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(54) **Title**: SURGICAL ENDOSCOPIC DEVICE WITH DETACHABLE CLAMP, CLAMP RETRIEVING DEVICE AND METHOD FOR THEIR USE.

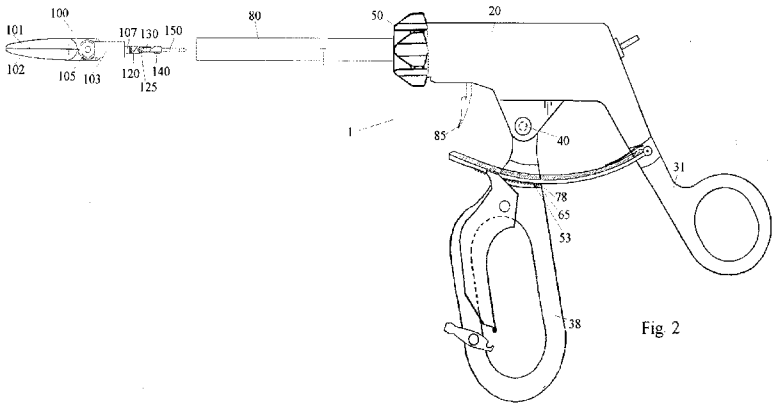

Fig 2

(57) **Abstract**: A surgical endoscopic instrument with detachable end tool as a clamp, a clamp retrieving device and a method for their use is provided. The instrument comprises a clamp, removably connected by a coupling to an elongated shaft, this comprising two concentric tubes, which can rotate about each other, connected to a rotating element, that is attached to a housing, inside which a push-pull rod, driven by a handle, transmits the surgeon's commands, leading to the actuating of the end tool's jaws, as well as the clamp detachment/retrieving, from/to the elongated shaft, by operating the coupling, given by the rotation of the concentric tubes about each other, thus resulting in the detachment/attachment of clamp with its jaws blocked in its given position at the time of detachment. The clamp retrieving device consisting of a grasping element, attached through an elongated shaft, consisting of concentric sheaths, to a handle, where the push of a plunger, leads to the sliding of some sheaths in relation to the other(s), and subsequent clamp seizing, clamp jaws release, and clamp retrieval from the human body.

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SURGICAL ENDOSCOPIC DEVICE WITH DETACHABLE CLAMP, CLAMP RETRIEVING DEVICE AND METHOD FOR THEIR USE.

The invention relates to an endoscopic surgical device with deployable clamp used in laparoscopic surgery, a clamp retrieving device and a method for their use.

In recent years, increasingly more surgeons replace the classic "open" surgery with endoscopic surgery techniques for accessing a surgical site in the abdominal and thoracic cavity, with endoscopic instruments that allow surgical approach through small access holes. The method requires the introduction of trocar (cannulas) in the abdominal or thoracic wall through small incisions. Through these trocars, with diameters between 5 and 12 mm , the devices needed for the intervention (laparoscope, electrocautery, special forceps, etc..) are inserted.

A haemostatic forceps is a pliers-like device which uses mechanical action between its jaws to compress blood vessels in order to stop a hemorrhage.

In open surgery, when the access to operating field is not limited, standard haemostatic forceps are used, which are applied directly on blood vessels or other bodily conducts, occluding them, thereafter the opening of forceps` jaws being blocked by means of a ratchet. In case of accidental damage to blood vessels, these forceps are applied, gathering between their jaws, the bleeding vessel, and surgery is continued after placing an underlying ligature. When tightening the ligature knot, the ratchet is released, followed by the opening of the forceps` jaws. These types of forceps can't be applied in endoscopic surgery because of the limits given by trocar size.

In endoscopic surgery, clamps are applied trough small access holes made by the surgeon. It is desirable to minimize the number of access holes for a certain intervention. Endoscopic clamps are either spring-tensioned, either applied using a threaded mechanism in order to occlude bodily conducts (segments of digestive tract, blood vessels).

During some endoscopic interventions, an accidental damage to blood vessels or of other bodily conducts may occur, lesions that would be difficult or impossible to repair endoscopically, resulting in the need of converting the endoscopic intervention to an "open surgery" intervention. Also, damage may occur in an anatomic segment which does not permit the primary application of monopolar or bipolar electrocauterization in

order to achieve haemostasis because of nearby elements that may be thermally damaged. The application in haemostatic purpose of an ordinary laparoscopy forceps in order to provisionally solve a hemorrhage will inevitably lead to blocking the trocar in which it is inserted, thus limiting the number of tools that can remedy the lesion, or leading to the necessity of creating additional access routes.

There is, currently, a great variety of devices and methods adapted to endoscopic surgery aimed at achieving haemostasis, among which haemostasis clips, pre-tensioned clamps and thread operated clamps are mentioned.

Document EP1654992 describes a surgical system comprising a clamp, a delivery / retrieval device and an actuator. The delivery / retrieval device is removable connected to the surgical clamp and is used by the surgeon to either apply clamp, or to retrieve it from an anatomical site, it being driven by the actuator, the clamp being locked in a certain position of its jaws before and after it is applied at the anatomical site. The disadvantage of this technical solution is its intentional application, the technique not being feasible in case of accidental damage to blood vessels or other bodily conducts.

Document WO1998000066 describes a surgical clamp comprising a pair of jaws that can be maneuvered to occlude bodily conducts, namely of the digestive tract. Clamp applicator can be adapted to catch and maneuver the jaws from closed position to open and vice versa. Similar to the aforementioned patent, the disadvantage of this technical solution is its intentional application, the technique not being feasible in case of accidental damage to blood vessels or other bodily conducts.

Document US 6350269 describes an applicator of surgical clips in order to occlude vascular segments, which is composed of a holder, a pair of applicators arms and a set of pending clips. The clip is pushed forward to be taken over by the arms and applied to the anatomical site, followed by the device to automatically reload. The disadvantage of this device and of all known clips applicators is the necessity of the vascular segment to be perfectly dissected and isolated to prevent dislodging of the clip, which makes it less feasible in case of accidental damage to vessels.

Document US 5368600 presents an apparatus for the application of spring-loaded bulldog endoscopic clips comprising a handle, an elongated portion and a clip applicator. The disadvantage of this device is that the clamping force is the same regardless the thickness of the tissue caught by the clips `arms, which can lead to the dislocation of the clip.

Document US 5368606 presents an endoscopic device consisting of a handle, an elongated shaft and a multitude of disposable tools that are screwed in the distal portion of the elongated shaft. This device acts as an ordinary laparoscopic forceps and the disadvantage is that assembling/disassembling of the disposable tool to the elongated shaft can be done only outside the human body.

The purpose of the invention is to achieve an endoscopic surgical instrument with its end tool detachable as a clamp, a clamp retrieving device and to provide a method for their use.

The problem the invention solves is the use of an endoscopic surgical instrument as a ordinary laparoscopic forceps, which, when accidental or deliberated damage to a blood vessel or other bodily conduct occurs, allows the detachment of its end tool at a site inside the body of the pacient as a temporary occlusion clamp, in a similar manner to the hemostatic forceps used in open surgery, in order to facilitate the proper treatment of intraoperative injuries in areas where usual laparoscopic haemostasis methods would be hazardous or time consuming. After aquiering proper haemostasis by permanent methods with the aid of the said clamp, a clamp retrieving device is used to safely remove the clamp from the surgical site.

The endoscopic surgical instrument with deployable clamp eludes the disadvantages mentioned above in that it comprises a removable end tool detachably connected by a coupling device to an elongated shaft consisting of two concentric tubes, which can rotate about each other, in connection with a rotating assembly, that is fixed to a housing in which an push-pull rod, driven by a handle transmits the commands of the surgeon for the purposes of opening or closing the end tool's jaws, as well as the detachment / coupling of the end tool to the elongated shaft by operating the coupling device determined by the turning of the concentric tubes about each other, thus resulting in unscrewing / screwing of the end tool, and locking the jaws in their given position at the time it was detached.

The clamp retrieval device eliminates the disadvantages mentioned above in that it comprises a grasppping element comprised of a fixed jaw with a distal hook and a mobile jaw, attached by an elongated shaft composed of concentric sheaths to a handle, which determines, by pressing a plunger, the sliding of some of some sheaths over the other(s) and the seizing of the clamp, the release of its jaws and the removal of the clamp from the human body.

The method of using the surgical instrument with detachable end tool as a clamp eliminates the disadvantages mentioned above in that it comprises the use of the instrument as a normal laparoscopic or thoracoscopic forceps during routine surgeries, and that in order to achieve hemostasis or occluding a bodily conduct, accidentally or intentionally sectioned during surgery, includes the graspping of the bodily conduct or blood vessel with clamp`s jaws in order to achieve hemostasis, the detachment of the end tool as a temporary occlusion clamp inside the human body until the implementation of proper measures for hemostasis or definitive treatment of the lesion, followed by the removal of the clamp with an extraction device of the clamp, as well as replacing the end tool of the instrument with various forceps jaws and even scissors.

By applying the invention the following advantages are gained:

- The possibility to use the instrument as a laparoscopic dissection or grasping forceps that can be also connected to electrical current, until the necessity arrises, usually by intraoperative accident to deploy the end tool of the instrument consisting of its jaws together with a small frame as a temporary hemostatic/occlusion clamp;
- The possibility to apply the clamp at an accidental bleeding site where the usual laparoscopic hemostasis methods could prove to be hazardous(dense adesions or proximity of anatomical structures that could be damaged by thermal injury), followed by the proper treatment of the bleeding vessel by proper dissection and removal of the clamp in a safe manner.
- The fact that the tip of the instrument is detachable, leads to the possibility of replacing it with various types of laparoscopic forceps jaws, including intestinal clamps and even scissors;
- Also the detachment of the tip(of various types) could be deliberated in various endoscopic interventions;
- The fact that the tip of the instrument is detachable, leads to the possibility of providing a reusable body of the device, while the tip could be of single use.

Brief description of the drawings:

Fig.1. Side view of an endoscopic surgical instrument with a detachable end tool.

Fig.2 Side view of an endoscopic surgical instrument with the end tool detached as a clamp.

Fig.3 Side view, partially sectioned through the clamp`s upper jaw.

Fig.4 Bottom view of the clamp's upper jaw.

Fig.5 Top view of one embodiment of the clamp.

Fig.6 Side view of one embodiment of the clamp.

Fig.7 Perspective view of an embodiment of the clamp.

Fig.8 Perspective view of an embodiment of the clamp.

Fig.9 Perspective view of another embodiment of the clamp.

Fig.10 Perspective view of the clamp's locking system.

Fig.11 Perspective view of a variant of the clamp's locking system

Fig.12 Perspective view of a variant of the clamp's locking system

Fig.13 Perspective view of another variant of the clamp's locking system

Fig.14 Perspective view of another variant of the clamp's locking system

Fig.15 Sectional perspective view of the elongated shaft`s distal end.

Fig.16 Side view partially sectioned of clamp-elongated shaft coupling in one embodiment.

Fig.17 Top view partially sectioned of the clamp-elongated shaft coupling in one embodiment

Fig.18 Side view in section of the clamp-elongated shaft coupling in one embodiment at the time of clamp detachment.

Fig.19 Top view in section of the clamp-elongated shaft coupling in one embodiment at the time of clamp detachment.

Fig.20 Side view of the clamp's retrieving device.

Fig.21 Side sectional view of the retrieving device's grasp of the clamp.

Fig.22 Side sectional view of the retrieving device's grasp of the clamp.

Fig.23 Side sectional view of the retrieving device's grasp of the clamp.

Fig.24 Sectional side view of the handle, housing and rotating assembly.

Fig.25 Sectional side view of the housing and rotating assembly.

Fig.26 Top view of another embodiment of the clamp.

Fig.27 Side view of another embodiment of the clamp.

Fig.28 Side sectional view of the clamp's framework in this embodiment

Fig.29 Side sectional view of the clamp`s framework in another embodiment.

Fig.30 Side sectional view of the clamp`s framework in another embodiment

Fig.31 Superior sectional view of the clamp`s framework in another embodiment.

Fig.32 Side view partially sectioned of clamp-elongated shaft coupling in this embodiment.

Fig.33 Side view in section of clamp-elongated shaft coupling in this embodiment at the time of clamp detachment

Fig.34 Top view of an another clamp embodiment

Fig.35 Side view of another clamp embodiment

Fig.36 Side view of another clamp embodiment

Fig.37 Side section view of clamp`s framework in an this embodiment

Fig.38 Cross-section view through the clamp's framework.

Fig.39 Side section view of clamp`s framework in this embodiment.

Fig.40 Cross-sectional view through the clamp's framework.

Fig.41 Side view partially sectioned of clamp-elongated shaft coupling in this embodiment

Fig.42 Side view partially sectioned of clamp-elongated shaft coupling in this embodiment

Fig.43 Side view partially sectioned of clamp-elongated shaft coupling at the moment of clamp`s detachment in this embodiment

Fig.44 Side-sectional view of the housing and rotating assembly in this embodiment.

Fig.45 Side-sectional view of the housing and rotating assembly in this embodiment.

Fig.46 Side sectional view of the retrieving device

Fig.47 Side sectional view of the retrieving device's grasp of the clamp

Fig.48 Side sectional view of the retrieving device's grasp of the clamp

Fig.49 Side section profile through the upper jaw of the clamp in another embodiment.

Fig.50 Top view of another embodiment of the clamp

Fig.51 Side view of a another embodiment of the clamp

Fig.52 Top view of an embodiment in which the jaws are represented by scissors.

Fig.53 Side view of an embodiment in which the jaws are represented by scissors.

Fig.54 Side view of another embodiment of the clamp.

Fig.55 Side view of another embodiment of the clamp.

In the following description, I shall refer to as "proximal" the elements that are close to the surgeon, and as "distal" the elements located further away.

Figure 1 presents a side view of a embodiment of an endoscopic surgical instrument **1**, endowed with the ability to detach the end tool as a haemostatic clamp during a surgical intervention, consisting of a handle **30**, a housing **20**, an elongated shaft **80**, attached to the housing via a rotating assembly **50**, and end tool **100**, this presenting the forceps `jaws **101,102**, mobile and opposable, which pivot around axle **105**, that is attached to frame **103**. At the level of the proximal side of housing **20** , there is a metal rod **57** provided, intended for application at this level of a monopolar electrode for the including of the device in an electrical circuit.

Handle **30**, located proximally, consists of an immobile arm **31** attached to housing **20** which has an orifice **32** through which the thumb of the surgeon is inserted, a recess **33,** in which a pivot **72** is attached, on which rod **70** is attached.

Distal arm **38** of the handle has an orifice **39** designed to receive other fingers of the operator, and it is mobile, being articulated by pivot **40** to housing **20** of instrument **1**. On the distal side of orifice **39,** a flap mechanism **41** is shown, having a transversal rod **45** at its lower end, meant to be received, in need, in recess **49** of blocking element **47**, which is manually operated at its distal end, pivoting around the axle **48**. Also, mobile arm **38** of the handle has a recess **51** in its thickness, and at that level, on the lower surface, some indentations **53** are present, with the aim to engage with the indentations **78** located on the lower surface **76** of the rod **70,** thus forming a ratchet mechanism **65**. The flap **41** is attached to handle **38** by a pivot **42** and engages with rod **70** on its lower surface **74** through extension **54**, which, if the flap is pushed, elevates the surface **76** of rod **70** that presents indentations **78,** from indentations **53** of arm **38**, permitting thus free movements of arm **38** of the handle **30**. Rod **70** has an arciform shape and presents one inferior surface **74** which is plane, more elevated than the other inferior surface **76**, at its level taking place the engagement with extension **54** of flap **41**. Surface **76** located at a lower level presents in its distal portion indentations **78** which engage the indentations **53** of handle arm **38**, thus forming a ratchet mechanism **65**, thereby preventing the accidental opening of the handle arms

30. Also, rod **70** is held in place with teeth **78** and **53** engaged by the leaf spring **73** attached to the upper surface of recess **33** of the fixed arm **31.**

The housing **20** of instrument **1** is mobile articulated with arm **38** of forceps handle by pin **40.** Arm **31** of the handle is fixed to housing **20**. In the distal portion of the housing, the rotating assembly **50** is attached. This presents outstanding knobs in order to facilitate the rotation of the elongated shaft **80** for a better approach in the operative field. In distal part of the housing **20,** trigger assembly 85 is illustrated, whose extension enters the casing **20** through an inferior slot.

Elongated shaft **80** receives in its distal part the end tool **100** of the instrument, this presenting the jaws of the forceps **101,102**, opposable, attached to frame **103** by axel **105**.

Figure 2 shows a side view of the embodiment of instrument **1** described above, with end tool **100** detached as a clamp from the level of the elongated shaft **80**, for temporary clamping of a bleeding vessel or bodily conduct accidentally or intentionally injured intraoperative, until the measures for haemostasis or definitive treatment of the lesion are taken.

It can be observed that the mobile arm **38** of the handle is held in position by the engaging of teeth **53** and **78** of ratchet mechanism **65,** and the trigger assembly 85 is pulled proximally by the surgeon. By inducing a rotational movement to the rotating assembly **50** with attending a quarter circle, clamp **100** is released, as will become obvious from subsequent description.

The clamp presents the forceps` jaws **101,102,** opposable, attached to frame **103** by axel **105**, around which they pivot. External frame **103**, always located outside the elongated shaft **80**, continues with the insertable frame **107**, more narrow, which enters inside the elongated shaft **80**, engaging with it by recesses **120**. Also at the frame's **107** level, a blocking element **130** is attached, which overturns around axle **125**. When released from the elongated shaft, the blocking fold is pushed in closed position, not allowing the push-pull rod **150**, which mobilizes the clamp`s jaws, to perform translational motion, thus maintaining the clamp's opposable jaws **101,102** fixed. Unlocking element **140** is represented by a wedge centered by push-pull rod **150**, which, when it is pushed distally, elevates blocking element **130** from the closed position, permitting thus the mobilization of push-pull rod **150**.

Figure 3 shows a side section view through the superior jaw **101** of clamp **100**, this presenting a gripping part **170**, with a lower surface **178**, provided with teeth that do not allow to the tissue caught between forceps jaws to side-slip, and a cylindrical part **180**, which fits between the frame's **103** arms.

Jaw's segment **170** gradually increases in thickness towards the proximal, where it joins the cylindrical segment **180** of jaw **101**, which pivots around the axel inserted into central orifice **179**. The cylindrical segment has an upper part **172**, located in the extension of the forceps jaw and an inferior one **176**. At the level of portion **172**, towards proximal a protuberance **174** with an orifice **175** is found, which receives the axel **115** of the lever **110**. This lever is made of a solid portion **117**, and two lateral blades **114** in its continuation, which bilaterally address the protuberance **174** of cylindrical segment **180,** articulating with it by pivot **115**. It is preferably that the contact surface **119** between solid portion **117** of lever **110** and protuberance **174** to be indented or rough for their better gearing and a more efficient transmission of force. At the proximal end, the lever has an orifice **112**.

Figure 4 shows an inferior view of the clamp`s upper jaw **101**, composed of a portion with prehensile function **170,** having a concave and a convex edge, a gripping surface provided with teeth **178,** and a cylindrical segment **180**, featured in cross-section that pivots around the orifice **179**. The protuberance **174** can be also seen, located the articulation with lever **110** is made by axle **115** which attaches the blades **114** to protuberance **174**, and through direct contact between protuberance **174** and solid portion **117** of lever **110**. At the proximal end, the lever **110** has an orifice **112**.

Figure 5 shows a top view of a this embodiment of the clamp **100**, viewing the upper jaw **101**, which continues proximally to its cylindrical segment **180**, viewing the top surface **172** of it, and which is articulated at its prominence **174** with the lever **110**. Parallel to the cylindrical segment **180** is seen the inferior portion **176'** of cylindrical segment of the opposite forceps jaw and prominence **174 '**, articulating the lever **110'** in a similar manner. Note the external frame **103** comprising two parallel arms **102**, which include cylindrical segments **180** and **180'** of the forceps' jaws, in their center being routed by pivot **105**, that is fixed on the frame **103**, around which they overturn, being driven by levers **110, 110 '.** Levers rotate with their proximal part around the axis **185**, which runs in a longitudinal recess **117** located on the inner surface of the frame **103** and are anchored on the distal end **153** of push-pull rod **150**. The rod is centrally

crossing the transverse part **106** of the frame **103**. In the distal part, push-pull rod **150** presents a narrowing **153**, which is interposed between the levers **110, 110 '**, hereby anchoring the pivot **185**. The wider terminal portion of push-pull rod **150** also serves to push the lever **110** towards the distal increasing thus the force which will be transmitted for closing the forceps 'jaws.

Continuing, to the proximal, is the insertable frame **107**, which is attached to the transverse part **106** of external frame **103**, being narrower than it , and showing in the middle of the lateral sides a thread composed of two lateral sockets, **120,120'** of triangular form, with a distal vertical surface **122**, and a proximal oblique one 124, the two oblique surfaces **124** being oriented in opposite directions in order to be screwed in the distal part of the elongated shaft **80** (Fig. 15).

The proximal part of frame **107** presents a narrowing from which two axles **125, 125`** derive , around which the blocking flap **130** pivots. The blocking flap presents three surfaces that partially circumscribe the push-pull rod **150**, a superior one **132** which is illustrated here transparent and two side surfaces **134**, provided with indentations **138** on the inside, designed to engage with teeth **157** of push-pull rod **150**, thus achieving the blocking of its movements. Continued toward proximal, also centered by push-pull rod **150**, which it circumscribes is unblocking element **140**. It presents to the distal two side surfaces **142**, shaped as a wedge with an oblique upper surface, which when unblocking element **140** is pushed toward the distal, disengage indentations **138** of the blocking flap **130** from the teeth **157** of push-pull rod **150**, thus unlocking it and allowing its free translational movement. Also, unlocking element **140** presents in its proximal part a multiangulated surface **148**.

The push-pull rod **150** has in its proximal part two triangular sockets **152**, bordering a polygonal segment **155**, the acting on push-pull rod **150** being made at this level, as will result in further description. Segment **155** of push-pull rod **150** presents centrally an orifice **157**.

Figure 6 shows a side view of clamp **100**. Forceps `jaws **101,102** present a portion with prehensional purpose **170,170'**, continuing with their correspondent cylindrical segment **180**. At the level of orifice **179** of the cylindrical segment, it is attached to frame **103** , figured here transparently, by pivot axle **105,** which allows the forceps jaws to swing , they being trained by levers **110,110 '**, which are in turn mobilized by push-pull rod **150**, which is pushed or withdrawn by its proximal segment **155** and traverses

centrally from proximal to the distal unblocking element **140**, blocking flap **130**, frame **107**, transverse portion **106** of external frame **103**. The rod leads in case of its pushing towards the distal the closing of forceps 'jaws and in case of its pulling towards the proximal their opening by transmitting the force along the levers **110**.

The frame **103** presents of two paralleled arms **102**, which include the cylindrical segments **180** of the forceps jaws. In the distal portion of frame **103,** axle **105** is attached, around which the forceps` jaws **101,102** pivot. In the proximal portion, the frame **103** presents a transverse part centrally crossed by push-pull rod **150**.

The external frame **103** is always located outside the elongated shaft and its transverse portion **106** continues with insertable frame **107**, of parallelepiped shape in this embodiment, which presents in its proximal portion a narrowing on which an axle **125** is assembled, around which blocking fold **130** pivots. In the middle portion of the frame **107** on its lateral sides are two sockets **120** located diametrically opposite, which form together a thread, for anchoring the clamp **100** to the elongated shaft **80** as will become obvious from further description. These recesses have a distal vertical surface **122**, and a proximal obliquely oriented surface **124,** in order to be screwed into the external sheath **300** of elongated shaft **80**.

The blocking flap **130** pivots around axle **125**, which is attached to frame **107**, presenting three surfaces that partially comprise the push-pull rod **150**. In the position of flap **130** shown in the drawing, it blocks the free movement of the push-pull rod **150**. The lateral surfaces of the flap present in their proximal side a curved edge **126**. This has the purpose to be engaged by wedge **142** of unlocking element **140**, in order to elevate flap **130**, respectively to unlock push-pull rod **150**.

Unlocking element **140** presents a proximal polygonal area **144**, which circumscribes push-pull rod **150** and a distal triangular area **142**, placed sideways to the rod. It aims to catch on, when unlocking element **140** is pushed toward the distal, the blocking flap **130**, at its proximal edge **126** of the lateral surface, thus forcing it to swing around the axle **125** and to release push-pull rod **150**. Unlocking element **140** presents in its proximal part the angulated surface **148**.

The push-pull rod **150** has in its proximal portion, the segment **155**, bordered by two lateral symmetrical sockets **152**.

Figure 7 shows a perspective view of a preferable embodiment of the clamp, making abstraction of forceps arms and the axis around they pivot.

Frame **103** is illustrated with its parallel arms **102**, which present in their distal portion an orifice **108, 108`**, meant to receive axle **105** (fig. 5), around which the forceps 'jaws pivot **101,102** (Fig. 5). Also side arms **102** of external frame presents on their internal surface a recess **117**, in which axle **185** glides, this being attached to the distal terminal portion **153** of push-pull rod **150**, which crosses the transversal portion **106** of frame **103** through a central quadrangular orifice **121**. The frame **107**, narrower than frame **103** which it continues to the proximal, has the purpose to anchor clamp **100** to external sheath **300** of the elongated shaft **80** (Fig.15). Insertable frame **107** is of quadrangle shape on transversal section, being centrally crossed by push-pull rod **150**. The frame presents on its lateral sides two triangular recesses **120,120`** forming a screw. The frame **107** narrows proximally, presenting at this level two axles **125** oppositely located, around which blocking flap **130** pivots. In this image, the flap is in "closed" position, blocking the free movement of push-pull rod **150**. The flap **130** consists of an horizontal surface **132**, superiorly located, which unites the two lateral surfaces **134, 134`**, which in their proximal part present a curved edge **126**.

Continuing to proximal, and figurated distant of blocking flap **130,** is unblocking element **140** centered by push-pull rod **150**, having a polygonal portion **144**, which continues sideways to the rod with wedge **142**, having the purpose to elevate flap **130** off the push-pull rod **150**.

The proximal portion of push-pull rod **150** presents two triangular recesses **152** which border a segment **155** with orifice 157.

Figure 8 presents a perspective view of clamp **100** of the version illustrated in previous figure, having the same elements, except for unlocking element **140** which is pushed distally along push-pull rod **150**, catching with its wedge part **142** the curved edge **126** of side surface **134** of blocking flap **130**, urging it to an overturning movement around axle **125**, realizing thus its elevation from the plan of push-pull rod **150**, unlocking it and permitting its translational free movement.

Figure 9 shows a perspective view of another embodiment of clamp **100**, with the difference from the version presented in Figures **7** and **8** that the attachment of the locking flap **160** of the frame **107**, is not by an axle located at the proximal end of the insertable framework, but through an upper leaf plate **168,** that is attached to frame **107** in its distal portion, thus allowing the free movement of plate **168**, respectively the

elevation of the locking flap **160** off the push-pull rod **250**. Note that the push-pull rod **250** presents along the lateral sides an edge **256**.

The blocking flap **160** consists of an upper surface **162**, attached to leaf plate **168**, which connects the two side surfaces **164**. Lateral surfaces show a proximal rigid portion **164** with a proximal curved edge **166**, meant to be engaged on by the wedged portion **142** of the unlocking element **140** when pushed towards the distal, thus elevating flap **160** of the push-pull rod **250**, allowing free translational movement of it. On the distal side of the lateral surfaces, separated from the rigid segment **164**, there is a flexible segment **264**, with a lower bent termination **266**, providing a clamp mechanism around the edge **256** of the push-pull rod **250** when flap **160** is in the closed position in order to maintain a solid grip.

The proximal part of the push-pull rod **250** has the same elements as those described in previous figures, and lower proximal portion of the frame **107** is designed to prevent excessive movement of the unlocking element **140** towards distally.

The frame **103** has the same elements as in the previous figures and the sockets **120,120'** that compose a thread from the frame **107** are having the same specifications as those described above.

Figure 10 shows a perspective view of the clamp's rod blocking system, composed of the frame **107**, which shows a thread composed of two lateral sockets **120** and **120 '**, and a narrowing in its proximal portion where two axles **125,125'** are anchored, around them the blocking flap **130** is pivoting, in this image it being shown in a opened position, disposed away from its place of action.

The blocking flap has three surfaces which partially circumscribe push-pull rod **150**, namely a horizontal top surface **132** which connects two vertical surfaces **134**. Vertical surfaces present in their distal portion, two holes **135,135'** for the engagement with the pivots **125,125',** and a proximal bent edge **126, 126'** which is held elevated by the contact with the distal portion **142** of the unlocking element **140**, pushed towards the distal.

On the inner side of the vertical surface **134** of the locking flap **130**, there is a batch of teeth **138**, which, in the moment when the flap **130** is pushed in the "closed" position, engages with lateral indentations **157** of the push-pull rod **150**, blocking thus its free translational movement. Also, the unlocking element **140** is pushed toward the proximal when applying the blocking flap **130** on the push-pull rod **150**.

Figure **11** presents another embodiment of the locking element, consisting of the frame **107** with the two lateral sockets **120**, **120'** and axles **125**, **125'** described above, the frame being centrally transversed by the push-pull rod **250**.

Locking flap **230**, which is disposed in the figure in open position, is composed from a horizontal surface **232**, which shows in its distal side two rings which border the orifices **235**, **235'** which pivot around the axles **125**, **125'** of the frame **107**.

At the middle of the lower surface of the horizontal surface **232**, in its proximal portion there is a cross slide **238** together with a supporting element **239**. In case of inwards tipping of the locking fold **230**, the slide **238** will enter into the transverse sockets **257**, cut in the median portion of the push-pull rod **250**.

The lateral surfaces of the fold are consisted of a rigid proximal portion **234**, with a proximal curved edge **236**, which will be elevated together with the fold, by driving towards the distal the unlocking element **140**, through its wedged portion **142**, as previously described.

Inside the distal portion of lateral surface, separated from the rigid surface **234**, there is a flexible segment **264** with bent lower edge **266**, acting as a clamp which maintains the locking fold **230** in a closed position by sliding over the edge **256** of the push-pull rod **250**, the distance between the two edges of the rod being greater than the distance between the peaks of the curved edges **266**, **266 '**.

Figure 12 presents a perspective inferior lateral view of embodiment shown in figure 11, with flap **230** in closed position. The frame **107** is represented, as previously described, with the two lateral axles **125**, around which the locking fold **230** is swinging, engaging the push-pull rod **250**, thus blocking its translation movement.

Note the locking fold's **230** lateral surface consisting of a rigid proximal portion with a proximal curved edge **234**, drawn away from wedged portion **142** of the unlocking element **140**, and elastic segment **264**, presenting a lower curve **266**, which circumscribes the edge **256** of the push-pull rod **250**, blocking a too easy opening of the locking fold **230**.

Figure 13 presents an inferior-lateral perspective view of the locking fold **160**, as previously described in Figure 9. It consists of the frame **107** which presents a thread composed of two lateral sockets **120**, **120'** meant to anchor the end tool to the elongated shaft.

The engagement between the frame **107** and locking fold is performed through a elastic metal plate **168**, which is attached on the distal top of the frame **107**, the locking element **160** being shown in opened position, distantly to the frame, namely from the push-pull rod **250**.

Proximal, the metal plate **168** is attached to the upper transverse surface **162** of the blocking fold. Its construction is similar to the fold version introduced in figure 11, except for the engagement manner with the frame **107**.

In the middle of the horizontal upper surface **162**, on its lower surface, is a proximally located transverse lamella **238**, together with a longitudinal supporting element **239**, which penetrates, in case of downward placement of fold **160,** one of the transversal sockets **257** of push-pull rod **250**, thus stopping the translational movement of push-pull rod **250**.

Lateral surfaces present a rigid portion **164**, with a proximal curved edge **166**, serving for the elevation of the fold **160** from the push-pull rod **250**, thereby unlocking it, when engaged by the wedged portion **142** of the unlocking element **140**.

At the lateral distal portion of the fold **160** there is an elastic segment **264** with a curved lower edge **266**, acting as a clamp to maintain the locking fold **160** closed through the mechanism described above.

Figure 14 presents an inferior lateral perspective view of clamp's locking system , in the version described in figure **13**, with the flap in the "closed" position. It presents the frame **107** with the two sockets **120**, **120'** described above, the unlocking element **140** located at a distance from locking fold **160** this being applied to the upper horizontal surface on push-pull rod **250**, thereby blocking its movement .

Note on the lateral surface of the fold, a proximal rigid part **164**, showing a proximal curved edge **166,** and a flexible distal segment **264** with its lower curved edge **266**, that includes as a clamp the edge **256** of the push-pull rod **250**. In this case accidental free movements are not allowed of locking fold **160** unless the application of a sufficient strength by unlocking element **140** on the proximal edge **166**.

Figure 15 presents a sectional elevation view of the terminal part of the elongated shaft **80**. Elongated shaft consists of two concentric tubes, an external tube **300**, circular on the transverse section, circumscribing the internal tube **320** centrally routed by a drive rod 340, whose translational movement along the longitudinal axis of the elongated shaft leads to the opening / closing the jaws of the clamp.

Between the external tube **300** and internal one **320** there is a cleavage space, they not being fused together, the external tube having in relation with the internal one, the possibility of circular movements which will lead to attaching / detaching the clamp by screwing / unscrewing. In its distal portion, the external tube **300** shows inwards a fastening mechanism of the clamp **199**, consisting of two lamellas - a lower and an upper one **310**, **310'**, which are visualized partially cut, rigid, obliquely oriented in relation with the tube's axis, on section of triangular shape, the thickness decreasing progressively from the center to the lamella lateral borders, to mention the fact that the internal edge of the lamella is straight and the insertion base is thicker.

These lamellas, which are meant to be inserted into sockets **120**, **120** 'of the insertable frame of the clamp (Figure 7), described above, delimit a quadrilateral slot at the distal orifice of the elongated shaft, with its long axis oriented vertically when the clamp is engaged to the elongated shaft, and horizontally, by rotating the external tube around the internal one, as shown in the figure when the clamp is in the process of detachment or attachment.

The alignment of the lamellas **310**, **310'**, is oblique and in opposite direction so in the rotational motion of the external tube **300** in relation with the internal one **320**, will result a motion of screwing / unscrewing of the clamp, depending on the direction of rotation, of a quarter circle. Also, their oblique orientation increases the stability of the clamp in the coupling with the elongated shaft.

The drive rod 340 centrally routes the elongated shaft **80** respectively the internal tube **320**, presenting in its distal portion a terminal quadrilateral surface **342**, which is to be applied on the proximal portion **155** of the clamp rod, pushing it toward distally.

Also, in the distal part of the rod **340** there is the clamp rod fastening mechanism **347**, consisting of two symmetric elastic lamellas **344**, **344'** located laterally from terminal surface **342**, applied on the opposite lateral sides of the drive rod 340, presenting in their distal part two triangular thickenings **346**, **346'**, which are designed to be inserted into recesses **152** that border the distal side of the clamp rod **155** having the purpose to pull toward proximal the clamp push-pull rod **150** together with the drive rod 340.

The distal portion of the internal tube **320** ends in two parallel arms **322** inwardly flattened, each with transversal section of circular segment, the upper arm **322'** being

cut in this figure. On the internal surface of the arms **322**, medially, there is a prominent surface **330** having the width lower than that of the arms.

The arms **322** delimit a quadrilateral slot **326**, with its long axis horizontally oriented, at its level being made the engagement between the proximal portion of the clamp's push-pull rod **150** and the drive rod 340. The arm **322** ends distally in an oblique surface **328**, which firstly aims to facilitate the insertion of the clamp in the elongated shaft by directing the clamp's rod toward the slot **326**, which has a corresponding thickness, and on the other side, the oblique surfaces have the same slope as the proximal oblique cut edges **148** (Fig.6) of the unlocking element **140**.

The prominent surface **330**, ends distally in the oblique surface **328** and proximally presents the trapezoidal edge which catches on the triangular elements **346**, **346'** of the fastening mechanism of clamp rod **347**, when it is pushed towards the distal for the deployment of the clamp.

Regarding to the slot **326** delimited by the two terminal arms **322** of the internal tube **320**, it has a lower width in the prominent portion of the surfaces **330**, sufficient to receive the rod of the clamp with its short transverse diameter, but the width of the slot is shorter than elements **346** width, forcing them through the trapezoidal proximal surface edge **330** to part from the midline, disengaging thus from the sockets **152** of the clamp rod in which they are anchored.

In a more proximal plan than the prominent surface **330,** at the terminal side of the internal tube **320** two blades **323,** are added which connect the two arms **322**, resulting in an outer circular section that forms the internal tube's body **320** and to the inside a quadrilateral empty section, routed by the drive rod 340.

Thus, depending on the position of drive rod 340, will result, either the disengaging of the triangular elements **346** from the proximal sockets of the clamp rod by the surface **330** which pushes them sideways, when drive rod 340 is pushed toward the distal end of the tube **320** for clamp deployment, or either their engagement, when drive rod 340 is withdrawn toward proximal due to pushing elements **346** towards medial by the blades **323**, as happens while the clamp is attached to the elongated shaft **80.**

Also, the rod is withdrawn inside the tube **320** between blades **323** during the use as a laparoscopic forceps of the endoscopic instrument **1**, preventing the accidental detachment of the clamp rod from the element **346** of the drive rod 340.

Figure **16** presents a sectional side - view in of the clamp - elongated shaft coupling in an embodiment.

Clamp **100**, as previously described, presents the forceps jaws **101**, **102'**, which are continued with the cylindrical segment **180**, pivoting around axis **105**, which is fixed on the frame **103** (which is transparently shown).

Forceps jaws' movement is transmitted through levers **110**, **110'**, those being mobilized by pushing/pulling the push-pull rod **150**, which crosses centrally the transverse portion **106** of external frame **103**, the insertable frame **107**, the locking fold **130** and the unlocking element **140**, all these elements being described above.

Elongated shaft **80** comprises an external tube **300** which circumscribes the internal tube **320** and surpasses it distally, the internal tube being shorter than the external one. At the distal portion of the external tube **300**, it presents inwards a fastening mechanism **199** consisted of two lamellas **310**, located diametrically opposite, obliquely sloped towards the axis of the elongated shaft, which, by rotating the external tube **300** in relation to the internal one **320**, are screwed into sockets **120**, located on lateral sides of the insertable frame **107** of clamp **100**, these being equally sloped on their proximal surface **124** as the lamellas **310**.

The engaging of the lamella **310** and socket **120** is solid when lamella **310** is presented to it with its thickest portion (the middle), meaning after the external tube's rotation at **90°** in relation with the internal one, knowing that the internal edge of the lamella is straight.

The unlocking element **140** is pushed distally when inserting the clamp **100** inside the elongated shaft **80** and the lamella **310** of the external tube **300** is screwed into clamp's socket **120**. Thus, the unlocking element elevates the locking fold **130** from push-pull rod **150** by its wedged portion **142**, which engages the edge **126** of the flap **130**, making it pivot around axis **125.** Thus, the free movements of translation of the push-pull rod **150** are allowed, so are the movements of the forceps jaws **101**, **102** while the fold **130** is elevated.

Drive rod 340 routes centrally the internal tube **320**, to it being attached the clamp rod fastening mechanism **347**, consisted of lamella **344** which distally ends in triangular element **346**, that catches the proximal portion **155** of the push-pull rod **150** at recesses **152**.

When pushing the drive rod 340 toward distal, this will transmit the force toward push-pull rod **150** of the clamp, and by pulling, the force will be transmitted through lamellas **344**, respectively to the triangular element **346**, which do not allow the slippage of the proximal portion **155** of push-pull rod **150**.

Internal tube **320** ends distally in two parallel arms **322**, **322'**, which internally show a prominent proximal surface **330**, bordering together a polygonal slot **326** sufficient to permit the introduction of push-pull rod **150**.

Figure 17 presents a sectional top view of the clamp - elongated shaft's coupling in this embodiment.

Clamp **100** presents the upper forceps jaw **101**, which continues with its according cylindrical segment **180**. Parallel to it and centered on the pivot **105** of the external frame there the cylindrical segment **180'** of the lower forceps jaw.

Cylindrical segments are engaged by the levers **110**, **110 '** in the manner described above, these, being trained by the push-pull rod **150.**

Elongated shaft consists of an external tube **300**, which is rotated by 90 degrees in relation to the internal tube **320**, thus, making the fastening mechanism of the clamp **199**, comprising lamellas **310**, **310'** to be inserted and screwed into sockets **120**, **120'** of the insertable frame **107** of the clamp, thus, locking it in the distal portion of the elongated shaft **80**.

By screwing, the translation toward proximal of clamp **100** is made, fixing the unlocking element **140** through its proximal oblique surface **148**, to the terminal oblique surfaces **328** of the internal sheath's **320** arms **322,322'**.

At the distal side of tube **320,** an inner quadrilateral slot is delimited, in which the rods **340** and **150** engage.

With the clamp **100** engaged to the elongated shaft **80** by lamellas **310** of the external tube screwed into sockets **120**, **120'** of the insertable frame **107**, the drive rod 340 together with lamellas **344** and elements **346** will remain within the internal tube, bordered by lateral blades **323**, which do not allow the elements **346** to side away from the midline, so do not allow their disengaging from sockets **152** that border the proximal portion **155** of the push-pull rod **150**.

Figures 18 and **19** presents a sectional lateral side view, respectively upper view of the coupling between clamp-elongated shaft at the time of attaching - detaching the clamp.

Clamp **100**, having the structural elements described above is presented for insertion into the elongated shaft **80** (described above) with blocking flap **130** applied on the push-pull rod **150**, thus blocking its movement. This allows the clamp push-pull rod **150** to fully enter into the slot **326**, which is delimited by terminal arms **322**, **322'** of the internal tube **320**.

Note that the external tube **300** is not rotated relative to the internal **320,** so that the slot delimited by the two transverse oblique lamellas **310**, **310'** with triangular section and opposite orientation, has the same orientation as slot **326** delimited by the two terminal arms **322**, **322'** of the internal tube, so that the introduction of the push-pull rod **150**, the unlocking element **140**, the locking fold **130** in the closed position and the insertable frame **107** is allowed.

When the unlocking element **140** is applied to the surface **328** of the terminal arms **322,322'** of the internal tube **320**, with the screwing of the lamellas **310**, **310'** of external tube into sockets **120**, **120'** of the insertable frame **107**, this meaning the turning of a quarter circle of the external tube relative to the internal one, the unlocking element **140** will be pushed towards distal, and approaches through its wedged surface **142** the curved edge **126** of lateral surfaces of the locking fold **130**.

The fold **130** is then elevated from the push-pull rod **150**, unlocking it, resulting the configuration model of the instrument presented in figure 16 having the slot delimited by lamellas **310**, **310'** of external tube **300** perpendicularly oriented to slot **326**.

Drive rod 340 is engaging the proximal portion of push-pull rod **150** with its distal surface **342** and the fastening mechanism of the clamp's rod **347**, comprising of the elements **346**, attached to drive rod 340 through lamellas **344,** being shown apart from the midline, being directed this way by prominent surface **330**, having its proximal edge of trapezoidal shape.

As the clamp push-pull rod **150** enters in the slot **326** of the internal tube, it pushes toward the proximal the drive rod 340, bringing the elements **346** of the rod along with it, progressively releasing them from the edges of the prominent surfaces, thus allowing them to close toward median until engaging with sockets **152** of the push-pull rod **150**, as is previously described in figure 17.

Also, the lateral lamellas **323** of the internal tube prevent the distancing of elements **346** from the midline, not allowing thus the disengaging of the fastening over the

proximal portion **155** of push-pull rod **150**, as the drive rod 340 migrates towards proximal.

Detachment of the clamp **100** from the elongated shaft **80** goes through these events in reversed order to those listed above. From the coupling illustrated in figures 16,17, with the rotation of the external tube **300** by 90 degrees in relation to internal tube **320**, the unscrewing of the lamellas **310** from sockets **120** of insertable framework is achieved, thus releasing the clamp.

Thus, the lamellas **310** delimit a slot with a long horizontal axis, allowing the proper detachment of the insertable frame **107**, of the locking fold **130** in a closed position, of the unlocking element **140** and push-pull rod **150**.

Fold **130** is forced to pivot around axis **125** and to close on push-pull rod **150** when it moves through the delimited slot by the two oblique lamellas **310**, **310'**, because, in the opened position, it has a height which does not allow its crossing. Thus, the blocking of push-pull rod **150** in its given position in relation to the fixed elements of the clamp is acquired , leading to the blocking of the forceps arms **101**, **102**.

Drive rod 340 passes the internal tube **320,** pushing the clamp push-pull rod **150** in the same direction by surface **342** applied to the proximal portion **155** of clamp **100**. At the same time the elements **346** of the fastening mechanism of clamp's rod **347** are disengaged from sockets **152** of the rod by engaging the trapezoidal edge of the prominent surface **330**, being pushed laterally.

By urging the locking flap **130** into the closed position, this will push through its edge **126** of the lateral surfaces of flap, the unlocking element **140** towards the proximal loosing the direct contact with it. It is desirable that the movement toward distal of the drive rod 340 to be made simultaneously with the unscrewing of the frame **107** from lamellas **310** of the external tube **300**.

Figure 20 illustrates a side view of a retrieval instrument **400** of the clamp **100**. The retrieving instrument **400** comprises a handle **410**, an elongated shaft **420** and a prehensile element **440**.

The elongated shaft **420** consists of two sheaths, a fixed external one **422**, that is circumscribing an internal sheath **424**, that is mobile, lengthwise crossed by a rod **426**, which continues to its distal termination with prehensile element **440**. This one, consists of an immobile arm **442**, which continues the axis of rod **426** and presents a

hook **444** at the distal termination, and at the proximal termination an axle **446** around which the mobile arm **449** pivots.

Prehensile element's arms are maintained in opened position by an elastic lamella **448** interposed between arms **442** and **449**. The handle **410** consists of a plunger **412** which shows in its proximal part, a ring **414**, in which the operator's thumb is inserted.

The plunger **412** enters the solid portion **416** of the handle which presents two lateral sockets **418**, **418'** in which the operator's index and medius fits. In this way, the handle is gripped similarly to a syringe. By pushing the plunger **412** toward distal, similar sliding of the internal sheath **424**, toward distal, is achieved.

Figures 21, **22**, **23**, illustrate the operation mode of the retrieving device, in order to extract the intracorporeal applied clamp.

By pressing the plunger **412** in relation to the solid part **416** of the handle **410** (Fig. 20), the correspondent sliding of the internal sheath **424** is made in relation to external sheath **422** and central rod **426**, these being attached to the solid portion **416** of the handle.

End tool **100**, having the characters described above, is applied as an intracorporeal clamp during a surgical intervention. In order to extract it from the body, the hook **444** located at distal termination of prehensile element **440** of the extractor instrument is inserted into the hole **157** (Fig. 5) located on the proximal portion **155** of push-pull rod **150**.

By pressing the plunger **414,** the sliding of the internal sheath **424** is made, in relation to rod **426** and consequently to the prehensile element **440**, resulting at a first-time the closing of the mobile arm **449** on the fixed arm **442,** and thus providing a fixed grip on the distal portion of push-pull rod **150**, as appears in figure 21.

Figure 22: subsequent sliding toward distal of plunger **414** performs in the next phase the alignment of the axis of the clamp **100** to the one of extractor device **400** and the engaging of the proximal portion of unlocking element **140,** with pushing it toward distal to engage the locking fold **130** at its proximal curved edge **126**. The elevation of the blocking flap **130** from push-pull rod **150**, by overturning around axle **125** is realized in this way. The result is the unlocking of forceps 'jaws **101,102** of clamp **100**.

Figure 23: the additional distal sliding of internal sheath **424** will achieve the opening forceps 'jaws **101,102** by pushing towards distal the framework of clamp **100**,

in relation to push-pull rod **150**, releasing thus the clamp from the tissue which was grasped by it, and extracting it from the body.

Thus, a clamp extraction mechanism is performed in a similar manner to the one applied in "opened" surgery, allowing the application of ligations to blood vessels, and knot tying to be made simultaneously with clamp extraction.

Figure **24** presents a sectional view of the handle, housing from the embodiment illustrated above. It shows handle **30**, housing **20**, and an elongated shaft **80,** attached to the housing via a rotating assembly **50**. Handle arm **31**, proximally located, has been described above, being fixed to housing **20**.

Distal arm **38** of the handle is mobile, being articulated by pivot **40** to housing **20** of instrument **1**. On the distal surface of the orifice **39** there is a fold **41**, which, in the figure is pushed distally by the operator's fingers in an extension movement of the hand, turning around pivot **42** and acting as a lever through its extension **54**, raising thus (applying on inferior surface **74** of curved rod **70**), the surface **76** of the rod **70** with teeth **78** from the indentations **53** provided on arm **38**. This unlocks the ratchet mechanism **65** and allows free movement of the arm **38** of handle **30** in relation to the fixed arm **31** .

It is also showed the locking mechanism **47**, which, manually operated at its distal end will allow the fastening of transversal stick **45** located at the lower extremity of fold **41** by socket **49**. Thus, the curved rod **70** is maintained elevated with ratchet **65** teeth kept disengaged, thus, allowing permanent free movement of the mobile arm of the handle **38**.

Housing **20** of the endoscopic instrument, is articulated with mobile handle arm **38** by pivot **40**, the arm **38** engaging through its extension **11** the push-pull rod **12** located inside the housing, at a vertical orifice **13** of it.

The push-pull rod **12** which crosses centrally the housing **20** is articulated at the site of the rotating assembly **50** through a cylindrical articulation **15** with the drive rod 340, which longitudinally crosses the elongated shaft **80**, transmitting the controls of the operator, and setting in motion the forceps jaws.

Thus, the closing of the handle arms will lead the push-pull rod **12** to make a translational movement towards distal, and to the closing of the clamp's jaws, and their opening will lead the rod toward proximal. The proximal side of the housing **20** presents a metal stick **57** meant for the application at this level of a monopolar

electrode for the inclusion of the device in an electrical circuit, transmitting the electrical current through wire **58** to the push-pull rod **12**.

Within its distal portion, the housing is engaged to rotating assembly **50**, which also engages distally with the elongated shaft **80**. Elongated shaft **80** consists of two tubes, an external tube **300**, circumscribing the internal tube **320**, there, being a cleavage plain provided between the two tubes, which allows the free rotation of the external tube in relation to the internal one. Centrally, the internal tube is routed by the drive rod 340.

Rotating assembly **50** comprises two segments, an external one **60**, having a frustum shape, on which the external tube **300** of the elongated shaft **80** is fixed, the external segment **60** not being attached to the internal tube **320**. Portion **60** of the rotating assembly presents on the surface outstanding knobs for the facilitation of manipulation, and is articulated (rotational) to the housing **20** through articulation **62**, located at the distal edge of the housing **20**.

The rotating assembly **50** presents a second segment **90**, having a cylindrical shape, set within the housing **20**, movable in relation to the first one in sense of proximal displacement. The internal segment **90** is mobile articulated with the internal tube **320** of the elongated shaft at the level of some fins **84**, with a longitudinal long axis, which are inserted into correspondent internal sockets **82** of the cylinder **90**.

External segment **60** of the rotating assembly **50** engages with the internal segment **90** through a number of rods **64**, originating from the proximal surface of the external segment **60**, and entering into the appropriate sockets **63** located on the distal surface of internal segment **90**.

In this configuration the two segments of rotating assembly are engaged and set in motion in the same direction by turning the external segment **60** at its outstanding knobs, making an according rotation of the internal and external tubes of the elongated shaft. At the distal extremity of the elongated shaft we find the clamp-shaft coupling shown in figures 16, 17.

Internal cylinder **90** rotationally revolves inside the distal portion of the housing **20** (this having a circular shape on cross-section in its distal portion), under the influence of the movements engraved to external segment **60** of the rotating assembly 50. Internal cylinder shows on its lateral surface, the proximal prominences **75** which enter

into corresponding longitudinal notches **97**, located on the internal surface of the housing when the cylinder is pulled toward proximal by the trigger assembly 85.

Trigger assembly 85 is manually operated, and enters the housing **20** through a longitudinal slot **87** located on the inferior surface of the housing. Here it is continued with a circumferential collar **95** that is inserted in a circumferential recess **79** located on the outer surface the internal cylindrical segment **90** allowing thus free rotational movement of it.

With the manual pulling of the trigger assembly 85 toward proximal we will obtain the coupling of the rotating assembly **50** illustrated in figure 25.

Following the direction of the trigger assembly 85 through collar **95**, the internal cylinder **90** of the rotating assembly will be pulled toward proximal with it disengaging from the external segment **60,** by rods **64** extraction from their correspondent sockets **63**.

The prominences **75** are received into sockets **97** (in this figure they are not all shown) of the housing **20**, thus blocking the internal cylindrical segment's **90** rotation in its given position.

In this way, the rotation of external segment **60** by 90 degrees will no longer be transmitted to the internal cylinder, respectively to the internal tube **320** which remain fixed in rotational sense, leading only to the according rotation of the external tube **300**, leading to the clamp unscrewing and locking of its jaws while detaching from the elongated shaft, as illustrated in Figures 18, 19.

Figure **26** reveals another preferred embodiment of clamp **500**.

Forceps jaws **101,102**, the external frame **103** show the same specifications as described in figure 5, thus viewing the upper jaw **101** of the forceps, which continues proximally with cylindrical segment **180**, viewing its top surface **172**, which is articulated at its prominence **174** with lever **110**. Lamellas **114** are bilaterally including prominence **174** being attached to it by an axle **115**. Parallel with the cylindrical segment is viewed the lower portion **176'** of forceps' cylindrical segment of the opposite side and prominence **174'**, the articulation with lever **110'** being of similar making. Note the frame **103** with two parallel arms **102**, which include sideways the cylindrical segments **180** and **180** ' of the forceps jaws, being attached to them at the center axis **105**, around which the jaws overturn, being driven by levers **110**, **110'**. Levers pivot around the axle **185**, which runs in a recess located on the inner side of frame arms

102 (Figure 7), and is anchored to the narrowed distal end **251** of push-pull rod **250**, which crosses through the center of the transversal part **106** of frame**103**.

Further proximally , is the insertable frame **507**, which is attached to the transversal part **106** of external frame **103**, of cylindrical shape, and presenting on its surface a thread **508** with several rounds, for screwing into the distal part of the elongated shaft. This frame is also centrally routed by push-pull rod **250** described above. Attachment of the blocking flap **160** to frame **507**, is made by a lamella **168**, allowing the elevation of blocking flap **160** from push-pull rod **250**. The blocking flap **160** comprises an upper surface **162**, which connects the two side surfaces **164**, attached to slide **168**. The top surface presents two upper prominences **165** with the longitudinal shape of an ellipse segment, and rectangular in cross-section, located symmetrical in relation to midline. Side surfaces have a rigid proximal portion **164** which is to be engaged by the wedged portion **142** of unlocking element **140** when pushing it to the distal, elevating flap **160** from push-pull rod **250**, thereby allowing its free movement. In the distal side of flap lateral surface, separated from the rigid part **164**, there is a flexible lamella **264**. Unlocking element **140** has the same constructive characters as described above. The proximal segment of push-pull rod **250** has two symmetrical sockets **252**, bordering the proximal portion **255** of push-pull rod **250**, this presenting a polycyclic outline with a central hole **258**.

Figure **27** shows a side view of the embodiment of the clamp **500** illustrated above. Forceps arms **101,102** consist of a gripping portion **170**, **170** ', which continues with their according cylindrical segment **180**. This is attached to frame **103** (Figured transparent) by pivot **105**, which allows the forceps jaws overturning, these being trained by levers **110,110** ', which are in turn mobilized by the push-pull rod **250**, which is pulled or withdrawn by its proximal portion and centrally traverses from proximal to distal unlocking element **140**, locking flap **160**, frame **507**, and the transversal portion **106** of external frame **103**. If it is pushed, the rod leads to the closure of the jaws **101**, **102** and with traction to their opening, force being transmitted along the levers **110**.

The frame **507** presents at the level of the inferior surface of push-pull rod **250** an extension **509**, which acts as a barrier for the unlocking element **140**, blocking its excessive pushing towards distal, in this case existing the risk of fracturing the lamella **168**.

The locking flap **160** is attached to frame **507** by an elastic lamella **168**, which allows the elevation of the blocking flap **160** off push-pull rod **250**. Push-pull rod **250** presents along its lateral side an edge **256**.

The locking flap **160** presents a superior surface, and two side surfaces **164**. The superior surface has two outstanding knobs **165**. The side surfaces present a rigid proximal portion **164** with a curved edge **166**, which is to be engaged by wedged portion **142** of unlocking element **140** in case of its pushing towards distal, elevating flap **160** off push-pull rod **250**, permitting thus its free translation movement. In the distal part of flap`s **160** side surface, apart of the rigid part **164**, is another surface, this time a flexible lamella **264**, with its curved inferior part **266**, realizing thus a clamp mechanism around edge **256** of push-pull rod **250**, in order to maintain a solid grip. The proximal part of push-pull rod **250** has the same elements as those described in previous figures.

Unlocking element **140** presents a proximal area, that circumscribes the push-pull rod **250** and a triangular distal area, located laterally to the rod which presents the oblique surface **142**. It aims to catch on, when the unlocking element **140** is pushed toward distal, the locking fold **160**, at the proximal edge **166** of the lateral rigid surface **164**, thus, forcing the fold to elevate and release the push-pull rod **250**.

Figure 28 illustrates a sectional lateral view of the clamp's framework in the embodiment shown in the two previous figures.

The push-pull rod **250** is being visualized, that centrally crosses from the proximal toward distal the unlocking element **140** (described above), the locking fold **160**, illustrated in the closed position, the insertable frame **507**, cylindrical, with a thread **508** on its external surface, attached to the transverse portion **106** of the external frame by an extension of it **506,** having an asymmetrical form and being inserted within the insertable frame.

To the upper surface of the frame **506** is attached the lamella **168** of the locking fold **160,** and the lower surface **509** is greater in thickness and length, exceeding the insertable frame **507** toward proximal, having the purpose of blocking the excessive advancement of the unlocking element **140** toward proximal.

Figure 29 presents a side section view of the clamp's framework **500** in another embodiment. Figured is the locking fold **230** (built similar with the one illustrated in

Figure 11, 12) that is attached to the frame **507**, featured in section, together with the transverse portion **106** of the external frame.

External frame is attached to the internal one by a extension of it **506,** centrally crossed by the push-pull rod **250**. The locking fold **230**, illustrated in closed position, consists of a horizontal surface **232**, which shows in its distal part two vertical rings **235**, which engage and pivot around symmetrical axis **525**, oriented toward the inside, from the extension **506,** in its proximal portion.

Within the proximal portion of the horizontal surface are present two upper prominences **165**. Lateral surfaces of the fold are formed of a proximal rigid portion **234**, presenting a proximal curved edge **236**, which will be elevated together with the fold by acting of the unlocking element **140** toward the distal.

Within the distal portion of lateral surface, separated from the rigid surface **234** there is a flexible slide **264** having its inferior part **266** curved, acting as a clamp which maintains the locking fold **230** in the closed position, by sliding over the edge **256** of push-pull rod **250**, the distance between the two edges being greater than the distance between the tip of the curved segments **266, 266'**.

Figure 30 presents a side-section view of the clamp's framework shown in the previous figure having the locking flap **230** opened. The unlocking element **140**, is pushed distally, and engages by the wedged portion **142** the curved edge **236** of the fold **230**, accomplishing the elevation of the locking fold from the push-pull rod **250** by pivoting around the axis **525**. Thus, the unlocking of the push-pull rod **250** is performed.

Figure 31 presents an top section view of the clamp framework shown in previous figures 29, 30. Note the push-pull rod **250**, which crosses centrally the unlocking element **140**, the locking fold **230**, which is pivoting around axis **525**, this being anchored on the internal surface of the framework **506**.

The locking fold **230**, in the closed position, consists of a horizontal surface **232**, which presents in the proximal portion of two upper prominences **165.**

Figure 32 presents a side section view of the clamp - elongated shaft coupling . Clamp **500**, as previously described, presents the forceps jaws **101,102'**, which are pivoting around axis **105**, this being fixed to the external frame **103**. Transverse portion of the external frame is continued with the insertable frame **507**, described above, being centrally crossed by the push-pull rod **250**.

The frame **507**, having a cylindrical shape, presents on its surface a thread **508** with several coils in order to be screwed into the external sheath of the elongated shaft **570**.

Locking fold **160** is in elevated position, lateral surfaces presenting a rigid proximal segment **164** with an curved edge **166**, which is to be engaged by the portion **142** of the unlocking element **140.** This happens due to its pushing towards distal, when contacting the terminal oblique surfaces **328** of the arms **322,322'**, by screwing the insertable frame into the external tube **580**, thus, elevating the fold **160** from the push-pull rod **250**, and allowing its free movement of translation.

Frame **507** presents under the lower surface of push-pull rod **250** a rectangular extension **509**, which is acting as an barrier for the unlocking element **140**, blocking its excessive pushing toward distal, there, being a risk, in this case of fracturing lamella **168**. The proximal part of the push-pull rod **250** has the same elements as those described in previous figures.

Elongated shaft **570** comprises an external tube **580** that circumscribes the internal tube **320** and exceeds it toward distal, there being provided a plane of cleavage between the two tubes, which allows free rotation of the external tube in relation to the internal one.

At the distal portion of the external tube **580**, this one presents to the inside the clamp fastening mechanism **599** composed of a thread **590**, which, by rotating the external tube **580** relative to the internal one **320** and the clamp **500,** is screwed into thread **508** located on the outer surface of the insertable frame **507**, thus making the fastening of the clamp to the elongated shaft.

Proximally from the thread **590**, the external tube is provided with a collar thickening **595**, which delimits a narrower space inside, having the purpose to apply the locking element **160** on push-pull rod **250**, when detaching the clamp, in order to block the movements of the forceps arms **101**, **102**.

Internal tube **320**, which has the same specifications as described in figure 15 ends proximally to the external one, showing terminally two oblique surfaces **328**, **328'**, which, on one hand allow an easy introduction of push-pull rod **250**, delimiting a slot with transverse diameter corresponding to its thickness, and on the other hand engage with proximal portion **148** of the unlocking element **140**.

The unlocking element **140** is pushed toward distal when inserting the clamp **500** into the elongated shaft **570**. Drive rod 340 centrally crosses in longitudinal manner the

internal tube **320**, on it being attached the lamella **344,** which ends in the element **346**, which clings on the proximal portion of push-pull rod **250**.

When pushing the drive rod 340 toward distal, it will transmit the force toward push-pull rod **250** of the clamp, and by pulling, the force will be transmitted through the fastening mechanism **347**, which does not permit the escape of proximal portion of push-pull rod **250**.

Figure 33 shows a side section view of the clamp - elongated shaft coupling when detaching/attaching the clamp.

Clamp **500**, as previously described, presents the forceps arms **101**, **102'**, which are swinging around axis **105**, this being fixed of the external frame **103**.

Transverse portion of the external frame continues with the insertable frame **507,** this and the locking fold **160** described above, being centrally crossed by the push-pull rod **250**, and leaving, in this order the distal portion of the elongated shaft by the unscrewing of the thread **590** of the clamp fastening mechanism **599** located on the internal end surface of the external tube **580,** from the thread **508** of insertable frame **507**.

The blocking element **160** is forced to be applied on push-pull rod **250** with the consecutive blocking of its translation movements, by the traversing of the blocking element **160** (previously in elevated position) of the narrower space of collar **595,** which engages knobs **165**, symmetrically located on the superior surface of the horizontal surface of blocking flap. The side surfaces present a proximal rigid surface **164** with a curved edge **166**, which push unlocking element **140** proximally. Thus it is accomplished the blocking of the push-pull rod **250** in the given position at the moment of extraction related to fixed elements of the clamp, and blocking of the forceps 'jaws **101,102**, arising from this the clamp function of the forceps detached from the elongated shaft.

The drive rod 340 centrally traverses the internal tube **320** towards distal pushing push-pull rod **250** of clamp **500** in the same way, by surface **342** applied on proximal rod segment **255**. At the same time elements **346** disengage off recesses **252** of the rod by clambering the border of the prominent surface **330**, being pushed to the side.

It is desirable that the movement to distal of drive rod 340 to be done simultaneously with the unscrewing of frame **507** off thread **590** of the external tube **580**.

The insertion of clamp in the elongated shaft, passes through the same stages in backward order as previously described, reaching to the configuration described in figure 32 with the mention that when introducing clamp, flap **160** must be in closed position, to be able to traverse the narrowing of the external tube given by the collar **595**.

The retrieving of the clamp **500**, applied intracorporeal will be done with the same instrument, and passing through the same stages as the ones described in figures 20,21,22,23.

In this embodiment, housing **20**, handle **30** and rotating assembly **50** have the same characteristics as the ones illustrated in previous example on figures 24,25 having as a difference, the fact that, for detaching, respectively attaching clamp **500** to the elongated shaft **570** more rotation turns are needed at the level of the external segment **60** of rotating assembly **50** with the internal segment **90** hauled to proximal by trigger assembly 85, achieving thus unthreading, respectively threading of the clamp to the elongated shaft on level with the fastening device **599**.

In **figure 34** is featured another embodiment of the clamp in top view, in functional position, the modality of blocking the rod changing in comparison with the previous examples. The clamp **600** comprises the forceps 'jaws **101**, the external frame **103,** with its transversal portion **106**, this being attached to the cylindrical insertable frame **607,** which proximally presents the extension **383** of the unlocking element **380**, all these being centrally traversed by push-pull rod 350. The push-pull rod 350, of rectangular shape, having the horizontal transversal diameter longer than the vertical one, proximally presents two triangular side recesses **352, 352`**, which border proximal segment **355**, by which the rod`s mobilization is accomplished. Segment **355** of the rod also presents a vertical orifice **358**, on which the retrieving instrument is applied. On side surfaces, the rod presents some indents **357**, with the purpose of blocking the rod in a certain position in proportion to the longitudinal axle, around which it can rotate. In the distal part, inside the frame **103**, the rod ends on circular section, in a cylindrical articulation **360**, received by frame **367**, which continues with an extension **368**, interposed between levers **110,110`**,on which axle **185** is inserted. This is transmitting the movement to levers **110,110`**, mobilizing forceps 'jaws. The wider portion of cylindrical articulation **360** has the purpose to also engage and push lever **110** towards

distal, increasing thus the force which will be transmitted for the closing of the forceps 'jaws.

The forceps 'jaws **101,102**, the external frame **103** present the same assembling manner as the ones described in figure 5, thus viewing the superior arm **101** of the forceps, which proximally continues with its cylindrical segment **180**, viewing its superior side **172**, which articulates on its knob extension **174**, with lever **110**, being fixed to it by an axle **115**. In parallel with the cylindrical segment, the inferior portion **176** of the cylindrical segment of forceps `jaw of the opposite side is visualized, and knob **174`**, the articulation with lever **110`** being made in similar way. It is observed frame **103** with its two parallel arms **102**, which bilaterally include cylindrical segments **180** and **180`** of forceps 'jaws, in their centre passing axle **105**, around which they overturn, being driven by levers **110,110`**. These pivot with their proximal portion around axle **185**, which runs through a recess located on the internal surface of frame`s arms **102** (Fig. 7) , and is anchored by the distal extremity **368** of cylindrical articulation **360**, which articulates with the distal part of push-pull rod **350**.

Proximally is the insertable frame **607**, which is attached to the transversal part **106** of the external frame **103**, of cylindrical shape and presenting on its outer surface a thread **608** with several coils, in order to be screwed in the distal part of the elongated shaft. In the proximal half, the insertable frame has no thread, and the proximal circular extremity has some indents **603** which have a purpose in extracting the clamp **600.** From the inside of the proximal portion of cylindrical frame **607**, comes out towards proximal the extension **383** of the locking element of rotation **380** , applied on the superior surface of push-pull rod **350**, the terminal surface having a oblique orientation **385**.

Figure 35 presents a side view of the version of the clamp **600** previously illustrated, with push-pull rod **350** in functional position, having the long transversal axle horizontally oriented. Forceps 'jaws **101,102** are formed of a portion with prehensile purpose **170,170`**, which continues with its corresponding cylindrical segment **180**. This is attached to frame **103** by pivot axle **105**, which permits the overturning of forceps 'jaws around it, they being trained by levers **110,110`.** These are being mobilized by push-pull rod **350** through cylindrical articulation **360**, the rod being pushed or redrawn in its proximal portion **355** and centrally traverses from distal to proximal the external frame **103** , its transversal part **106**, and the insertable frame **607.**

From the inside of frame **607**, emerge the extensions of the blocking element **383, 383`**, applied on superior and inferior surfaces of push-pull rod **350**. The rod trains in case of its pushing to distal the closing the of the forceps arms and in case of its drawing towards proximal their opening by transmitting the force along levers **110.**

Figure 36 presents a side view of clamp **600**, with the push-pull rod **350** blocked, this having the transverse long axis vertically oriented. The constructive elements are similar to those illustrated in the previous figure, the difference being given by the rotation of push-pull rod **350** around its longitudinal axle, so that it traverses the insertable frame **607,** respectively the transversal part of the external frame with the long transversal axis in vertical position. Push-pull rod **350** presents on side surfaces now vertically oriented, indentations **357**, with the purpose of blocking the rod in its position in relation to the longitudinal axis, around which this can rotate. In the distal part, included by frame **103**, the rod ends in a cylindrical articulation **360,** engaging it with its terminal portion **365**, circular in section and rotated to 90 degrees in relation to frame **367**, which cannot rotate. The frame **367** continues with an extension **368**, through which the movement is transmitted to levers **110,110`** mobilizing the forceps 'jaws. Also, from the insertable frame **607** emerges the prominent proximal extension **383** of locking element of the rod's rotation **380** (Fig.37) which is also rotate together with push-pull rod **350**.

Figure 37 presents a side sectional view of the clamp`s **600** framework, in the embodiment exposed in the three previous figures. The push-pull rod **350,** having the transversal horizontal diameter longer than the vertical one, proximally presents side recess **352,** which border the proximal segment **355**. On side surfaces, the rod presents indentations **357**, with the purpose to block the rod in a certain position in relation to the longitudinal axle, around which it can rotate. In the distal part, the rod ends in a cylindrical articulation **360,** in which the terminal portion of rod **365**, on circular section is engaging, with frame **367**, as previously described.

In the distal half of insertable frame **607,** that is provided with a thread **608**, are located on the internal surface, superior and inferior, several indentations which form the blocking element **612**, horizontally oriented, on transversal section having the shape of a circle segment, which are to be engaged with teeth **357** located on the side surfaces of push-pull rod **350** at the moment that this is rotated with the long transversal axle in vertical position. In this figure, the rod is in functional position with

the long transversal axle horizontally oriented, so that free translational movements of it are allowed. The non-threaded proximal portion **609** of the insertable frame **607**, is also cylindrical, presenting on its terminal border a crown of teeth **603** with purpose in extracting the clamp. Inside it, pushed towards proximal by a spring **615**, is located the blocking element of the rod's rotation **380**, also of cylindrical shape, presenting proximally an extension **383, 383`** , applied on the superior, respectively inferior surface of push-pull rod **350**, which surpasses the border of frame **607.**

At the base of the extensions **383,383`** is a set of teeth **381,381`**, which are to be engaged with another set of indentations **610,** in crown disposal and prominent on the internal terminal surface of frame **609**. The blocking element of the rotation is pushed in proximal position with teeth **381,381`** engaged with the internal indentations **610** of frame **609** by spring **615**, which proximally applies on blocking element **380**, and distally on the threaded portion **608** of frame **607**, narrower in the internal diameter than portion **609**. In this way, the accidental rotation of push-pull rod **350** is prevented, respectively blocking / unlocking of the translation movements of the rod. The only way in which the blocking element can be passed from the position of blocking the rod to the position of unlocking it, or vice-versa, is to push towards distal the extensions **383, 383`** of locking element **380**, with consecutive disengaging of teeth **381,381`** from indentations **610**.

Figure 38 shows a sectional transversal view through clamp`s framework, illustrated in the previous figure at the level indicated by the arrows. It is illustrated the insertable frame **607**, presenting on its surface a thread **608** and on the interior surface blocking element **612**, represented by superior and inferior horizontal indentations of circle segment shape. Push-pull rod **350** is presented with its long transversal axle with horizontal orientation, so the indentations placed on its side surfaces are not engaged with those of the blocking element **612**, permitting thus the free movements of the rod.

Figure 39 shows a side sectional view of the clamp's framework in the embodiment described above, with the push-pull rod **350** vertically rotated. In this way, indentations **357** located on the sides of the push-pull rod **350** engage with horizontal indentations of blocking element **612**, blocking the movement of push-pull rod **350**. Components are the same as illustrated above, the difference being given by the push-pull rod **350** rotated around its longitudinal axis, ending it in a cylindrical articulation **360**, in which its terminal portion **365**, circular in section and also rotated 90 degrees engages with the

frame **367**, not rotated . Also rotated by 90 degrees, are extensions **383** of locking element **380**. Note the frame **609** in which the blocking element **380**, is rotated by 90 degrees together with the push-pull rod **350** so that the teeth **381** located at the base of its proximal extension, vertically oriented, are engaging with the indentations **610** of frame **609**. The rotation lock element **380** is pushed toward the proximal end of portion **609** of insertable frame maintaining thus the engagement between indentations above - mentioned by spring **615**, thus stopping the accidental rotation of the rod which could lead to clamp dislodging. It is also visualized the proximal part of the push-pull rod **350**, bordered by two sockets **352** on the side surfaces and orifice **358**.

Figure 40 shows a cross-sectional view through the clamp framework shown in the previous figure on the level indicated by the arrow. It is illustrated the insertable frame **607**, with thread **608** on its surface and the locking element **612**, represented by indentations in the form of upper and lower horizontal circles segments. Push-pull rod **350** is presented with its long transverse axis having vertical orientation, so that arciform indentations placed on its side surfaces engage with the locking element **612**, thus blocking the rod moves.

Figure 41 shows a sectional side view of the clamp - elongated shaft coupling.

Clamp **600**, as it was previously described, presents forceps jaws **101,102**, overturning around axis **105** which is fixed to the external frame **103**. Transversal portion of the external frame continues with the insertable frame **607**, described above, centrally routed by push-pull rod **350**. Elongated shaft **670** comprises an external tube **680** circumscribing the internal tube **320** and surpassing it distally. Also, there is a cleavage space between the two tubes, which allows the free rotation of the external tube in relation to the internal one and vice versa. At the distal portion of external tube **680**, this presents on its inner surface the clamp fastening device **699,** consisting of a screw **690**, which, by rotating the external tube **680** in relation to the internal one **320**, leads to the attachment/detachment of the clamp **600** by threads **608** , thereby fastening the clamp to the elongated shaft.

Internal tube **320**, which presents the same specifications as described in figure 15, is shorter compared to the external one, distally showing two oblique surfaces **328**, which, on one hand allow an easy introduction of the push-pull rod **350**, delimiting a slot with width corresponding to its transverse diameter, and on the other hand engage the proximal oblique surfaces **385**, **385'**, of proximal extensions **383** of the rotation

locking element **380** of push-pull rod **350**, which show the same slope. Locking element **380** is pushed towards distal after the engagement of its proximal extension **385** to the oblique surfaces **328** of the insertable frame **320,** when inserting the clamp **600** in the elongated shaft **670** and the screwing of the two, viewing that the spring **615** is being compressed. Also this leads to the disengaging of teeth **381** , off indentations **610** located on the insertable framework. This allows the free rotation of push-pull rod **350**, respectively the locking / unlocking of its translational movements. Note also the push-pull rod **350** driven with its long transversal axis horizontally oriented, allowing free movement. Drive rod 340 centrally crosses through the internal tube **320**, to it being attached to the rod fastening device **347,** as previously described. When pushing the drive rod 340 towards distal, it will transmit its force to the push-pull rod **350** of the clamp, and by pulling, the force will be transmitted through the slides **344**, respectively element **346**, which prevents the dislodging of the proximal segment **355** of push-pull rod **350**. Internal tube **320** distally ends in two parallel arms **322** each having a prominent proximal surface **330**, delimiting a polygonal slot **326** previously described.

Figure 42 shows a sectional side view of the clamp - elongated shaft coupling , with the push-pull rod **350** rotated in vertical position, thus locking its translational movements. This rotation is accomplished by, and together with the internal tube **320,** also illustrated in a vertical position, and is an intermediate stage in the process of attachment, respectively detachment of clamp **600** to / off the elongated shaft **670**. Clamp **600**, as previously described, presents forceps jaws **101,102**, overturning around axis **105**, which is fixed to the external frame **103**. Transversal portion of the external frame continues with the insertable frame **607**, described above, centrally routed by push-pull rod **350**, also figured in vertical position. In this way, the indentations **357** of the push-pull rod **350** engage with locking device **612** represented by horizontal indentations applied on the inner surface of the insertable frame **608**, blocking the movement of the push-pull rod **350**. Components are similar to those illustrated in the previous figure, the difference being given by the rotation of the push-pull rod **350** by 90 degrees around its longitudinal axis. Note, in the proximal portion of the frame **607**, the locking element **380** being pushed to the distal , compressing spring **615**, by the backpressure given by the engagement of its extensions **383** to the internal tube **320,** when fixing the clamp **600** by screwing into the external tube **680**. Locking element is rotated by 90 degrees together with the push-pull rod **350** so that

the teeth **381** located at its proximal extension are located in vertical position, and also disengaged from teeth **610** of the insertable frame, thus allowing the rotation of the push-pull rod **350**, respectively to lock / unlock the translational motion of the rod.

Elongated shaft **670** comprises an external tube **680**, that is circumscribing the internal tube **320**, there being a cleavage space between the two tubes, which allow their separate rotation. Internal tube **320** is shown rotated, with terminal arms **322** in vertical position, which present the same specifications as described in figure 15, ending in two oblique surfaces **328**, that engage the obliquely cut proximal portion **385**, of the rotation lock element **380** of push-pull rod **350**, which presents the same slope. Inducing a rotational movement to the internal tube will also lead to the consequent turning of the push-pull rod **350,** and of the blocking element.

Drive rod 340 centrally routes the internal tube **320**, to it being attached the clamp rod fastening mechanism **347**. The rod **340** will remain within the internal tube, bordered by the two side fins **323**, which do not allow the disengaging of **347** from recesses **352** which border the proximal portion of push-pull rod **350**.

Figure 43 shows a sectional side view of the clamp-tube coupling , at the time of attaching , respectively detaching the clamp. This stage is preceded by the rotation of the rod in a vertical position, as illustrated in previous figure, and in case of attaching the clamp, the sequence of events is reversed (Figure 43, 42, 41).

In this way indentations **357** located on lateral sides of the push-pull rod **350** engage the locking element represented by the horizontal teeth **612** applied on the upper and lower inner surface of the insertable frame **608**, blocking the movements of the push-pull rod **350**. This is a necessary condition for detaching the clamp. Locking element **380** is rotated by 90 degrees, together with the push-pull rod **350,** so that teeth **381** located at its proximal extension's **383** base lie vertically, engaging with the indentations **610** which are located in crown on the internal proximal edge of the insertable frame. This happens because the lock element's **380** extensions **383** are released from the counter pressure given by the terminal surface **328** of the internal tube **320**, while unscrewing the clamp from the elongated shaft. The rotation lock element **380** is pushed proximally, maintaining the engagement between indentations above mentioned by spring **615**, thus stopping accidental rotation and skidding of the clamp until the proximal extension of the rotation lock is pushed toward the distal.

Elongated shaft **670** comprises an external tube **680,** that is circumscribing the internal one **320**. In the distal portion of the external tube **680**, it presents on its inner surface the clamp fastening mechanism **699,** consisting of a screw **690**, which, depending on the direction of rotation of the external tube **680** in relation to the inner one **320** , leads to the screwing/unscrewing of the clamp **600** by the thread **608** located on the outer surface of the insertable frame **607**, making the attachment of the clamp to the elongated shaft possible.

As described previously, drive rod 340 passes through the internal tube **320** , pushing push-pull rod **350** in the same direction through surface **342** applied on the proximal clamp portion **355**. Meanwhile, triangular elements **346** are disengaged from recesses **352,** after contacting the prominent surface **330**, being pushed sideways, as previously described. The clamp is presented with the rod rotated vertically blocking its translational movements.

Figure 44 shows a sectional side view of the housing and rotating assembly in this embodiment. Constituent elements are essentially the same as those described in figures 24, 25, except recesses **98** located on the inner distal portion of the housing **20** (which replace recesses **97** described above), in this variant of curved form, which are entered by the projections **75** located on the outer surface of internal segment **90** of the rotating assembly **50,** when the proximal segment **90** is pulled by trigger assembly 85. With external segments **60** and **90** internal of the rotating assembly **50** engaged, and the trigger assembly 85 being pushed to the distal, as illustrated in the figure, we find the elongated shaft-clamp coupling as illustrated in Figure **41**.

Once with pulling the trigger assembly 85 proximally we obtain the rotating assembly module coupling **50** illustrated in **Figure 45**.

Following the movement of trigger assembly 85 through collar **95**, the internal cylinder's outer projections **75** will enter into recesses **98** (not seen in this figure) of the housing, which leads to the internal cylindrical segment **90** rotation by 90 degrees relative to initial position. This motion is also induced to the internal tube by sockets **82** in which the lamellar radial extensions **84** of the tube **320** penetrate. At the distal end of elongated shaft result the joining configuration shown in Figure 42.

Also the disengaging of external segment **60** from the internal one **90** is produced, by extraction of rods **64** off the correspondent recesses located on the distal surface of the internal segment. In this way, the rotation of the external element will not be

transmitted to the internal cylinder, respectively to internal tube **320**, leading only to the rotation in the same direction of the external tube **680**, so to the screwing/unscrewing of the clamp with its jaws blocked at the operating site as it is shown in figure 43.

Figure 46 illustrates a sectional view of a retrieving device of the clamp **700**. The retrieving device **700** consists of a handle **710**, an elongated shaft **720** and a prehensile element **440**.

The elongated shaft **720** consists of three concentric sheaths, an external one **722** fixed to the handle, an internal mobile sheath **724,** acted by the plunger, presenting in its distal portion two internal knobs located diametral opposite **725,725`**. Between the two sheaths a middle sheath **726** is interposed, which comprises the internal sheath, being rotationally immobile to the external sheath **722** due to of some lamellar radial extensions **728** proximally located, which enter into longitudinal recesses **721,** located on the internal surface of the external sheath, which allow thus only the translational movement of the middle sheath in relation to the external one. The middle sheath is also translational immobile in relation to the internal sheath **724**, being attached proximally by an internal collar **730**, which enters in a circular recess located on the external surface of the internal sheath, and also distally, level on which it exceeds the internal sheath, where it presents a crown **731** with indentations **732** on its distal border, permitting thus only rotational movements between the two mentioned sheaths. The internal sheath is routed by a rod **736**, which continues on its distal end with the prehensile element **440**. This comprises a fixed part **442**, which continues the rod **736** and presents on its distal end a hook **444** and at the proximal end an axle **446** around which the mobile segment **449** pivots. The prehensile element is maintained in opened position by a leaf spring **448,** interposed between arms **442** and **449**.

The handle **710** presents a plunger **712** with a rotating cylinder **711** in its proximal part, which is articulated by a cylindrical articulation **713** with a ring **714**, in which the operator`s thumb is inserted. The plunger **712** penetrates in the solid portion **716** of the handle which presents two side recesses **718,718`**, in which the index and middle finger of the operator are inserted.

The internal sheath **724** is in extension of the plunger **712**, and, at the level of the solid portion **716** of the handle, presents an elliptic hole **748.** At this level, rod **736** is fixed on the handle, by a transversal bar **746**. The attachment of the rod **736** is done by a cylindrical articulation **740**, which permits free rotational movements of the rod.

By pushing towards distal the plunger **712,** the according gliding of the internal sheath **726** and of the middle one is accomplished, and by rotating the cylinder **711,** the according rotation of the internal sheath **726**, and the prehensile element **440** is made, along with rod **736**, in relation to the external sheath **722** and the medial one **726**.

Figures **47**, **48** illustrate the functional mode of the retrieving device **700**, in order to extract the intracorporeal placed clamp **600**.

By pressing the plunger **712** in relation to the solid part **716** of handle **710**, the according gliding of the medium **726** and internal **724** sheaths is accomplished, in relation to the external sheath **722** and the central rod **726**, these being fixed at the level of the handle **716.**

The clamp **600**, having the characteristics previously described is applied during a surgical intervention, with push-pull rod **350** rotated in vertical position, thus blocking the movements of the clamp`s jaws **101,102**. To extract it from the body, the hook **444** located at the distal end of prehensile element is inserted in orifice **357** of the proximal segment **355** of push-pull rod **350**.

By pressing plunger **714,** the according gliding of the internal sheath **724** and medium one **726** is accomplished, in relation to rod **736** and prehensile element **440,** resulting at a first time the closing the mobile arm **449** on fixed arm **442** and assuring a fixed grip on the proximal segment **355** of push-pull rod **350**. The progressive gilding towards distal accomplishes the alignment of the long axis of the clamp **600** to the one of extractor instrument **700** and the approach of the proximal extension of unlocking element of rotation **383** by the internal knobs **725,725`** of the internal sheath with their pushing towards distal. This way, the blocking element **380** of the rotation (Fig. 37) is pushed towards distal, permitting the free rotation of push-pull rod **350**. At the same time, crown **731** with indentations **732** is applied on the proximal border of cylinder **607**, provided with congruent indentations **603**. The rotation by 90 degrees of cylinder **711** the pivoting of the internal sheath **726** and the prehensile element **440** is realized, along with rod **736**, related to the external **722** and the medium **726** sheath. Teeth **732** located on the distal border of the medial sheath **726** block the clamp's framework rotation, by engaging with teeth **603**, permitting only the rotation of push-pull rod **350**, thus unlocked.

The additional gliding of internal sheath **724** with push-pull rod **350** in horizontal position will lead to the opening of the forceps 'jaws **101,102**, releasing the forceps off the tissue which was grasped by it and extracting it from the body.

It is accomplished thus an extraction mechanism similar to that applied in "opened" surgery, permitting the use of ligatures.

Figure 49 illustrates a side view of an alternative embodiment of the clamp`s jaws **801**, they presenting a prehensional part **170**, with same elements as previously described. Forceps jaw progressively thickens towards proximal, where its segment **880**, pivots around the axle introduced in central orifice **879**. The segment **880** presents a superior side **872**, located in the extension of the jaw and an inferior one **876**, progressively narrowing towards proximal by a triangular extension **874** of the same thickness as the portion **880** which presents a elongated slot **875** with oblique orientation.

Figures 50, **51** shows a superior view respectively side view of the clamp **600** in the embodiment of using opposable jaws **801,802** built as illustrated in the previous figure. The forceps 'jaws are attached to frame **103** by pivot axle **105,** which allows their overturning around it, they being mobilized by push-pull rod **350**.

In the distal part, bilaterally included by frame **103**, the rod ends in a cylindrical articulation **860** in which the terminal portion **365** of rod engages with a frame **867**. The frame continues with a lamellar extension **868**, interposed between the triangular extensions **874**, from which axle **185** derives, and enters into the slots **875** located in the thickness of extensions **874** and sideways is inserted in the internal recesses of arms **102** (Fig. 7) of frame **103.** The distal portion **869** of cylindrical articulation **860** has a semi-elliptic shape on section, having the purpose to engage and push divergently the oblique surfaces of extensions **874,874`**, thus transmitting an augmented force for the closing of the forceps 'jaws. The training the forceps 'jaws is made, by divergent pushing of extensions **874** with the progression of push-pull rod **350** towards distal, and their converging in case of pulling towards proximal, by the axle **185** that is inserted in slots **875**. At the level of the articulation **860** starts a transversal axle **865**, also inserted in internal recesses of arms **102**, which gives it stability.

The other constitutive elements of clamp **600** were previously described. Also arms **801,802** can be applied as an alternative embodiment of clamp`s construction in the previous embodiments.

Figures 52 and **53** illustrate a superior, respectively side view of the clamp in an alternative embodiment in which the forceps 'jaws are replaced by scissors **901,902**. The constitutive elements are the same as the ones described in figures 34,35,36 as concerning the cylindrical segments **180**, their engaging with push-pull rod **350**, frame **103**, except for the insertable frame **607,** which is embodied in this version only by the portion which presents the outer thread **608** with the purpose of its screwing in the elongated shaft **670,** and push-pull rod **350**, which no longer presents indentations on its side surfaces.

Figures 54, **55** and **56** illustrate a side view through clamp **600,** with opposable jaws of the forceps have shapes that allow them special purposes in a surgical intervention. There are represented the arms of a " crocodile- forceps" **911,912**, in figure **54**, these presenting strong teeth **913** oriented towards proximal, which accomplishes a strong gripping force on the tissue. The opposable arms **921,922** illustrated in figure **55** have a shape which delimitates an internal cavity **923** resulting a biopsy forceps.

CLAIMS

1. A surgical endoscopic instrument (1) with detachable end tool as a clamp, comprising a retrievable clamp (100,500,600), removably connected by a coupling (199,599,699) to an elongated shaft (80,570,670), this comprising of two concentric tubes, an internal one(320), and an external one(300,580,680), which can rotate about each other, connected to a rotating assembly (50), that is attached to a housing (20), inside which a push-pull rod (12), driven by a handle (30), transmits the surgeon's commands, leading to the actuation of the clamp's jaws (101,102,801,802), as well as the clamp deployment /retrieving , from /to the elongated shaft, by operating the coupling(199,599,699), given by the rotation of the concentric tubes in relation to each other, thus resulting the detachment /attachment of clamp with its jaws blocked in their given position at the time of detachment.

2. The retrieving device (400, 700) of the detachable clamp comprising a grasping element (440), provided with a fixed arm (442) with a distal hook (444) and a mobile arm (449), attached trough an elongated shaft (420, 720) consisting of concentric sheaths (422,424,722,724,726), to a handle (410, 710), where the push of a plunger (412, 712), leads to the sliding of some sheaths in relation to the other(s), and subsequent clamp (100,500,600) seizing, clamp jaws release (101,102,801,802), and clamp(100,500,600) retrieval from the human body.

3. The clamp (100,500,600) of claim 1 , that comprises two actuatable opposable jaws (101,102) driven by a push-pull rod (150,250,350), by means of levers (110,110'), which convert the translational motion of the push-pull rod into pivoting movement of said jaws, being included within an external frame (103) and an insertable frame(107, 507, 607) that is provided with a thread (120,508,608), meant for the coupling of the removable clamp to the elongated shaft (80, 570, 670), and a locking element (130,160,612,230) for the translational movement of the push-pull rod by ratchet teeth (157,257,357,138,238,612), activated when detaching the clamp from

the elongated shaft, that is released by an unlocking element (140), or by acting upon the rod's rotation locking element(380).

4. The retrievable clamp (600) of claim 3, that comprises two actuatable opposable jaws (801,802) driven directly by a plunger (350), through a cylindrical articulation(860), which converts the translational motion of the rod into pivoting movement of said jaws.

5. The elongated shaft (80,570,670) of the endoscopic surgical instrument of claim 1, comprising an external tube (300,580,680), provided with an inner thread (310,590,690) to which the removable clamp (100,500,600) is removably attached by screwing, and an internal tube (320), longitudinally crossed by an axially moving drive rod (340), with a fastening mechanism (347) for the clamp's push-pull rod (150,250,350), thereby transmitting the surgeon's movements to the clamp jaws.

6. The rotating assembly(50) of the endoscopic surgical instrument of claim 1 that comprises two segments detachable by means of a trigger assembly (85), an external segment (60) fixed to the external tube (300,580,680) of the elongated shaft (80,570,670), and an internal segment (90) that is attached to the internal tube (320) of the elongated shaft, said segments determining by actuating upon the external segment (60) either the deployment or retrieving of the clamp with segments in detached position, or the overall elongated shaft rotation when the segments are in attached position.

7. The coupling(199,599,699) of claims 1 and 3, comprising a thread (120,508,608) on the surface of the insertable frame(107,507,607) of the removable clamp, that is screwed into a thread (310,590,690) of the external tube (300,580,680) of the elongated shaft (80,570,670), whereby the acting upon the coupling is made from the rotating assembly.

8. The housing (20) of the endoscopic surgical instrument of claims 1 and 6, that presents in the portion where it is engaged to the rotating assembly (50) the recesses (97,98) that lead to the locking in a specific position of the internal segment (90) of the rotating assembly when the internal segment (90) is detached from the external segment (60).

9. The handle (30) of the endoscopic surgical instrument of claim 1 that comprises one fixed arm (31), on which a ratcheted rod (70) is attached, that engages teeth (53) of the mobile arm (38), this being provided with a flap mechanism(41), acted upon by extending the operator fingers, that unlocks the ratchet mechanism (65), to release the handle arms (31,38), into acting on the rod (12) of housing (20) for the purpose of opening the jaws (101,102,801,802) of the removable clamp (100,500,600), flap (41) being optional locked with blocking element (47).

10. The method of using the endoscopic surgical instrument with detachable clamp according to claims 1-9, characterized in that in order to achieve hemostasis or to occlude bodily conducts accidentally or intentionally sectioned during surgery comprises the gripping of the bodily conduct or blood vessel with the clamp jaws (101, 102) in order to achieve hemostasis, deployment of the clamp (100,500,600) inside the human body until the application of measures of permanent hemostasis or proper treatment of the injury, followed by retrieval of the clamp from the surgical site using the retrieving device (400,700).

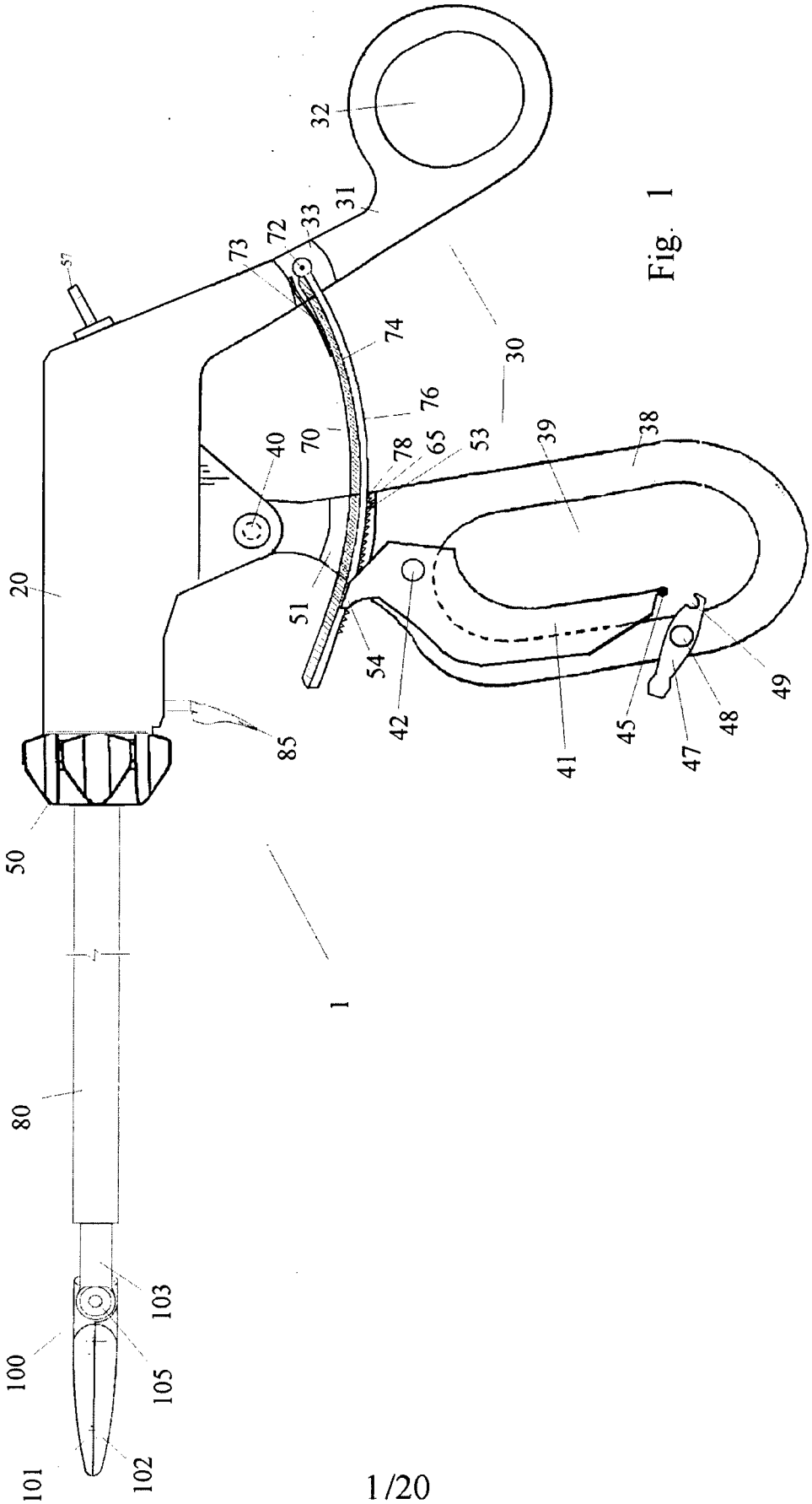
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Fig. 1

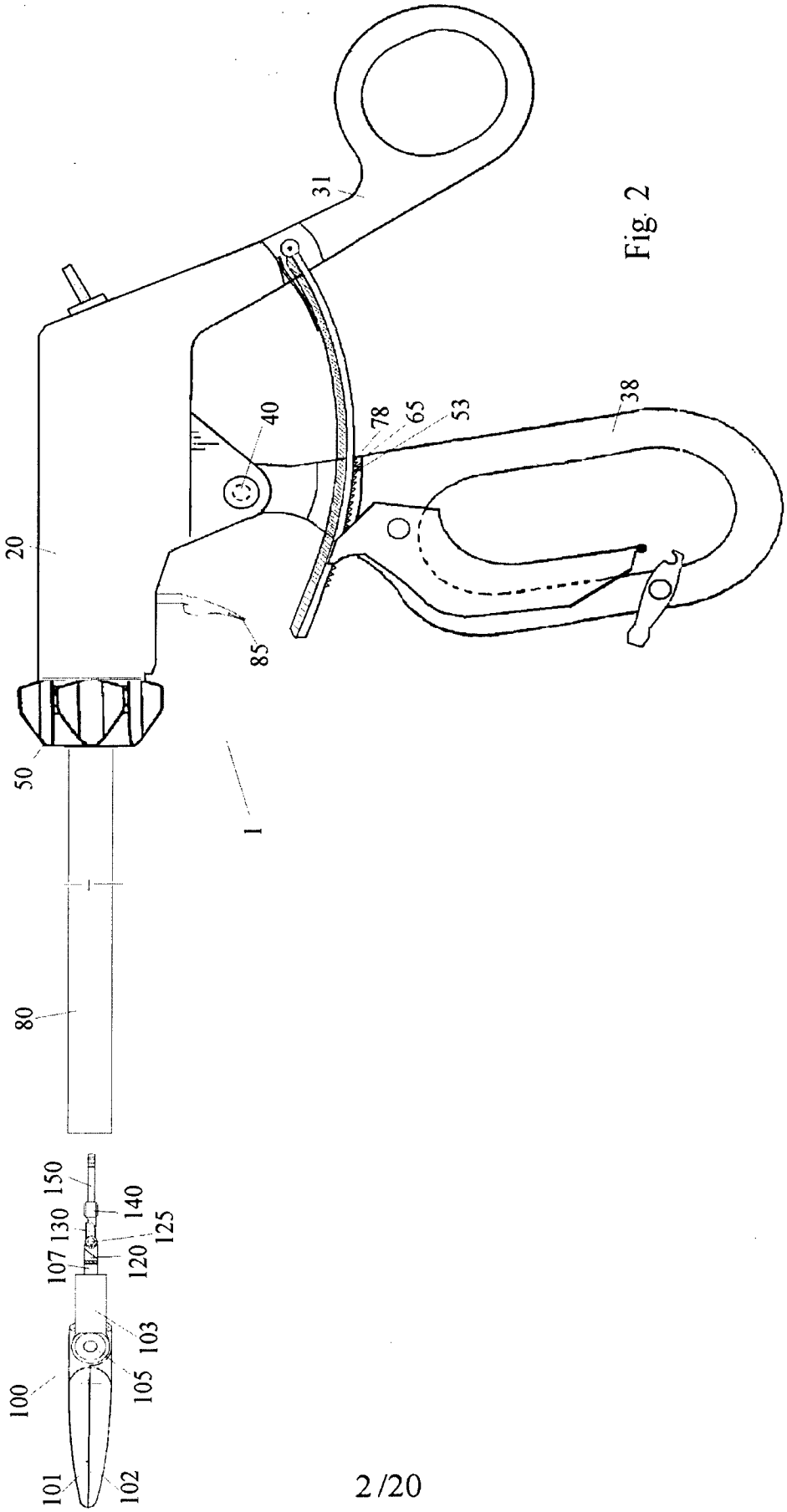
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Fig. 2

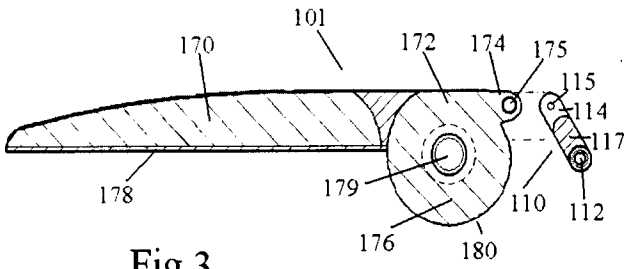


Fig.3

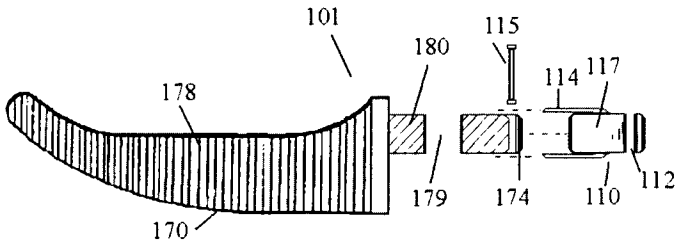


Fig.4

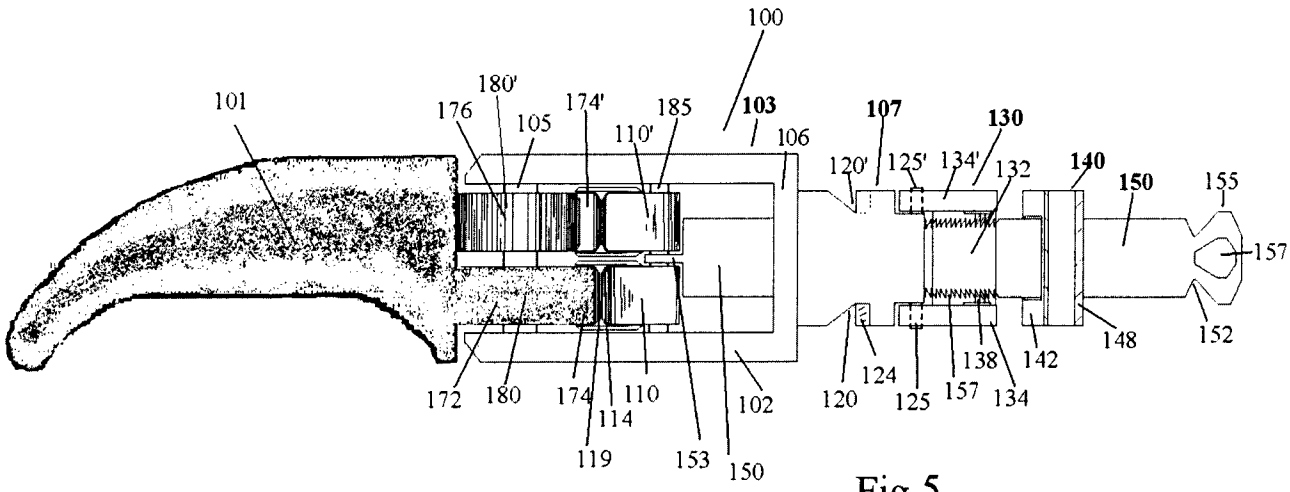


Fig. 5

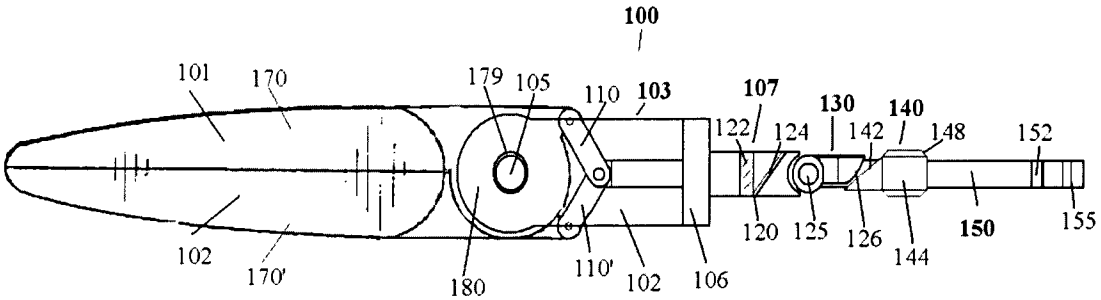


Fig.6

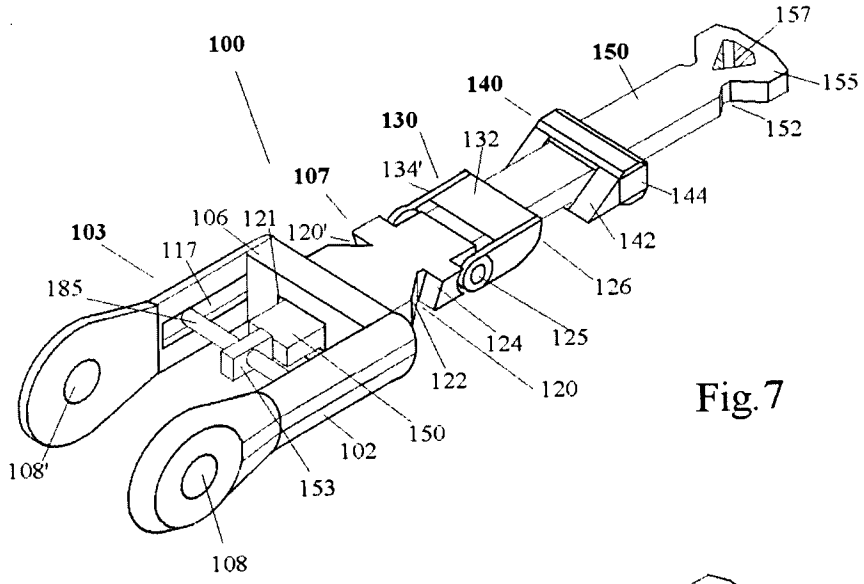


Fig. 7

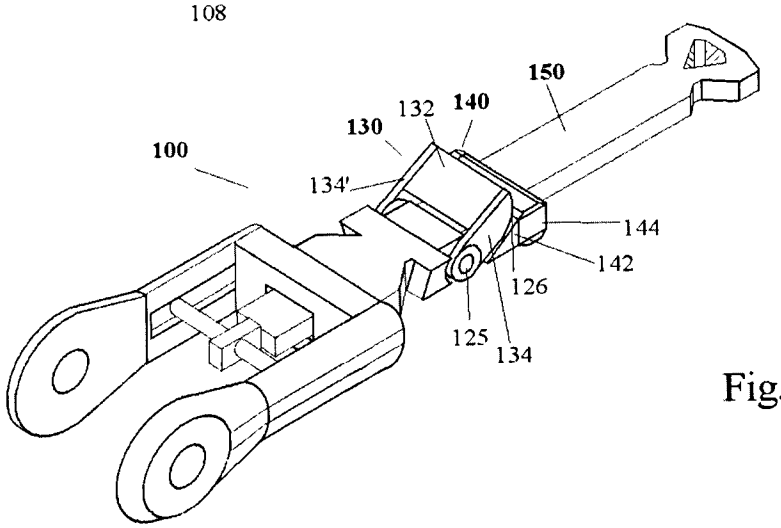


Fig. 8

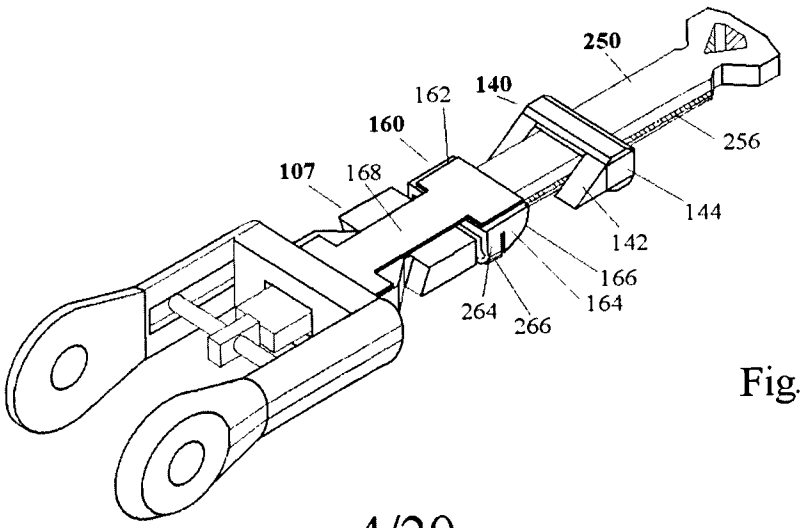


Fig. 9

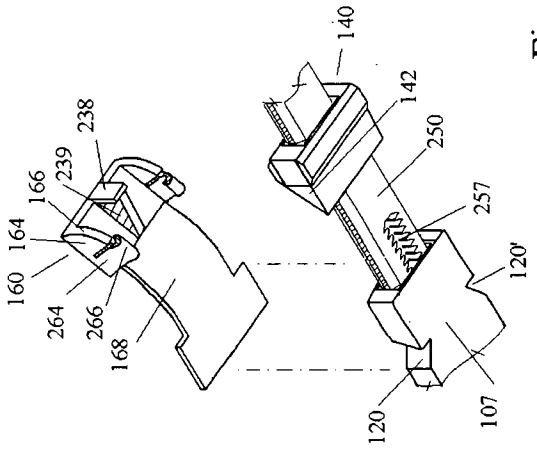


Fig. 13

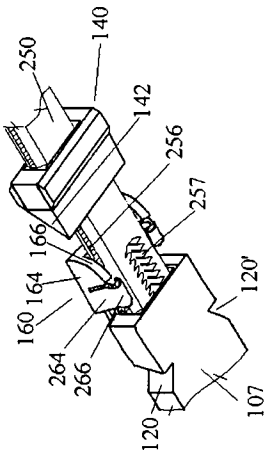


Fig. 14

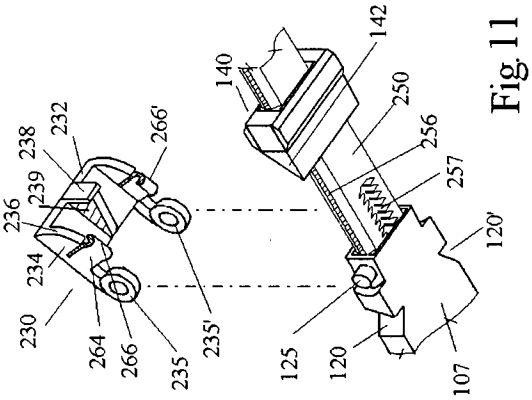
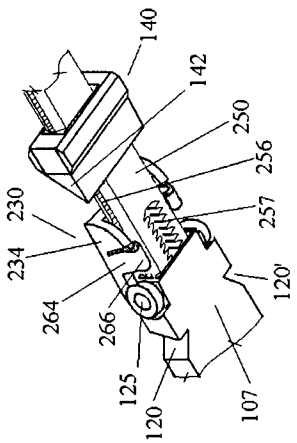


Fig. 11



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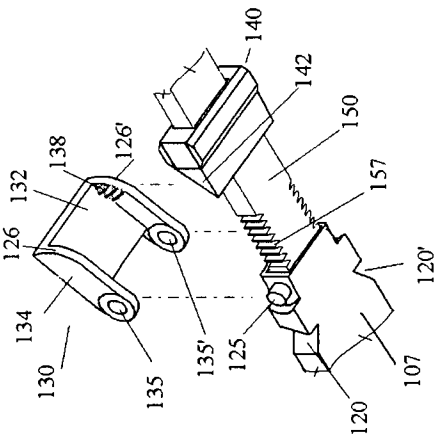

Fig. 10

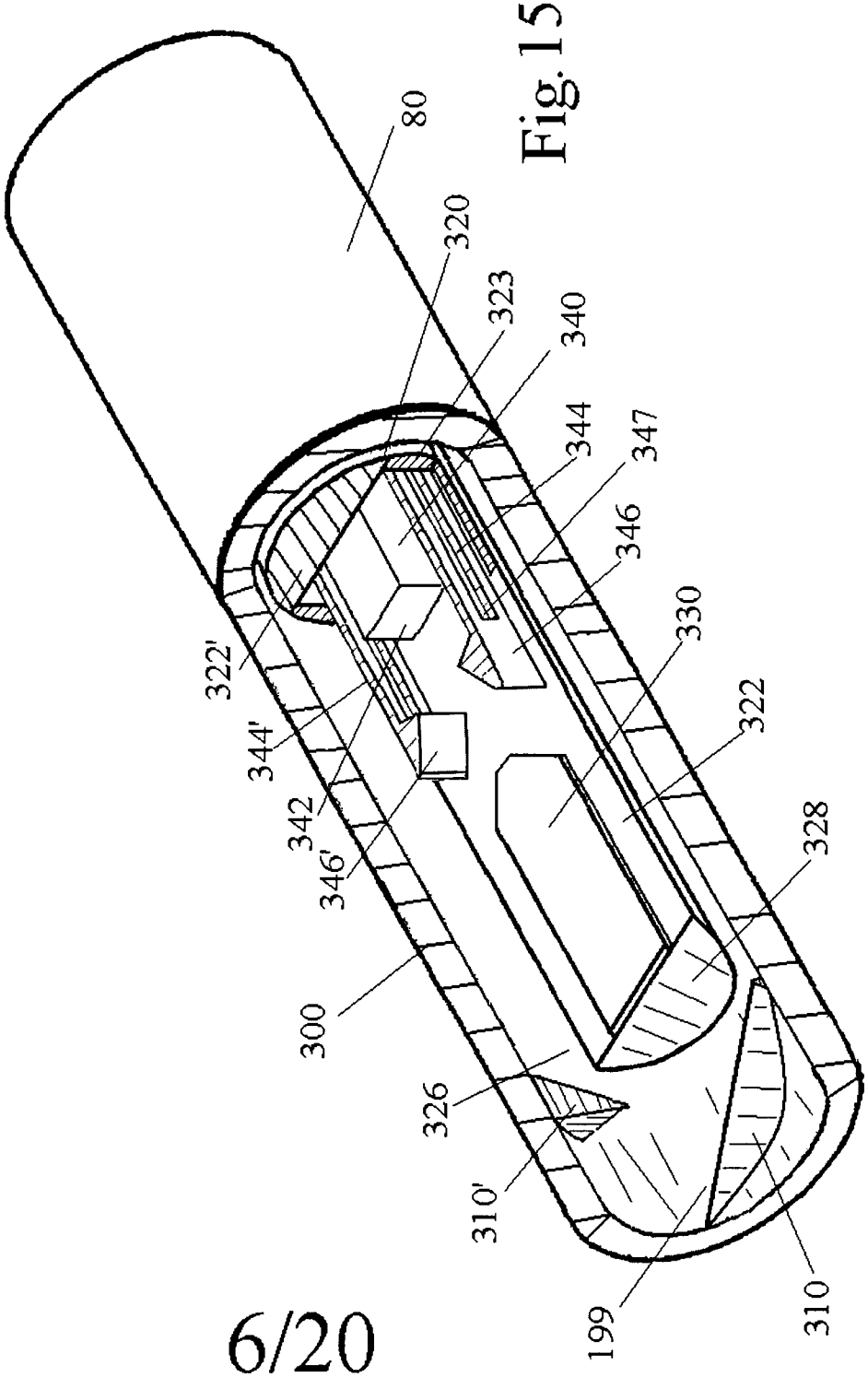
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Fig. 15

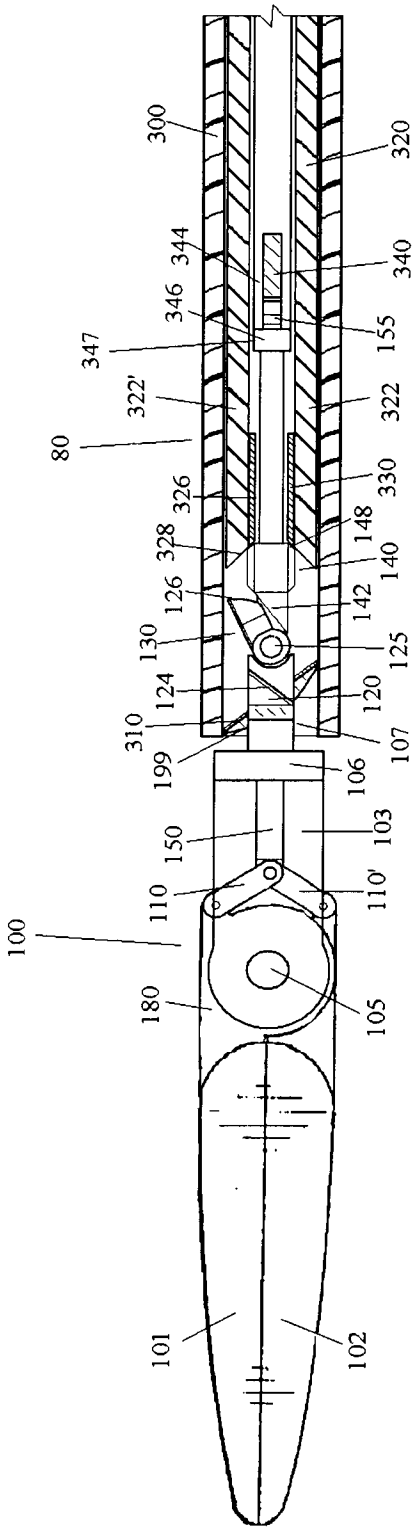
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Fig. 16

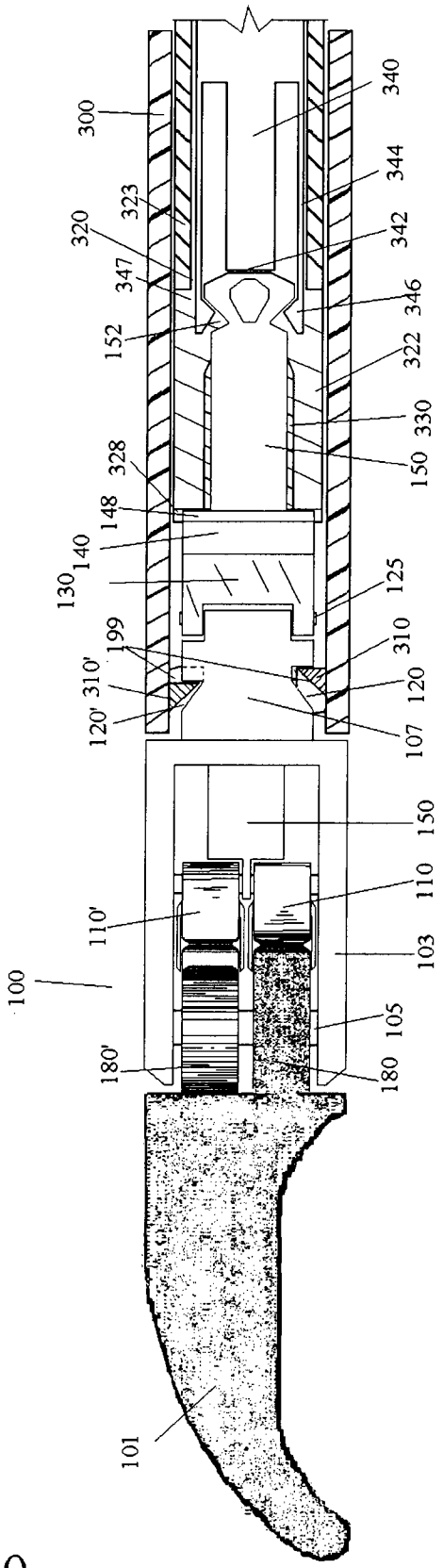
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Fig. 17

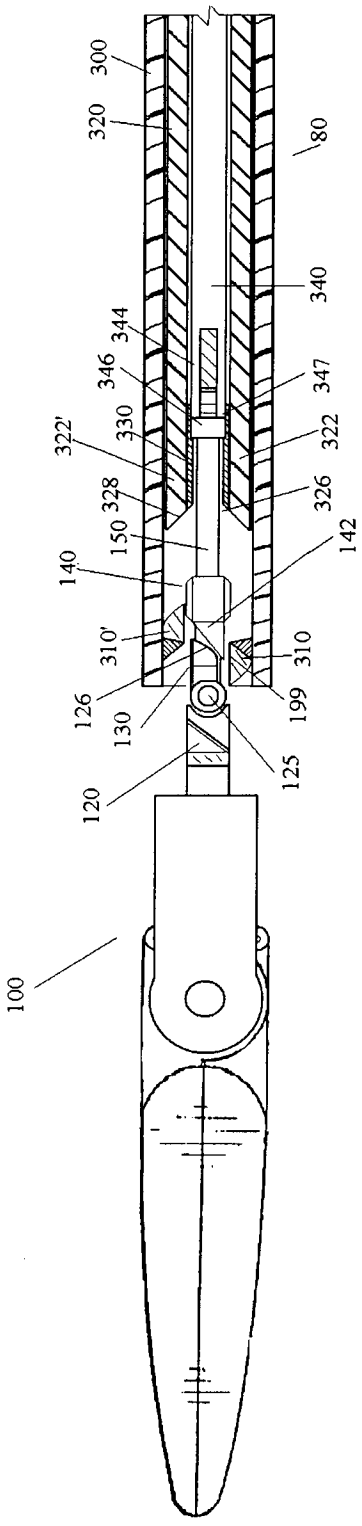
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Fig. 18

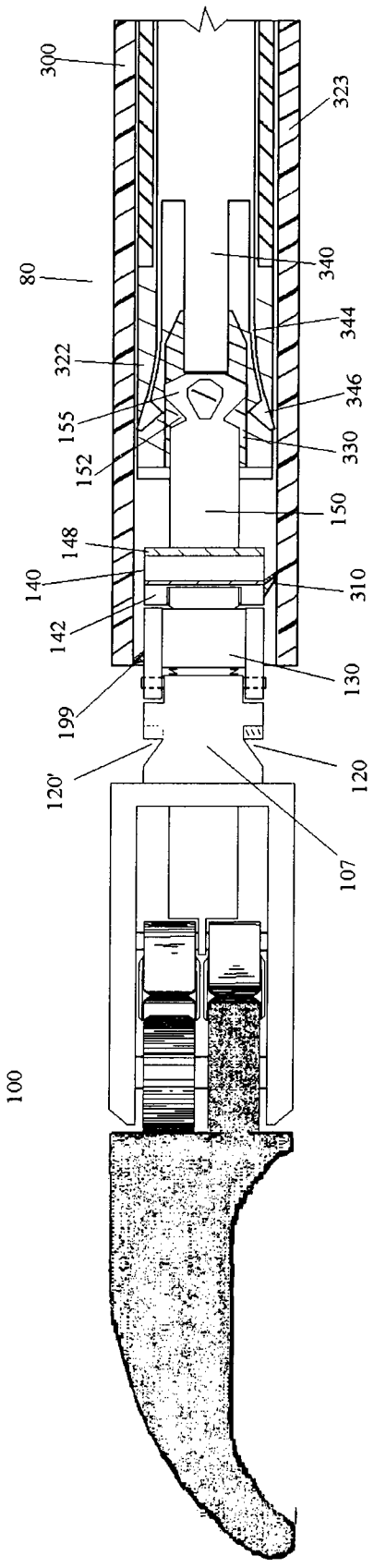
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Fig. 19

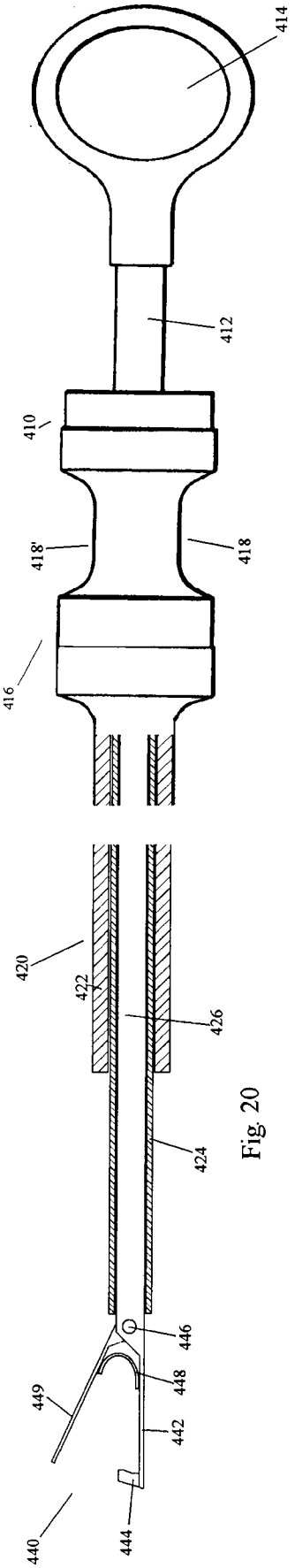


Fig. 20

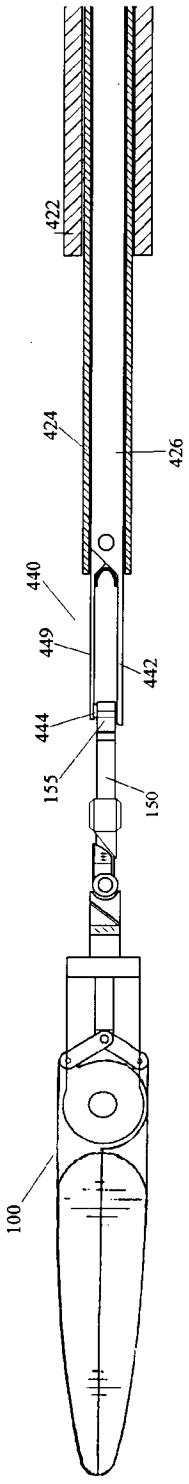


Fig. 21

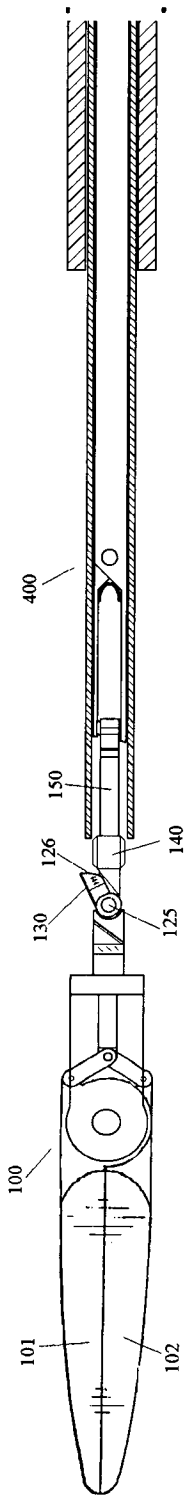
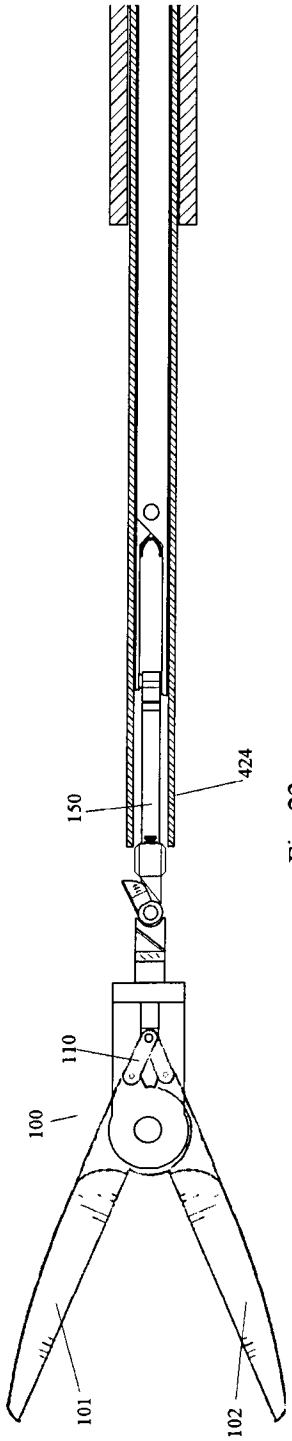


Fig. 22



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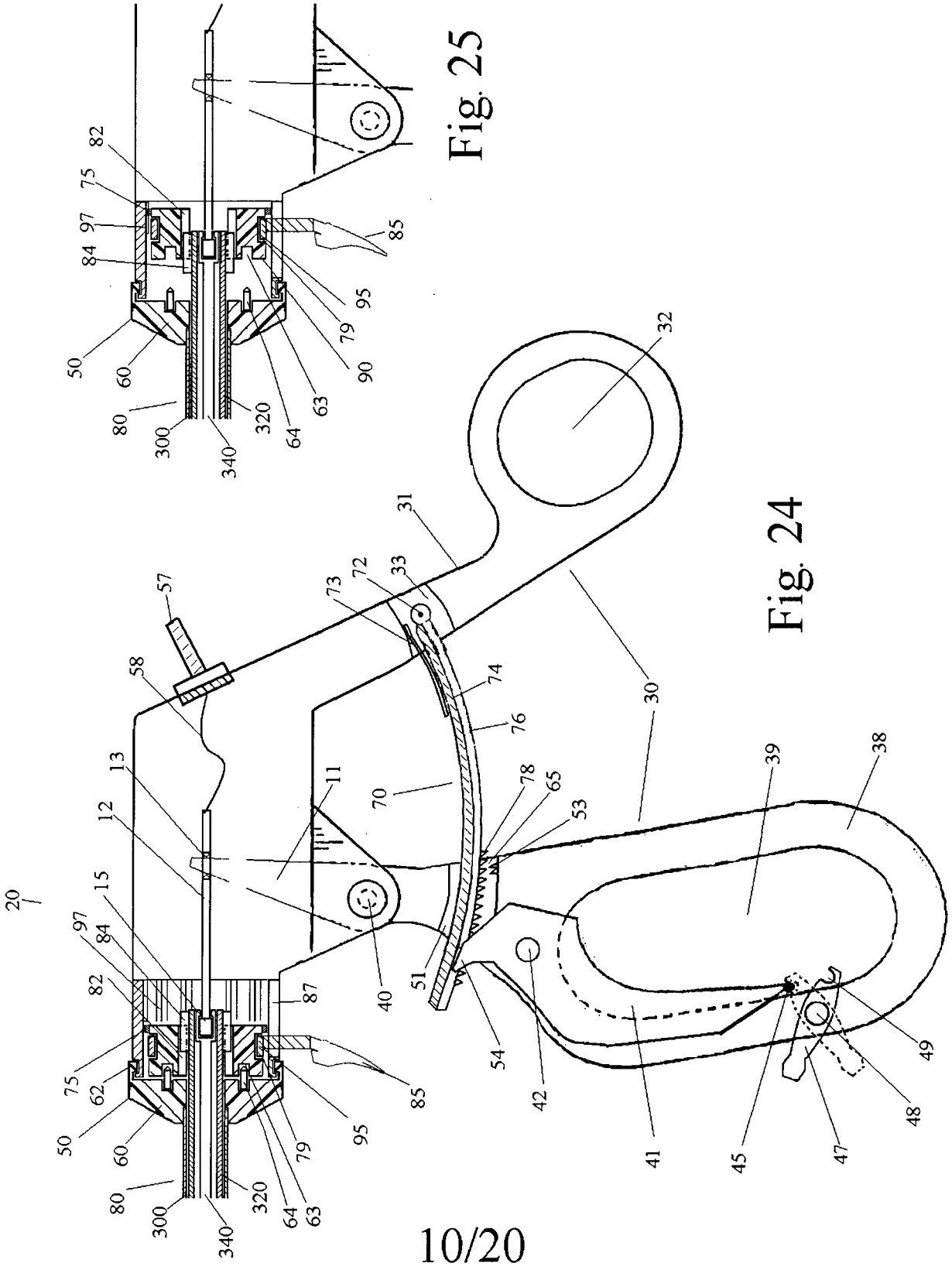
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Fig. 24

Fig. 25

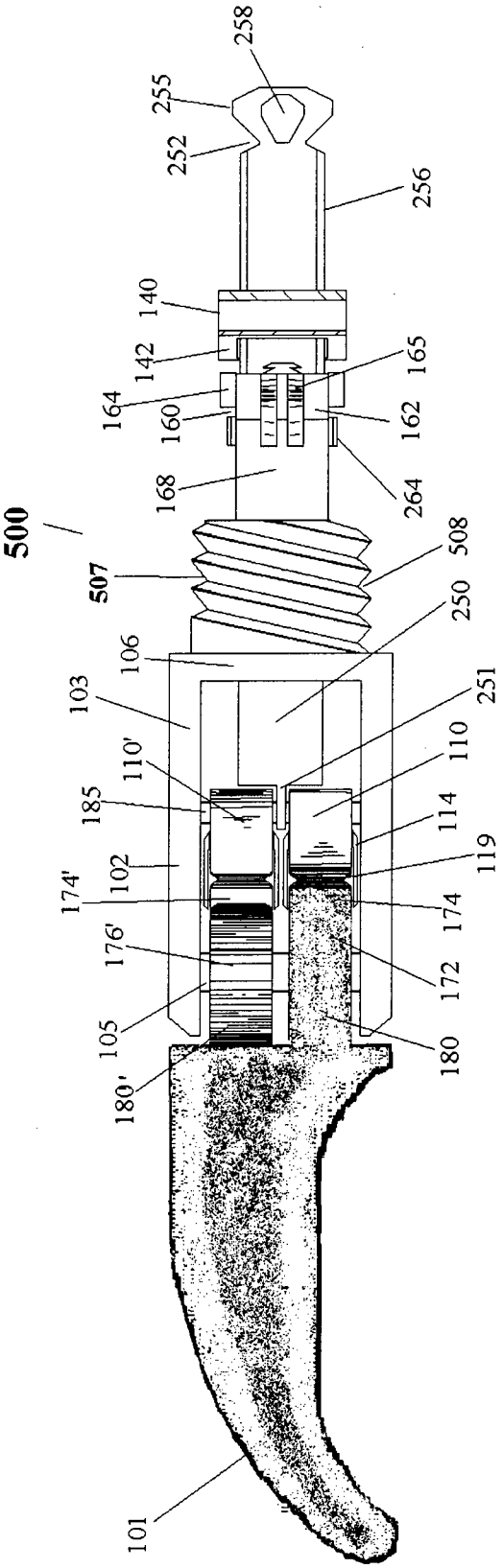
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Fig. 26

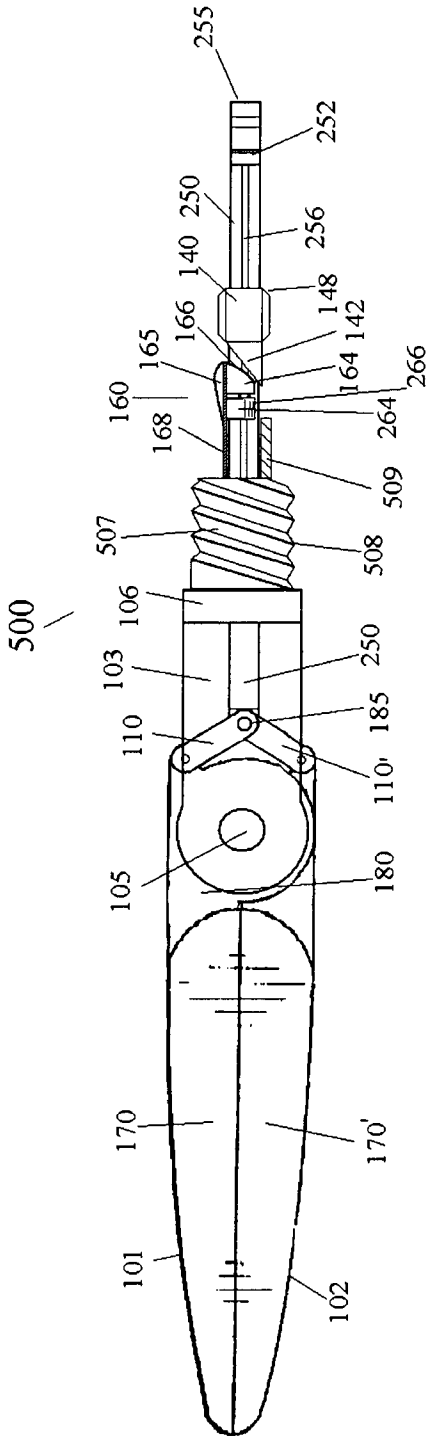
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Fig. 27

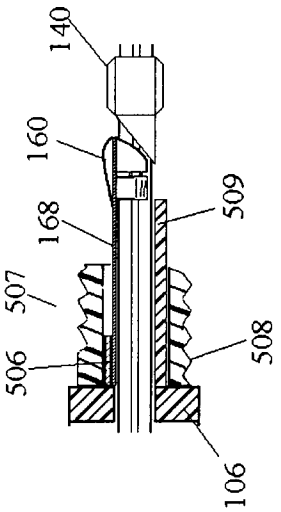

Fig. 28

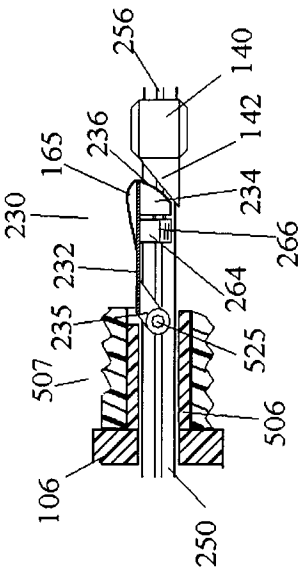

Fig. 29

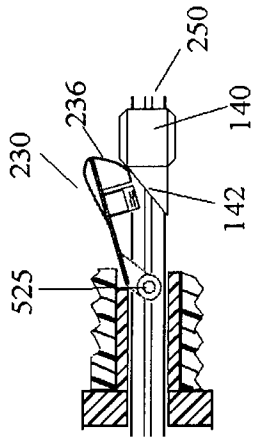

Fig. 30

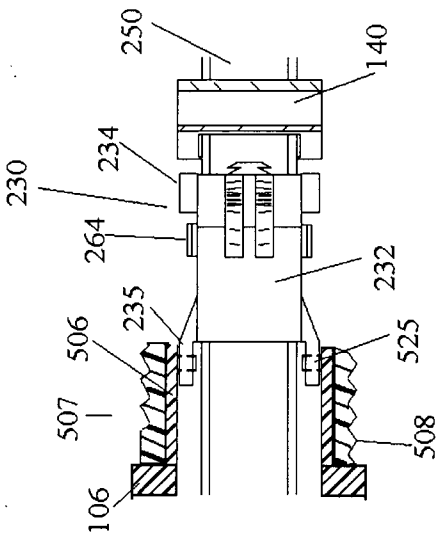

Fig. 31

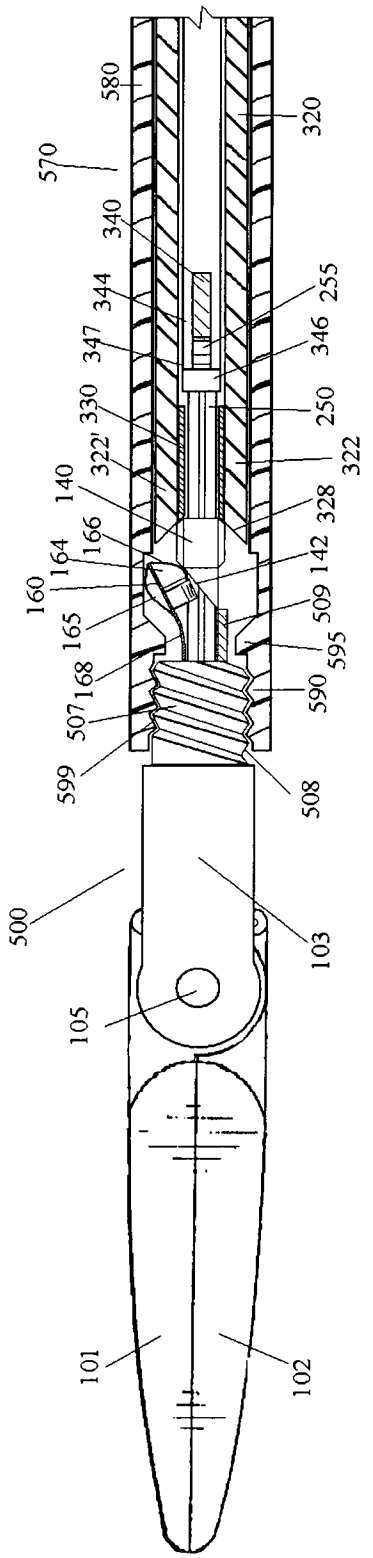
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Fig. 32

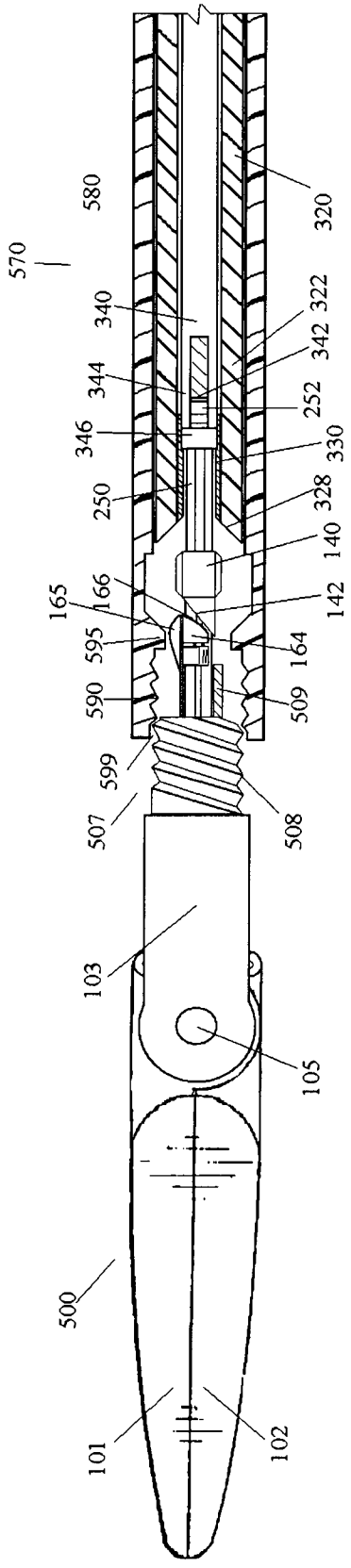
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Fig. 33

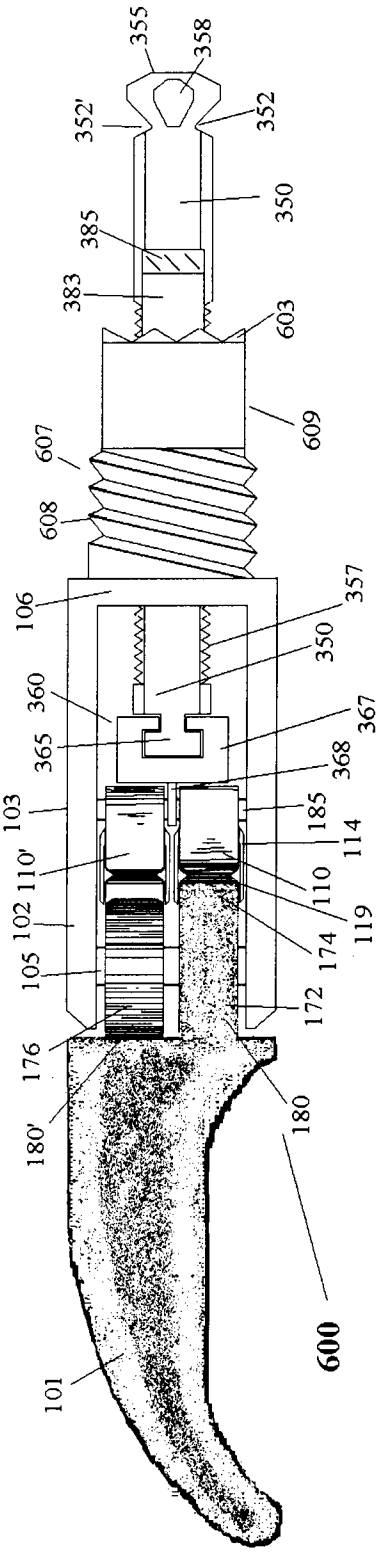

Fig. 34

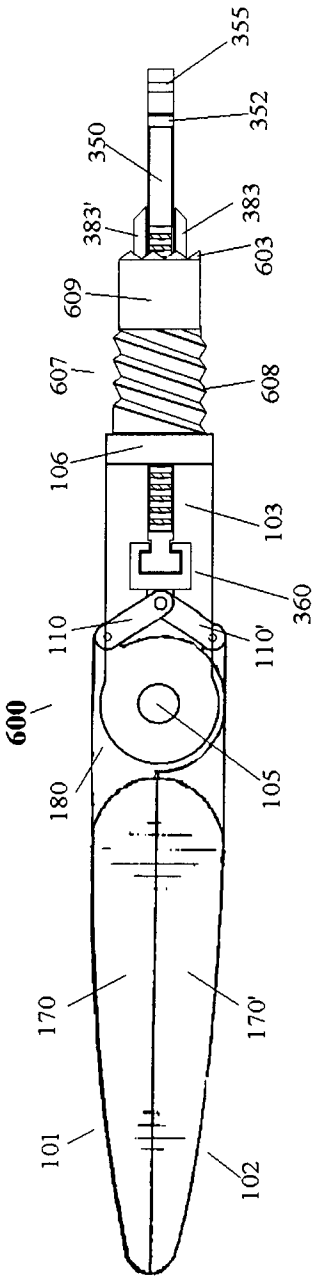

Fig. 35

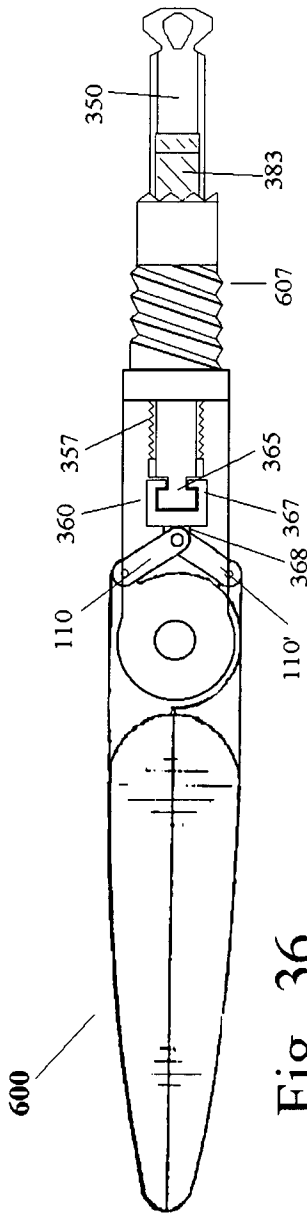

Fig. 36

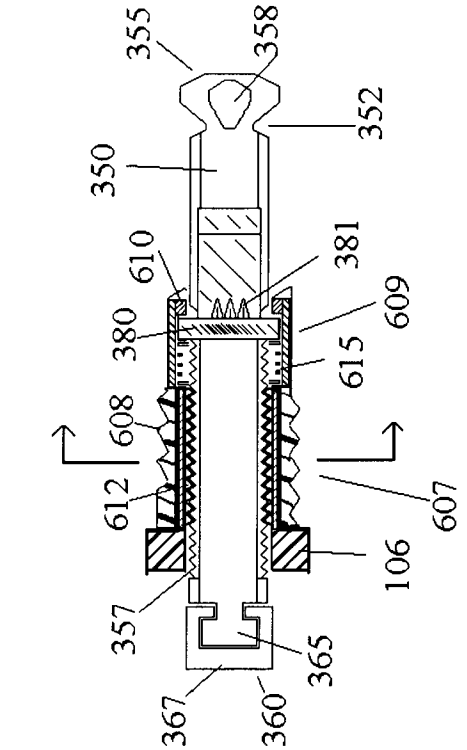

Fig. 39

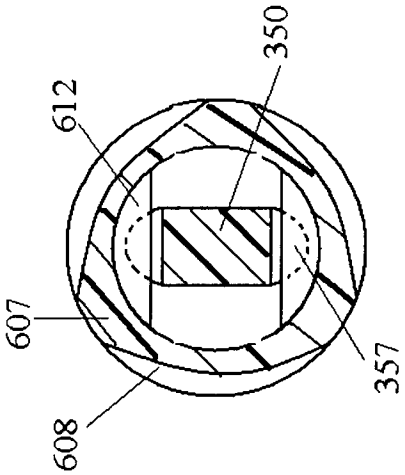

Fig. 40

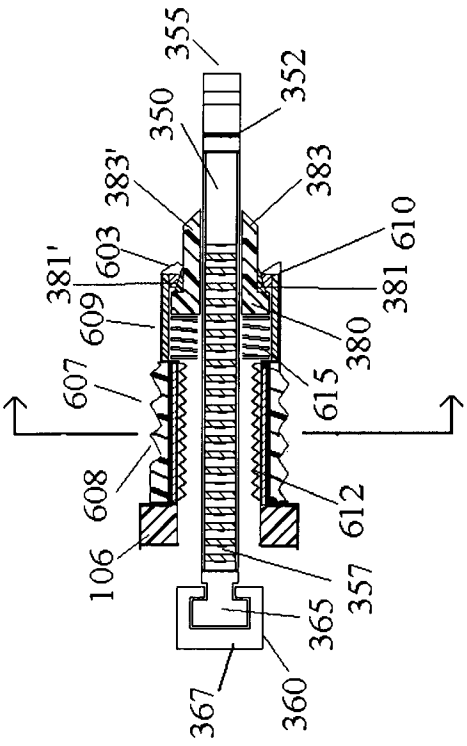

Fig. 37

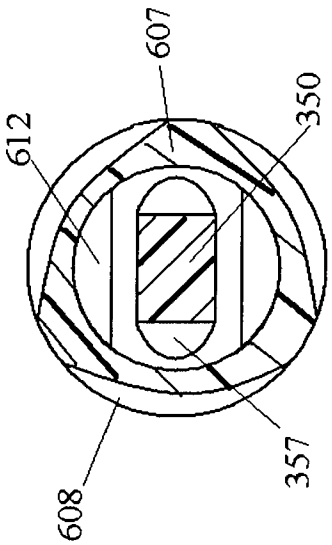

Fig. 38

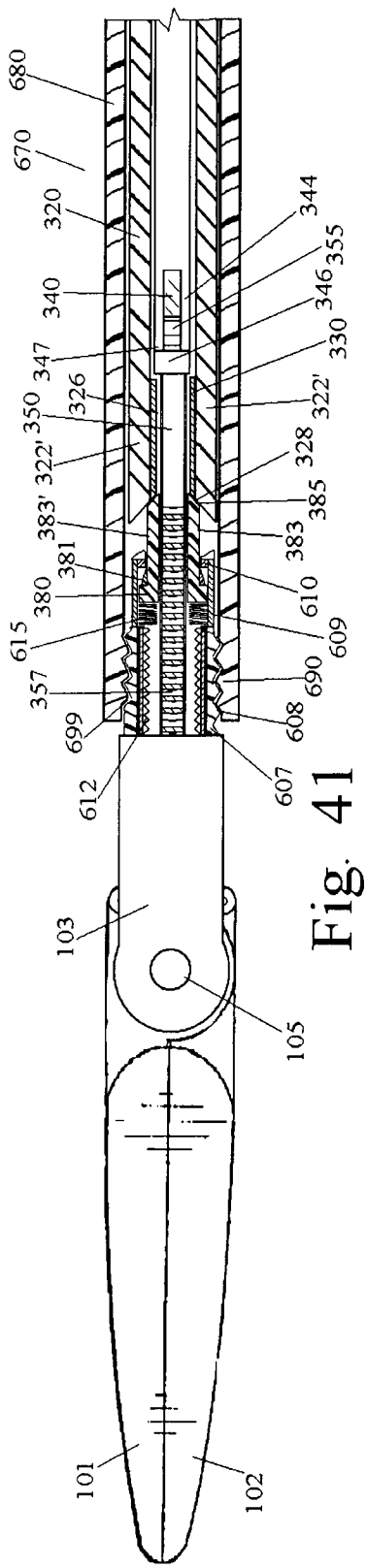

Fig. 41

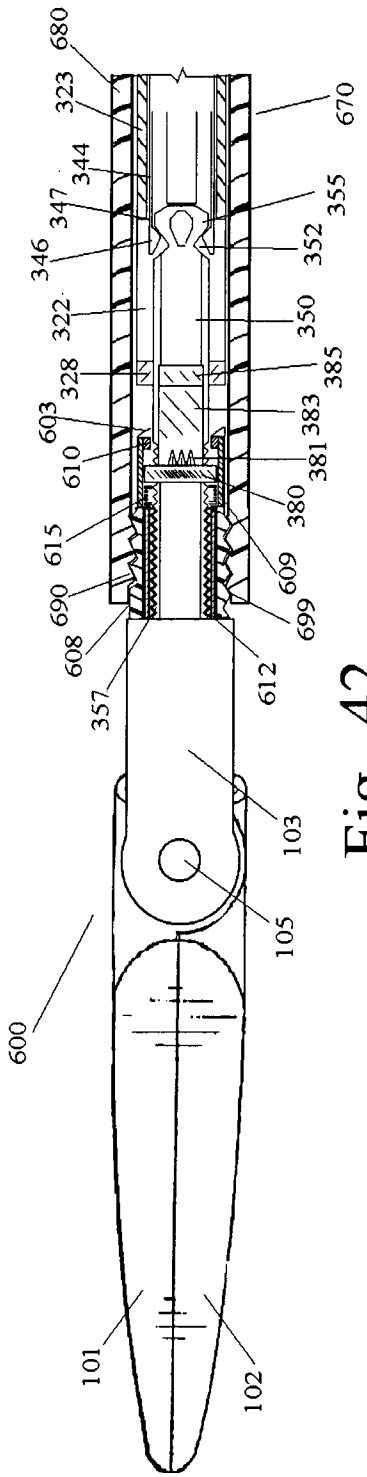

Fig. 42

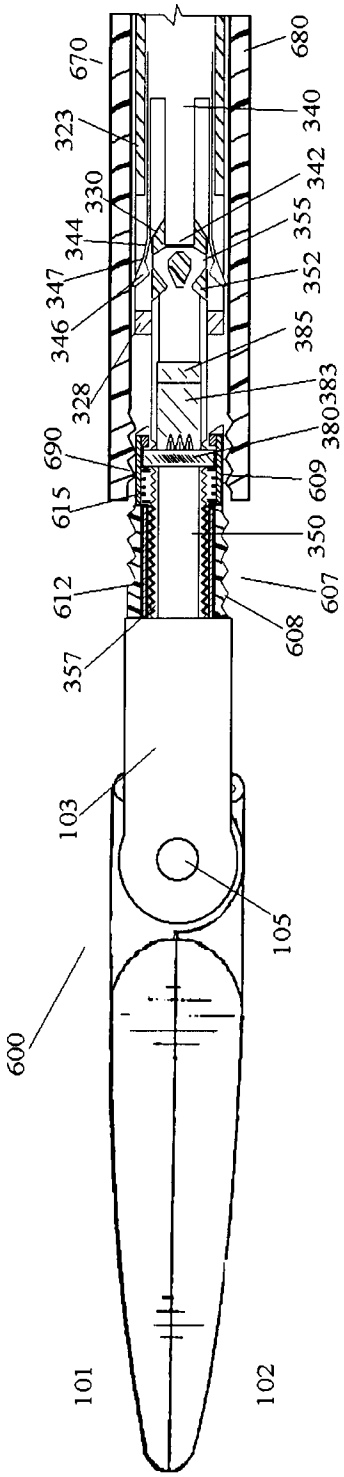

Fig. 43

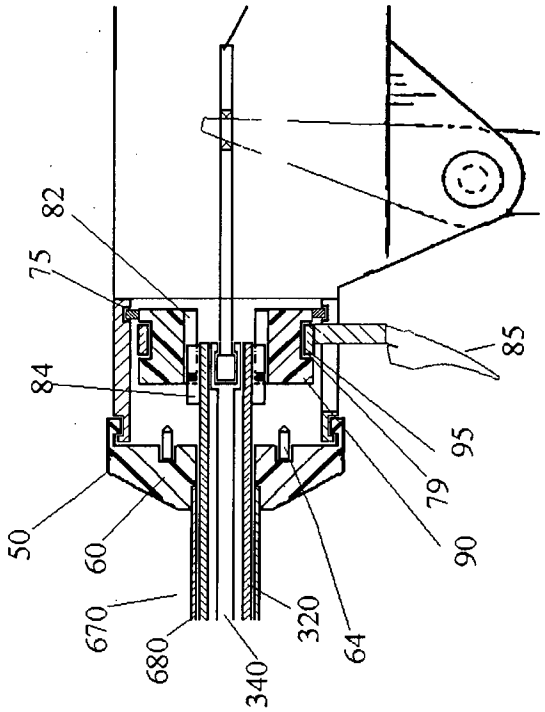
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Fig. 45

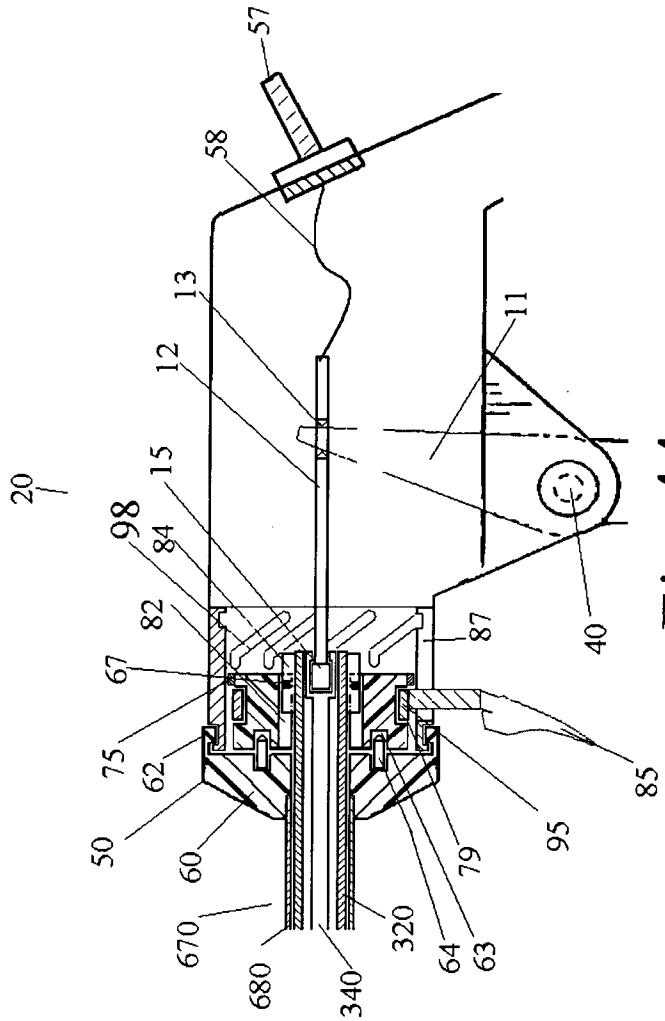
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Fig. 44

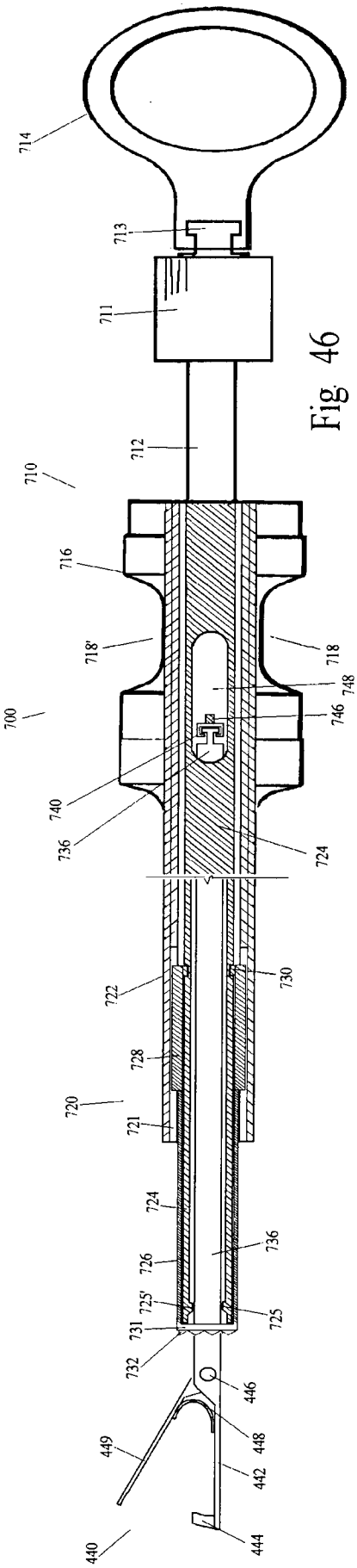

Fig. 46

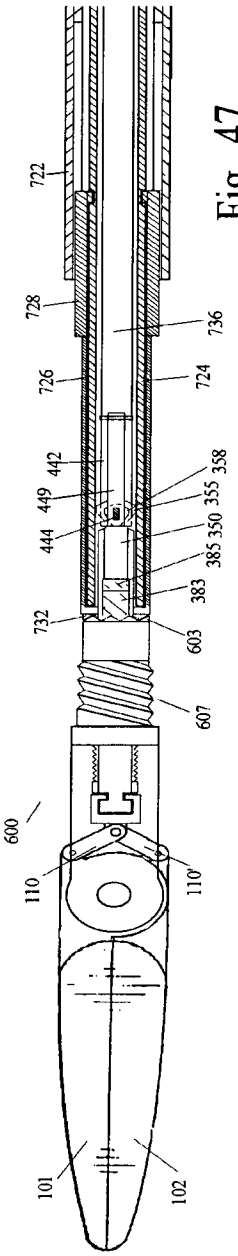

Fig. 47

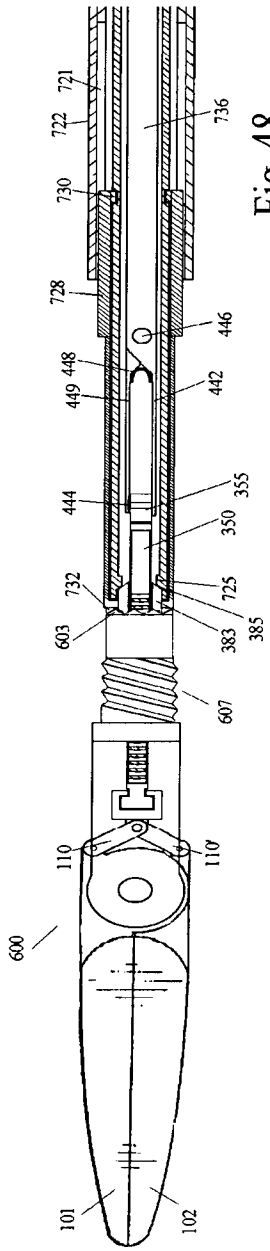

Fig. 48

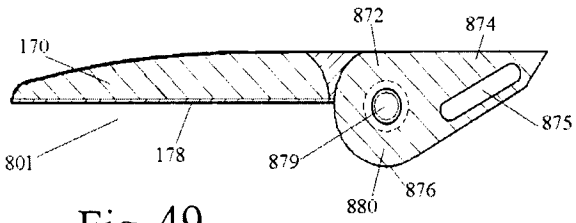

Fig. 49

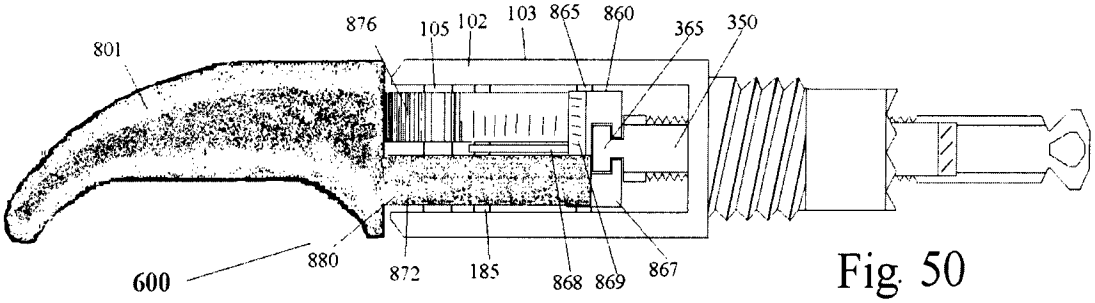

Fig. 50

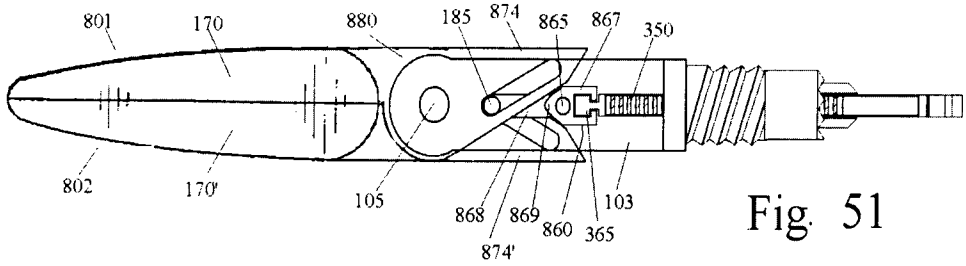

Fig. 51

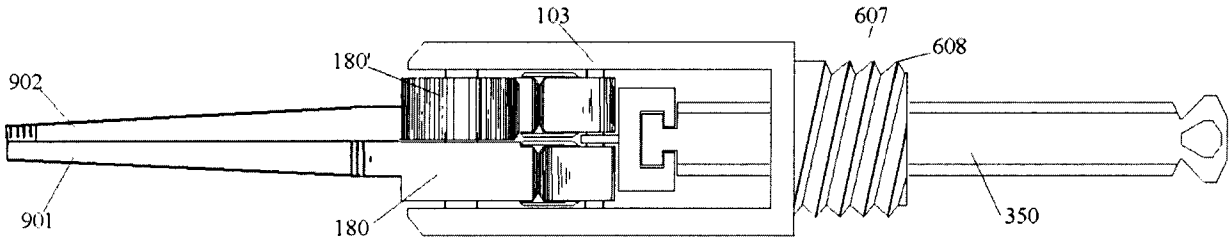

Fig. 52

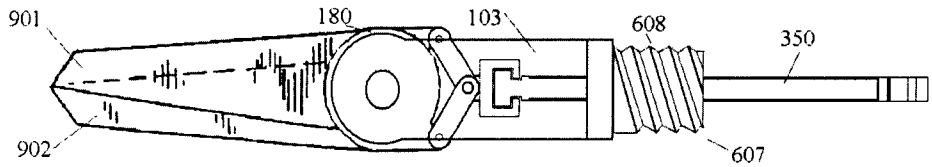

Fig. 53

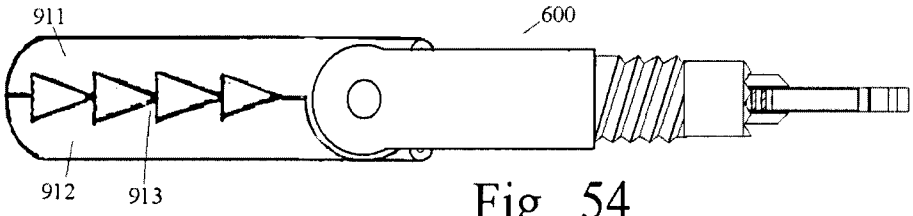

Fig. 54

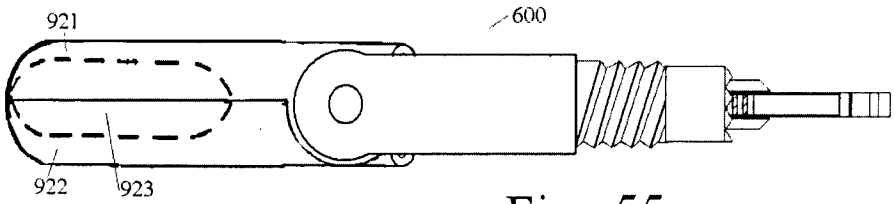

Fig. 55