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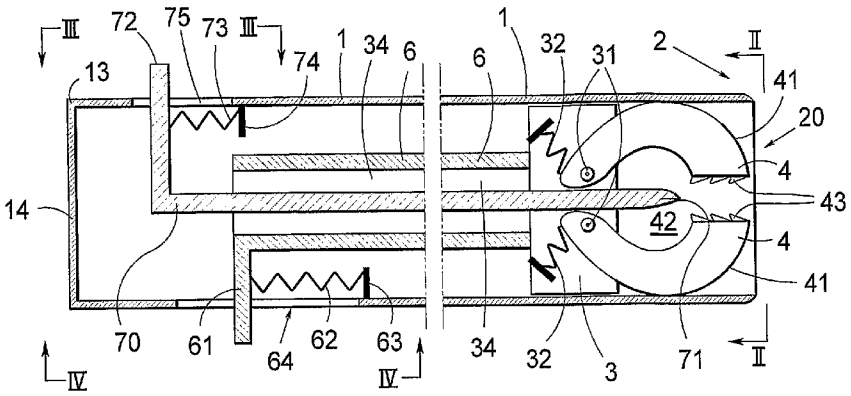
(54) Title: SURGICAL TOOL



(57) Abstract: The invention relates to a surgical instrument for probing, gripping and puncturing operations. The instrument includes a probe (101) and rods (102, 103) displaceable in the probe (101) for independent maneuvering of gripping means and puncturing means. According to the invention, the instrument includes spring means (108) for biasing the gripping means with a predetermined gripping force.

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SURGICAL TOOL

Field of invention

A surgical instrument for probing, gripping and puncturing operations, wherein the instrument comprises:

- an elongate tubular probe having a first end portion and a second end portion, wherein the first end portion includes an end opening;
- a gripping element and a puncturing or piercing element, both of which are displaceable independently of one another in the first end portion and can be displaced beyond the end opening;
- a transmission rod which extends through the probe and which is connected to the gripping element;
- a puncturing rod which extends through the probe and which is connected to the puncturing element;
- a first maneuvering element disposed at the second end portion of the probe for displacement of the transmission rod relative to the probe; and
-a second maneuvering means disposed at the second end portion of the probe for displacement of the puncturing rod relative to the probe.

In the case of surgical operations it is often necessary to be able to grip precisely a ligature (thread, filament) and to draw the ligature around a vessel without damaging the vessel. This cannot always be achieved successfully with conventional surgical instruments. A gripping instrument that will only grip the target object positively and smoothly is therefore desirable. It is also desirable that the instrument will also include a dissecting or piercing/cutting function since such a function is able to facilitate surgical operations. A surgical instrument that includes such gripping and puncturing functions is earlier known from US 5665100.

It is important that a tool of this kind is able to grip and move, for instance, ligatures positively and safely, and/or to grip anatomic structures, such as gall bladders, gall stones, bladder stones, etc. In addition to probing operations, such an instrument will also be able to establish holes and lead-through or transit openings so as to

enable the problem of relocating an initially established hole or opening to be avoided in respect of a later introduced instrument probe.

A significant aspect is that the gripping element is able to producing a clamping force that is distinct, well adapted with respect to the object to be gripped and that is generally constant. In the case of prior art technology, the clamping force is set manually as the instrument is maneuvered; resulting in the risk that the clamping force may vary.

The object of the present invention is to provide a surgical instrument which resolves this problem and with which the clamping force exerted by the gripping element is generally constant.

Summary of the invention

This object is achieved with a surgical instrument of the type defined in the introduction that has the particular feature of including spring means at the second end portion of the probe, wherein the spring means is adapted to bias the gripping element with a pre-determined gripping force.

As a result of biasing the gripping element, the gripping force is independent of manual actuation. This ensures that the gripping force is, on the one hand, sufficiently large to firmly hold the gripped object and, on the other hand, is restricted so as to reduce the risk of damage to the gripped object.

This thereby avoids the serious risk associated with prior art instruments with which the clamping force can be easily, but unintentionally, made manually so large as to cause damage to the tissue and object gripped by the clamping jaws. This facility enhances the safety of the surgical operation. Partly because actual gripping of the object is made safer and more positive in this case, and also because the operator need not concentrate on maintaining an adequate gripping force but can, instead, direct his/her concentration on other simultaneous aspects of the surgery underway. According to one preferred embodiment of the invention, the gripping element includes at least one clamping jaw which is carried by a transmission-rod connected

body and which is pivotally mounted on said body, wherein the embodiment also includes a transmission that translates displacement movement of the body to a clamping jaw closing and opening movement respectively; wherein the puncturing element is comprised of a sharp point on the front end of the puncturing rod; wherein the point is displaceable to a position beyond the first end portion of the probe even in the closed position of the clamping jaw, and wherein the spring means is a spring which biases the transmission rod towards a withdrawn position, whereby said at least one clamping jaw is closed by the biasing action of the spring via the transmission. This embodiment ensures positive transfer of the translatory movement of the transmission rod to rotational movement of the gripping element, which enhances the possibility of maintaining a distinct gripping force. This enhances the reliability of the instrument in cooperation with the manner in which the spring biases the transmission rod. The possibility of utilizing the puncturing element is made more flexible by virtue of enabling the point to be displaced even when the clamping jaws are closed.

According to another preferred embodiment, the clamping jaws can be withdrawn fully into the first end portion of the probe. This prevents the gripping location from being influenced by the surroundings when the gripped object shall be withdrawn, therewith reducing the risk of damage.

According to another preferred embodiment, said first end portion is opened axially and receives the body for axial displacement therein, wherein the clamping jaw is pivotally mounted for pivotal movement in an axial plane of the probe, and wherein the transmission rod is tubular and the puncturing rod extends through the transmission rod and through said body.

As a result of this pivotal mounting in the axial plane, the clamping force can be related with maximum ease to the spring force, which enhances precision. The co-axial arrangement of the transmission rod and the puncturing rod saves space and reduces the risk of unintentional interference of said components with one another. It is also a constructively simple solution.

According to a further preferred embodiment, the clamping jaw is spring biased towards a radially outer end position so as to be able to co-act with the inner wall of the probe for gripping an object between the clamping jaw and the edge of the probe opening when withdrawing the body and the clamping jaw into the outer end portion of the probe, wherewith the object can be released by exerting a manual force against the rod and against its spring bias, such as to displace the clamping jaw out of the first end portion of the probe.

This embodiment enables a gripping effect to be readily achieved with solely one clamping jaw.

According to another preferred embodiment of the invention, the puncturing rod extends through an opening in the clamping jaw.

This enables the puncturing element to reach beyond the clamping jaw in a constructively easy manner.

According to another preferred embodiment, the body carries at least two clamping jaws which are pivotally mounted on the body for pivotal movement in the axial plane of the probe, whereby there is achieved spring biased movement of the clamping jaws relative to the body to mutually outwardly swung end positions, wherein the puncturing rod is displaceable through an opening between the clamping jaws even in there combined end positions, and wherein the transmission includes a guide cam formed by the first end portion of the probe for co-action with radial outwardly curved and bordering cam surfaces on the clamping jaws.

As a result of the co-action between the spring-biasing of the clamping jaws and the cam guidance of the outwardly curved surfaces, clamping functions will be achieved in a positive and simple manner.

Another preferred embodiment of the invention includes means for manually stepping up the clamping force exerted between the mutually facing gripping surfaces of the clamping jaws in addition to the clamping force created by the spring biasing effect.

This enables the clamping force to be adjusted and adapted to different operation situations and different types of objects to be gripped.

According to another preferred embodiment of the invention, the clamping jaws are generally similar at least around the longitudinal axis of the probe, and the clamping jaws are at least three in number.

In this way there is achieved a symmetry which provides greater safety and simple maneuverability at the same time as the arrangement including a plurality of clamping jaws provides an evenly distributed clamping action on the object to be gripped, wherewith the object is subjected to more gentle treatment than would otherwise be the case.

According to another preferred embodiment of the invention the gripping element includes two or more resilient tongues which constitute an extension of the transmission rod and which are adapted to produce a gripping effect therebetween.

By designing the gripping element in the form of resilient tongues, the probe can be given a relatively small diameter. This space saving construction is highly beneficial. The gripping element is also simple and is therewith at small risk of functional disturbances.

According to another preferred embodiment of the invention, the gripping element includes a tongue which constitutes an extension of the transmission rod and which is adapted to provide a gripping effect in co-action with the first end portion of the probe.

The embodiment that comprises one single tongue minimizes the number of movable components of the instrument and therewith contributes towards the simplicity of the instrument and the small risk of functional disturbances.

According to another preferred embodiment of the invention, the spring element is comprised of a pressure spring disposed between a support on the probe and a support on the transmission rod.

A spring element disposed in this way provides a simple solution with respect to said biasing effect and also results in a well-defined relationship between the tension of the spring and the clamping force of the gripping element.

According to another preferred embodiment of the invention the spring element is comprised of a generally U-shaped so-called shackle spring that extends radially outwards from the second end portion of the probe.

According to another preferred embodiment the instrument includes means for setting the biasing effect of the spring means in several distinct positions for adjustment of the gripping element to different gripping forces.

This possibility of adjusting the setting of the gripping element is beneficial in adapting the instrument for different types of operation functions and with respect to objects to be gripped that have different degrees of sensitivity to clamping forces.

According to another preferred embodiment of the invention, the probe is curved. Curvature of the probe enables the probe to be positioned comfortably around structures and to grip or insert a ligature in the opening formed by the gripping element. Curvature of the probe may be constant or may vary. It is believed that a radius of curvature in the range of 10-15cm will be satisfactory in the majority of cases.

According to another preferred embodiment of the invention the instrument is comprised mainly of a plastic material.

The simple and flexible construction of the inventive instrument enables it to be produced substantially from a plastic material. Because a plastic instrument can be produced very cheaply, the instrument can be used as a disposable tool. For instance, when the actual probe, transmission rod and puncturing rod are made of

plastic, some of the remaining components, such as spring means and gripping element, may also be made from plastic material. The beneficial embodiments of the inventive instrument are set forth in the claims dependent on claim 1.

Brief description of the figures

Figure 1 is a diagrammatic illustration of an axial section of an instrument according to the invention.

Figure 2 is a diagrammatic illustration taken on the line II-II in figure 1.

Figure 3 is a partial view taken on the line III-III in figure 1.

Figure 4 is a partial view taken on the line IV-IV in figure 1.

Figure 5 is a diagrammatic illustration of another embodiment of the instrument in an image corresponding to figure 2.

Figure 6 is a diagrammatic illustration of the use of the instrument.

Figure 7 illustrates a modified embodiment of the instrument.

Figure 8 is a side view of a further embodiment of the instrument.

Figures 9-11 illustrate the major components of the instrument shown in figure 8 separated from one another.

Figure 12 is a side view of one end of the instrument shown in figure 8.

Figure 13 is a side view of the other end of the instrument shown in figure 8.

Description of beneficial embodiments

Figure 1 illustrates an elongate tubular probe which has an axial opening 20 at its first end portion 2. A body 3 is received displacably in the first end portion 2 of the probe and carries at least three clamping jaws 4 which are pivotally mounted on the body 3, for instance by pivot bearings 31. The illustrated body 3 carries spring means 32 which acts against the clamping jaws 4 such as to bias the jaws towards an outer pivotal end position in which the clamping jaws are swung away from each other in an axial plane. As will be understood, the spring means 32 may, of course, be replaced with equivalent forms that provide the same biasing function. For instance, the clamping jaws may be integral with the body 3 and connected thereto via a highly flexible material part that functions as a leaf spring. The outer surfaces 41 of the clamping jaws are shown to be continuous and arched to co-act with the

inner wall of the tubular probe at the opening 20 in a manner such that the clamping jaws 4 will be driven towards each other until reaching a closed end position, where upon the body 3 is withdrawn into the probe 1 and the clamping jaws 4 therewith brought into contact with the inner wall of the probe 1.

The clamping jaws 4 may be formed for co-action with the front-located gripping surfaces 43, wherewith the clamping jaws form between the gripping surfaces 43 and the pivot bearings 31 a space 42 which is larger than the space between the gripping surfaces 43 in the closed position of the jaws 4.

As will be seen from figure 2, the gripping surfaces have depressions in the central region of the probe, such as together essentially define a gripping area which is generally circular in shape when seen in the axial view according to figure 2, while the peripheral parts of the jaws 4 have generally parallel gripping parts which extend parallel with a diameter of the generally circular probe cross-section.

The second end portion 3 of the probe 2 has an end wall 14. A central tubular rod 6 is connected to the body 3 and extends to the second end portion 13 of the probe where said rod 6 has a radial projection 61 which projects out through an opening 64 in the wall of the probe 1. The projection 61 supports against a support 63 fixed to the probe 1 via a pressure spring 62. The spring 62 thus biases the clamping jaws towards the illustrated end position, in which the body 3 is withdrawn into the front end portion 2 of the probe and the clamping jaws 4 are fully or, as illustrated, partially withdrawn into the end portion 2. The co-action between the edge of the probe opening 20 and the curved convex outer surface 41 of the clamping jaws, the characteristics of the illustrated pressure springs 31 and the lever effect afforded by the parts of the clamping jaws 4 relative to the bearings 51 and the characteristics of the spring 62 define a closing force between the gripping surfaces 43. If the user of the instrument wishes to increase the mutual clamping force of the clamping surfaces and the mechanism defined by the outer surfaces 41 of the clamping jaws and the edge 40 of the opening so as to enable the gripping surfaces 43 to be moved closer together, it may be desirable to move the gripping surfaces beyond the limit value defined by the spring 62, and to this end the opening 64 has a generally serrated opening edge 66 which is inclined axially and which defines a row

of notches 67 for co-action with the projection 61. A user of the instrument can thus manually grip the radial projection 61 and pull it back beyond the end position defined by the spring 62 to a chosen position and secure the rod against displacement in a direction towards the end portion 2 of the probe, by inserting the projection 61 into an axially nearby notch 67. There extends through the rod 6 and through a passageway 34 in the body 3 and towards the rod 6 is a rod 70 that has a sharp front edge 71, for instance a chisel-like edge. The rod 70 has a rest or idle position in which the edge 71 is, for instance, located in the passage way 34 of the body 3. The rear end portion of the rod 70 has a radial projection 72 which extends out radially through an associated axially extending opening 75 in the probe wall 1. A pressure spring 73 is shown to be active axially between the projection 72 and an abutment 74 carried by the probe 1. The characteristic of the spring 73 is chosen so that an operator is able to drive the projection 72 axially forwards so as to enable the edge 71 of the rod 70 to be thrust forwards between the jaws 4 and out between the gripping surfaces 43 so as to expose the edge 71 axially in front of the clamping jaws 43. The load on the rod 70 is relieved, by drawing back the rod and placing the edge in a returned position.

In the variant shown in figure 5 the instrument has at least three clamping jaws 4 which are mutually separated around the perimeter of the long axis of the instrument and which can be pivoted radially to the axis in order to grip an object between the jaws.

Figure 6 illustrates that an instrument 10 according to figures 1-4 can be inserted through an opening 81 established through a wall of a tubular body part 82 over a distance along said body parts, wherewith the user or surgeon, who is able to manipulate the instrument 10 from its rear end portion 13, is able to establish an opening 83 in a more distant part of the body part 82 from the opening 81, with the aid of the edge 71 of the rod 70, by thrusting the edge from the front end portion 2 of the probe and axially driving the instrument 10 forwards so that the front end portion 2 will be exposed on the outside of the tubular body part 82, wherewith the rod 70 can be returned and the clamping jaws 4 maneuvered to grip one end 81 of an elongate object 92 that shall be drawn back through the tubular body part 82 so as to remove the end 91 via the opening 81.

Figure 7 illustrates a modified embodiment of the first end portion of the instrument. Thus, it is possible to recognize from figure 7 the first end portion 2 of the probe 1, the body 3 that is displaceable in the probe 1, the tubular rod 6 which carries the body 3, and the rod 70. Figure 7 shows only one clamping jaw 4 in the form of a leaf-spring element which is fixedly connected to the body 3 and which is bendable in a plane axial to the probe 1. It will be seen that an outer free end portion of the leaf spring 4' projects out over the free inner cross-section of the probe 1, so that an object 91 can be positioned in the end portion 2 of the probe and firmly clamped between the end 2 of the probe and the end of the leaf spring 4´ when the body 3 is withdrawn from the position shown in figure 7. When the body 3 is drawn further into the probe 1, the leaf spring element 4´ is caused to bend outwards and therewith restrict pinching of the object 91 against the inner wall of the probe 1. The object 91 can be released by displacing the rod 6, and therewith also the body 3, relative to the probe 1 in a direction towards its outer opening. Figure 7 shows that the clamping jaw 4´ also has an opening, 44, and that the rod 70 can be driven out through the opening 44 in order to carry out a puncturing operation.

A further embodiment of the invention is illustrated in figures 8 through 13, where figure 8 is a diagrammatic side view of the instrument showing the probe 101 and its first end portion 104, which is the operating end of the instrument, and its second end portion 105, which is the maneuvering end of the instrument. The transmission rod 102 protrudes from the probe 101 at the maneuvering end of the instrument and furthest to the left in the figure is shown the puncturing rod 103 which protrudes out of the transmission rod 102. The three main components of the instrument, i.e. the probe 101, the transmission rod 102 and the puncturing rod 103 are also shown respectively in a mutually withdrawn state in figures 9, 10 and 11.

Figure 12 is a side view of the operating end of the instrument and illustrates a position in which both the gripping element 106 and the puncturing element project out through the axial end opening 113 of this end portion 104.

In this case, the gripping element is comprised of two resilient tongues which form an extension of the transmission rod 102.

The puncturing element 107 is comprised of a pointed portion of the puncturing rod.

The puncturing element 107 and the gripping element 106 can be maneuvered independently of one another, so that both of these elements, neither of said elements or either one of said elements extends through the end opening 13 depending on the step of the procedure underway at that time.

Figure 13 is a side view of the maneuvering end 105 with the elements that are arranged for maneuvering the gripping elements 106 and the puncturing element 107 via the transmission rod 102 and the puncturing rod 103 respectively.

The maneuvering element for the gripping element 106 is comprised of the so-called shackle spring 108 and the puncturing element maneuvering element is comprised of a plate 112.

The shackle spring is mounted with one of its legs in abutment with a support 109, which terminates the operating end 105 of the probe 101, while the other leg of the spring abuts a support 110 which terminates the transmission rod 102. The shackle spring has an inbuilt spring effect that strives to separate the legs. The support 110 on the transmission rod is fastened to the adjacent leg of the spring 108.

The puncturing rod 103 extends out from the transmission rod 102 beyond its support 110 and up to the maneuvering plate 112. A pressure spring is provided between the maneuvering plate 112 and the support 110. In the idling position illustrated in figure 13, the transmission rod 102 and the puncturing rod 103 are both in a withdrawn position, in which the gripping element 106 and the puncturing element 107 are withdrawn fully into the first end portion 104 of the probe 101. The shackle spring 108 and the pressure spring 111 hold the instrument in this idling state.

The puncturing element 107 is used by applying pressure to the maneuvering plate 112 so as to displace the puncturing rod to the right in the figure, while overcoming the spring force of the spring 111. The opposite end of the puncturing rod 103 with

its puncturing element will therewith be pressed out through the end opening 113 at the first end portion 104 of the probe 101 to a position for carrying out the puncturing operation. Upon completion of the puncturing operation, the puncturing element 107 is drawn back into the first end portion 104 of the probe 101, by removing the pressure on the pressure plate 112. The pressure spring 111 will then press the maneuvering plate 112 to the left, wherewith the plate draws with it the puncturing rod 111 together with the puncturing element 107. The puncturing function is then again in its idle position.

The gripping element 106 is applied by pressing together both legs of the shackle spring, wherewith the leg located nearest the support 110 will draw with it the support to the right and therewith push the transmission rod 102 into the probe 101. The opposite end of the transmission rod will therewith be pressed out through the end opening 113 at the first end portion 104 of the probe 101, so that the resilient tongues of the puncturing rod 102 forming the gripping element will protrude out beyond the end opening 113. When the resilient tongues are located within the probe 101, they are pressed together by the inner walls of the probe 101. The tongues are disposed resiliently on the transmission rod 102 with a spring force that acts in diverging directions. When the tongues are pressed out beyond the end opening 113, they spring apart and take the position shown in figure 12.

The object is gripped by virtue of the tongues of the gripping element 106 straddling the object. The tongues are then drawn back into the end portion 104 of the probe 101, wherewith the tongues are pressed together and grip firmly around the intended object. The tongues are drawn back by releasing the pressure force on the shackle spring 108, wherewith the transmission rod 102 is drawn to the left out from the maneuvering end 105 of the probe. Outward springing of the shackle spring is restricted by a rod 114, so that the distance through which tongues need be drawn back is well defined and corresponds to the original idle position. The extent to which the gripping element 106 needs to be drawn into the end portion 104 of the probe 101 will be correspondingly long and determines the force that the tongues of the gripping element 106 exert on the object. The object, for instance a ligature, can then be moved with the aid of the probe 101, wherewith the gripping position or location lies protected within the probe.

The magnitude of the gripping force as a function of the extent to which the tongues of the gripping element 106 need to be withdrawn can be readily achieved by giving the end portion 113 of the probe 101 an internal diameter that decreases inwardly to some extent from the end opening 113, or by causing the outer side of respective tongues to diverge slightly outwards.

The rod 114 is removable and can be replaced with a rod of a different length. This enables different lengths to be obtained for the withdrawal that takes place when the shackle spring is allowed to spring out.

CLAIMS

1. A surgical instrument for probing, gripping and puncturing operations, wherein the instrument includes:

an elongate tubular probe (1, 101) having a first end portion (2, 104) and a second end portion (13, 105), said first end portion (2, 104) having an end opening (20, 113);

a gripping element (4, 4′, 106) and a puncturing element (71, 107) both of which are displaceable independently of one another in the first end portion (2, 104) and also displaceable beyond the end opening (20, 113);

an elongate transmission rod (6, 102) which is connected to the gripping element (4, 4′, 106) and which extends through the probe (1, 101);

an elongate puncturing rod (70, 103) which is connected to the puncturing element (71, 107) and which extends through the probe (1, 101);

a first maneuvering element (61, 108) provided at the second end portion (13, 115) of the probe (1, 101) and intended for displacing the transmission rod (6, 102) relative to the probe (1, 101) and;

a second maneuvering element (72, 112) at the other end portion (13, 115) of the probe (1, 101) and intended for displacing the puncturing rod (70, 113) relative to the probe (1, 101); **characterized in** that the instrument includes spring means (62, 108) at the second end portion (13, 115) of the probe (1, 101) said spring means (62, 108) being intended to bias the gripping element (4, 4′, 18) with a predetermined gripping force.

2. A surgical instrument according to claim 1, **characterized in** that the gripping element (4, 4′) includes at least one clamping jaw (4, 4′) which is pivotally mounted on a displaceable body (3) connected to the transmission rod, wherein the instrument further includes a transmission (31, 32, 41) which translates displacement movement of the body (3) to a closing and opening movement of the clamping jaw (4, 4′); in that the puncturing element (71, 107) is comprised of a pointed part on the front end of the puncturing rod (70); in that the pointed part (71) is displaceable to a position beyond the first end portion (2) of the probe even in the closed position of the clamping jaw; and in that the spring means (62) is a pressure spring (62) which biases the transmission rod (6) towards a withdrawn position,

whereby said at least one clamping jaw (4, 4´) is closed by pre-tensioning of the pressure spring (62) via the transmission.

3. A surgical instrument according to claim 2, **characterized in** that the clamping jaws (4) can be withdrawn completely into the first end portion (2) of the probe (1).

4. A surgical instrument according to claim 2 or 3, **characterized in** that said first end portion (2) is axially open and receives the body (3) for axial displacement therein; in that the clamping jaw (4, 4´) is pivotally mounted for pivotal movement in an axial plane relative to the probe; and in that the transmission rod (6) is tubular, wherewith the puncturing rod (70) extends through the transmission rod (6) and through the body (3).

5. A surgical instrument according to any one of claims 2-4, **characterized in** that the clamping jaw (4´) is spring biased towards a radially outer end position so as to be able to co-act with the inner wall of the probe for gripping an object (91) between the clamping jaw (4´) and the opening-defining edge of the probe (1) when withdrawing the body (3) and the clamping jaw (4´) back into the outer end portion (2) of the probe, wherewith the object (91) can be released by manually applying a force against the rod (6) and against the effect of its spring loading (62), in order to thrust the clamping jaw (4´) out of the first end portion of the probe (1).

6. A surgical instrument according to claim 5, **characterized in** that the puncturing rod (70) extends through an opening (44) through the clamping jaw (4´).

7. A surgical instrument according to any one of claims 2-4, **characterized in** that the body (3) carries at least two clamping jaws (4) which are pivotally mounted on the body (3) for pivotal movement in the axial plane of the probe (1); in that the clamping jaws (4) are spring biased (36) relative to the body (3) to outwardly swung mutual end positions; in that the puncturing rod (70) is displaceable through an opening between the clamping jaws even in their combined end positions; and in that the transmission includes a guiding cam formed on the first end portion (2) of

the probe (1) for guiding radially outwardly curved and therewith nearby cam-following surfaces on the clamping jaws (4).

8. A surgical instrument according to claim 7, **characterized by** means (61, 64, 66, 67) for manually setting an increased clamping force between the mutually facing gripping surfaces (43) of the clamping jaws (4) in excess of the clamping forces generated by the biasing effect of the spring (62).

9. A surgical instrument according to claim 7 or 8, **characterized in** that the clamping jaws (4) are mutually spaced generally equidistantly around the long axis of the probe; and in that the clamping jaws (4) are at least three in number.

10. A surgical instrument according to any one of claims 1-9, **characterized in** that the gripping element (106) includes two or more resilient tongues that constitute an extension of the transmission rod (102) and that are adapted to produce said gripping action therebetween.

11. A surgical instrument according to claim 1, **characterized in** that the gripping element (106) includes a resilient tongue which constitutes an extension of the transmission rod (102) and which is adapted to achieve said gripping action in co-action with the first end portion (105) of the probe.

12. A surgical instrument according to any one of claims 1-11, **characterized in** that the spring means (62) is a pressure spring (62, 108) disposed between a support (63, 109) on the probe (1, 101) and a support (62, 110) on the transmission rod (6, 102).

13. A surgical instrument according to any one of claims 1-11, **characterized in** that the spring means (108) is a shackle spring (108) which extends radially outwards from the second end portion (105) of the probe (101).

14. A surgical instrument according to any one of claims 1-13, **characterized in** that the instrument includes means (60, 67, 114) for setting the biasing effect the

spring (62, 108) in a number of distinct precisions for producing different gripping forces of the gripping element (4, 4´,106).

15. A surgical instrument according to any one of claims 1-14, **characterized in** that the probe (101) is curved, preferably with a radius of curvature in the range of 10-15cm.

Fig. 1

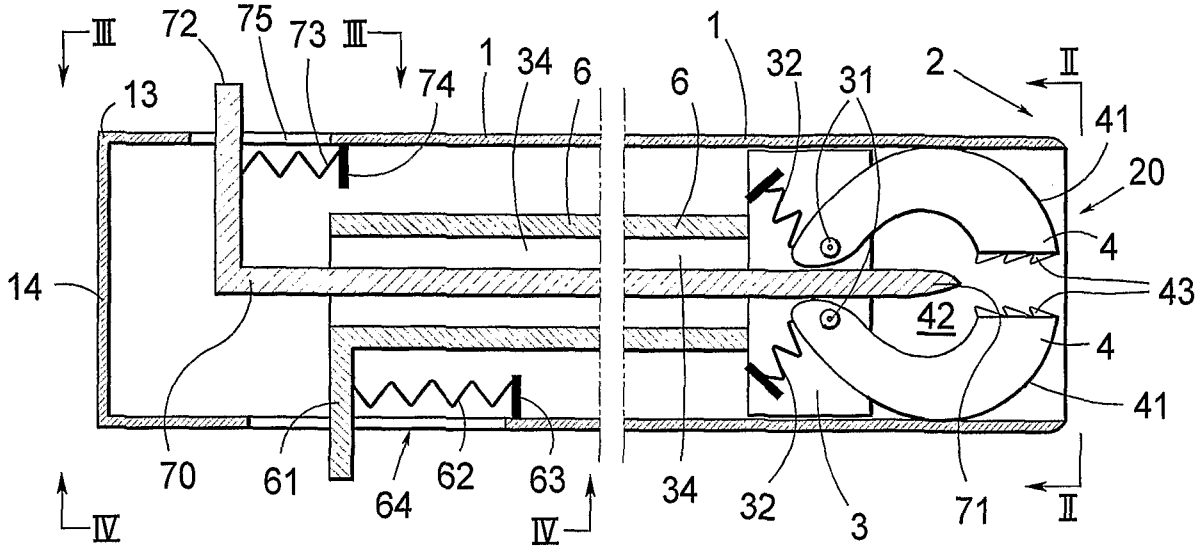


Fig. 4

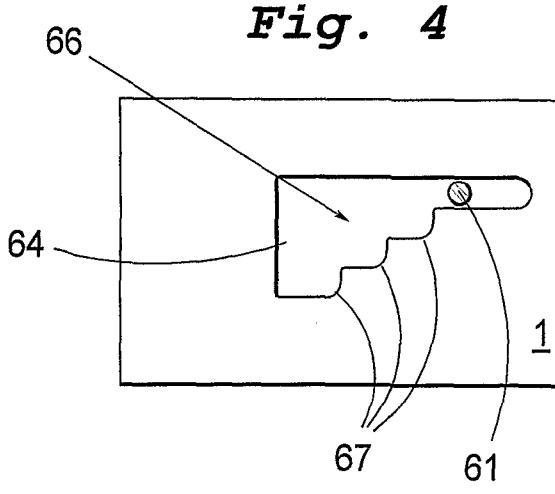


Fig. 3

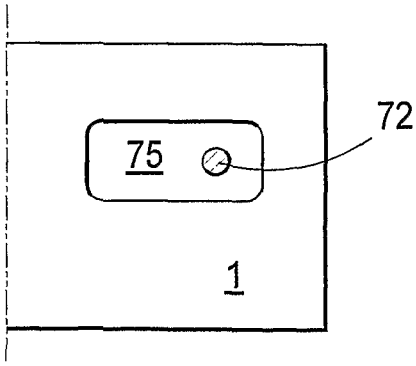


Fig. 2

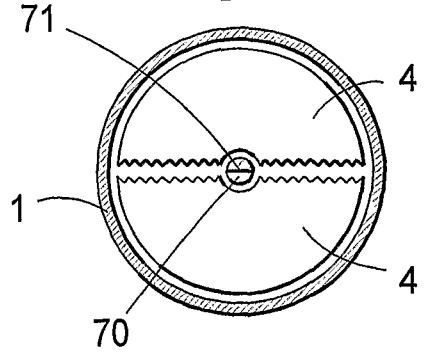
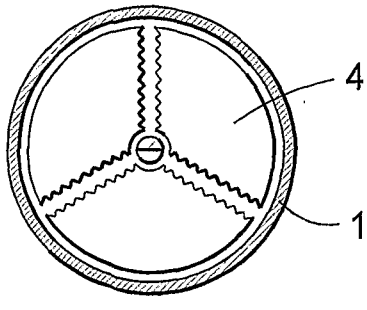


Fig. 5



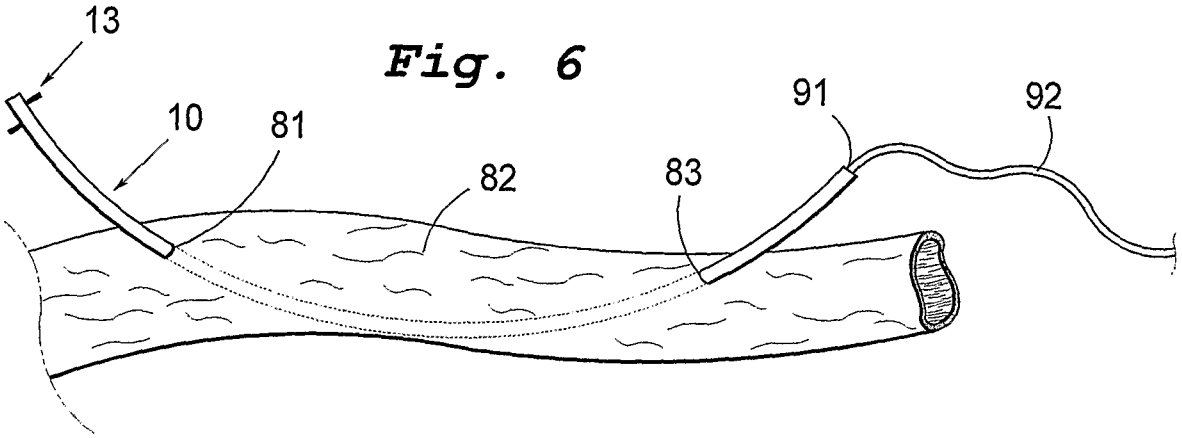


Fig. 6

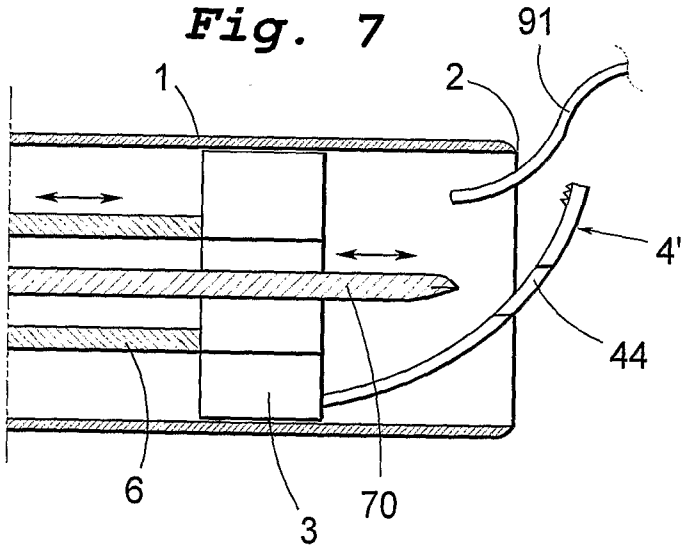


Fig. 7

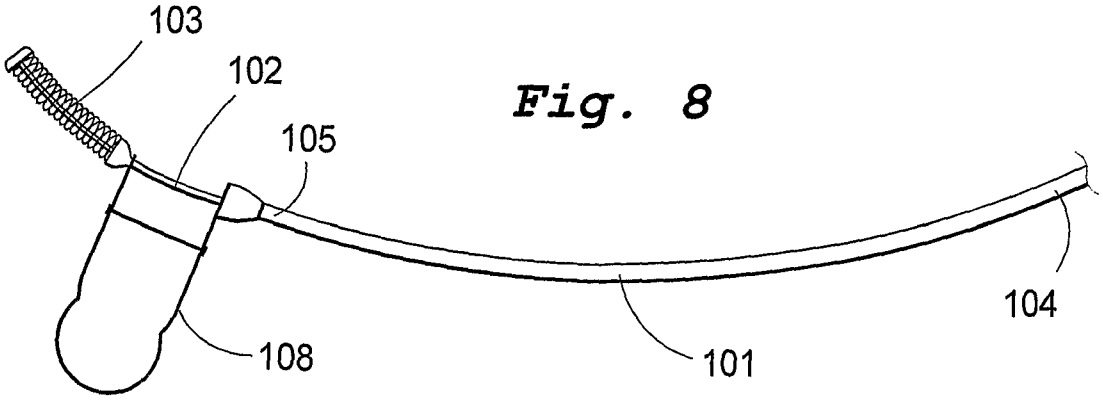


Fig. 8

Fig. 9

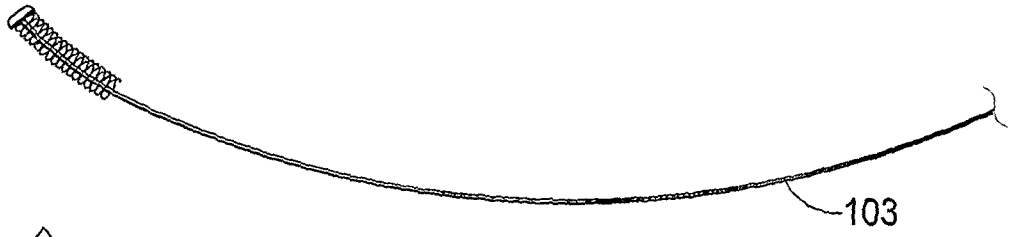


Fig. 10

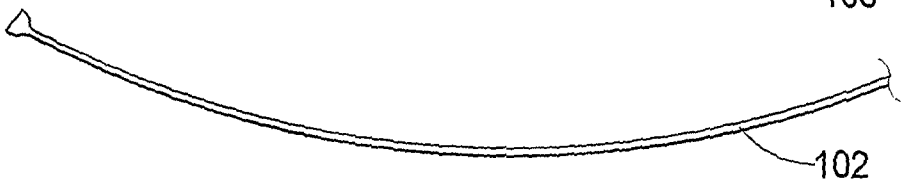


Fig. 11

Fig. 12

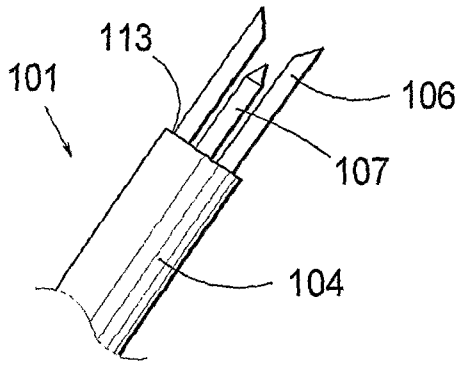
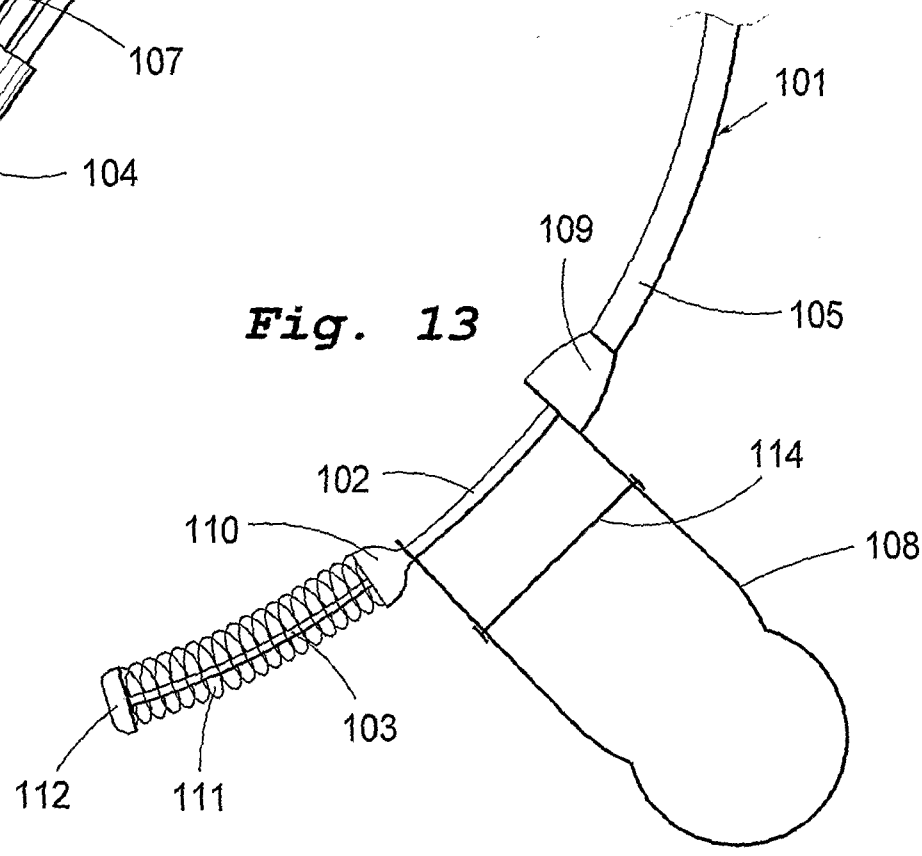


Fig. 13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2007/050404

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5665100 A (YOON), 9 Sept 1997 (09.09.1997), column 7, line 5 - line 28; column 12, line 7 - line 30; column 14, line 17 - line 63, figures 2,32-34	1,10-12,16
Y		2-9,13-15
	--	
Y	US 5281230 A (HEIDMUELLER), 25 January 1994 (25.01.1994), figure 2	2-9,13-15
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Y	US 4509517 A (ZIBELIN), 9 April 1985 (09.04.1985), figures 10-11	2-9,13-15
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 Sept 2007	17 -09- 2007
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Tomas Lund / JA A Telephone No. +46 8 782 25 00

International patent classification (IPC)

A61B 17/28 (2006.01)
A61B 17/34 (2006.01)
A61B 17/12 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

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