hand, does not constitute a problem. In contrast in a minimally invasive surgery procedure, such as the hand-assisted laparoscopic surgery, the use of the conventional surgical forceps is not possible both in view of their shape,
20 incompatible with the space available in the surgical field, and taking into account of the way this type of intervention is carried out, according to which it is advisable to reduce to a minimum the number of times the non-dominant hand is extracted and re-inserted in the
25 surgical field.

Summary of the invention

The main object of the present invention is to provide a structurally simple, reliable and low dimension forceps for surgical use, which can be used by the surgeon,
30 when necessary, in video-assisted, minimally invasive surgical procedures, in particular according to the hand-assisted laparoscopic technique.

A particular object of the present invention is to provide a forceps of the above mentioned type, whose structure, shape and dimensions is such that it can be kept at the surgeon's disposal in the abdominal cavity during the intervention in such a position that it can be quickly and easily grasped with the fingers by the surgeon, once it is necessary or, it can be parked after the use without any risk of accidentally damaging the surrounding organs and tissues.

10 Another object of the present invention is to provide a forceps of the above mentioned type which is able to be kept integral to the surgeon's hand and, when not in use, during the intervention can be parked in the abdominal cavity with no risk that its jaws can constitute a danger of possible lesions to the surrounding structures.

A further object of the present invention is to provide a forceps of the above mentioned type which is so configured that it can be operated with a minimum number of fingers (two).

20 Another object of the present invention is to provide a method for performing surgical procedures with a hand-assisted laparoscopic technique, which thanks to the use of the auxiliary forceps of the above mentioned type, makes easier the surgeon's task and allows the accomplishments of operations which would be impossible to perform by manual way only.

The above objects are reached with the auxiliary forceps for video-assisted, minimally invasive surgery, such as the hand-assisted laparoscopic surgery, according to the invention, which is formed by two actuating plates, elastically hinged to each other and having a shape and dimensions such that they can be operated by keeping them

between the tips of two fingers, and by two jaws each extending from a respective of said actuating plates. The forceps further comprises means for the temporarily connection to the surgeon's hand for maintaining the
5 forceps at an adjustable distance from the hand not greater than a prefixed value and means for housing the jaws in a mutually side-by-side condition, within said housing means the jaws being engaged when, during the intervention, the forceps is not used.

10 According to a presently preferred embodiment of the invention, the forceps is fixed to the surgeon's hand by means of a rope connected to the plates and having an anchoring device such as a loop made with the same rope, an elastic ring or a clamp having adjustable width and
15 distance from the plates.

In particular, the housing for the jaws can be formed by a removable protective cap connected to the plates by means of an adjustable length rope, or by a seat perimetrically formed at the edge of the plates, in which
20 case the jaws are of the retractable type as a result of an angular displacement from an operating position to a rest position within said seat and have a curved shape.

Brief description of the drawings

Those and other features and advantages of the
25 auxiliary forceps for video-assisted, minimally invasive surgery such as the hand-assisted laparoscopic surgery will become apparent from the following description of some exemplifying, non-limiting embodiments thereof, made with reference to annexed drawings, wherein:

- 30 - figure 1 is an assembly view of a first embodiment of the auxiliary forceps according to the invention;
- figure 2 is an enlarged perspective view of the

forceps of figure 1;

- figure 3 is a diametrical section of the forceps of figure 2 according to the axis of the jaws;

- figures 4 and 5 show in a perspective view a second
5 embodiment of the forceps according to the invention, in a closed and, respectively, open condition;

- figure 6 is a diametrical section of the forceps according to line VI-VI of figure 4;

- figure 7 is a partially sectioned, plan view of the
10 forceps of figure 5.

Description of the preferred embodiment

With reference to figures 1, 2 and 3, 10 generally indicates a forceps formed by a pair of substantially circular actuating plates 1a, 1b connected to each other by
15 means of a pin 3 extending at a chord thereof. Actuating plates 1a, 1b are of a very low size, sufficient to be grasped and actuated by holding them between the tips of two fingers, which corresponds to a few centimeter diameter (for example, 3 cm). Respective jaws 2a, 2b are fixedly
20 connected to plates 1a, 1b in any way, for example, as shown in the figures, by means of screws 4, and extend from the part diametrically opposed to pin 3 and perpendicularly to it. The heads of screws 4 are housed within respective seats 5 formed on plates 1a, 1b and concealed by covering
25 caps 6, for example snap-fitted to them. A spring 7, for example of the flat type, is interposed between plates 1a and 1b for keeping jaws 2a, 2b spaced apart. A diametrical channel 9, extending from the perimetrical edge of plate 1a to the inner end of jaw 2a is formed in plate 1a to connect
30 jaw 2a through an electric cable to an electric power source, for example to enable the forceps to be used to perform unipolar or bipolar electrocoagulation.

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A bracket 12 with a through hole 13 extends from a facing 11 formed on the perimetrical edge of plate 1a (plate 1b has a corresponding facing), from the part diametrically opposed to jaw 2a. A rope 14 is tied to hole 13 and a cap 15 is fixed to rope 14 for acting as a sheath for the pair of jaws 2a, b of the forceps, when it is not in use. Rope 14 forms a loop 14a of adjustable width by sliding a rope-clamping slider 15. A second slider 16, engaged with rope 14 immediately downstream of bracket 12, assists in adjusting the length of the rope at the end of which cap 15 is fixed. As an alternative to loop 14a with a fully equivalent function, rope 14 can be provided with an elastic ring or a fixing clamp.

In the use, forceps is fixed by means of loop 14a to a phalanx or the wrist of the surgeon's non-dominant hand, before inserting the hand in the abdomen, while jaws 2a, 2b are placed in cap 15, whereby any risk of lesions accidentally caused to the surrounding tissues is avoided and, at the same time, jaws 2a, 2b are kept close to each other thus overcoming the bias of spring 7 and keeping forceps 10 closed. When the forceps must be used, the surgeon takes cap 15 off and operates the forceps by holding actuating plates between two finger tips. In order to make the grasp between the fingers easier, the surface of plates 1a, b can be variously processed, for example by grooving, as in the present embodiment, or ribbing, curling and the like.

When during a surgery procedure, forceps is not used, it anyway remains anchored to the surgeon's hand through rope 14 at a distance not greater than the length of the rope portion comprised between rope clamps 15 and 16 and then at a distance fixable according to the needs.

In a possible variation, not shown, protective cap 15 can be replaced by a substantially C-shaped sheath pivotally connected to one of the plates. By rotation of the sheath jaws can be engaged within C-shaped sheath or
5 disengaged from it, thus achieving the same function of cap 15.

A second embodiment of the invention is shown in figures 4, 5, 6 and 7, wherein the same components of the forceps as those of forceps of figures 1-3 are referred with
10 the same numerals. The feature of the forceps according to this embodiment of the invention consists in that its jaws, indicated at 20a and 20b, are retractibly housable within a housing seat 22 formed on perimetrical edge of actuating plates 1a and 1b. As a consequence, jaws 20a and 20b have a
15 curved shape extending from respective enlarged portion, or root, 23 and 24, at which they are hinged to actuating plates 1a and 1b by means of respective pins 21. Actuating plates 1a and 1b are hinged to each other through a pin 3, as in the previous embodiment, and elastic means 30, for
20 example as shown in figure 6, are provided therebetween to keep the forceps open.

As shown in figure 4, jaws 20a, 20b are formed at respective roots 23 and 24 with a side protrusion 25 which allows a tangential force to be exerted on roots 23 and 24
25 to release jaws 20a, 20b and let them reach the working position shown in figure 5.

In order to keep the forceps closed when jaws 20a, 20b are in their rest position shown in figure 4, a fastening device is provided between the actuating plates and constituted, in the present embodiment of the
30 invention, by a substantially T-shaped bracket 26 fixed to one of the plates, for example plate 10b, by its leg 26a

and extending with its transverse portion 26b within seat 22 in a groove 27 correspondingly formed in the other plate, for example plate 10a. In this way, when jaws 20a, 20b are placed in housing seat 22, the jaw integral to the plate within which groove 27 is formed, abuts on the transverse part 26b of bracket 26, whereby it cannot escape from groove 27 and, as a result, the plates are secured to each other.

In order to ensure a perfect mutual parallelism of jaws 20a and 20b in any of their positions, a pin 28 (figures 6 and 7) extends from a plate towards the other one and engages within a slot 29 formed in the root of the latter plate. Slot 29 is so oriented as to be perpendicular to the forceps hing when jaws are in the operating position. In this way, pin 28 can freely tilt within slot 29 when the jaws are made to space apart and keep them secured to each other when they are closed.

As a consequence of the force exerted on jaws 20a, 20b, when they are in the retracted position, by elastic means 30 through transverse portion 26b of bracket 26, the forceps is normally kept closed and it is necessary to slightly urge against protrusion 25 to open it. In order to keep the jaws in their operating position, an end-stroke locking device is provided, which is constituted, in the present embodiment, by a tooth 31 (figures 5 and 7), protruding from one of the plates towards the other one and snap engaging within a cavity 32 correspondingly formed on the jaws integral to the same plate. Cavity 32 and/or tooth 31 can be formed with inclined walls or sides to make easier the snap engagement/disengagement taking also advantage of the elasticity of the material. Other types of end-stroke locking device, fully equivalent from the

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functional point of view, can be provided in a obvious way.

With the forceps according to the present embodiment of the invention there is no need for its jaws to be capped, because, when not in use, they are retractably
5 housed in seat 22 perimetrically formed on edges of plates 1a, 1b. To secure the forceps to the surgeon's hand, the same solution as shown for forceps of figures 1-3 can be adopted consisting in the use of a rope 14 tied to bracket 12 through hole 13 and forming a loop 14a of a diameter
10 which is adjustable by a means of a rope clamp slider 15.

Another way to secure the auxiliary forceps according to the invention to the surgeon's hand consists in providing a rope-anchoring adhesive member to be applied to the glove worn by the surgeon in such a position not to
15 hinder the hand movements, for example on the back of the hand, or again at the base of a finger phalanx like a ring or hemi-ring with adhesive plate.

The facing surfaces of the jaws of the forceps according to the invention are shaped in a substantially
20 conventional way according to the type of function they are designed to perform; for example they can be formed with a toothed surface to better grasp the tissues and/or with a suitable seat to hold a needle thereby performing the function of a needle holder, or with other shapes resulting
25 in an obvious way from the specific function.

The use of the auxiliary forceps according to the present invention results in a number of advantages in the hand-assisted laparoscopic surgery. As a matter of fact, the forceps of the invention allows a number of operations
30 to be performed which cannot carried out with the only help of the surgeon hand (vascular peduncula isolation, lymphoglandula ablation, grasping of small portions of

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tissues). The small size of the forceps (the operating plates 1a, 1b are of a diameter of few centimeters) give rise to a minimum hindrance, still they allow an easy and firm handling of the forceps when the plates are grasped
5 with two fingers. In fact, they have a wide actuating surface for the fingers which makes unnecessary a third fulcrum (for example the hollow at the thumb root), as requested with the conventional, elongated structure forceps.

10 The substantially circular shape, with streamlined and/or rounded off edges, makes also extremely safe the use thereof, which is practically riskless as regards possible accidental lesions to the tissues. Furthermore, it has to be pointed out that, in the case of the embodiment of the
15 forceps in which the jaws are curved, the curved shape of the jaws offer the advantage of a minimum hindrance when the instrument is its rest condition, and allows for the use of the forceps both with a grasping and a dissecting effect on the tissues, with the possibility of surrounding
20 vascular structures according to techniques well-known in the field.

The forceps according to the invention is designed to be used as a disposable instrument. However, it can be made of materials able to be subjected to sterilization
25 according to known techniques and therefore to be re-used. Preferably, the operating plates will be made of a dark color or a transparent color, to avoid unwanted reflections which could disturb the sight of the surgical field through a monitor. The transparency of the plates also allows the
30 sight of the otherwise concealed portion of the surgical field to be maintained through the plates.

Variations and/or modifications can be brought to the

auxiliary forceps for hand-assisted laparoscopic surgery according to the present invention, without departing from the scope of the invention as defined in the appended claims.

CLAIMS

1. Auxiliary forceps for video-assisted, minimally-invasive surgery, such as the hand-assisted laparoscopic surgery, intended to be operated by the surgeon's non-dominant hand inserted in an incision for entering a patient body natural cavity, characterized in that it comprises:

two actuating plates (1a, 1b) elastically hinged to each other and having a shape and size suitable for being operated by holding them with the tips of two fingers: two jaws (2a, b; 20a, b) each extending from a respective of said actuating plates; means (14) for temporarily connecting the forceps to the surgeon's hand for maintaining the forceps at an adjustable distance from the hand not greater than a prefixed value; means (15, 22) for housing said jaws close to each other, within which said jaws are engaged when, during operation, said forceps is not used.

2. Forceps according to claim 1, wherein said connection means comprise a rope (14) which can be connected to said actuating plates and provided with a connection device (14a), adjustable as to its width and distance from said plates, for being applied to a finger or the wrist of the surgeon's non-dominant hand.

3. Forceps according to claim 2, wherein said connection device is a loop (14a) made with the same rope (14).

4. Forceps according to claim 2, wherein said connection device is an adhesive member, applied to the surgeon's glove in such position not to hinder the movements of the hand to which said rope is fixed.

5. Forceps according to anyone of the previous claims, wherein said jaws (2a, b) are firmly connected to the

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respective actuating plates (1a, b) and said housing means for the jaws comprise a protective cap (15) to be removably applied to them and connected to said plates through a rope (14) of adjustable length.

5 6. Forceps according to anyone of the claims 1 to 4, wherein said jaws (2a, b) are pivotally connected to the respective actuating plates (1a, b) and said housing means comprise a seat (22) formed along the perimetrical edge of said plates, said jaws having a correspondingly curved
10 shape to be placed within said seat in a rest position following an angular displacement from an operating position, wherein said jaws extend in a substantially radial direction from said plates, said jaws being formed with a side protrusion (25) through which a force for
15 causing said angular displacement from the rest position to the operating position can be exerted.

7. Forceps according to claim 6, wherein fastening means (26) are provided for keeping said actuating plates close to each other when said jaws are in their rest position.

20 8. Forceps according to claim 7, wherein said fastening means comprise a bracket (26) integral to one of said plates and extending toward the other plate and having an arm (26b) arranged in a groove (27) formed in the other plate in said housing seat (22) for the jaws, whereby, when
25 said jaws are engaged in said housing seat (22), the jaw integral to the plate, in which the groove (27) for said arm is formed, abuts against the arm integral to the other plate, thus anchoring said plates to each other.

9. Forceps according to anyone of the claims 6, 7 or 8,
30 wherein a slot (29) is formed on one of said jaws in such a way to be arranged in a position substantially orthogonal to the hinge axis of said actuating plates, when said jaws

are in the operating position, a pin (28) extending from the other jaw for engaging within said slot to prevent any relative sliding of the jaws when they are angularly displaced between the rest position and the operating position, while allowing their spreading apart during the use.

10. Forceps according to anyone of the claims 6 to 9, wherein reversible locking means (31, 32) of the jaws in the operating position and in the rest position are provided.

11. Forceps according to claim 10, wherein said means for reversibly locking said jaws in the operating position comprise a cavity (32) formed in at least one of said jaws and a tooth (31) correspondingly extending from the respective actuating plate, for reversibly snap engaging within said cavity when said jaws reach their operating position.

12. Forceps according to claim 10, wherein elastic means are provided between said actuating plates (1a, b) for keeping them spread apart and urging the arm (26b) of said bracket (26) against said jaws (20a, b) to reversibly fasten them in the rest position.

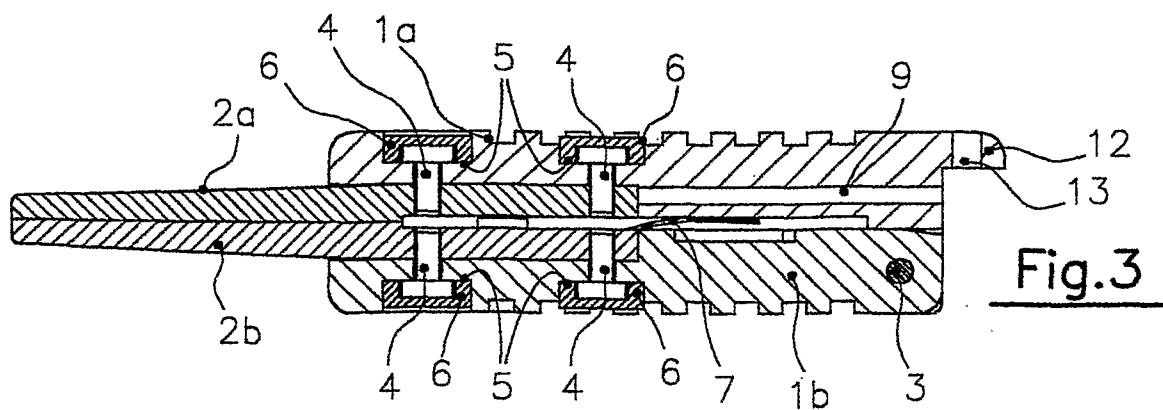
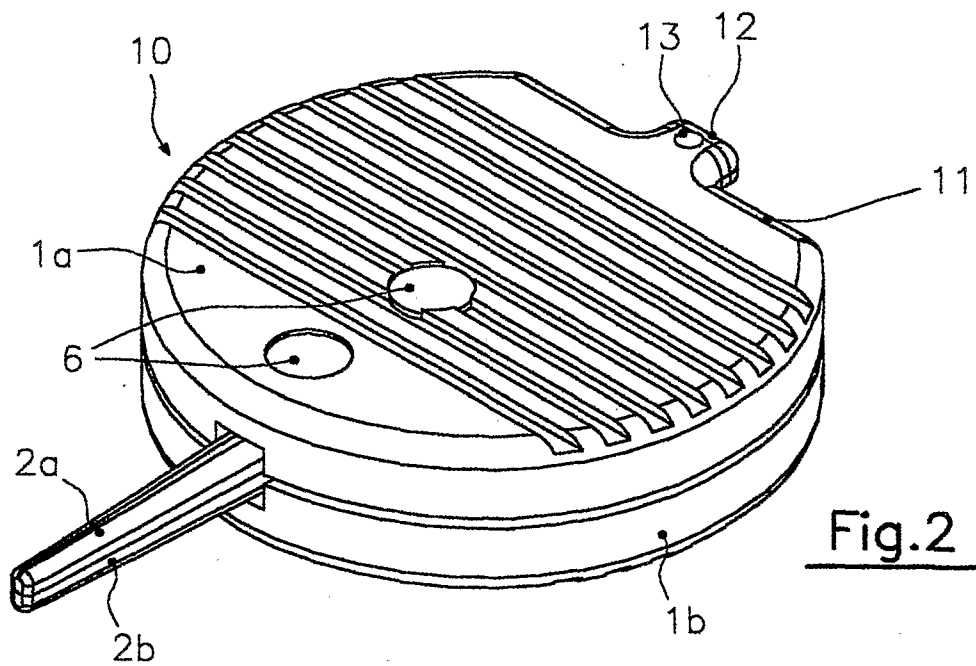
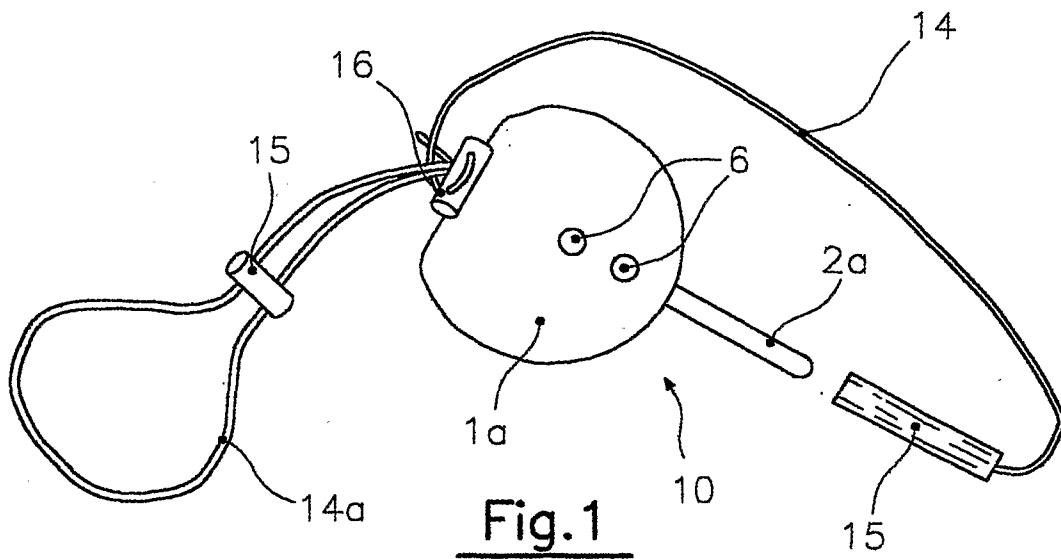
13. Forceps according to claim 1, wherein said housing means comprise a sheath connected to one of said plates and turnable to cover said jaws following an angular displacement when said forceps is not in use.

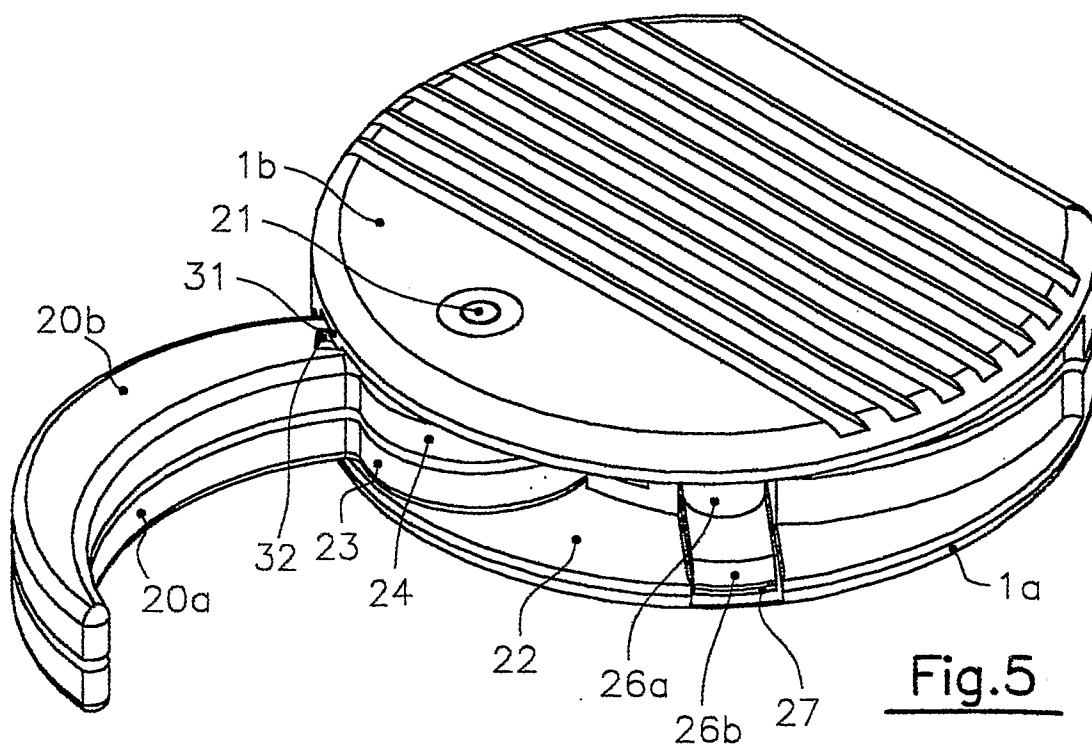
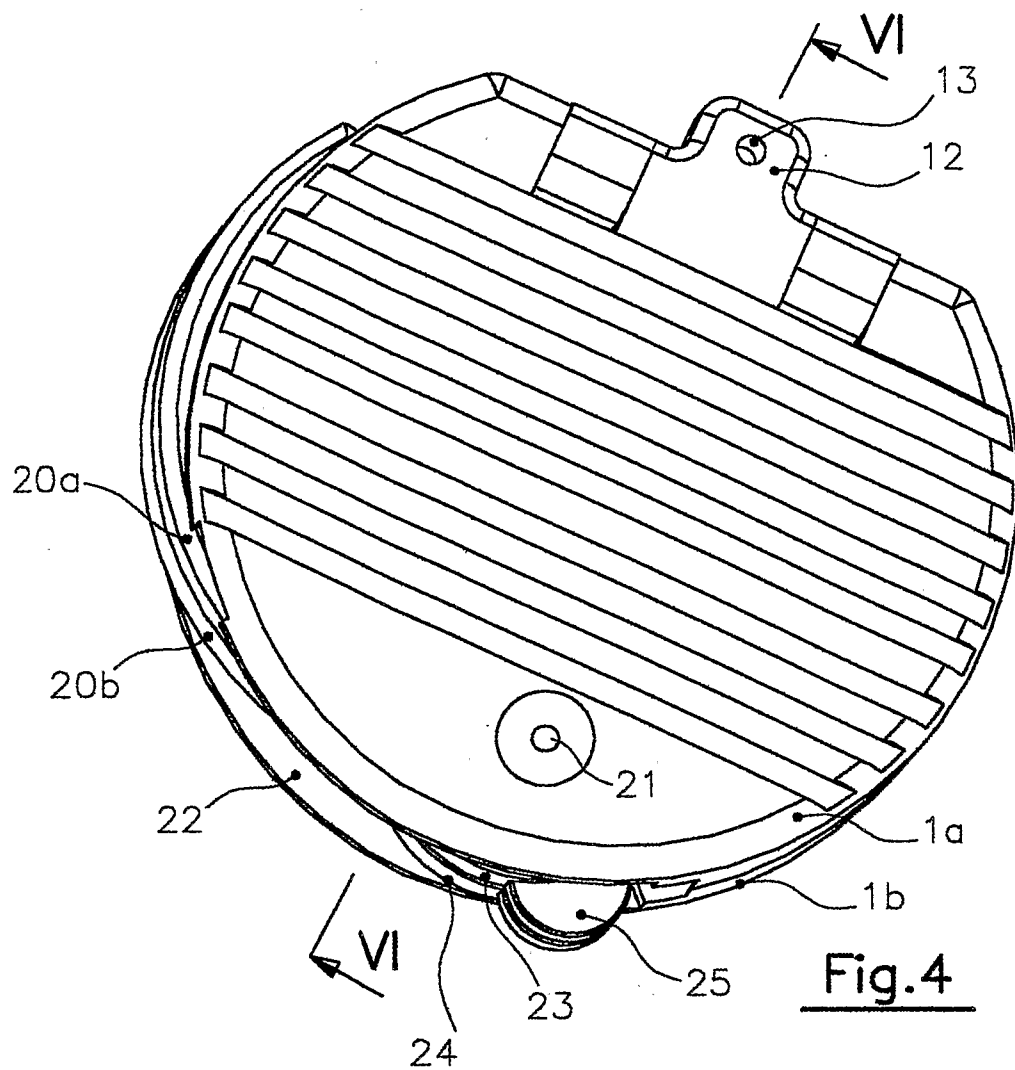
14. Forceps according to anyone of the previous claims, wherein said actuating plates are made of transparent or dark colored material.

15. Forceps according to anyone of the previous claims, wherein said actuating plates have a substantially circular shape and rounded edges.

16. A method for performing interventions of video-assisted, minimally-invasive surgery, such as the hand-assisted laparoscopic surgery, wherein the surgeon's non-dominant hand is inserted in the operative field through an incision made near the incisions in which trocars are engaged, characterized in that an auxiliary forceps is associated to said hand and is made integral therewith at the time of the intervention through temporary connection means for maintaining the forceps at an adjustable distance from the hand not greater than a prefixed value, said forceps comprising two actuating plates elastically hinged to each other and having such shape and size to enable them to be actuated by holding them with the tips of two fingers, and two jaws extending from said plates and means for housing said jaws, integral to said plates, when said forceps is not in use, said jaws being released from said housing means through a sliding movement or an angular displacement applied to them by the surgeon when said forceps has to be used.
17. Method according to claim 16, wherein said auxiliary forceps is characterized by the features according to anyone of the claims 1 to 15.

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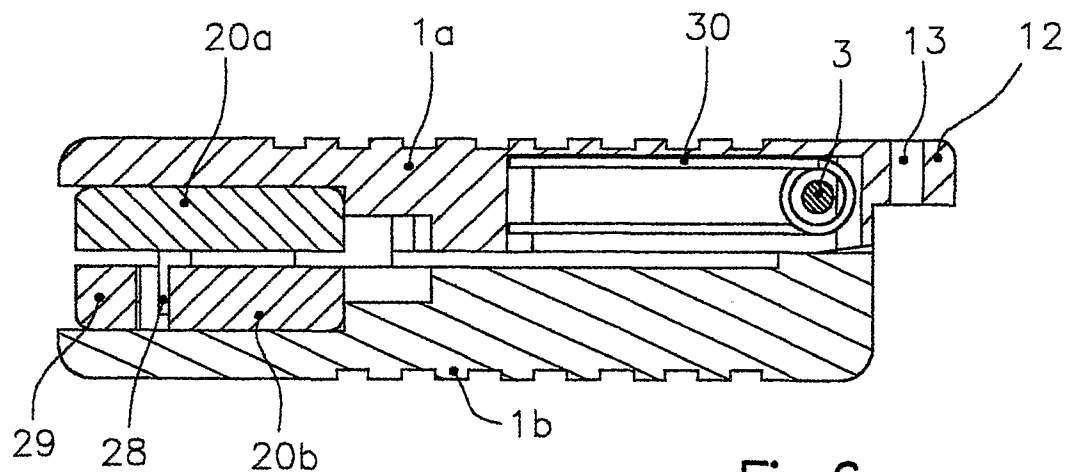


Fig. 6

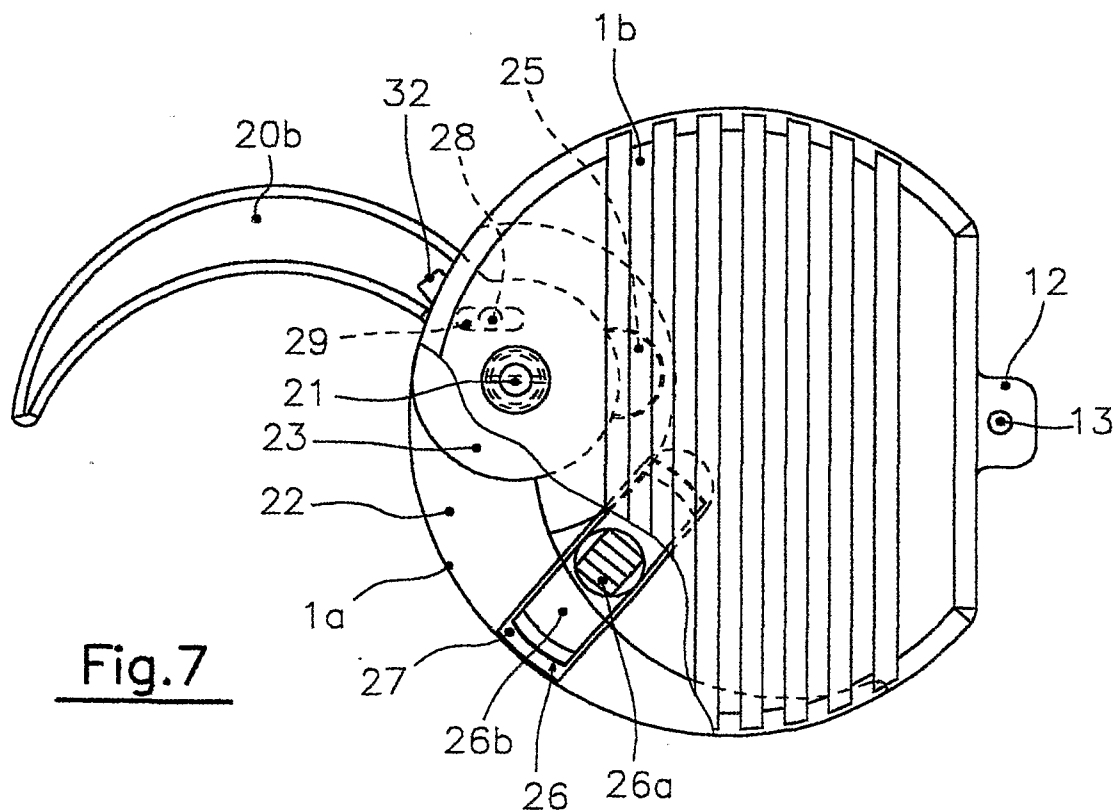


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 01/00298

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61B17/28 A61B17/30

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)

IPC 7 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.
Y	WO 98 00069 A (EK STEVEN ; BEANE RICHARD M (US); MEYERS WILLIAM C (US); SMITH & NE) 8 January 1998 (1998-01-08) abstract; claims 1,12,16; figures 5,12,13,26 ---	1-5, 13-15
Y	US 6 174 321 B1 (WEBB NICHOLAS J) 16 January 2001 (2001-01-16) abstract; claim 1; figure 1 ---	1-5, 13-15
A	US 6 159 200 A (CARROLL MAUREEN E ET AL) 12 December 2000 (2000-12-12) column 9, line 22 -column 10, line 56; figures 1-3 ---	1
A	US 6 149 642 A (GERHART CLARK D ET AL) 21 November 2000 (2000-11-21) abstract; figure 3 ---	1
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

17 January 2002

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 01/00298

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 37 22 311 A (BRAUN MELSUNGEN AG) 19 January 1989 (1989-01-19) abstract; figure 1 -----	1
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专利名称(译)	用于手助腹腔镜手术 (HALS) 的辅助钳		
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摘要(译)

用于视频辅助微创手术的辅助钳，例如手助腹腔镜手术，旨在由插入切口中以进入患者身体自然腔的外科医生的非优势手操作，包括：两个致动板（1a，1b）弹性地相互铰接，并且具有适于通过用两个指状物的尖端保持它们来操作的形状和尺寸：两个爪（2a，b；20a，b），每个爪从相应的致动板延伸；装置（14）用于将钳子暂时连接到外科医生的手上，以便将钳子保持在离手的可调节距离不大于预定值的位置；用于容纳钳口彼此靠近的装置（15,22），当在操作期间不使用所述钳子时，钳口接合在钳口中。