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(54) **MULTIPLE-ANGLE SCISSOR BLADE**

SCHERENKLINGE MIT MEHREREN WINKELN

LAME DE CISEAUX A ANGLES MULTIPLES

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention generally relates to laparoscopic scissors and, more particular, to laparoscopic scissors having multiple cutting angles and multiple thicknesses.

Discussion of Related Art

[0002] During surgery, surgeons will typically need to cut into a multitude of objects such as tissues, suture and metal staples. A goal in the design of scissors and, in particular, in the design of scissors' blades is to optimize its effectiveness in cutting through different objects. For cutting through soft tissues, a large angle ground into the blade is most effective. That is, when sharp edges shear against each other, any tissue which comes between the blades of the scissors will get cut. The large angle on each blade is effective when cutting soft material because the blades can stay thin and razor sharp throughout the cut. A thin and sharp edge is optimal for soft materials because there is less resistance throughout the cut.

[0003] In contrast, when cutting through something hard such as a metal staple, the fine edge of a typical scissors' blade may not be as effective as when cutting soft tissue. A very fine and sharp edge may deform when required to cut a hard object. That is, a blade having a very large angle ground into it will deform if used to cut hard objects. To prevent the blades from deforming, the blades have to be designed to be thicker at and behind the point of cutting so that the blade edges do not deform. Having a small angle on the cutting edge of a scissor blade like this would help when cutting through hard materials such as staples or hard objects. Accordingly, because tissue and staples are typically cut with the same instrument, there is a need in the art for a laparoscopic scissors having both a large angle cutting edge and a small angle cutting edge on the same device.

[0004] EP 1 066 798 A2 discloses a pair of laparoscopic scissors according to preamble of claim 1.

SUMMARY OF THE INVENTION

[0005] The invention is directed to a pair of laparoscopic scissors according to claim 1 and a process of manufacturing the pair of laparoscopic scissors according to claim 12. Preferred embodiments are disclosed in the dependent claims.

DESCRIPTION OF THE DRAWINGS

[0006] The accompanying drawings, which are included in and constitute a part of this specification, illustrate the embodiments of the invention and, together with the description, explain the features, advantages and principles of the invention. In the drawings:

FIG. 1 illustrates a multiple-angle scissor blade in accordance with a first embodiment of the invention where the angle is continuously changing;
FIG. 2 illustrates a multiple-angle scissor blade in accordance with another embodiment of the invention where an angle is held constant in each section of the blade;
FIG. 3 illustrates a side view of a blade having multiple thicknesses in accordance with another embodiment of the invention;
FIG. 4 illustrates a profile of a blade formed from grinding in accordance with a manufacturing process of the invention;
FIG. 5 illustrates a top view of a blade formed from another independent profile manufacturing process in accordance with an embodiment of the invention; and
FIG. 6 shows pair of scissors and illustrating the cutting edges and throat portion in accordance with an embodiment of the invention.

DESCRIPTION OF THE INVENTION

[0007] The following description refers to the accompanying drawings that illustrate the embodiments of the invention. Other embodiments are possible and modifications may be made to the embodiments without departing from the scope of the invention as defined in the claims.

[0008] Thus, the following description is not meant to limit the invention.

[0009] Referring now to the drawings, and in particular to FIG. 1, there is shown an exemplary blade 10 of a scissors in accordance with the first embodiment of the invention. The blade 10 includes a tip portion 12, a body or throat portion 14, an outer surface 16, an inner surface 18, a cutting edge 22 and a pivot area 20. The cutting edge 22 forms an angle with the outer surface 16 along the length of the blade 10 such that tension at the tip portion 12 is about the same as tension at the body or throat portion 14. The function and effectiveness of the scissor blades depend heavily on the tension and angle the cutting surfaces are to each other. The blades are designed such that the tension when cutting is about the same throughout the length of the blades, e.g., at the tip and at the body or throat portion. In contrast, the conventional scissors have uniform blade thicknesses where tension at the tip is less than tension at the body portion because it is further away from the pivot. As a result, the conventional scissors blades may deform when cutting through harder and denser objects.

[0010] A novel feature of the invention is that an angle α formed between the cutting edge 22 and the axes perpendicular to the outer surface 16 at the tip portion 12 is different from an angle β formed between the cutting edge

22 and the axes perpendicular to the outer surface 16 at the body or throat portion 14. That is, the angle formed between the cutting edge 22 and the axes perpendicular to the outer surface 16 may be continuously changing over the length of the blade 10. In one aspect, the angle α is greater than the angle β. With this aspect, the edge of the blade would start at a very large angle α at the tip portion 12 and as it proceeds back along the edge toward the back of the blade, the angle starts to reduce until it is much smaller at the body or throat portion 14 of the blade. An advantage of the multiple-angle scissor blade 10 of the invention is the angles that most effectively cut different materials are all included on the same blade. Surgeons typically "snip" at tissue with the tip of the blades. Thus, grinding a large angle edge near the tip portion 12 of blade 10 would be most effective. Surgeons typically cut suture, which is a little harder than tissue, somewhere in the middle of the blades. Thus, grinding a smaller angle near the mid-portion of blade 10 would be optimal for suture. When cutting through very hard staples, surgeons will typically take a bite and force the staple somewhere between the center and the throat of the blades as illustrated in FIG. 6. Thus, grinding a very small angle into the blade near the throat portion 14 would be optimal for cutting hard materials. Also, the most leverage is available at the throat section, making the cut easier.

[0011] It is further appreciated that the blades may be of any shape. In one aspect, the blades define a slight curve towards one another, which provides sharper cutting due to a single point cutting action. The tip portion 12 may also be provided by an outer edge 26. The tapered tip portion 12 allows insertion of the scissor blades into a cavity in the body of a patient. Additionally, the tip is rounded at its outer edge 26 to avoid inadvertent puncturing or abrasion by the tip during use.

[0012] In another embodiment of the invention as illustrated in FIG. 2, multiple sections of different angles may be grinded in the blade 10b of the scissors. For example, the cutting edge 22b of the blade 10b may start out forming a very large angle α with the axes perpendicular to the outer surface 16b at the tip portion 12b. This angle α could be held constant for a given length. The angle α could then transition into a smaller angle β, which then could be held constant for a next given length. There could be as many sections along the blade as desired to obtain the various angles needed. For example, the angle α may be held constant over the tip portion 12b and the angle β may be held constant over the throat portion 14b with an angle transition portion 24b formed between the tip portion 12b and the throat portion 14b as illustrated in FIG. 2.

[0013] Another method for keeping the tension tight at the tips of the blades is to vary the thicknesses of the scissors blades. Referring to FIG. 3, there is shown a side view of a blade 30 having a tip portion 32, a mid-portion 34 and proximal portion 36. In this embodiment of the invention, the mid-portion 34 is thicker than the tip portion 32 and the proximal portion 36. That is, when the blades slide over each other during a cutting stroke, the blades flex so that only one point is actually touching. This flexure and the tension between the blades can be controlled and "forced" to different areas by varying the thickness of the blades. By providing a scissors with the blades having multiple thicknesses, the tension of each blade can be controlled and the flexure can be forced into certain areas on the blade. A thicker blade is also stronger in that section. When cutting through hard materials such as staples, a thicker, stronger blade is always beneficial.

[0014] It is appreciated that the scissors blades can be thickened in a number of locations and combinations such as:

(1) One blade could be thicker than the other to force the opposing blade to flex;
(2) Both blades could be thicker at the throat section to give more strength when cutting staples;
(3) Individual blades could be thickened on one side or the other to stiffen certain locations; and
(4) The tips of the blades could be thicker than the throat section to provide increased tension at the tips.

[0015] In another aspect of the invention, it is appreciated that the scissors can be manufactured in a number of different ways. The most common method is to stamp and form the blades from a predetermined thick material, and then grind a razor edge into them. This method is relatively inexpensive, but if the blades need to be heat treated after forming, the parts can twist and distort thereby reducing or eliminating the tension between the blades. Thus, another process may be required to bring the parts back into specification so the proper blade tension may be realized.

[0016] Since the blade tension is the most critical aspect of a scissors, it needs to be controlled from the beginning. A block of material that is heat treated to the required hardness can be manufactured prior to manufacturing the blades. A form-grinding machine can grind one profile into the blade such as the cutting profile 40 illustrated in FIG. 4. Form grinding is the process of taking a diamond impregnated grinding stone that has a particular shape cut into it, and shaving away the pre-hardened material until a block has the desired profile.

[0017] The profile as shown in FIG. 4 is not limited to grinding and may be cut with Wire EDM (Electrical Discharge Machining). Wire EDM is a metal removal technique using a controlled electrical current or spark erosion. The EDM machine moves a wire through the part eroding material away. With Wire EDM, there is always a gap between the part and the wire so there is no contact and virtually no deflecting force applied to the part, which ensures greater accuracy and tight tolerances of the finished part. The parts can also be formed by machining, cast injection molding or metal injection molding. The molded or cast part or block can then be further proc-

essed by EDM, laser cutting, waterjet cutting, or other manufacturing process to produce the finished parts. Waterjet cutting is a process of directing a fine, very high-pressure water stream to a material to cut or form a part. The waterjet stream may include fine metal particles to facilitate cutting. With the process of the invention, the profile can be accurately controlled, and the parts can be accurately produced every time. Additionally, there is no heat-treating step afterwards because it was done prior to grinding and cutting. The final step would be the edge sharpening. Another advantage of the independent profile manufacturing process is that the parts can be made with any number of multiple thickness sections in either profile as illustrated in FIG. 3. To do this with a traditional stamping process would be difficult as well as expensive, if possible at all.

[0018] Many alterations and modifications may be made by those having ordinary skill in the art without departing from the scope of the invention defined by the claims. Therefore, it must be understood that the illustrated embodiments may have been set forth only for the purposes of examples and that they should not be taken as limiting the invention.

Claims

1. A pair of laparoscopic scissors, comprising:

a pair of blades (10) connected at a pivot, each of the blades (10) having a length, a tip portion (12), a body portion (14), a pivot area (20), an outer surface (16), an inner surface (18) and a cutting edge (22), the cutting edge (22) forming an angle with the axes perpendicular to the outer surface (16) along the length of the tip and body portions;

characterized in that the angle (α) at the tip portion (12) is greater than the angle (β) at the body portion (14), such that tension during a cutting operation at the tip portion(12) is about the same as tension at the body portion (14) during the cutting operation.

2. The pair of scissors of Claim 1, wherein the angle formed is continuously changing over the length of the blade (10).

3. The pair of scissors of Claim 1, wherein the angle progressively decreases from the tip portion (12) to the body portion (14).

4. The pair of scissors of Claim 1, wherein the tip portion (12) has a first body thickness and the body portion (14) has a second body thickness.

5. The pair of scissors of Claim 4, further comprising a proximal portion having a third body thickness, wherein the second body thickness is thicker than the first and third body thicknesses.

6. The pair of scissors of Claim 1, wherein the tip portion (12) is tapered.

7. The pair of scissors of Claim 1, wherein the pair of scossors is suitable for cutting at least one of a body tissue, a suture and a surgical staple.

8. The pair of scissors of Claim 1, wherein the blades progressively move over each other and provide a point contact along the cutting edges during the cutting operation.

9. The pair of scissors of Claim 1, wherein the first blade is thicker than the second blade forcing the second blade to flex during the cutting operation.

10. The pair of scissors of Claim 4, wherein the second body thickness is greater than or equal to the first body thickness to provide more tension when cutting a surgical staple.

11. The pair of scissors of Claim 1, wherein at least one of the inner surface and outer surface of at least one of the blades is thickened to stiffen that section.

12. A process of manufacturing the pair of laparoscopic scissors of any of the preceding claims, comprising the steps of:

heat treating a block of material to form a pre-hardened block of material having a required hardness;
forming the blades into a blade profile from the pre-hardened block of material; and
sharpening the cutting edges of the blades.

13. The process of Claim 12, wherein forming the blades comprises applying an electrical discharge machining technique to the pre-hardened block of material to accurately form the blade profile.

14. The process of Claim 13, wherein the electrical discharge machining process comprises a wire electrical discharge machining process using controlled electrical current erosion.

15. The process of Claim 13, wherein the electrical discharge machining process comprises a wire electrical discharge machining process using spark erosion.

16. The process of Claim 13 wherein the blade profile defines a blade comprising a curve.

17. The process of any of Claims 13 to 16, wherein ap-

plying an electrical discharge machining process to accurately form the blades into a desired blade profile comprises accurately forming the blades into a desired blade profile without an additional heat-treating step.

18. The process of Claim 12, wherein forming the blades comprises form grinding the blades into a desired shape from the pre-hardened block of material.

19. The process of Claim 12, wherein forming the blades comprises laser cutting the blades into a desired shape from the pre-hardened block of material.

20. The process of Claim 12, wherein forming the blades comprises waterjet cutting the blades into a desired shape from the pre-hardened block of material.

Patentansprüche

1. Eine laparoskopische Schere, die Folgendes beinhaltet:

ein Paar Klingen (10), die an einem Drehpunkt verbunden sind, wobei jede der Klingen (10) Folgendes aufweist: eine Länge, einen Spitzenanteil (12), einen Körperanteil (14), einen Drehpunktbereich (20), eine Außenfläche (16), eine Innenfläche (18) und eine Schneidkante (22), wobei die Schneidkante (22), rechtwinklig zu der Außenfläche (16) entlang der Länge des Spitzen- und Körperanteils, einen Winkel mit den Achsen bildet; **dadurch gekennzeichnet, dass** der Winkel (α) an dem Spitzenanteil (12) größer ist als der Winkel (β) an dem Körperanteil (14), so dass die Spannung während eines Schneidvorgangs an dem Spitzenanteil (12) etwa die gleiche ist wie die Spannung an dem Körperanteil (14) während des Schneidvorgangs.

2. Die Schere gemäß Anspruch 1, wobei der gebildete Winkel sich über die Länge der Klinge (10) kontinuierlich verändert.

3. Die Schere gemäß Anspruch 1, wobei der Winkel sich von dem Spitzenanteil (12) bis zu dem Körperanteil (14) zunehmend verringert.

4. Die Schere gemäß Anspruch 1, wobei der Spitzenanteil (12) eine erste Körperdicke aufweist und der Körperanteil (14) eine zweite Körperdicke aufweist.

5. Die Schere gemäß Anspruch 4, die ferner einen proximalen Anteil beinhaltet, der eine dritte Körperdicke aufweist, wobei die zweite Körperdicke dicker ist als die erste und die dritte Körperdicke.

6. Die Schere gemäß Anspruch 1, wobei der Spitzenanteil (12) konisch zuläuft.

7. Die Schere gemäß Anspruch 1, wobei die Schere sich dazu eignet, mindestens eines von einem Körpergewebe, einer Naht und einer chirurgischen Klammer zu schneiden.

8. Die Schere gemäß Anspruch 1, wobei die Klingen sich zunehmend übereinander bewegen und während des Schneidvorgangs einen Punktkontakt entlang der Schneidkanten bereitstellen.

9. Die Schere gemäß Anspruch 1, wobei die erste Klinge dicker ist als die zweite Klinge, wodurch die zweite Klinge gezwungen wird, sich während des Schneidvorgangs zu biegen.

10. Die Schere gemäß Anspruch 4, wobei die zweite Körperdicke größer als oder gleich groß wie die erste Körperdicke ist, um mehr Spannung bereitzustellen, wenn eine chirurgische Klammer geschnitten wird.

11. Die Schere gemäß Anspruch 1, wobei mindestens eine von der Innenfläche und der Außenfläche von mindestens einer der Klingen verdickt ist, um diesen Abschnitt steifer zu machen.

12. Ein Verfahren zum Herstellen der laparoskopischen Schere gemäß einem der vorhergehenden Ansprüche, das die folgenden Schritte beinhaltet:

Wärmebehandeln eines Materialblocks, um einen zuvor gehärteten Materialblock mit der erforderlichen Härte zu bilden;
Formen der Klingen zu einem Klingenprofil aus dem zuvor gehärteten Materialblock; und
Schärfen der Schneidkanten der Klingen.

13. Das Verfahren gemäß Anspruch 12, wobei das Formen der Klingen das Anwenden einer elektroerosiven Bearbeitungstechnik auf den zuvor gehärteten Materialblock beinhaltet, um das Klingenprofil genau zu formen.

14. Das Verfahren gemäß Anspruch 13, wobei das elektroerosive Bearbeitungsverfahren ein Drahterosionsbearbeitungsverfahren unter Verwendung von gesteuerter elektrischer Stromerosion beinhaltet.

15. Das Verfahren gemäß Anspruch 13, wobei das elektroerosive Bearbeitungsverfahren ein Drahterosionsbearbeitungsverfahren unter Verwendung von Funkenerosion beinhaltet.

16. Das Verfahren gemäß Anspruch 13, wobei das Klingenprofil eine Klinge definiert, die eine Kurve beinhaltet.

17. Das Verfahren gemäß einem der Ansprüche 13 bis 16, wobei das Anwenden des elektroerosive Bearbeitungsverfahrens, um die Klingen genau zu einem gewünschten Klingenprofil zu formen, das genaue Formen der Klingen zu einem gewünschten Klingenprofil ohne einen zusätzlichen Wärmebehandlungsschritt beinhaltet.

18. Das Verfahren gemäß Anspruch 12, wobei das Formen der Klingen das Formschleifen der Klingen zu einer gewünschten Gestalt aus dem zuvor gehärteten Materialblock beinhaltet.

19. Das Verfahren gemäß Anspruch 12, wobei das Formen der Klingen das Laserschneiden der Klingen zu einer gewünschten Gestalt aus dem zuvor gehärteten Materialblock beinhaltet.

20. Das Verfahren gemäß Anspruch 12, wobei das Formen der Klingen das Wasserstrahlschneiden der Klingen zu einer gewünschten Gestalt aus dem zuvor gehärteten Materialblock beinhaltet.

Revendications

1. Paire de ciseaux laparoscopiques, comprenant :

une paire de lames (10) reliées à un pivot, chacune de ces lames (10) ayant une longueur, une partie pointe (12), une partie corps (14), une surface de pivotement (20), une surface extérieure (16), une surface intérieure (18) et une arête tranchante (22), cette arête tranchante (22) formant un angle avec les axes perpendiculaires à la surface extérieure (16) le long de la longueur des parties pointe et corps ;
caractérisée en ce que l'angle (α) à la partie pointe (12) est plus grand que l'angle (β) à la partie corps (14), de manière à ce que la tension pendant une opération de coupe à la partie pointe (12) soit à peu près la même que la tension à la partie corps (14) pendant l'opération de coupe.

2. Paire de ciseaux selon la revendication 1, dans laquelle l'angle formé change de façon continue sur la longueur de la lame (10).

3. Paire de ciseaux selon la revendication 1, dans lequel l'angle diminue progressivement de la partie pointe (12) à la partie corps (14).

4. Paire de ciseaux selon la revendication 1, dans laquelle la partie pointe (12) a une première épaisseur de corps et la partie corps (14) a une deuxième épaisseur de corps.

5. Paire de ciseaux selon la revendication 4, comprenant en outre une partie proximale ayant une troisième épaisseur de corps, la deuxième épaisseur de corps étant plus épaisse que la première et la troisième épaisseur de corps.

6. Paire de ciseaux selon la revendication 1, dans laquelle la partie pointe (12) est tronconique.

7. Paire de ciseaux selon la revendication 1, cette paire de ciseaux étant appropriée pour couper au moins soit un tissu biologique, soit une suture, soit une agrafe chirurgicale.

8. Paire de ciseaux selon la revendication 1, dans laquelle les lames bougent progressivement l'une sur l'autre et fournissent un point de contact le long des arêtes tranchantes pendant l'opération de coupe.

9. Paire de ciseaux selon la revendication 1, dans laquelle la première lame est plus épaisse que la deuxième lame, forçant la deuxième lame à fléchir pendant l'opération de coupe.

10. Paire de ciseaux selon la revendication 4, dans laquelle la deuxième épaisseur de corps est plus grande que ou égale à la première épaisseur de corps de façon à fournir plus de tension lors de la coupe d'une agrafe chirurgicale.

11. Paire de ciseaux selon la revendication 1, dans laquelle au moins soit la surface intérieure, soit la surface extérieure d'au moins une des lames est épaissie pour raidir cette section.

12. Procédé de fabrication de la paire de ciseaux laparoscopiques selon l'une quelconque des revendications précédentes, comprenant les étapes consistant à :

traiter thermiquement un bloc de matériau de façon à former un bloc de matériau pré-trempé ayant une dureté requise ;
former les lames en un profil de lame à partir du bloc de matériau pré-trempé ; et à
affiler les arêtes tranchantes des lames.

13. Procédé selon la revendication 12, dans lequel la formation des lames comprend l'application d'une technique d'usinage par électro-érosion sur le bloc de matériau pré-trempé de façon à former le profil de la lame avec précision.

14. Procédé selon la revendication 13, dans lequel le procédé d'usinage par électro-érosion consiste en un procédé d'usinage par électro-érosion à fil utilisant une érosion par courant électrique contrôlée.

15. Procédé selon la revendication 13, dans lequel le procédé d'usinage par électro-érosion consiste en un procédé d'usinage par électro-érosion à fil utilisant une érosion par étincelles.

16. Procédé selon la revendication 13, dans lequel le profil de lame définit une lame comportant une courbe.

17. Procédé selon l'une quelconque des revendications 13 à 16, dans lequel l'application d'un procédé d'usinage par électro-érosion pour former les lames avec précision en un profil de lame désiré comprend la formation des lames avec précision en un profil de lame désiré sans étape supplémentaire de traitement thermique.

18. Procédé selon la revendication 12, dans lequel la formation des lames comprend le meulage de forme des lames en une forme désirée à partir du bloc de matériau pré-trempé.

19. Procédé selon la revendication 12, dans lequel la formation des lames comprend la découpe au laser des lames en une forme désirée à partir du bloc de matériau pré-trempé.

20. Procédé selon la revendication 12, dans lequel la formation des lames comprend la découpe au jet d'eau des lames en une forme désirée à partir du bloc de matériau pré-trempé.

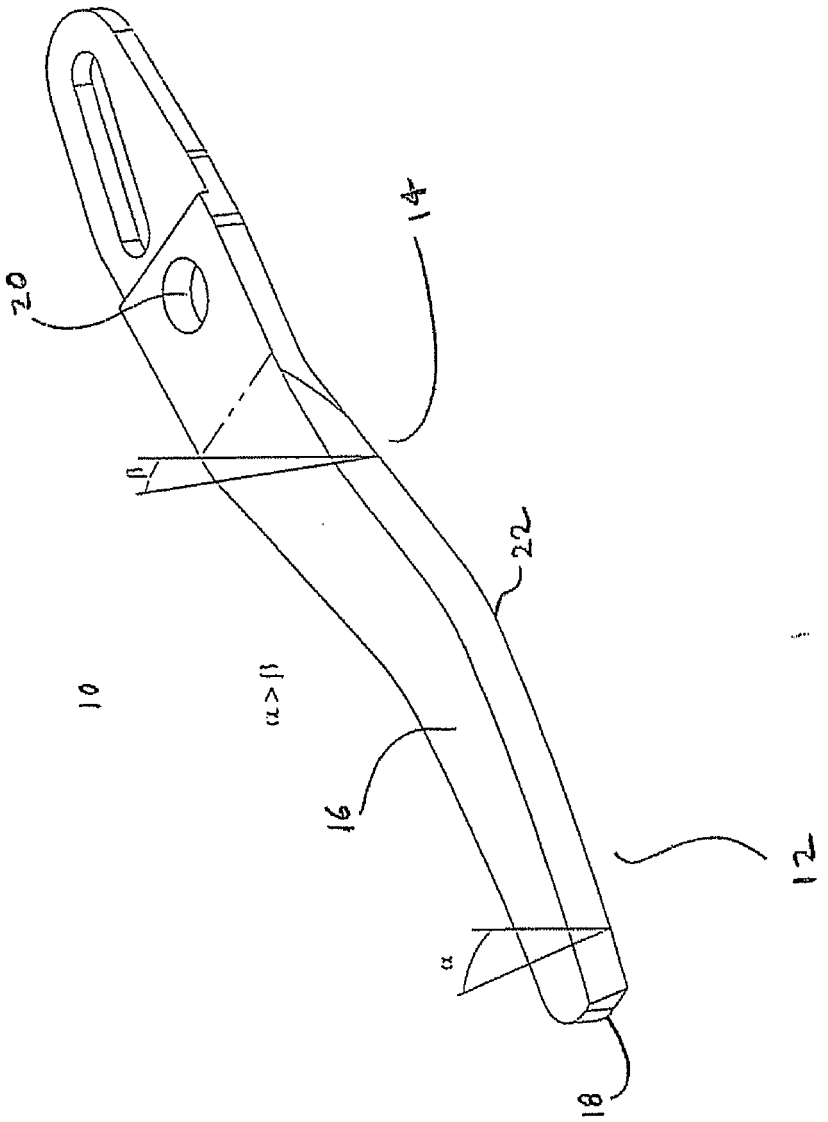

FIGURE 1

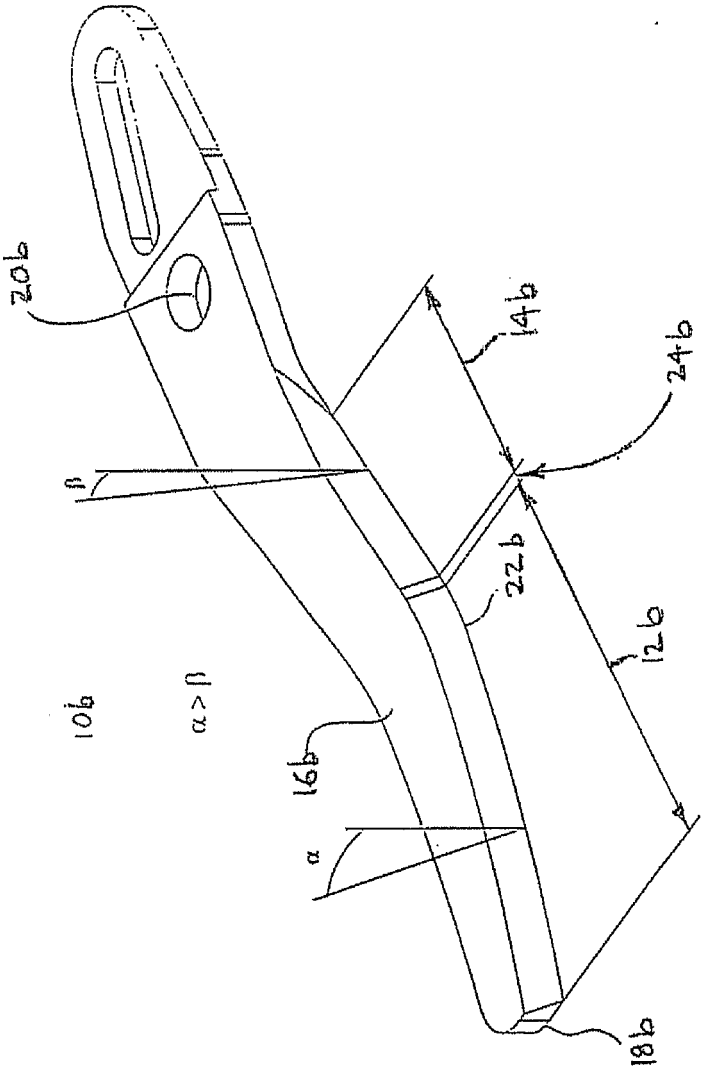

FIGURE 2

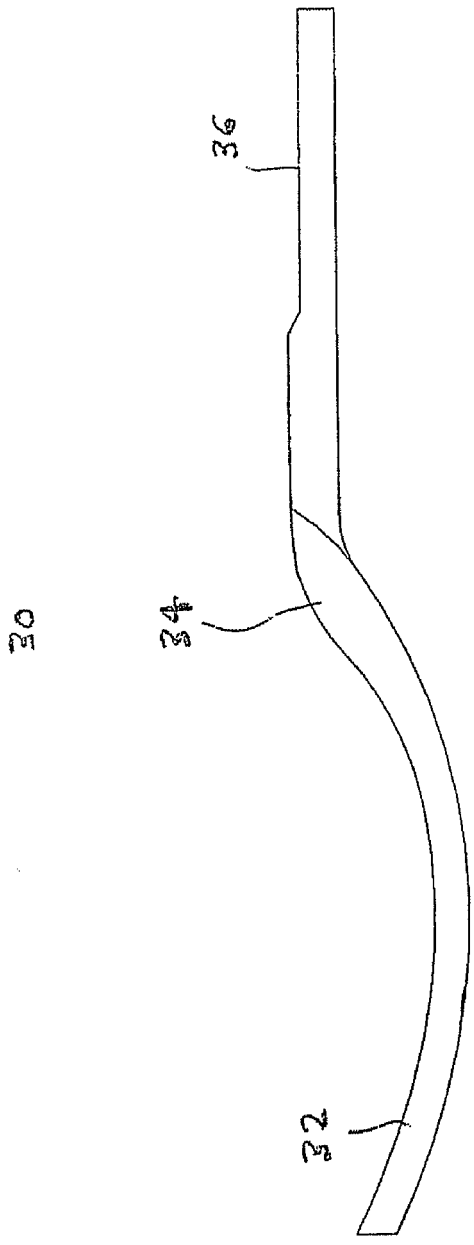

FIGURE 3

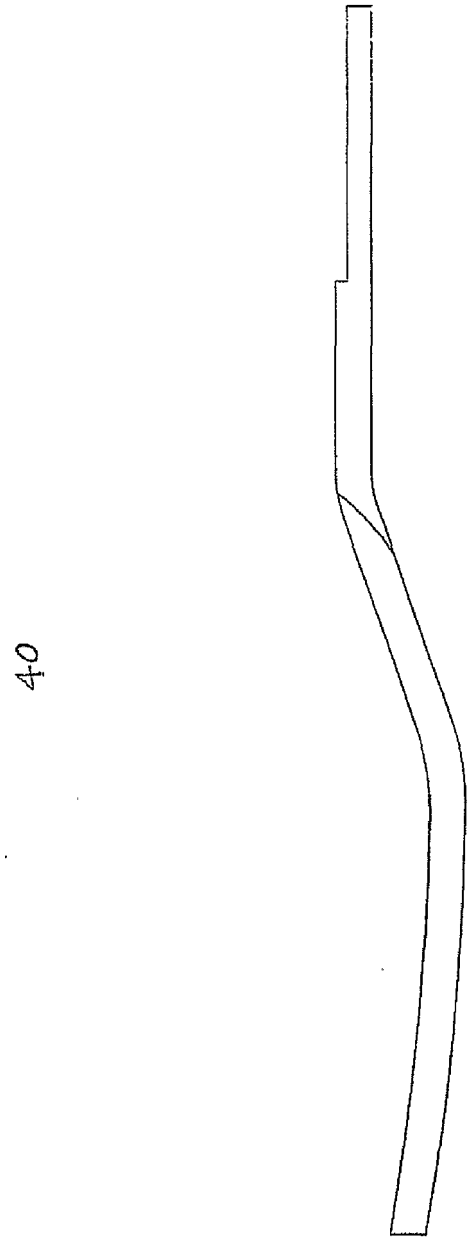

FIGURE 4

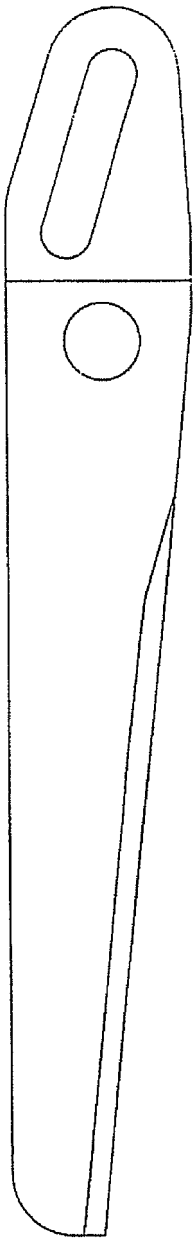

FIGURE 5

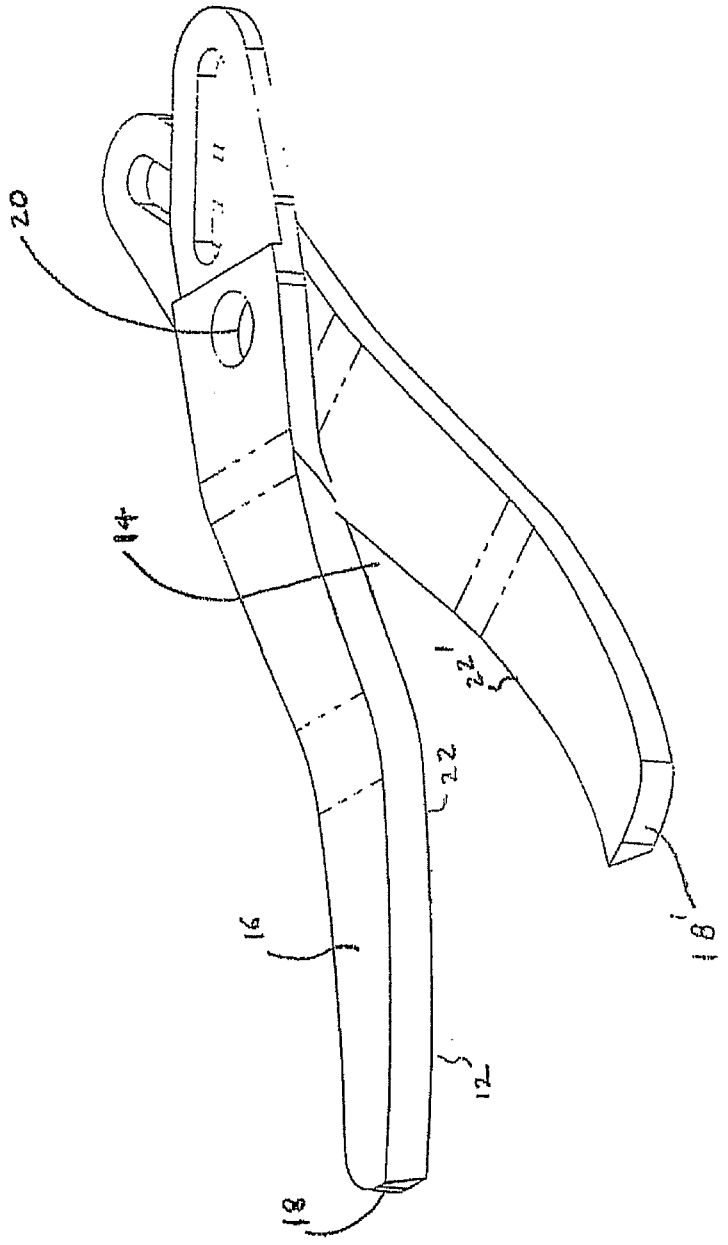

FIGURE 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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摘要(译)

一种腹腔镜剪刀，包括在枢轴处连接的一对刀片，每个刀片具有长度，尖端部分，主体部分，外表面，内表面和切割边缘。尖端部分可以具有第一主体厚度，主体部分可以具有不同于第一主体厚度的第二主体厚度。在切割操作期间，刀片逐渐地彼此移动，以提供沿着切割刃的点接触。在本发明的另一方面，公开了一种制造本发明的剪刀的方法，包括以下步骤：用来自预硬化材料块的线材EDM工艺将刀片形成为期望的形状;以及将刀刃的叶片。