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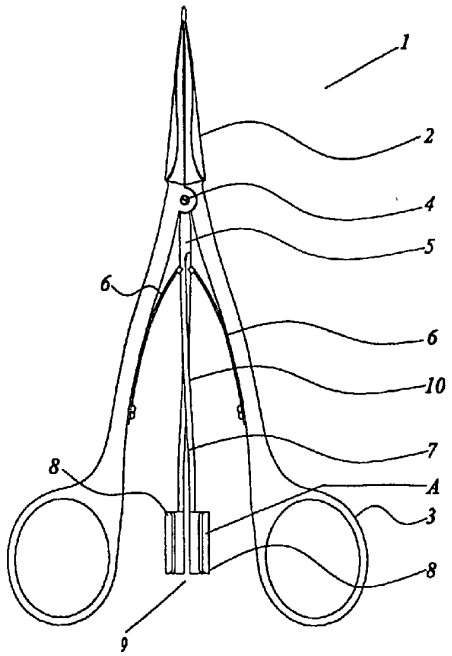
(54) Title: A SURGICAL FORCEPS

(57) Abstract

A surgical forceps (1) has blades (2) of arcuate shape and handles (3) which are urged apart by springs (6) on a guide blade (5) which mounts the blades (2) by a pivot joint (4). The guide blade (5) projects below the blades (2). Gripping means (9) formed by bifurcated arms (7) on the guide blade (5) will, when moved apart, grip an intercostal drain tube between grippers (8). The forceps (1) carrying an intercostal drain tube, can be inserted between a patients ribs and the handles (3) are then moved towards each other to splay the blades (2) apart to provide a channel for the insertion of a tube. The guide blade (5) may also be mounted between the blades (2).



# "A Surgical Forceps"

## Introduction

The present invention relates to a construction of forceps and in particular to a construction of forceps for the insertion of intercostal chest drains and the like devices into patients.

Collapse of the lung is a serious condition and can often arise due to an injury to the chest. The lung collapses under the pressure of air or blood leakage into the space between the lung and the inside of the chest wall. This usually arises in a state of emergency such as following trauma to the chest requiring urgent medical treatment. The treatment is the insertion of a chest drain between the ribs into the chest cavity. The drain is essentially a flexible plastic tube with a hole at the tip and perforations on either side adjacent the tip. Insertion of the drain is a difficult and hazardous job. It can be performed in several ways.

One way of inserting the drain is by means of a trocar which is a metal rod which is mounted within the drain. The rod has a sharp tip and projects out the hole in the top of the drain for about 5mm. The trocar is used to force the drain into the chest cavity by piercing through the intercostal muscles. This is a dangerous method of inserting the drain as it is possible to overshoot too deeply into the chest cavity and damage other organs such as the heart, or the large arteries or veins of the chest. Due to these potential lethal hazards the use of the trocar is discouraged.

The recommended method of introduction of the drain is by what is commonly known as the "open technique". This involves the use of a surgical forceps which is a general purpose instrument used in surgery for many different tasks. The forceps is used to separate the muscle fibres situated between the ribs to create a channel for the drain. The drain is then passed through the channel without the use of the trocar. Making the channel with the forceps is no easy task nor indeed is the subsequent manipulation of the drain into position.

While this latter open method is much safer than the use of a trocar, it has many

difficulties and limitations. The two major problem areas are the creation of the channel and alignment of the drain to it. These stem from the fact that the forceps is not designed for this job. Indeed it is designed for the exact opposite task: that is for gripping rather than separating tissue. As the tips of the forceps are blunt, considerable inward force has to be applied to penetrate the muscle causing some trauma to the area. Since, as mentioned already, the forceps are designed for gripping rather than separating and therefore using them in the reverse mode to separate the muscle does not provide optimum power or manipulation. Indeed, they are extremely awkward to use. Thus, it requires several spreading actions to create an adequate channel through the muscle leading to excess damage and trauma to the muscle.

When the forceps has formed the required channel, it is then necessary to maintain the channel open with the forceps as the drain is inserted through the muscle channel into the chest cavity. This leads to the second major problem with the current methods: alignment of the drain to the channel. The tip of the drain has now to be inserted and aligned with the channel which is effectively occupied mainly by the forceps. It is always difficult to thread the drain through the remaining part of the channel along the forceps. The safest way that this is done is by using a second forceps to grip the drain and force it through. This in turn causes damage to the drain and an even wider channel to be made.

A further problem of removing the forceps and positioning the drain into the correct position is then encountered. When two forceps are used, pulling out either of the forceps in the tight confined space of the muscle channel may inadvertently dislodge the drain. The drain is required to be positioned either upward to drain air or downward to drain blood or fluid as indicated. This task is difficult with the limitations of the forceps to direct the drain once inside the chest cavity.

In summary, trocars, though reasonably efficient in operation, are dangerous especially in emergencies where medical personnel are under stress or are working in less than ideal conditions. The trocar can be positively lethal. The use of a surgical forceps to insert the chest drain is a safer method of carrying out the procedure but is inefficient and is associated with many difficulties and problems such as those

referred to above.

While the discussion above has related specifically to intercostal drains, it should be appreciated that the present invention is directed towards the introduction of not alone intercostal drains, but any other such drains, tubes or devices into body structures included, but not limited to, the abdominal cavity, the oro-pharynx, larynx or pharynx, any part of the intestinal tract, any vascular structure or other anatomical or pathological structure within the human body. However, in this specification, reference is only made generally to intercostal chest drains but it will be appreciated that the term has to be used in the broadest sense.

The present invention is directed towards providing an improved method and apparatus for the insertion of an intercostal chest drain or the like device into the bodies of mammals.

**Statements of Invention**

According to the invention there is provided a surgical forceps of the type comprising a scissors-like implement having a pair of blades connected by a pivot joint and extending rearwardly therefrom to form handles characterised in that each handle is cranked adjacent the pivot joint so that the handles are splayed apart with the blades in engagement. In this way the optimum force can be exerted by a user on the handles to provide a separating action and the handles are in the correct position for allowing the blades to be splayed apart, for example, for the insertion of an intercostal drain.

Ideally, each blade is arcuate in shape having an open mouth which faces the open mouth of the other blade. By having the blades arcuate in shape, the channel formed by the forceps when, for example, inserting a chest drain will be substantially circular in cross section which is the ideal shape for the insertion of, for example, tubing. Ideally, each blade tapers towards its free end. The arcuate shape of the blades and the tapering ensures a very small and suitably shaped configuration at the tip which, in use, ensures a limited opening at the tip.

Preferably, the surgical forceps is provided with releasable grip means to carry an

intercostal drain. Also, ideally there is a third guide blade carrying the pivot joint. This guide blade may be below or between the other two blades at the pivot joint. The guide blade may be below the other two blades. The advantage of using a third guide blade is that, for example, the third blade can be used to guide the forceps on top of a rib into the chest cavity thereby avoiding injury to the blood vessels that run just below each rib. It also provides direction for the drain through the muscle channel into the chest cavity and also directs the drain in the appropriate position once in the chest.

In a still further embodiment of the invention, there is provided grip means on the forceps to carry an intercostal drain. Ideally, the grip means is mounted on the guide blade which is preferably substantially flat and tapers towards its free end and carries a pivot pin to form the pivot joint. Alternatively, the guide blade is substantially rectangular in cross section tapering from the pivot joint towards its free end. The guide blade may also be mounted between the other blades so that the guide blade is sandwiched therebetween with the handles splayed apart. The guide blade may extend rearwardly of the pivot joint and terminate in a bifurcating portion, each arm of which carries an intercostal drain gripper of arcuate shape which can be urged apart to receive the intercostal drain and form releasable grip means.

In one embodiment of the invention, the arms cross intermediate their ends when an intercostal drain is not mounted therein. This configuration ensures that they are effectively spring urged or biased urged or biased together when gripping something therebetween.

Ideally, the dimensions of the blades are chosen so that the blades project at approximately the same height above the guide blade as the intercostal drain. This ensures that a smooth passage of the intercostal drain is achieved, for example, between a patient's ribs.

Ideally, the handles are spring urged apart and in one embodiment, they are provided by a spring which is mounted between each handle and guide blade to urge the handles away from the guide blade and thus apart.

**Detailed Description of the Invention**

The invention will be more clearly understood from the following description of some embodiments thereof given by way of example only with reference to the accompanying drawings in which:

Fig. 1 is a plan view in the closed position of a surgical forceps according to the present invention;

Fig. 2 is a plan view of the forceps in the open position;

Fig. 3 is a side view of the forceps carrying the chest drain;

Fig. 4 is a detailed side view of portion of the forceps in the direction of the arrow A of Fig. 1;

Fig. 5 is a perspective view again in the direction of the arrow A of Fig. 1;

Fig. 6 is a sectional view along the lines VI-VI of Fig. 2;

Fig. 7 is an enlarged sectional view along the lines VII-VII of Fig. 2;

Fig. 8 is a plan view in the closed position of an alternative construction of surgical forceps;

Fig. 9 is a plan view of portion of the surgical forceps of Fig. 8in the open position;

Fig. 10 is a side view of a guide blade forming part of the surgical forceps of Fig. 8;

Fig. 11 is a side view of the guide blade;

Fig. 12 is a sectional view in the direction of the arrows XII-XII of Fig. 11; and

Fig. 13 is an enlarged sectional view along the lines XIII-XIII of Fig. 8.

Referring to the drawings there is provided a surgical forceps indicated generally by the reference numeral 1 having a pair of curved blades 2 extending rearwardly to form integral handles 3. The blades 2 are mounted together by a pivot joint 4 provided by a pivot pin on a further guide blade 5. The guide blade 5 carries leaf springs 6 which engage the handles 3 to force the blades into the closed position as can be seen in Fig. 1. It will be noted from Fig. 7 that the guide blade 5 is below the blades 2 and handles 3 at the pivot joint 4. It is possible to refer here to the blades 2 or handles 3 since this is where the transition occurs between each blade 2 and handle 3. For convenience and consistency, reference is made throughout to the blades 2 at the pivot joint 4. The guide blade 5 extends rearwardly to terminate bifurcated arms 7 each carrying an arcuate drain gripper 8 to form releasable grip means to carry an intercostal drain. The releasable grip means is indicated generally by the reference numeral 9. It will be noted that the bifurcated arms 7 cross intermediate their ends at 10.

Referring to Fig. 3 there is illustrated portion of a conventional intercostal chest drain 11 mounted between the arcuate drain grips 8 on the bifurcated arms 7. Because the bifurcated arms 7 cross, the grips 8 exert a gripping action on the intercostal chest drain 11.

In operation it will be appreciated that the drain 11 can be placed at any time, and therefore secured in position, on the arcuate drain grips 8 and the guide blade 3 and blades 2 in the position illustrated in Fig. 1 can be inserted into the intercostal muscle of a patient. The handles 3 can be manipulated to separate the curved blades 2 thus creating the channel through the muscle for the drain. Meanwhile the guide blade 5, which will be held stationary by the leaf springs 6, forms a guide for the forceps. Thus, the forceps can be inserted generally into the chest cavity. Essentially it will be appreciated that the blades 2 provide the separating action to split the muscle and their curvature along the inside of their length creates a hollow centre. A circular conduit or channel of the appropriate size is therefore provided for easy passage of the drain 10.

It will be noted that in the embodiment described above, the blades 2 and the releasable grip means 9 are so configured as to carry the intercostal drain 11 directly behind the blades 2. Further, it will be noted that the drain 11 is slightly below or in line with the deepest portion of the blades 2. This ensures that the drain 11 will easily follow in the channel created by the blades 2.

Referring now to Figs. 8 to 13 inclusive, there is illustrated an alternative construction of surgical forceps, indicated generally by the reference numeral 20, in which parts substantially similar to the parts previously described are identified by the same reference numerals. Minor variations in construction are, where necessary, described below. In this embodiment, there is provided a guide blade 21 substantially rectangular in cross section terminating in a rectangular tip 22. The guide blade 21 extends rearwardly from a central boss 23 to again terminate in bifurcated arms 7 carrying solid arcuate drain grips 24. It will be noted from Fig. 13 that one blade 2 lies above the other blade 2 and on either side of the central boss 23 where they are retained on the guide blade 21 by the pivot joint 4. Further, as can be seen from Fig. 8, the tip 22 of the guide blade 21 projects slightly beyond the other blades 2 which also are of slightly different construction than the previous blades 2.

It will be appreciated that the actual physical configuration and construction of the forceps can be varied depending on its proposed use. For example, the shape of the handles may be chosen as to prevent excessive expansion of the blades at their tips thus reducing damage to a patients muscle.

The advantage of the guide blade is that not alone does it provide a guide for the forceps but it also directs the drain, which is held in alignment along the guide blade by the arcuate drain grips, directly through the channel. Since the drain can be carried on the guide blade as the bore is formed, there is no need to further manipulate or align the drain. When the drain is inserted into the chest cavity then the arcuate drain grips can be easily disengaged to allow the forceps to be disconnected and removed from the muscle channel without disturbing the position of the drain. One of the major advantages of the third blade is that it allows the forceps to be positioned over the apex of the rib so preventing the other blades from

damaging blood vessels that are sited just below each rib.

However, one of the most important features of the present invention is that since the handles operate the blades in the same direction they are much easier to manipulate than the conventional forceps. It should be noted that the term "blades in engagement" is used somewhat loosely in the specification in the sense, not alone of actual contact, but as close as they can get having regard to the configuration of the forceps since, in certain constructions, the guide blade may prevent actual contact.

As has been explained already, the surgical forceps could be used to introduce drains or other devices into the abdominal cavity, the oro-pharynx, larynx or pharynx, the intestinal tract, or indeed any vascular structure or other anatomical or pathological structure within the human body. While the invention is particularly used in connection with intercostal drains, it is not to be limited to the use with them.

In the specification the terms "comprise", "comprises", "comprised" and "comprising" or any variation thereof and the terms "include", "includes", "included" and "including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation and vice versa.

The invention is not limited to the embodiments hereinbefore described but may be varied in both construction and detail within the scope of the claims.

**CLAIMS**

1. A surgical forceps of the type comprising a scissors-like implement having a pair of blades (2) connected by a pivot joint (4) and extending rearwardly therefrom to form handles (3) characterised in that each handle (3) is cranked adjacent the pivot joint (4) so that the handles (3) are splayed apart with the blades (2) in engagement and there is provided means to carry a length of tubing.

2. A surgical forceps as claimed in claim 1, in which each blade (2) is arcuate in shape having an open mouth facing the open mouth of the other blade (2).

3. A surgical forceps as claimed in claim 1 or 2, in which each blade (2) tapers towards its free end.

4. A surgical forceps as claimed in any preceding claim, including releasable grip means (9) to carry an intercostal drain (11).

5. A surgical forceps as claimed in any preceding claim, in which there is a third guide blade (5) mounted on the pivot joint (4).

6. A surgical forceps as claimed in claim 5, in which the third guide blade (5) lies below the other blades (2) on the pivot joint (4).

7. A surgical forceps as claimed in claim 5, in which the third guide blade (21) lies between the other two blades (2) and the pivot joint (4).

8. A surgical forceps as claimed in any of claims 5 to 7, in which the guide blade (5) includes a releasable grip means (9) to carry an intercostal drain (11).

9. A surgical forceps as claimed in any of claims 5 to 8, in which the guide blade (5) extends rearwardly of the pivot joint (4).

10. A surgical forceps as claimed in any of claims 5 to 9 in which the guide blade (5) extends substantially the same distance from the pivot joint (4) as the

other blades (2).

11. A surgical forceps as claimed in any of claims 5 to 10, in which the guide blade (5) is substantially flat, tapers towards it free end and carries a pivot pin to form the pivot joint (4).

12. A surgical forceps as claimed in any of claims 5 to 11, in which the guide blade (5) lies below the other blades (2).

13. A surgical forceps as claimed in any of claims 5 to 12, in which the guide blade (21) is substantially rectangular in cross-section tapering from the pivot joint towards its free end (22).

14. A surgical forceps as claimed in any of claims 5 to 13, in which the guide blade (21) is mounted between the other blades (2) so that the guide blade (21) is sandwiched therebetween with the handles splayed apart.

15. A surgical forceps as claimed in any of claims 5 to 14 in which the guide blade (5) extends rearwardly of the pivot joint (4) and terminates in a bifurcated portion, each arm (7) of which carries an intercostal drain gripper (8) of arcuate shape which can be urged apart to receive the intercostal drain (11) and form releasable grip means (9).

16. A surgical forceps as claimed in claim 15, in which the arms (7) cross intermediate their ends when an intercostal drain (11) is not mounted therein.

17. A surgical forceps as claimed in any of claims 8 to 16 in which the dimensions of the blades (2) are so chosen that the blades (2) project at approximately the same height above the guide blade (5) as the intercostal drain (11).

18. A surgical forceps as claimed in any preceding claim, in which the handles (3) are spring urged apart.

19. A surgical forceps as claimed in claim 18, in which a spring (6) is mounted

between each handle (3) and the guide blade (5) to urge the handles (3) away from the guide blade (5) and thus apart.

20. A surgical forceps as claimed in claim 19, in which the spring (6) is a leaf spring.

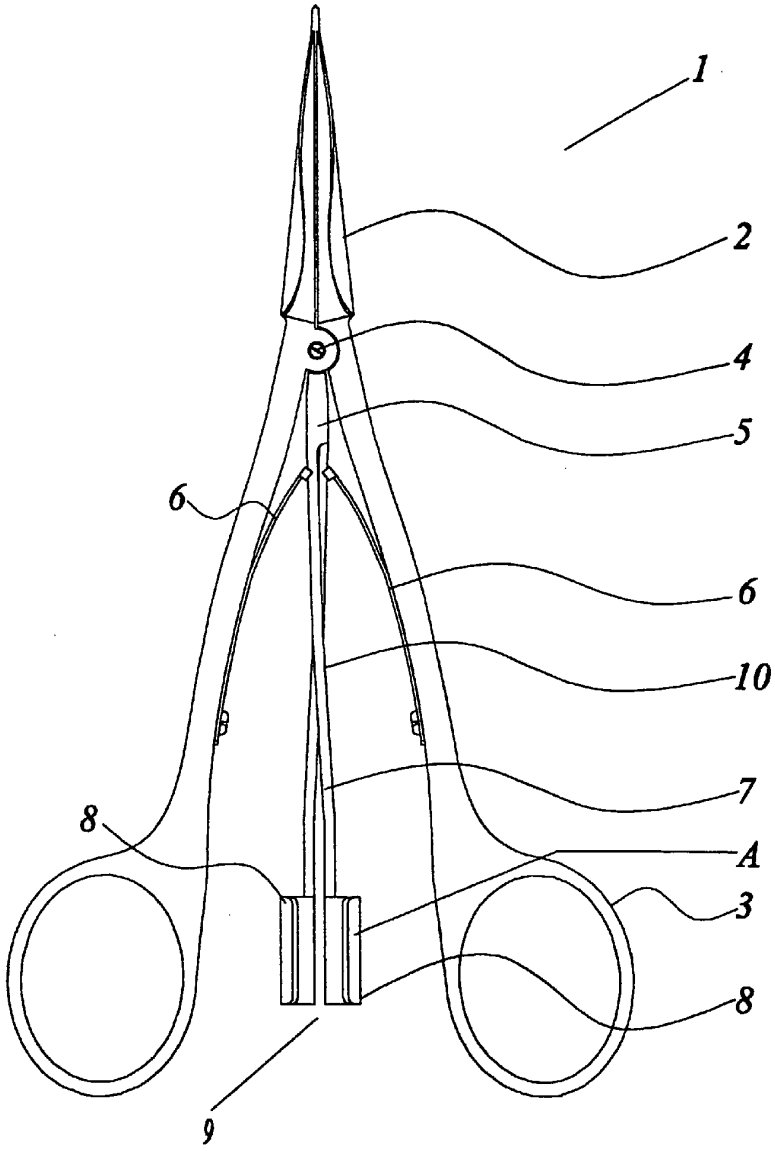



Fig. 1

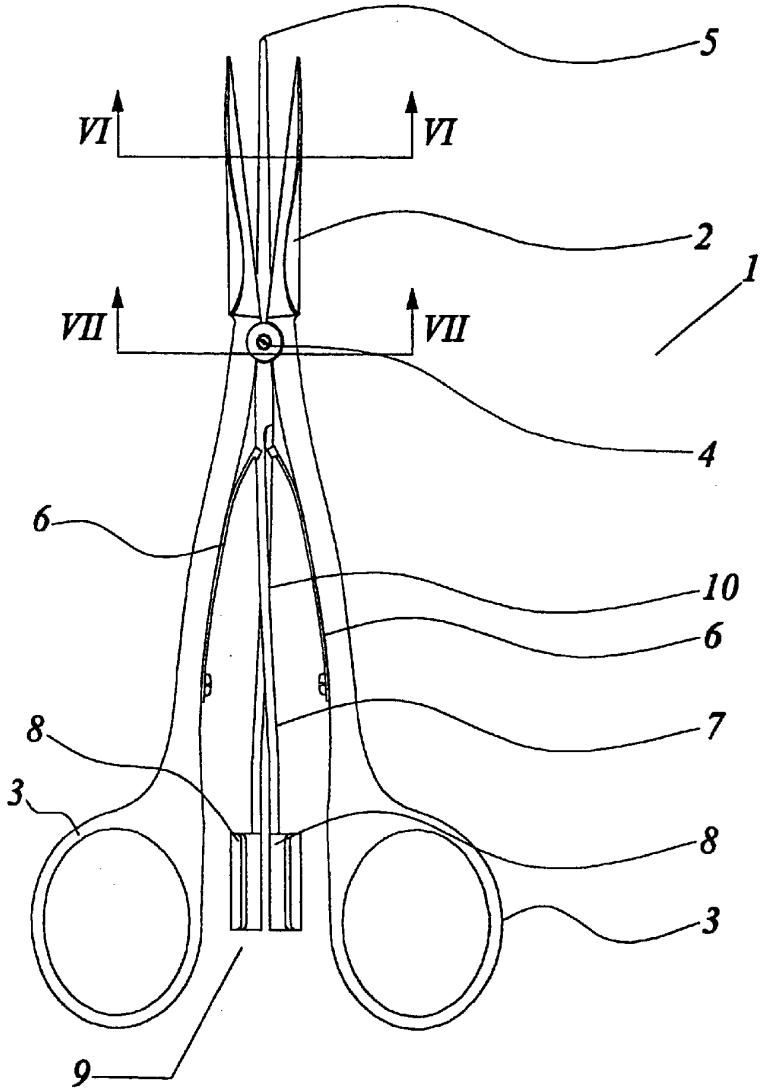



Fig. 2

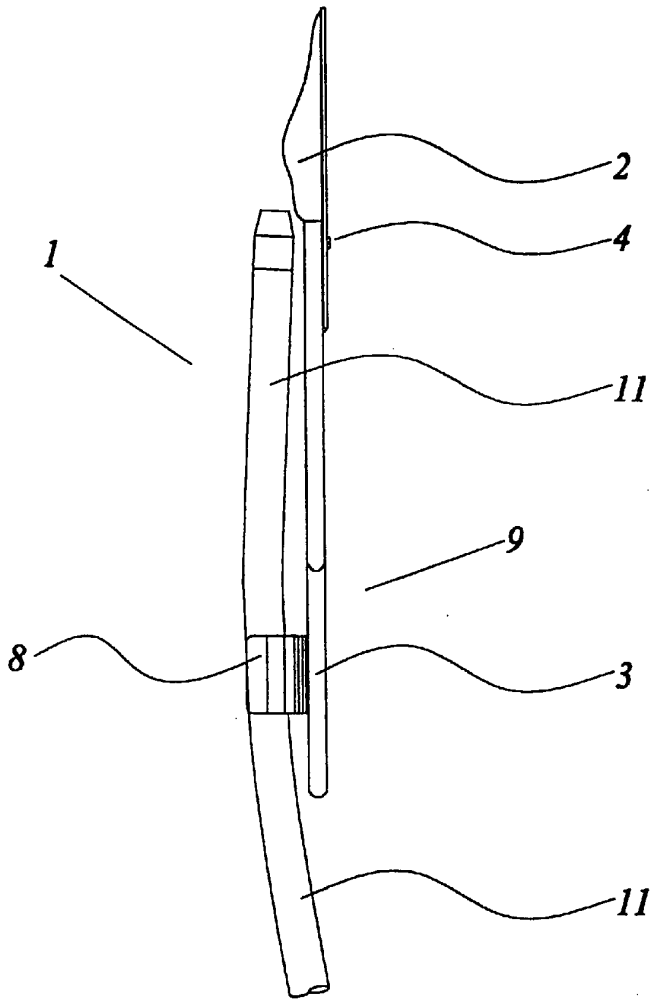



*Fig. 3*

Fig. 4

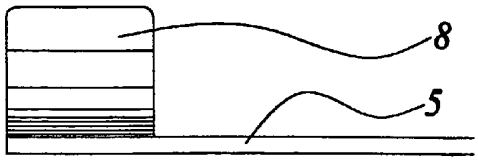



Fig. 5

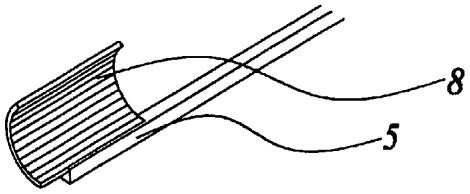
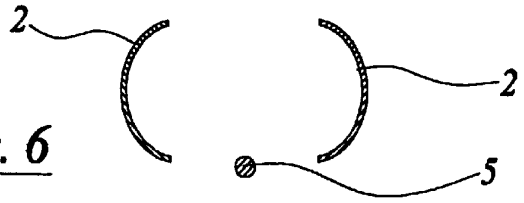



Fig. 6



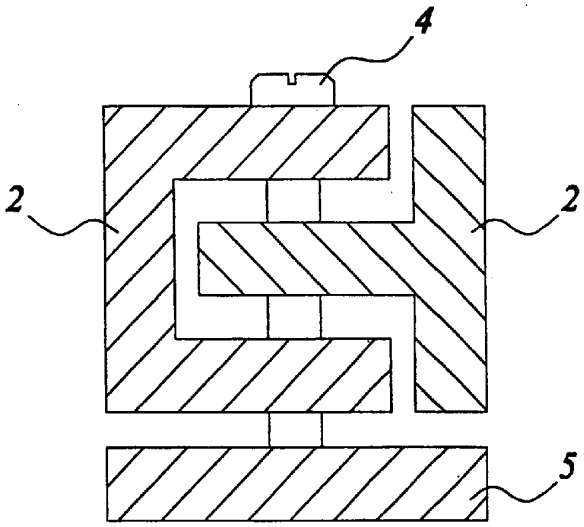



Fig. 7

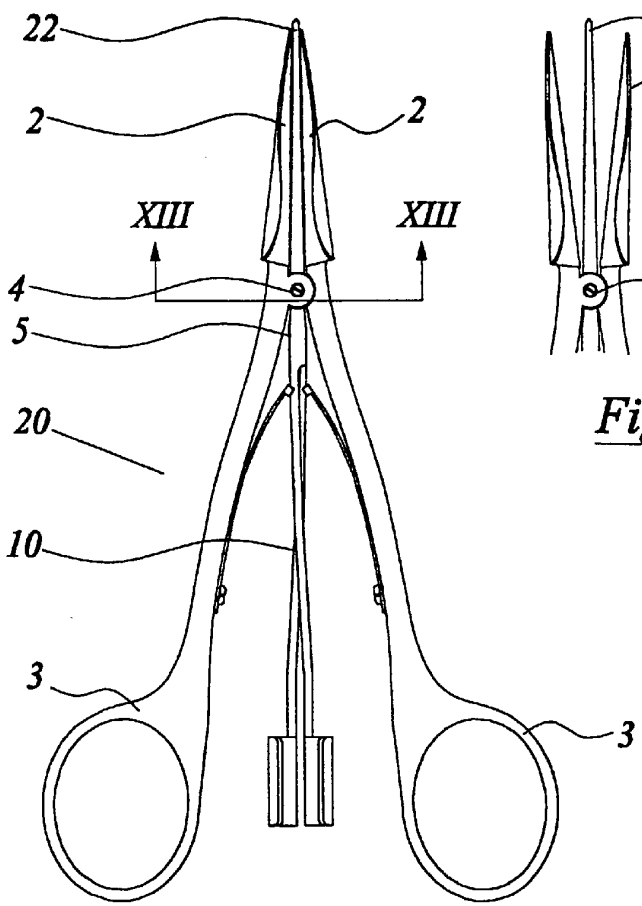



Fig. 8

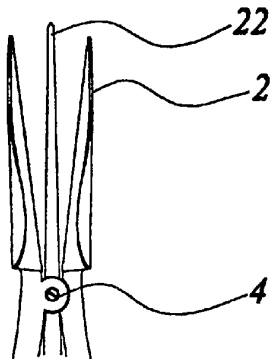



Fig. 9

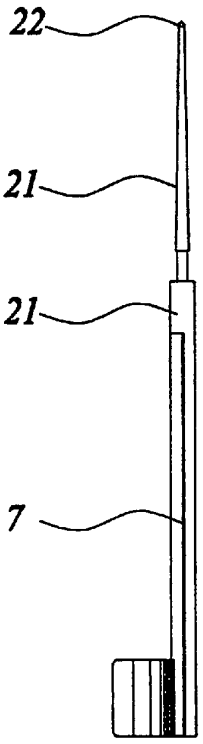



Fig. 10

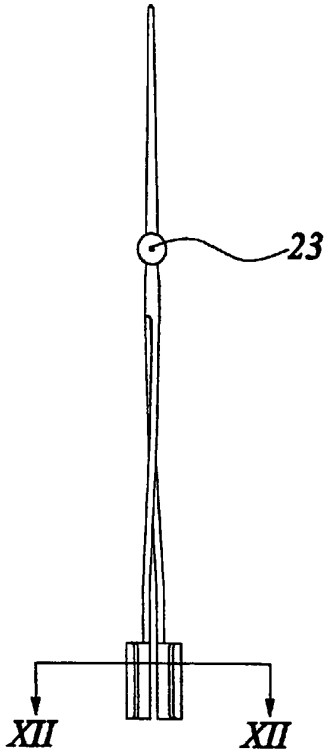



Fig. 11

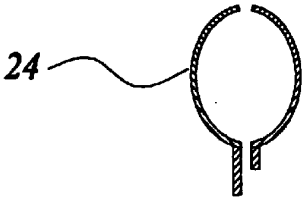



Fig. 12

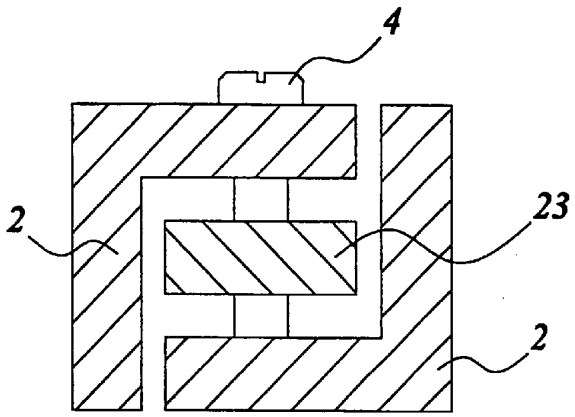



Fig. 13