(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 263 565 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**22.12.2010 Bulletin 2010/51**

(51) Int Cl.:
***A61B 17/072*** *(2006.01)*

(21) Application number: **10177535.1**

(22) Date of filing: **25.09.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**

(30) Priority: **26.09.2005 US 235591**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
**06254953.0 / 1 767 157**

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Remarks:
This application was filed on 20-09-2010 as a divisional application to the application mentioned under INID code 62.

# (54) Surgical stapling instrument having end effector gripping surfaces

(57) A surgical instrument (10) for being endoscopically or laparoscopically inserted through a cannula of a trocar into an insufflated body cavity or lumen ("surgical site") for simultaneous stapling and severing of tissue including gripping surfaces on inner surfaces of an upper and lower jaw that enhance use as a grasping instrument to preposition tissue prior to performing a stapling and severing procedure. An illustrative version advantageously includes a separate closure trigger (30) and closure mechanism that facilitates use as a grasper without the possibility for inadvertent firing (i.e., stapling and severing).

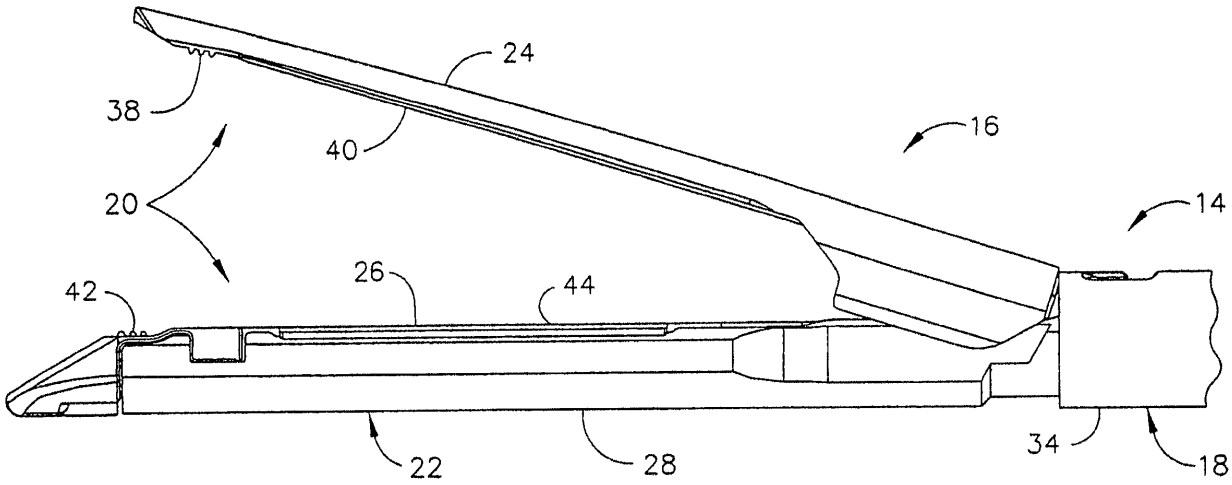


FIG. 2

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## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates in general to surgical stapler instruments that are capable of applying lines of staples to tissue while cutting the tissue between those staple lines and, more particularly, to improvements relating to stapler instruments and improvements in processes for forming various components of such stapler instruments including adding bolstering material to the severed and stapled tissue.

### BACKGROUND OF THE INVENTION

**[0002]** Endoscopic and laparoscopic surgical instruments are often preferred over traditional open surgical devices since a smaller incision tends to reduce the post-operative recovery time and complications. The use of laparoscopic and endoscopic surgical procedures have been relatively popular and has provided additional incentive to develop the procedures further. In laparoscopic procedures, surgery is performed in the interior of the abdomen through a small incision. Similarly, in endoscopic procedures, surgery is performed in any hollow viscus of the body through narrow endoscopic tubes inserted through small entrance wounds in the skin.

**[0003]** Laparoscopic and endoscopic procedures generally require that the surgical region be insufflated. Accordingly, any instrumentation inserted into the body must be sealed to ensure that gases do not enter or exit the body through the incision. Moreover, laparoscopic and endoscopic procedures often require the surgeon to act on organs, tissues and/or vessels far removed from the incision. Thus, instruments used in such procedures are typically long and narrow while being functionally controllable from a proximal end of the instrument.

**[0004]** Significant development has gone into a range of endoscopic surgical instruments that are suitable for precise placement of a distal end effector at a desired surgical site through a cannula of a trocar. These distal end effectors engage the tissue in a number of ways to achieve a diagnostic or therapeutic effect (e.g., endocutter, grasper, cutter, staplers, clip applier, access device, drug/gene therapy delivery device, and energy device using ultrasound, RF, laser, etc.).

**[0005]** Known surgical staplers include an end effector that simultaneously makes a longitudinal incision in tissue and applies lines of staples on opposing sides of the incision. The end effector includes a pair of cooperating jaw members that, if the instrument is intended for endoscopic or laparoscopic applications, are capable of passing through a cannula passageway. One of the jaw members receives a staple cartridge having at least two laterally spaced rows of staples. The other jaw member defines an anvil having staple-forming pockets aligned with the rows of staples in the cartridge. The instrument includes a plurality of translating wedges which, when driven distally, pass through openings in the staple cartridge and engage drivers supporting the staples to effect the firing of the staples toward the anvil.

**[0006]** Recently, an improved surgical stapling and severing instrument enhances clinical flexibility for both positioning tissue as well as stapling and severing, as described in U.S. Pat. Appln. No. 10/441,580, entitled "Surgical Stapling Instrument Having a Firing Lockout for an Unclosed Anvil", filed on June 20, 2003, the disclosure of which is hereby incorporated by reference in its entirety. A separate closure trigger allows use as a grasper without the risk of inadvertent firing (i.e., simultaneous stapling and severing). While a successful approach, further enhancements would be desirable so that a surgical stapling and severing instrument may serve as a grasper.

**[0007]** Consequently, a significant need exists for an improved surgical stapling and severing instrument that incorporates a staple applying assembly (end effector) that effectively grips tissue for prepositioning prior to performing a stapling and severing procedure.

### BRIEF SUMMARY OF THE INVENTION

**[0008]** The invention overcomes the above-noted and other deficiencies of the prior art by providing a surgical instrument that incorporates a surgical stapling instrument that has a lower jaw that upwardly dispenses staples that are formed against an inner surface of a pivotally attached upper jaw. A handle operates through an elongate shaft to to dispense and form the staples through clamped tissue. Prior to stapling, a trigger may be selectively employed to open and close the upper jaw while manipulating the handle, and thus the jaws, as a grasper to position tissue in preparation for stapling or other purposes. A nonplanar gripping surface on an inner surface of the jaws advantageously assists in gripping the tissue for positioning. Thereby, clinical flexibility and efficiency is enhanced.

**[0009]** In one aspect of the invention, gripping surfaces on both inner surfaces of the opposing jaws cooperate in grasping tissue.

**[0010]** In yet another aspect of the invention, a separate closure trigger and firing trigger enhance operation as a grasping instrument in conjunction with the gripping surfaces prior to actuating the firing trigger to operate as a stapling and severing instrument.

**[0011]** These and other objects and advantages of the present invention shall be made apparent from the accompanying drawings and the description thereof.

### BRIEF DESCRIPTION OF THE FIGURES

**[0012]** The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention, and, together with the general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the principles of the present invention.

**[0013]** FIG. 1 is a left isometric view in elevation of a surgical stapling and severing instrument with an open end effector (staple applying assembly) having tissue gripping surfaces.

**[0014]** FIG. 2 is a left side view of the staple applying assembly of FIG. 1 with opposing gripping surfaces on each open jaw.

**[0015]** FIG. 3 is a left side view of the staple applying assembly of FIG. 2 with closed jaws and nonplanar, loosely enmeshing (interdigitating) gripping surfaces.

**[0016]** FIG. 4 is a lower left isometric view of the staple applying assembly of FIG. 2 with open jaws.

**[0017]** FIG. 5 is an upper left isometric view of the staple applying assembly of FIG. 2 with open jaws.

## DETAILED DESCRIPTION OF THE INVENTION

**[0018]** Turning to the Drawings, wherein like numerals denote like components throughout the several views, in FIGS. 1-5, a surgical stapling and severing instrument 10 includes a handle portion 12 (FIG. 1) that manipulates to position an implement portion 14 formed from a fastening end effector, specifically a staple applying assembly 16, distally attached to an elongate shaft 18. The implement portion 14 is sized for insertion through a cannula of a trocar (not shown) for an endoscopic or laparoscopic surgical procedure. With the exception of features described here to add gripping surfaces 20 to inner surfaces of a lower jaw 22 and a pivotally attached upper jaw (anvil) 24 that form the end effector 16, the surgical stapling and severing instrument 10 is as described in U.S. Pat. Appln. Ser. Nos. 11/052,387 entitled "Surgical Stapling Instrument Incorporating A Multi-Stroke Firing Mechanism With Return Spring Rotary Manual Retraction System" to Shelton et al., the disclosure of which is hereby incorporated by reference in its entirety. These gripping surfaces 20 enhance use as a grasper and enhance positioning of tissue during severing and stapling.

**[0019]** In use, a staple cartridge 26 is inserted into an elongate staple channel 28 to form the lower jaw 22 as depicted. A surgeon pivots a closure trigger 30 toward a pistol grip 32 of the handle portion 12. Thereby, a closure sleeve 34 is distally translated to pivot shut the anvil 24. The implement portion 14 may then be inserted into a cannula of a trocar in an insufflated body cavity or lumen. The surgeon may rotate the implement portion 14 about its longitudinal axis by twisting a shaft rotation knob 36 that engages across a distal end of the handle 12 and a proximal end of the elongate shaft 18.

**[0020]** Thereafter, the closure trigger 30 may be repeatedly manipulated and the handle 12 positioned in order to grasp and move tissue. Upper lateral gripping ridges 38 (FIGS. 2-4) proximate to a distal end on an inner surface 40 of the anvil 24 cooperate with lower lateral gripping ridges 42 (FIGS. 1-5) on an inner surface 44 of the lower jaw 22. When the jaws 22, 24 are closed, the upper and lower gripping ridges 38, 42 loosely enmesh to form a strong grip on interposed tissue to assist in positioning. Shaping of staple forming apertures 46 (FIG. 4) on the inner surface 40 of the anvil 24 and staple dispensing apertures 48 (FIG. 5) in the inner surface 44 of the staple cartridge 26 may advantageously enhance the grip on tissue more proximally placed in the staple applying assembly 16.

**[0021]** In FIG. 1, once satisfied with the positioning of the jaws 22, 24 on tissue, the surgeon further depresses the closure trigger 30 until the closure trigger 30 locks in position proximate to the pistol grip 32. Then a firing trigger 50 is depressed, perhaps multiple times, with firing progress indicated on a firing gauge 52 on the handle portion 12. The firing trigger 50 is drawn toward the closure trigger 24 and pistol grip 26 to distally advance a firing member (not shown) within the elongate shaft 18 to effect stapling and severing within the staple applying assembly 16. Then, the firing trigger 50 is released. If the firing member does not retract automatically, the surgeon raises a manual retraction lever 54 to assist in retraction. Then, a closure release button 56 is depressed to unlock the closure trigger 30 to open the staple applying assembly 16 and thereby release the stapled, severed ends of tissue.

**[0022]** While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications may readily appear to those skilled in the art.

**[0023]** While lateral ridged surfaces 38, 42 are depicted, it should be appreciated that a toothed surface, a knurled surface, etc. may be used.

**[0024]** As a further example, although the illustrative version includes a gripping portion disposed distal to the stapling and severing region of the staple applying assembly 16, applications consistent with the present invention may include staple cartridges contoured to enmesh with mirror image contour of the inner surface of the anvil to increase the grip. For instance, outer lateral edges of each of the anvil and elongate channel may include loosely enmeshing rack segments along their length.

**[0025]** As an additional example, although the surgical stapling and severing instrument has a separate closure trigger and firing trigger, applications consistent with aspects of the invention may include those with a single trigger that sequentially closes the end effector and with further movement causes severing and stapling.

**[0026]** For another example, while a manually operated surgical stapling and severing instrument 10 is depicted for clarity, it should be appreciated that robotically manipulated and/or controlled fastening devices may incorporate a force controlled firing bar.

**[0027]** What is claimed is:

## Claims

1. A surgical instrument, comprising:

   a lower jaw operatively configured to upwardly dispense staples;
   an upper jaw pivotally attached to the lower jaw;
   an elongate shaft attached to the lower jaw;
   a handle portion proximally attached to the elongate shaft and operatively configured to drive the staples from the lower jaw;
   a trigger attached for movement to the handle portion operatively configured to close the upper jaw; and
   a nonplanar gripping portion disposed on an inner surface of at least one of a group consisting of the upper jaw and lower jaw.

2. The surgical instrument of claim 1, wherein the nonplanar gripping portion comprises a ridged surface.

3. The surgical instrument of claim 1, wherein the inner surface of the upper jaw include an upper gripping surface registered to loosely enmesh with a lower gripping surface on the inner surface of the lower jaw.

4. The surgical instrument of claim 3, wherein the upper and lower gripping surfaces comprise a laterally ridged surface.

5. The surgical instrument of claim 1, wherein the handle portion further comprises a firing trigger operatively configured to sever tissue clamped between the upper and lower jaws and to dispense staples from the lower jaw for forming against the inner surface of the upper jaw.

6. A surgical instrument, comprising:

   a lower jaw operatively configured to upwardly dispense staples;
   an upper jaw pivotally attached to the lower jaw;
   an elongate shaft attached to the lower jaw;
   a handle portion operatively coupled to the upper jaw through the elongate shaft;
   a trigger attached for movement to the handle portion and operatively configured to close the upper jaw;
   an upper nonplanar gripping surface disposed on an inner surface of the upper jaw; and
   a lower nonplanar gripping surface disposed on an inner surface of the lower jaw registered to the upper gripping surface.

7. The surgical instrument of claim 6, wherein the upper and lower gripping surfaces each comprise lateral ridged surfaces.

8. The surgical instrument of claim 6, wherein the handle portion further comprises a firing trigger operatively configured to sever tissue clamped between the upper and lower jaws and to dispense staples from the lower jaw for forming against the inner surface of the upper jaw.

9. A surgical instrument, comprising:

   an elongate staple channel;
   a staple cartridge engaged in the elongate staple channel to form a lower jaw;
   an anvil pivotally attached to the lower jaw;
   an elongate shaft attached to the lower jaw;
   a handle portion proximally attached to the elongate shaft and operatively coupled to the anvil through the elongate shaft;
   a closure trigger attached for movement to the handle portion and operatively configured to close the anvil;
   a firing trigger attached for movement to the handle portion and operatively configured to effect stapling by the staple cartridge and severing of tissue between the jaws;
   an upper nonplanar gripping surface disposed on an inner surface of the upper jaw; and
   a lower nonplanar gripping surface disposed on an inner surface of the lower jaw registered to the upper gripping surface for loose enmeshment.

10. The surgical instrument of claim 9, wherein the nonplanar gripping portion comprises a ridged surface.

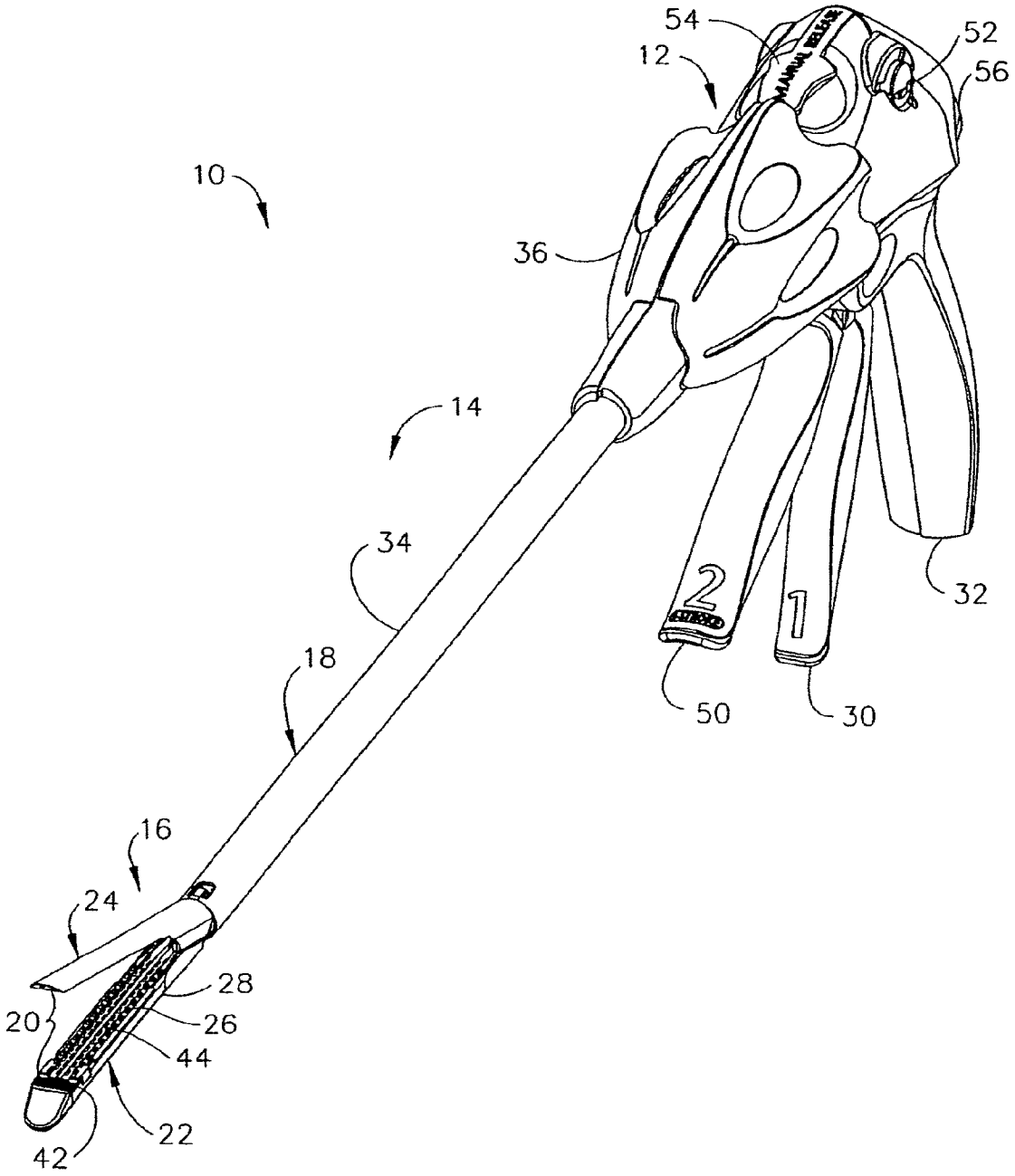


FIG. 1

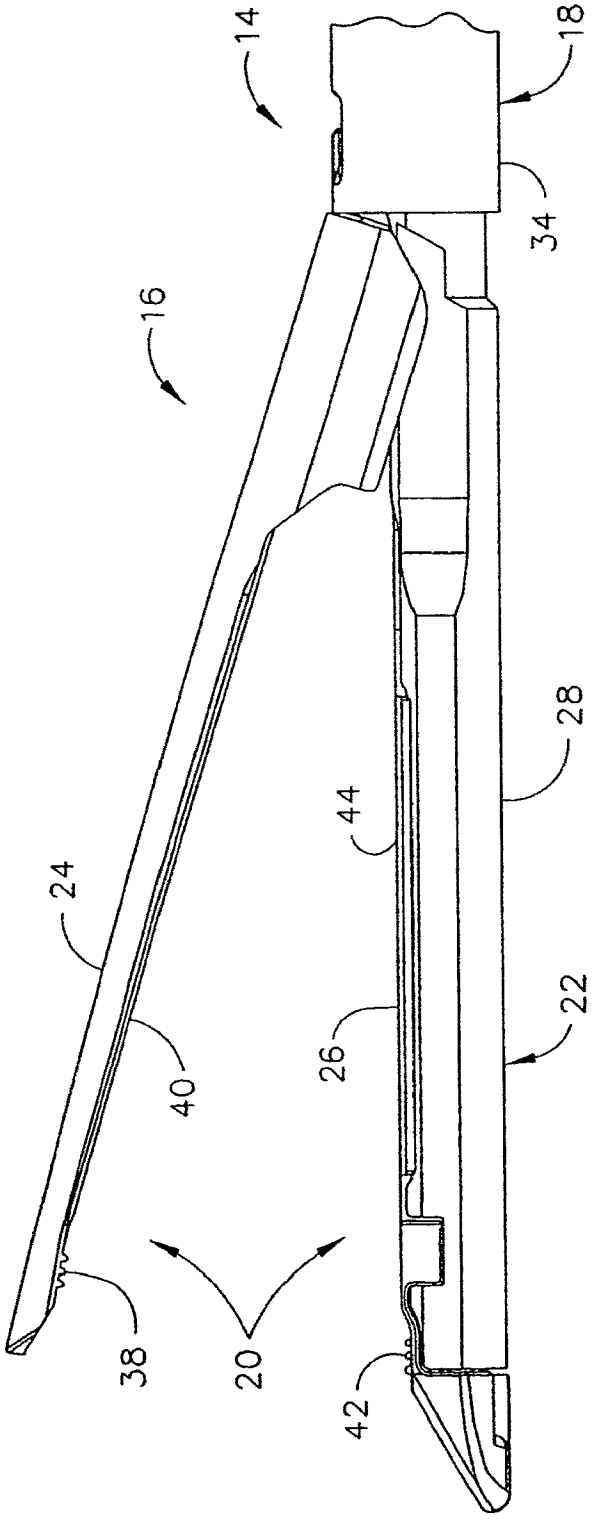


FIG. 2

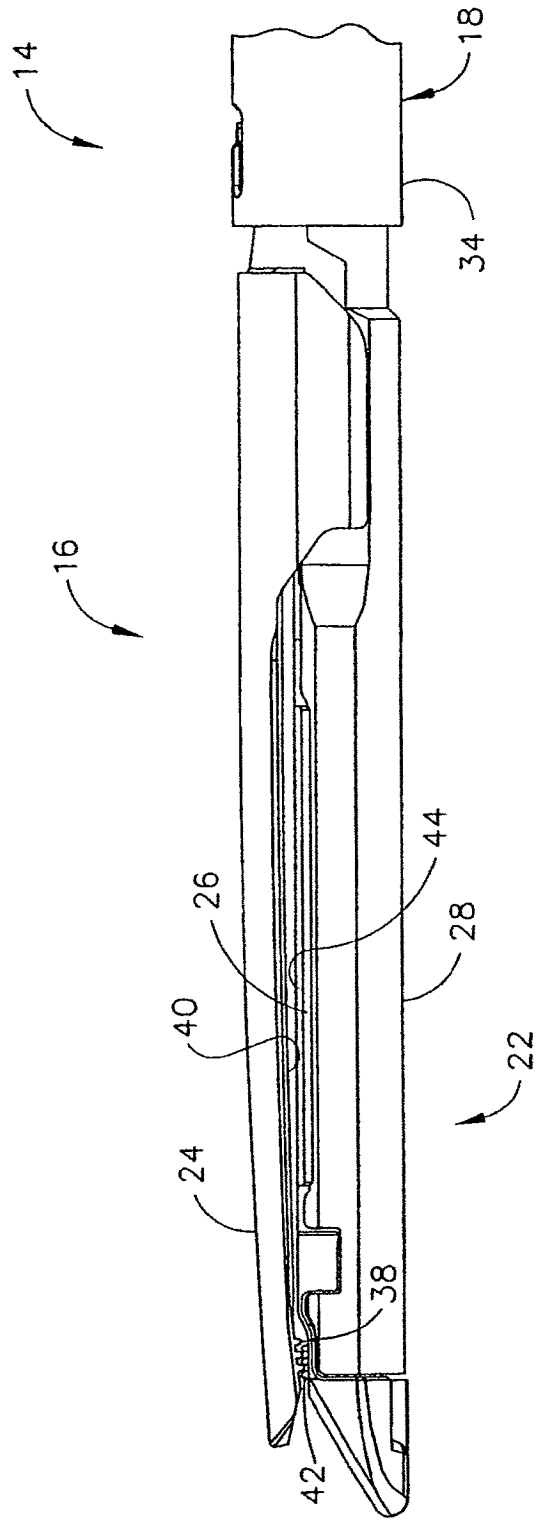


FIG. 3

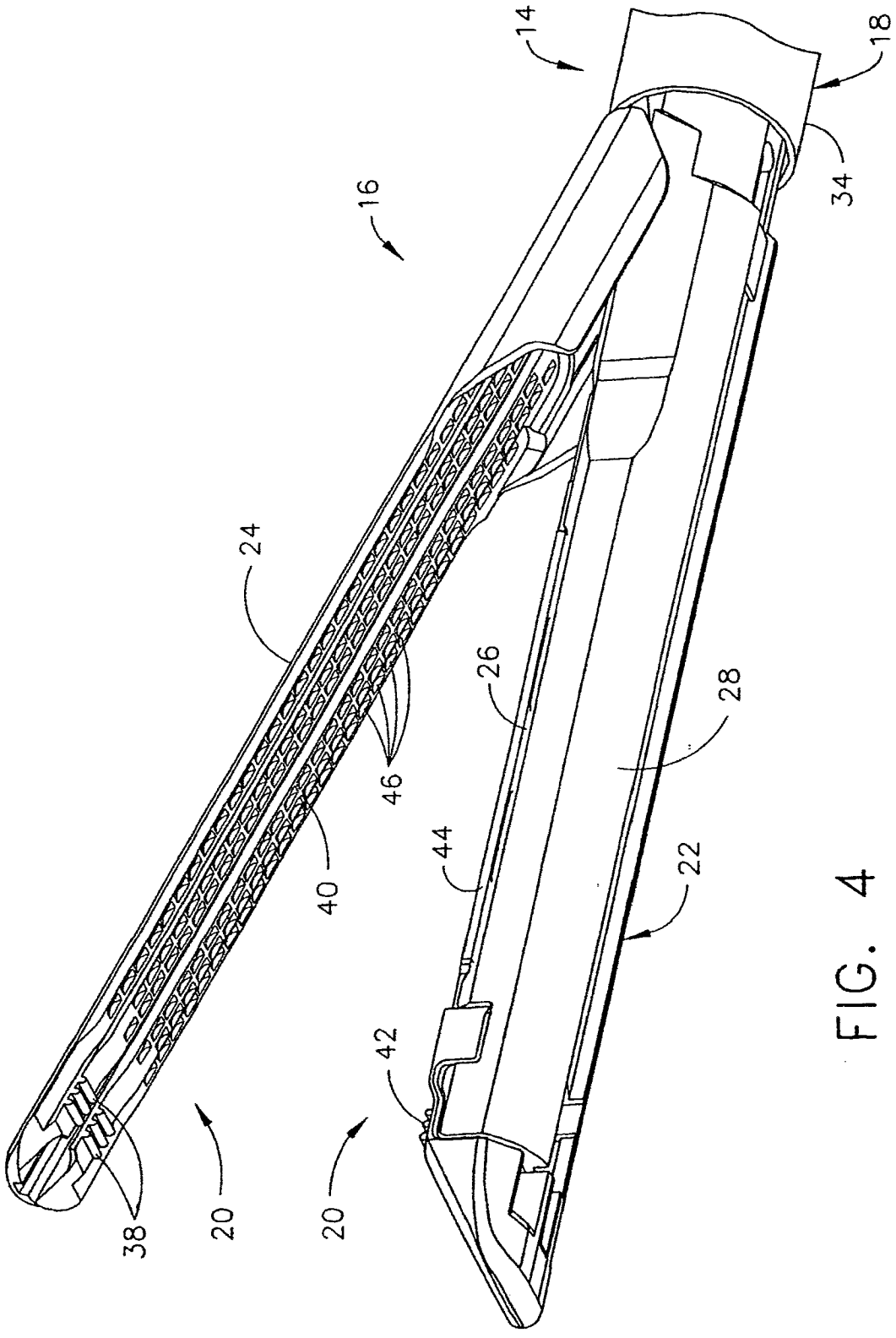


FIG. 4

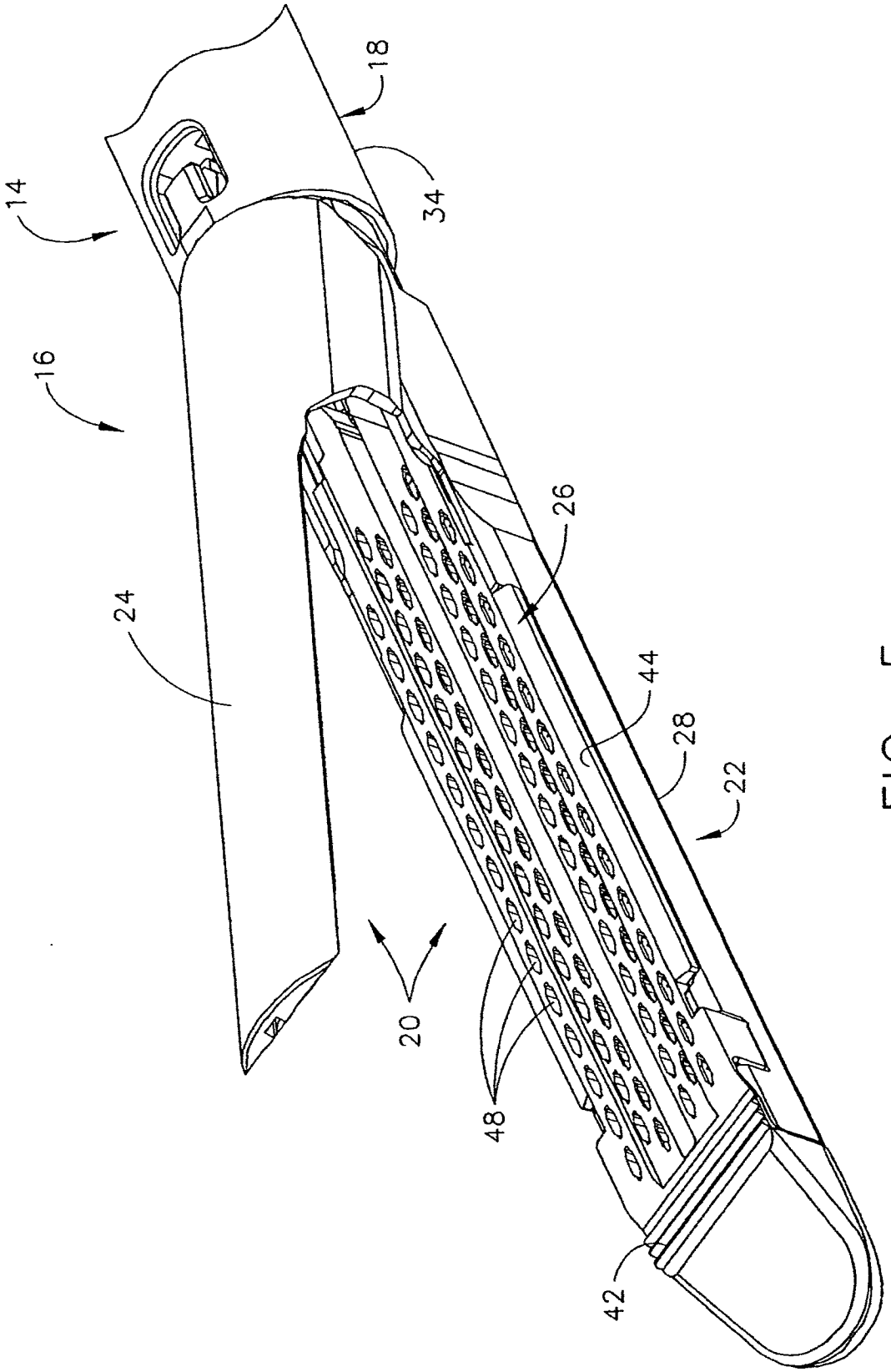


FIG. 5

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# EUROPEAN SEARCH REPORT

Application Number
EP 10 17 7535

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | US 5 452 837 A (WILLIAMSON IV WARREN P [US] ET AL) 26 September 1995 (1995-09-26)<br>* column 2, lines 42-67 *<br>* column 3, line 42 - column 4, line 14 *<br>* figures 1-3 *<br>----- | 1-10 | INV.<br>A61B17/072 |
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| A | * page 5, paragraph 76 - page 6, paragraph 86 *<br>* figures 1,10 *<br>----- | 2,10 | |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Berlin | 1 November 2010 | Kakoullis, Marios |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1 EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 17 7535

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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01-11-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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- US 052387 A **[0018]**

| | | | |
|---|---|---|---|
| 专利名称(译) | 具有末端执行器夹持表面的外科缝合器械 | | |
| 公开(公告)号 | EP2263565A1 | 公开(公告)日 | 2010-12-22 |
| 申请号 | EP2010177535 | 申请日 | 2006-09-25 |
| [标]申请(专利权)人(译) | 伊西康内外科公司 | | |
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| [标]发明人 | SHELTON IV FREDRICK E | | |
| 发明人 | SHELTON IV, FREDRICK E. | | |
| IPC分类号 | A61B17/072 A61B17/29 A61B17/32 | | |
| CPC分类号 | A61B17/07207 A61B2017/07214 A61B2017/2926 A61B2017/320052 | | |
| 优先权 | 11/235591 2005-09-26 US | | |
| 其他公开文献 | EP2263565B1 | | |
| 外部链接 | Espacenet | | |


摘要(译)

一种手术器械（10），用于通过套管针的套管内窥镜或腹腔镜插入到吹入的体腔或内腔（“手术部位”）中，用于同时缝合和切断组织，包括上下颌内表面上的抓握表面在进行吻合和切断手术之前，增强了作为抓握器械用于预先组织的用途。说明性的形式有利地包括单独的闭合触发器（30）和闭合机构，其有助于用作抓紧器而不会发生无意触发（即，钉合和切断）。


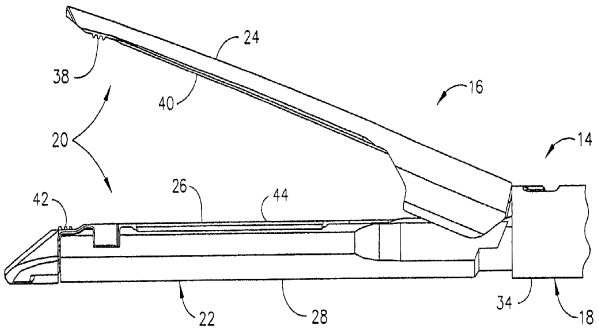


FIG. 2