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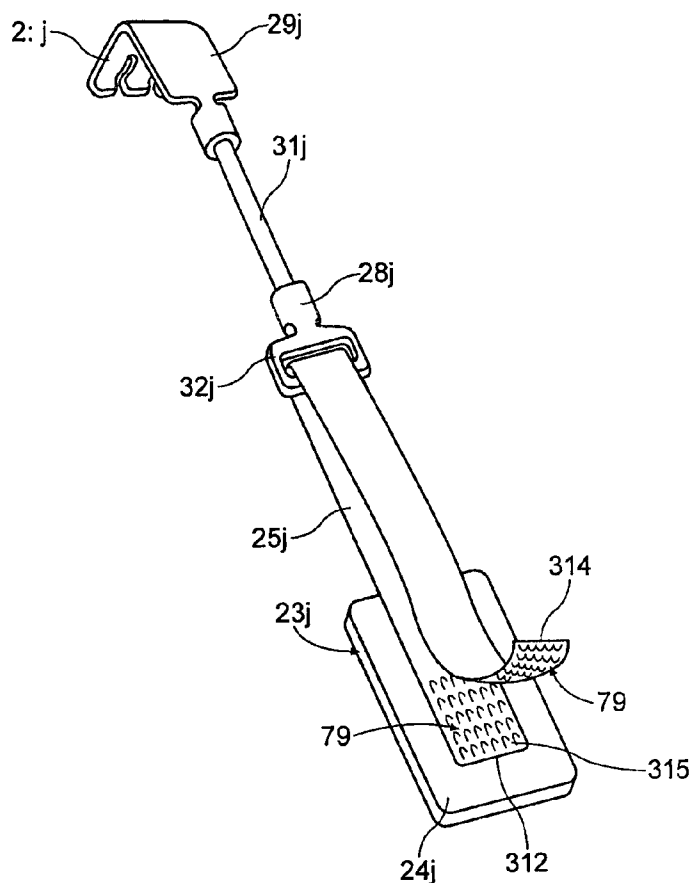
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- (71) Applicants (for all designated States except US):
NANYANG TECHNOLOGICAL UNIVERSITY [SG/SG]; 50 Nanyang Avenue, Singapore 639798 (SG).
INSIGHTRA MEDICAL, INC. [US/US]; 15560-c Rockfield Boulevard, Irvine, CA 92618 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): SHARP, Brad [US/US]; 8 Japonica, Irvine, CA 92618 (US). BELL,

Stephen, Graham [GB/IT]; Via Simone Martini 136, I-00142 Eur Roma (IT). NODA, Wayne, Arthur [US/US]; 28072 Paseo Rincon, Mission Viejo, CA 92692 (US). KHANOLKAR, Laxmikant [IN/IN]; 1201 Indra-drashan Phase II, Lokhandwala Complex Andheri,, Mumbai 400058 (IN). TAN, Meng, Pheng [SG/SG]; 98 Jalan Dermawan, Singapore 669409 (SG). BOEY, Yin, Chiang [SG/SG]; 8 Linden Drive, Singapore 288685 (SG). MA, Jan [SG/SG]; Blk 367 #08-437, Corporation Drive, Singapore 610367 (SG). WOUTERSON, Erwin, Merijn [NL/SG]; 460 Corporation Road, #06-01 Parc Vista, Singapore 649815 (SG).

- (74) Agent: SCHLEE, Alexander, R.; Schlee Intellectual Property International P.C., 3770 Highland Avenue, Suite 203, Manhattan Beach, CA 90266 (US).
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[Continued on next page]

(54) Title: A TISSUE RETRACTOR, TISSUE RETRACTOR KIT AND METHOD OF USE THEREOF



(57) Abstract: A tissue retractor for retracting tissue opened by an incision, said tissue retractor including a base support unit having a topside and an underside. The topside comprises at least one securing mechanism and the underside is adapted to be conformable and to be removably attachable to a surface proximate to the incision. The tissue retractor also includes at least one tissue hook having a tissue engagement portion and a mounting portion, wherein the tissue engagement portion is capable of engaging at least the periphery of the incision. The tissue retractor also includes at least one retractable member substantially inelastic in its central longitudinal axis and bendable in any axes deviating from said central longitudinal axis. The retractable member is adapted to receive the mounting portion of the tissue hook, wherein said retractable member is adapted to be removably attachable to said securing mechanism on the topside of the base support unit, and wherein said retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue it is engaged to.

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**A TISSUE RETRACTOR, TISSUE RETRACTOR KIT AND METHOD OF USE
THEREOF**

Cross Reference to Related Application Data

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[0001] The present application is related to and claims the benefit of United States provisional application 60/744,017, titled "Tissue Retractor System", filed on March 31, 2006, the entire contents of which is incorporated herein by reference for all purposes.

10

Technical Field

[0002] The present invention relates to the field of tissue retractors, and more specifically, to a tissue retractor and a tissue retractor kit for retracting tissue opened by an incision and to a method of use thereof.

15

Background

[0003] During the course of a surgical procedure, a surgeon opens tissue of a patient by first making at least one incision typically using a scalpel. After the incision is made in the
20 tissue, retractors are then used to retract the periphery of the incision in order to open the incision further. Once retracted, the open incision allows the surgeon to access other tissues or organs within the body, for example. Apart from just providing access, the tissue retractors serve to stabilize and present said retracted tissue in an orientation that is optimal for the surgeon to operate on.

25

[0004] During the retraction of incised tissue, care must be taken to avoid inflicting new, or as the case may be, additional trauma such as bruising, for example. Bruising may also be caused by viscoelastic forces inherently present in the contracting muscles or tissues of the patient, as said contracting muscles or tissues work against the forces exerted thereon by the
30 retractor. Accordingly, it is important to exercise care in the application of external forces typically requiring additional operating personnel during surgical procedures in order to minimize the possibility of causing any bruising or even tearing of the tissue during surgery.

[0005] In order to accommodate the aforesaid requirements of a tissue retractor (or surgical retractor), elastic surgical retractor systems have been used. Such elastic retractor systems typically include an elongated elastic member that is typically a length of hollow tubing. The elastic tube has its one end connected to a hooking mechanism adapted to engage with
5 the incised tissue, in particular, along the periphery of the incision.

[0006] An example of an elastic retractor system is disclosed in United States patent 4,430,991. This document discloses a surgical retractor having a hook affixed to an elastic hollow tubing member. The surgical retractor also includes a rigid annular retaining body
10 having a plurality of notches evenly distributed thereon. Each notch is adapted to tightly retain the elastic hollow tubing member when said member is stretched and installed therein. Accordingly, in use, the annular retaining body is arranged to surround incised tissue and a plurality of surgical retractors are used to engage and retract the tissue as needed. In this respect, the requirement for a rigid annular retaining body limits the
15 portability of the elastic retractor system as well as the flexibility in which said retractor may be employed.

[0007] Another example of a surgical retractor is described in United States patent 5,964,698. In this reference, the surgical retractor includes a sliding hook assembly having a
20 notch. The notch of the sliding hook assembly is capable of receiving an elongated elastic member, said elongated elastic member having a hook member. When the hook of the surgical retractor is engaged with tissue, the elongated elastic member is pulled back (stretched), thereby retracting the engaged tissue, and secured in the notch of the sliding hook assembly. The sliding hook assembly includes a hook that is used to engage the
25 assembly, to a surgical drape for example, in order to establish an anchor point. Although this tissue retractor is compact, it relies on the presence of surgical drapes to establish said anchor point. In this respect, the surgical drapes may not provide an optimal level of stability, which is crucial during surgery. Further examples of tissue retractors are also described in US patent 4,621,619 and US patent applications 2004/0186356 A1 and
30 2003/0092969 A1.

[0008] As such, there is still a need for a tissue retractor that is easy to use, compact, of a low-profile, portable and is yet cost-effective to manufacture, as recognized by the present invention.

5

Summary

[0009] A first aspect of the present invention relates to a tissue retractor including a base support unit, said base support unit having a topside and an underside. The topside includes at least one securing mechanism and the underside is adapted to be conformable and to be
10 removably attachable to a surface proximate to an incision. The tissue retractor also includes at least one tissue hook having a tissue engagement portion and a mounting portion. The tissue engagement portion is capable of engaging at least a portion of the periphery of tissue opened by the incision. The tissue retractor also includes a retractable member substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said
15 central longitudinal axis. The retractable member is adapted to receive the mounting portion of the at least one tissue hook, wherein said retractable member is adapted to be removably attachable to said securing mechanism on the topside of the base support unit. The retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged.

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[0010] A second aspect of the present invention relates to a base support unit of a tissue retractor. The base support unit includes a topside; and an underside being adapted to be conformable and to be removably attachable to a surface proximate to tissue opened by an incision. The base support unit is adapted to form an opening, which extends from the
25 topside through to the underside, and said opening surrounds the incision thereby providing access to the opened tissue surface beneath the base support unit.

[0011] A third aspect of the present invention relates to a tissue retractor kit. The kit includes at least one base support unit, said base support unit comprising a topside; and an underside
30 being adapted to be conformable and to be removably attachable to a surface proximate to tissue opened by an incision. The base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds the incision thereby providing access to the opened tissue surface beneath the base support unit. The kit

also includes at least one securing mechanism removably attachable to the topside and proximate to the opening; and a tissue hook and at least one retractable member. Each tissue hook comprises a tissue engagement portion and a mounting portion, said tissue engagement portion being capable of engaging at least the periphery of the tissue opened by
5 the incision. Each retractable member is at least substantially inelastic in its central longitudinal axis and flexible in any axis deviating from said central longitudinal axis. The retractable member is adapted to receive the tissue hook at its mounting portion, wherein said retractable member is adapted to be removably attachable to said securing mechanism, and wherein said retractable member is retractable away from the incision, such that the
10 tissue engagement portion retracts tissue to which it is engaged. In this respect, the invention also provides a two-part kit wherein the first part includes at least one base support unit, at least one securing mechanism removably attachable to the base support unit and at least one retractable member; and the second part includes at least one tissue hook adapted to attach to the retracting member.

15

[0012] A fourth aspect of the present invention relates to a method that retracts tissue opened by an incision with a tissue retractor including a base support unit, said base support unit having a topside and an underside. The topside includes at least one securing mechanism and the underside is adapted to be conformable and to be removably attachable to a surface
20 proximate to an incision. The tissue retractor also includes at least one tissue hook having a tissue engagement portion and a mounting portion. The tissue engagement portion is capable of engaging at least a portion of the periphery of tissue opened by the incision. The tissue retractor also includes a retractable member substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal
25 axis. The retractable member is adapted to receive the at least one tissue hook at its mounting portion, wherein said retractable member is adapted to be removably attachable to said securing mechanism on the topside of the base support unit. The retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged. The method includes attaching the base support unit on the surface
30 proximate to the incision; connecting the retractable member to the mounting portion of the tissue hook; engaging the tissue hook with at least the periphery of the incision; retracting the retractable member away from the incision, such that the tissue engagement portion of the tissue hook retracts tissue it is engaged with to a predetermined distance; and securing

the retracted retractable member to the securing mechanism on the topside of the base support unit.

[0013] A fifth aspect of the present invention relates to a method that retracts tissue opened
5 by an incision including attaching a base support unit on the surface proximate to the incision, wherein the base support unit comprises a topside; and an underside being adapted to be conformable and to be removably attachable to a surface proximate to the incision. The base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds tissue opened by the incision thereby
10 providing access to the opened tissue surface beneath the base support unit. The base support unit is positioned such that the opening surrounds the incision and provides access to the tissue surface beneath the base support unit.

Brief Description of the Drawings

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[0014] The various aspects of the present invention will be further described with reference to the following figures in which:

[0015] **Figures 1A – 1H** illustrate various exemplary embodiments of a tissue retractor
20 according to the present invention;

[0016] **Figures 2A – 2D** illustrate an exemplary embodiment of a tissue retractor including a hook and loop fastener strip;

25 [0017] **Figures 3A – 3E** illustrate exemplary embodiments of tissue retractors including ratchets;

[0018] **Figures 4A – 4D** illustrate various exemplary embodiments of base support units capable of having a plurality of retractable members;

30

[0019] **Figure 5** illustrates an exemplary embodiment of a base support unit; and

[0020] **Figures 6A – 6B** illustrate exemplary embodiments of tissue retractors in use.

Detailed Description and Exemplary Embodiments

[0021] **Figures 1A – 1H** illustrate exemplary embodiments of tissue retractors that disclose
5 the general principles of a tissue retractor according to the present invention. The present
invention will be explained in the following with reference to these figures.

[0022] Referring first to the tissue retractor of **Figure 1A**, the tissue retractor includes a base
support unit **12a** having a topside **13a** and an underside **15a**. The topside **13a** includes at
10 least one securing mechanism **16a** and the underside **15a** is adapted to be conformable, and
to be removably attachable, to a surface proximate to an incision (not shown). The tissue
retractor of **Figure 1A** also includes at least one tissue hook **18a** having a mounting portion
17a and a tissue engagement portion **19a**. The tissue engagement portion **19a** is capable of
engaging at least a portion of the periphery of tissue opened by the incision. The tissue
15 retractor of **Figure 1A** also includes a retractable member **14a**. The retractable member **14a**
is substantially inelastic in its central longitudinal axis (i.e. it is not stretchable) and is
flexible in at least one axis that deviates from said central longitudinal axis. The retractable
member **14a** includes an end **2a** that is adapted to receive the mounting portion **17a** of the at
least one tissue hook **18a**.

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[0023] In this exemplary embodiment of **Figure 1A**, the mounting portion **17a** of the tissue
hook **18a** is essentially a tube that is hollow and diametrically elastic. In this embodiment,
the end **2a** of the retractable member **14a** is a rod-like structure that is diametrically larger
than the tube **17a**. As such, when the end **2a** is assembled with the tube **17a**, via an
25 insertion, a tight fit, form fit or snap fit may take place. Alternatively, the tube **17a** may be
bonded to the retractable member **14a** using adhesives or thermal bonding, for example.

[0024] As also illustrated in the exemplary embodiment of **Figure 1A**, the retractable
member **14a** is also adapted to be removably attachable to said securing mechanism **16a** on
30 the topside **13a** of the base support unit **12a**. In this embodiment, the securing mechanism
16a is a releasable clamp, which may be spring-loaded, for example, through which the
retractable member **14a** is threaded through. When the retractable member **14a** is retracted
away from the incision (and towards the base unit **12a**, which is stationary), the tissue

engagement portion **19a** retracts tissue to which it is engaged, thereby opening up an area of tissue. Once a suitably sized area of tissue has been retracted, the retractable member **14a** is then clamped by the securing mechanism **16a** such that the retractable member **14a** and the tissue hook **18a** are held in a fixed position.

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[0025] The underside **15a** of the base **12a** of the embodiment of the tissue retractor of **Figure 1A** is sufficiently flexible such that it is capable of conforming to a surface to which it is attached to. In other words, the underside **15a** is flexible in that it adopts the shape and contouring of the surface, which in this case is typically that of a human body, on which it is placed, and adheres to that surface.

[0026] In another exemplary embodiment shown in **Figure 1B**, the tissue retractor also includes a base support unit **12b** having a securing mechanism **16b**, a (double-ended) tissue hook **18b** connected, via a mounting portion **17b**, to a retractable member **14b**. This retractable member **14b** is inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, and is connected (or coupled) to the tissue hook **18b**. In **Figure 1B**, the base support unit **12b** is illustrated as a flexible adhesion pad or a drape that is removably attachable to a surface (typically a tissue or a limb) proximate to the incision (not shown). In this embodiment, the securing mechanism **16b** is a metal wire bent in a teardrop shape, having a narrow end **166a** and a wide end **166b**. The wide end **166b** of the teardrop shaped wire securing mechanism permits the knobs **22** to pass through but not the narrow end **166a**.

[0027] The retracting member **14b**, which is essentially a flexible rod-like structure that is inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, includes a plurality of knobs **22** distributed along its length. The knobs **22** may be formed integrally with the retracting member **14b** or slid across the retracting member **14b** such that a predetermined distribution across the retracting member **14b** is created. The mounting portion **17b** may be integrally formed, as shown, with the rod-like structure **14b**. Alternatively the mounting portion **17b** may, as in the exemplary embodiment of **Figure 1A**, be insertable, removably or otherwise, into the knob **22** nearest an end of the rod-like structure **14b**. The mounting portion **17b**, if integrally formed, may be

made from the same material, such as plastic, which is used herein for the retractable member 14b for example.

[0028] Accordingly, when in use, the retracting member 14b, including its knobs 22 are
5 withdrawn away from the incision via the wide end 166b of the teardrop shaped wire
securing mechanism 16b until the tissue engaged to the tissue hook 18b is sufficiently
retracted. At that point, the retractable member 14b is raised into the narrow end 166a of the
teardrop shaped wire securing mechanism 16b. With the retracted tissue attempting to revert
to its original relaxed state from its presently retracted state, a reaction force is exerted on
10 the retractable member 14b directed towards the incision. However, due to the retractable
member 14b being in the narrow end 166a of the teardrop shaped wire securing mechanism
16b, the retractable member 14b is prevented from moving towards the incision as the knob
22 is caught by said narrow end 166a.

15 [0029] Similarly, the exemplary embodiment of Figure 1C also includes a base support unit
12c having a securing mechanism 16c, a tissue hook 18c and a retractable member 14c that
is inelastic in its central longitudinal axis and flexible in at least one axis deviating from said
central longitudinal axis. The retractable member 14c may be a braided multi-strand wire
(cable), or alternatively, may also be a belt or a strap made of plastic or a suitable fabric, for
20 example. The retractable member 14c is connected (or coupled) to the (single-ended) tissue
hook 18c via mounting portion 17c. In this exemplary embodiment, the base support unit
12c is a flexible thin pad having an adhesive underside (not shown). The securing
mechanism 16c is also teardrop shaped with a wide end 167b and a narrow end (notch)
167a and the retractable member 14c is a cord. Essentially, the retractable member 14c may
25 be, as mentioned, a cord, strip, strap, belt or any other suitable member that is substantially
inelastic in its central longitudinal axis (i.e. it is not stretchable) and flexible in at least one
axis that deviates from said central longitudinal axis. As in the previous exemplary
embodiment of Figure 1B, the retractable member 14c may be retracted up to a
predetermined distance via the wide end 167b of the teardrop shaped securing mechanism
30 16c upon which, it may be secured by inserting and wedging the retractable member 14c
into the narrow end (notch) 167a of the teardrop shaped securing mechanism 16c.

[0030] Referring to the exemplary embodiment of **Figure 1D**, the tissue retractor thereof, as in the previous exemplary embodiments, includes a base support unit **12d**, a retractable member **14d**, a tissue hook **18d** and a securing mechanism that includes a stopper **34** mounted on the topline **13d** of the base support unit **12d**, and a rotating body **32**. The stopper **34** may be of any suitable shape and is illustrated as being substantially rectangular in the present embodiment. The position of the rotating body is always behind the stopper, i.e. further from an incision than the stopper **34**, when in use. The tissue hook **18d** may be attached to the retractable member **14d** by any of the suitable mechanisms disclosed herein such as tight-fit means, form fit means and snap fit means, for example. The retractable member **14d** may then be removably coupled to the rotating body **32** after being threaded through the stopper **34**.

[0031] The rotating body **32** is slidably connected along retractable member **14d**. The rotating body **32** may include a chuck mechanism and rotates between an open position and a closed position. In the open position, the chuck mechanism is correspondingly open and the retractable member **14** (a cord, a strip, a strap or a belt, for example) may freely slide through the rotating body **32** and stopper **34**. Once the retractable member **14d** is retracted to a predetermined distance, the rotating body **32** may be rotated into its closed position, which closes the chuck mechanism and locks the rotating body **32** onto a specific portion of the retractable member **14d**.

[0032] If the tissue hook **18d** is engaged with retracted tissue while the rotating body **32** is in the closed position, the stopper **34** prevents the rotating body **32**, which is locked onto the retractable member **14d**, from moving towards the incision, thereby maintaining the retracted state of said incised tissue.

[0033] In **Figure 1E** the exemplary embodiment of the tissue retractor differs from that of **Figure 1D** with regard to its securing mechanism. The securing mechanism of the embodiment of **Figure 1E** includes a roller **38** that is lockable by an engagement lever (or frame) **36**. The engagement lever **36** is connected to the roller **38** along its central longitudinal axis of rotation and is pivoted about an axis parallel to said central longitudinal axis. Accordingly, in this embodiment, the retractable member **14e** is typically a belt-like form and when the retractable member **14e** is retracted away from an incision, the roller **38**

rotates, about its longitudinal axis, in a clockwise direction. However, once the engagement lever 36 is closed downwards, the roller 38 is pressed, by the engagement lever 36, against the retractable member 14e with sufficient force such that the roller 38 prevents the retractable member 14e from rolling in an anti-clockwise direction, i.e. towards the incision,
5 even if the retractable member is biased to do so.

[0034] The engagement lever 36 may be spring loaded such that it is biased towards being open upwards, i.e. in a release position such that the roller 38 may rotate freely. The engagement lever 36 may also include a catch that secures to the base support unit 12e when
10 the engagement lever 36 is closed downwards.

[0035] In Figure 1F, an exemplary embodiment of a tissue retractor having a complementary securing mechanism is shown. In this embodiment, as in the embodiment of Figure 1B, the retractable member 14f includes knobs 42 that may be integrally formed
15 therewith or arranged thereon in a slidable manner. The topside 13f of the base support unit 12f comprises a molded surface having a plurality of crevices 44 that are complementary to the shape of the knobs 42. The crevices 44 are adapted to accommodate therein in a secure fit (or tight fit) manner, at least a selection of the knobs 42 of the retractable member. As shown, when the two knobs 42 are received by the complementary crevices 44, the position
20 of the retractable member 14f is maintained with respect to base support unit 12f.

[0036] Exemplary embodiments illustrated in Figures 1G and 1H, utilize a similar slot 51 and 56 and pin 52 and 58 securing mechanism. In Figure 1G a common slot 51 having a plurality of notches 54 is formed on the base support unit 12g. A corresponding pin 52,
25 which may either be attached to the retractable member 14g or be an independent body, serves to secure the retractable member 14g to the base support unit 12g.

[0037] In the exemplary embodiment of Figure 1G where the pin 52 is attached to the retractable member, either integrally or as a tight gripping clip, for example, the retractable
30 member 14g is threaded through the base support unit such that the pin 52 slides freely along the slot 51. When the tissue hook 18g is engaged to tissue opened by an incision, the retractable member 14g is pulled away from the incision to retract the tissue to a predetermined distance. Typically, in this embodiment, where the pin is attached to the

retractable member 14g, the distance that the retractable member 14g may be retracted is limited by the length of the slot 51.

[0038] In the alternative exemplary embodiment of Figures 1G (i) – 1G (iii), where the pin 52 is an independent body, the retractable member 14g may still be threaded through the base 12g. In this embodiment, when the retractable member 14g has been sufficiently retracted, the pin 52 may then be placed in the notch 54 to secure the retractable member 14g via a pin to a press-fit mechanism, for example. The pin 52, when secured to the retractable member 14g, may still move along the slot 51 should the tissue in question require additional retraction without having to remove the pin 52 and re-insert it as previously described. This is especially useful if the adjustments (additional retraction) required to the retractable member 14g are not significant and slight.

[0039] As illustrated in Figures 1G (i) – (iii), with each subsequent notch 54 in which the pin 52 is inserted into, the retractable member retracts by a greater distance, such that the tissue hook 18 is drawn nearer to the base support unit 12.

[0040] In Figure 1H, the retractable member 14h includes a plurality of slots 56 or openings (through-holes) distributed along its length. The slots or openings 56 may be formed via punching out the required shape and sized slot or opening on a regular retractable member. The topside 13h of the base support member 12h includes a pin 58 having a diameter that may be slightly larger than the diameter of the slot 56. When in use, the pin 58 can provide for a tight and secure fit between the slot 56 and the pin 58.

[0041] Alternatively, the diameter of the pin 58 may be less than the diameter of the slot 56 thereby resulting in a loose fit, which can be easier for a surgeon, for example, to use during an operation.

[0042] Figures 2A and 2B illustrate an exemplary embodiment of a tissue retractor having a hook and loop fastener as a securing mechanism. With reference to these figures, the exemplary embodiment illustrated here, as in previous embodiments, includes a base support unit 12i having a topside 13i and an underside 15i. The topside 13i includes a securing mechanism 66, which removably secures a retractable member 14i to the base

support unit **12i**. The securing mechanism **66** may, for example, be an adhesive or (a part or a layer of) a hook and loop fastener. The underside **15i** is adapted to be conformable to any surface that it is to be attached to. The tissue retractor also includes a tissue hook **18i**, wherein the tissue hook **18i** includes a tissue engagement portion **19i** and a mounting
5 portion **17i**. The tissue hook **18i** is connected to one end **201** of the retractable member **14i** via the mounting portion **17i**. The mounting portion **17i** in **Figure 2A** may be an extended elastomeric or rigid cord or tube, for example. Alternatively, in the embodiment illustrated in **Figure 2B**, the mounting portion **17i** may be a clip or clamp that secures directly to the end **201** of the retractable member **14i**

10

[0043] In this exemplary embodiment of **Figures 2A** and **2B**, the retractable member **14i** is a hook and loop fastener strip having an underside **200**. Typically, a hook and loop fastener includes two layers namely a hook side and a loop side. Typically, the hook side comprises a fabric covered with plastic hooks and the loop side comprises plastic loops adapted to
15 engage with the hook side. An example of a hook and loop fastener strip includes VELCRO® materials as originally described in US patent 2,717,437, which is hereby incorporated by reference for all purposes.

[0044] In the exemplary embodiments of **Figure 2A** and **2B**, the underside **200** of the
20 retractable member **14i** may be the hook side, while the securing mechanism **66** on the top side **13i** of the base support unit **12i** may be the loop side. Accordingly, and in line with the above description provided about hook and loop fasteners, the underside **200** has raised pile threads **9**, the ends of which are hook shaped and ordinary raised pile threads **10** extending therefrom. Similarly the securing mechanism **66** on the top side **13i** of the base
25 support unit **12i** also includes raised pile threads **9**, the ends of which are hook shaped and ordinary raised pile threads **10**, both of which may be considered to be loops, extending therefrom. When connected together, the raised pile threads **9** on the underside **200** of the retractable member **14i** engage the pile threads **9** of the opposing face, i.e. the securing mechanism **66** located on the top side **13i** of the base support unit **12i** (see also US patent
30 2,717,437 for a detailed description of the principle behind the hook and loop fastener mechanism).

[0045] Referring to the mounting portion of the tissue hook, in another exemplary embodiment of the tissue retractor illustrated in **Figures 2C and 2D**, the mounting portion **17i** thereof includes an aperture or slot **21i**. The mounting portion **17i** also includes a shock prevention element **20i**. Turning to the securing mechanism of this embodiment, the first end **201** of the retractable member **14i** is secured to the securing mechanism **66** (not visible) on the topside **13i** of the base support unit **12i**. A second end **203** is threaded through said aperture **21i** and loops back to be removably attached to a facing side **204** of the retractable member **14i**. The facing side **204** is proximate to the first end **201**. The facing side **204** also includes an attaching mechanism **68** that attaches to a corresponding face of the looped back portion of the retractable member **14i**. The term "looped back portion" refers to the retractable member **14i** that passes through the aperture **21i**. Accordingly, the looped back portion of the retractable member **14i** may also include a complementary attaching mechanism adapted to removably attach to attaching mechanism **68**. Attaching mechanism **68** may be any one of a hook and loop fastener, as previously described, or an adhesive, for example.

[0046] While the retractable member of the embodiments of **Figures 2A and 2D** is formed as a hook and loop fastener strip with its entire underside **200** comprising a part of or a layer of a hook and loop fastener, the retractable member of the embodiment of **Figures 2C and 2D** is an illustration of an embodiment wherein only at least one portion of the retractable member comprises a part of or a layer of a hook and loop fastener.

[0047] Reverting to the mounting portion of **Figures 2C and 2D**, the shock prevention element **20i** is typically elastomeric and as illustrated, the shock prevention element **20i** can be an elastomeric tube. The shock prevention element **20i** serves the purpose of providing a greater degree of flexibility to the mounting portion **17i**. A completely rigid system (which is also considered as part of the present invention) may possibly impart, inadvertently, injury to the tissue being retracted. Examples of elastomeric materials that may be used in fabricating the shock prevention tube **20i** include, but are not limited to, latex rubber, silicone runner and thermoplastics, such as polyvinylchloride (PVC), for example.

[0048] In an alternative exemplary embodiment (not illustrated in a figure), the mounting portion **17i** may include two sub-portions. The first sub-portion may be the shock

prevention element **20i** attached to the tissue hook **17i** followed by the second sub-portion that includes the aperture **21i**. In this alternative exemplary embodiment, instead of an elastomeric tube, the shock prevention element **20i** may simply be a shock prevention cord that is also elastomeric, for example.

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[0049] The surface of the topside **13i** is adapted to secure a hook or a loop fastener strip and may include a shape selected from the group consisting of a continuous strip, a discrete element and a combination thereof. The surface shape of the at least one continuous fastener strip and the at least one discrete element is selected from the group consisting of
10 rectangular shapes, triangular shapes, elliptical shapes and any combination thereof.

[0050] **Figure 2D** is a perspective view of the exemplary embodiment of **Figure 2C**. In the embodiment of **Figure 2D**, one end portion of the hook and loop fastener **14i** is attached to the topside **13i** of the base support unit **12i**. This end portion of the hook and loop fastener
15 **14i** has on its surface, opposite the topside, a securing mechanism **66** adapted to secure a hook and loop fastener strip **14i** also having a corresponding securing mechanism **66**. In other words, the securing mechanism **66** attached to the topside **13i** of the base **12i** is complementary to the securing mechanism **66** located on the hook and loop fastener strip **14i**. In this particular embodiment, it should also be noted that the means of securing the
20 hook and loop fastener strip **14i** to the base **12i** may also be by way of hook and loop fasteners. Alternatively, the hook and loop fastener strip **14i** may be bonded to the base **12i** using adhesives or thermal bonding, for example.

[0051] **Figures 3A – 3E** illustrate exemplary embodiments of various ratchetable tissue
25 retractors. In the embodiment of **Figure 3A**, the retractable member **14j** is a plastic strap that includes a plurality of ratchet teeth **76** arranged along its longitudinal axis. The plastic strap **14j** is securable to the topside **13j** of the base support unit **12j** via securing mechanism **72**. The plastic strap is connected to a tissue hook **18j** via its mounting portion **17j**. Securing mechanism **72** on the topside **13j** of the base support unit **12j** includes a releasable pawl **74**,
30 which is made releasable by a push-button **78**. An example of such straps having a releasable securing mechanism as described above is disclosed in US patent 6,185,791, which is hereby incorporated by reference for all purposes.

[0052] In the embodiment of **Figure 3A**, the push-button **78**, when depressed, actuates the pawl **74** in an upward direction and out of the recesses formed between the ratchet teeth **76**. This allows the plastic strap **14j** to be moveable, i.e. to be retracted away from, or moved towards an incision. Upon release of the push-button **78**, the pawl **74** moves downwards to
5 its default position and slides into the nearest recess between two ratchet teeth **76** nearest thereto, thereby engaging and retaining the plastic strap **14j** in its current position.

[0053] As mentioned earlier, the plurality of ratchet teeth **76** of the plastic strap **14j** is adapted to releasably engage with the releasable pawl **74** as the plastic strap is retracted
10 away from the incision. In other words, the plastic strap **14j** may only retract or move in one direction, this direction being away from the incised tissue while the releasable pawl **74** is engaged. When the push-button **78** is actuated, the releasable pawl **74** is released (or disengaged) in the manner as previously described, and the plastic strap **14j** may then move in a second direction opposite to the first. More specifically, in one non-limiting
15 implementation, when medical personnel, such as a surgeon, for example, retracts tissue, the ratchet teeth **76** are drawn past the releasable pawl **74**, regardless whether the pawl is in its engaged or released position. Once the retraction of the retractable member **14** stops, the pawl drops into a recess defined between two of the nearest ratchet teeth **76** to provide an immovable engagement to the plastic strap **14j** until such time as the pawl **74** is lifted out of
20 the recess and therefore, removed from engagement with the ratchet teeth **76**, via actuation of the push-button **78**.

[0054] In this context it is to be noted that a ratchetable tissue retractor is taken to be one that includes a pawl (either mounted on the topside of the base support unit or on the
25 retractable member) working in combination with ratchet teeth, mounted to correspond to said pawl. This allows for motion in one direction only, unless said pawl is released. In this respect, **Figures 3B – 3E** illustrate other various embodiments of ratchetable tissue retractors according to the aforesaid definition. In **Figure 3B** the retractable member **14k** includes a pawl **84** that engages the ratcheted teeth **82** of the base support unit **12k**. In this
30 embodiment, the shape of the pawl **84** and the shape of the ratchet teeth **82** each have a curvature of a fixed radius such that the curvature of the pawl **84** corresponds to that of the ratchet teeth **82** thereby ensuring complementary mating surfaces between said pawl **84** and ratchet teeth **82**.

[0055] In Figures 3C – 3E, the ratchet teeth are all saw-tooth in shape. Accordingly, the corresponding pawls are also saw tooth in shape. Referring to Figure 3C, as in Figure 3B, the pawl 88 is located on the retractable member 14I and the ratchet teeth 86 are located on the topside 13I of the base support unit 12I. In Figures 3D and 3E, the ratchet teeth 96 are located on retractable member 14m and 14n. The base support units 12m and 12n of the respective tissue retractors of Figures 3D and 3E each have clamps 98 that engage a singular pawl 92 or a plurality of pawls 94 when actuated. The actuation of the pawls 92 and 94 may be a twisting motion, a screwing motion, a pressing motion or any combination thereof that results in the pawls 92 and 94 engaging their respective ratchet teeth 96, as described earlier.

[0056] In the embodiments of Figure 3A – 3E, the tissue hook may be attached to the plastic strap in several ways. In the exemplary embodiment of Figure 3A, the tissue hook 18j may be attached directly, via its mounting portion 17j to the plastic strap 14j. In this embodiment, the mounting portion 17j may simply be a sleeve that is a form-fit or a snap-fit over an end of the plastic strap. In another exemplary embodiment illustrated in Figure 2D, the mounting portion 17i may include two sub-portions 20i and 21i. The first sub-portion 20i may be a cord attached to the tissue hook 18i followed by the second sub-portion 21i that includes an aperture that fits onto the plastic strap 14i as described above. As a further alternative, any of the other methods and devices for mounting the tissue hook onto the retractable member, as described herein, may also be implemented.

[0057] At this juncture, it should be noted that any suitable tissue hook may be used in conjunction with any of the various exemplary embodiments of the tissue retractor of the present invention. It is also to be understood that the term “tissue hook” also includes tissue hooks having one, two three or four claws (fingers) or even a solid claw. In this respect, the exemplary embodiments of tissue retractors shown in Figures 1A, 1B, 2D and 2C have one, two, three claws and a solid claw, respectively. Further examples of tissue hooks include, but are not limited to, Tyrell delicate prong hook, Gillies skin hook, Kilner hooks and two – pronged Joseph hooks having prongs that vary between about 2mm-10mm in length. In addition, the term “tissue hooks” also includes the tissue engagement portions of commercially available Fomon retractors, Rake retractors and Desmarres retractors, for

example. Similarly, the mounting portion of the tissue hook that is connected, coupled to or received by the retractable member may also take on many forms and is typically dependent upon the type of retractable member used.

5 [0058] Figures 4A – 4D illustrate further exemplary embodiments of base support units of tissue retractors for retracting tissue opened by an incision. In Figure 4A, the base support unit 412 is a sheet-like structure having a topside 413 and an underside being adapted to be conformable and to be removably attachable to a surface proximate to the incision. The topside 413 of the base support unit 412 is adapted to form an opening 110, which extends
10 from the topside 413 through to the underside (not shown). The opening 110 surrounds the incision thereby providing access to the tissue surface opened by said incision beneath the base support unit 412. The base support unit 412 further includes at least one securing mechanism 416, typically removably attachable to the topside. In the embodiment of Figure 4A, any portion of the topside of the base support unit 412 may be suitable for attaching the
15 securing mechanism 416 to. However, depending on operational requirements, it may be most suitable to have the securing mechanism 416 arranged proximate to the opening 110.

[0059] The opening 110 may be formed by at least one of a perforation or a cut-out that extends from the topside 413 through to the underside of the base support unit 412. As also
20 shown in Figure 4A, a pair of retractable members 414, engaged with an opened tissue, via opening 110, is attached to a corresponding pair of securing mechanisms 416.

[0060] As an illustrative example, the retractable member 414 used in conjunction with the base support unit of Figure 4A may be a hook or loop strap as described with respect to
25 Figures 2A – 2D above. Accordingly, in this exemplary embodiment, the securing mechanism 416 attached to the topside of the base support unit 412 is adapted to secure the hook or loop strap 414.

[0061] In an alternative illustrative example, the retractable member may be a plastic strap
30 having a plurality of ratchet teeth, as in the embodiments of Figures 3A – 3E. Correspondingly, the securing mechanism 416 attached to the topside 413 then includes a releasable pawl, wherein the plastic strap is adapted to releasably engage the pawl as the plastic strap is retracted away from the incision.

[0062] In one embodiment of the tissue retractor, the base support unit 412 may be a clear incision drape. Essentially, incision drapes are medical grade plastic sheets, with adhesives typically underside thereof for attachment to skin, that provide a sterile environment around
5 the edge of any tissue opened by an incision. The incision drape may include antimicrobial properties and adheres securely to the wound edge and is also adapted to conform to body contours and stretches to allow limb manipulation. Incision drapes are commercially available and examples thereof include IOBANTM and LOBANTM from 3MTM.

10 [0063] Figure 4B is an exemplary embodiment of base support unit 412 (an incision drape) having an opening 110 in its central region through which access is provided to tissue on which a surgical procedure is to be performed. The topside 413 of the base support unit 412 includes a securing mechanism 104 having a surface adapted to secure a hook or loop fastener strip. As shown, the securing mechanism 104 is elongated and lies along the entire
15 length of two opposite sides of said base support unit 412. This provides the surgeon with the flexibility to retract said retractable member 414, which includes a complementary securing mechanism 416 thereon, and to secure it to any position along said securing mechanisms 104. In this embodiment, the base support unit 412 and its corresponding securing mechanisms 104 may secure a plurality of retractable members 414 via their
20 complementary securing mechanisms 416.

[0064] In Figure 4C, the base support unit 412 is circular in shape. Accordingly, the securing mechanism 104 follows, substantially, the shape of the periphery of the base support unit 412 in that the securing mechanism 104 is a substantially semi-circular. As in
25 the embodiments of Figures 4A and 4B, a pair of securing mechanisms 104 is placed along the periphery of the topside of the base support unit 412. As above, this provides the surgeon with the flexibility to retract said retractable member 414, or a plurality thereof (a hook or loop fastener strip), and to secure it to any position along said securing mechanisms 104.

30

[0065] Figure 4D shows an exemplary embodiment of a base support unit 412 (an incision drape), that is a variation of the base support unit 12i of Figure 2D, having an opening (not shown) in its central region through which access is provided to tissue on which a surgical

procedure is to be performed. The topside 413 of the base support unit 412 includes a securing mechanism 104 having a surface adapted to secure a hook and loop fastener strip. As shown, the securing mechanism 104 is elongated and lies substantially along the entire length of a side of said base support unit 412, much like the exemplary embodiment of
5 **Figure 4B**. Accordingly, there may be a corresponding securing mechanism 104 on the opposite length of the base support unit 412 (not shown). Securing mechanism 104 may be integrally formed with base support unit 412 or individually attached thereon by a user such as medical personnel like a surgeon, for example, in desired or appropriate locations on the topside 413 of the base support unit 12.

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[0066] In this embodiment of **Figure 4D**, a second securing mechanism 416 is placed on the initial (or first) securing mechanism 104. The securing mechanism 416 may be integrally formed with the retractable member 14i, which is described earlier with respect to **Figure 2D**. This embodiment provides a user, such as a surgeon, with the flexibility to retract said
15 retractable member 14i, and to secure it to the securing mechanism 416. Alternatively, the retractable member 14i may be attached to any position along said securing mechanisms 104. Where the securing mechanism 416 is integrally formed with the retractable member 14i, the securing mechanism 416 includes on either of its planar surfaces either hook or loop fasteners in order that it can be attached, via one surface, to the base support unit 412 and
20 secure, via its other surface, the retractable member 14i.

[0067] The underside of the base support units in any of **Figures 4A – 4D** (or incision drape) is typically adapted to be removably attachable to the surface of the tissue to be opened by any incision. The attachment may be carried out using a medical grade adhesive, for
25 example. In this respect, the medical grade adhesive can be selected from the group consisting of acrylic adhesives, silicone-based adhesives, urethane adhesives, synthetic rubber adhesives and natural rubber adhesives, for example.

[0068] In an alternative embodiment, the underside of the base support unit may also be
30 adapted to be removably attachable to said surface using suction cups as illustrated in **Figure 5**. In this embodiment, the base support unit 412 includes at least one (vacuum) suction cup 99 on its underside 415.

[0069] In another embodiment, the base support unit, securing mechanism, tissue hook and retractable member, as described in any of the previous embodiments, may each be individual components of a surgical kit. In this respect, the base support unit may simply be an incision drape on which a surgeon may pre-place, where necessary, the required securing
5 mechanisms onto the topside of said base support unit. Following that, the surgeon may then proceed to use a retracting member having a tissue hook attached at an end thereof and removably secure said retracting member to the pre-placed securing mechanisms.

[0070] **Figure 6A** illustrates the use of the embodiment of **Figures 2C** or **2D** in a surgical
10 procedure. An incision **102** opens the tissue as shown. Four tissue retractors **700**, **702**, **704** and **706** are used with two of the tissue retractors **704** and **706** being situated along the axis of the incision **102**. In other words, the base support unit **12i** (shown in **Figures 2C** or **2D**) associated with tissue retractors **704** and **706** is attached such that the securing mechanism **66** (not visible as it is located beneath the retractable member **12i**) on the topside **13i** of the
15 base support unit **12i** is at least substantially parallel and along the axis of the incision **102**. The remaining two tissue retractors **700** and **702** are situated approximately along an axis lateral (perpendicular) and midway to the axis of the incision **102**.

[0071] In this embodiment, the base support unit **12i** is attached on the tissue surface
20 proximate to the incision **102**. The topside **13i** of the base support unit **12i** includes a securing mechanism **66** (not visible) that is adapted to secure any one of a hook and loop fastener strap **14i**. The underside of said base support unit **12i** is adapted to be conformable and to be removably attachable to a surface of the skin proximate to the incision **102** as shown. As described in relation to **Figures 2C** and **2D**, one end **201** of the strap **14i** is
25 attached to the base support unit **12i**, via securing mechanism **66** (not visible). The remaining length of the hook or loop strap **14i** is then used to connect to the mounting portion **17i** of the tissue hook **18i**.

[0072] The tissue hook **18i** has a tissue engagement portion **19i** and a mounting portion **17i**.
30 In this embodiment, the tissue engagement portion **19i** is shown to be engaging a portion of the periphery of the tissue, along the axis of the incision **102**. Also in this embodiment of the tissue retractor, the mounting portion **17i** of the tissue hook **18i** includes two sub-portions. The first sub-portion **17i** is attached to the tissue hook **18i** and may be a shock

prevention cord (or shock prevention tube) of a fixed length or elastomeric in nature. The second sub-portion is an aperture or a slot 21i through which the second end 203 of the strap 14i passes through and then loops back such that the looped back portion is removably secured to the attaching mechanism 68 of its facing side 204 of the strap 14i.

5

[0073] Once the tissue retractor is setup in position, the remaining length of the 14i is retracted away from the engaged portion of the tissue opened by incision 102 as needed. The retraction may typically be such that the tissue engagement portion of the tissue hook 18i retracts the engaged portion of the tissue to a predetermined distance.

10

[0074] It should be noted that apart from using a hook or loop strap 14, and its associated securing mechanism, any other suitable retractable member and securing mechanism may be used to carry out the exemplary surgical procedure described above. In this respect, the securing mechanism may include a pawl and the retractable member may include a plastic
15 strap having a plurality of ratchet teeth adapted to releasably engage the pawl, as described earlier with respect to **Figures 3A – 3E** for example. It should also be noted that the base support unit may be any one of the exemplary embodiments described with respect to **Figures 4A – 4D** and **Figure 5**. In a case where the embodiments of **Figures 4A – 4D** are used, generally, the base support unit should be positioned such that the opening surrounds
20 the incision 102 and provides access to the tissue surface beneath the base support unit. Subsequently, as described above, at least one securing mechanism may be then attached onto the topside of the base support units of **Figures 4A – 4D**.

[0075] A further alternative in the above surgical setup may be the use of the base support
25 units described in relation to **Figures 4A – 4D**, for example. In this respect, the opening of the base support unit may be positioned over the incised tissue and the underside of the base support unit adhered to the limb of the patient. Subsequently, a plurality of securing mechanisms may be placed at suitable locations on the topside of said base support unit. Following the placement of the securing mechanisms, the retractable members having tissue
30 hooks connected thereto can engage the incised tissue and retract said incised tissue to open it up as shown in **Figure 6A**. Once sufficiently retracted, the retractable members are secured to the respective securing mechanisms.

[0076] Figure 6B is similar to the exemplary surgical use illustrated in Figure 6A. The only difference in this exemplary use and that as described above, is that an additional support frame 130 is used to provide a surface on which the base support units 12 associated with tissue retractors 700 and 702 are attached to. As illustrated, the weight of the limb of the patient rests and holds the additional support frame 130 in place. The arrangement of the tissue retractors 700 and 702, position wise, is similar to that illustrated in Figure 6A. As mentioned above, a base support unit described in relation to Figures 4A – 4D may also be used in conjunction with said additional support frame 130.

10 [0077] The surgical setup illustrated in Figure 6B may be used in the case where the limb of the patient does not provide an adequate surface area for all the required tissue retractors to be attached thereon. This may be the case with a child's limb, which is typically much smaller than an adult's limb, for example. The additional support frame 130 also serves to alter the direction of the retraction to provide some amount of lift (as in the retractors are
15 positions at a higher level than the limb) in order to provide improved subcutaneous visibility.

[0078] In the aforesaid embodiments of the tissue retractor, it is to be noted that the tissue retractor is compact meaning that the overall profile of it is typically low, relatively flat and
20 close to the tissue surface undergoing retraction. This compact construction of the tissue retractor is advantageous as it allows medical personal involved in the treatment of a patient to work without any hindrance from projecting structures, for example. Another advantage of the compact construction is that the tissue retractor is highly portable as well. Yet another advantage of the tissue retractor lies in its various components that are capable of being
25 disassembled. This allows for an interchangeability and interoperability of components to suit the procedure being carried out.

[0079] The interchangeability and interoperability of components of the tissue retractor of the present invention permits it to be packaged as a kit. In one embodiment of the kit, said
30 kit includes at least one base support unit having a topside and an underside. The underside of the base support unit is adapted to be conformable and to be removably attachable to a surface proximate to an incision.

[0080] The base support unit is adapted to form an opening, which extends from the topside through to the underside thereof. The opening surrounds the incision thereby providing access to the tissue surface opened by the incision beneath the base support unit. The kit also includes at least one securing mechanism removably attachable to the topside and
5 proximate to the opening of the base support unit. In addition, the kit also includes at least one tissue hook and a corresponding retractable member, wherein each tissue hook has a tissue engagement portion and a mounting portion.

[0081] The tissue engagement portion of the tissue hook is capable of engaging at least a
10 portion of the periphery of tissue opened by the incision. The retractable member is at least substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis and is adapted to receive the tissue hook (either removably or fixedly) at its mounting portion. The retractable member is adapted to be removably or fixedly attachable to said securing mechanism such that when the retractable
15 member is retractable away from the incision, the tissue engagement portion retracts tissue to which it is engaged.

[0082] In another embodiment of the kit, the base support unit, securing mechanism and at least one retractable member are grouped in a first part. In a second part, the kit may include
20 at least one tissue hook adapted to attach to the retracting member.

[0083] It is to be also noted that the above description of the various exemplary embodiments of the present method only serves to aid in the better understanding of said method. As such, the present method is not be construed as being limited to the illustrated
25 embodiments and its corresponding description, but, only as defined in the appended claims that follow.

Claims

What is claimed is:

1. A tissue retractor comprising:

a base support unit having a topside and an underside, wherein the topside comprises at least one securing mechanism and the underside is adapted to be conformable and to be removably attachable to a surface proximate to an incision;

at least one tissue hook having a tissue engagement portion and a mounting portion, wherein the tissue engagement portion is capable of engaging at least a portion of the periphery of tissue opened by the incision; and

a retractable member substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, wherein the retractable member is adapted to receive the mounting portion of the at least one tissue hook, wherein said retractable member is adapted to be removably attachable to said securing mechanism on the topside of the base support unit, and wherein said retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged.

2. The retractor of claim 1, wherein the mounting portion of the tissue hook comprises an aperture.

3. The retractor of claim 2, wherein the mounting portion further comprises a shock prevention element connecting the aperture to the tissue engagement portion.

4. The retractor of claim 1, wherein at least a portion of the retractable member comprises any one of a hook and loop fastener strip.

5. The retractor of claim 4, wherein a first end of the hook and loop fastener strip is attached to the topside of the base support unit, and a second end of the hook and loop fastener is secured to the first end via the aperture of the mounting portion.

6. The retractor of claim 5, wherein the first end of the hook and loop fastener is further removably attachable to the securing mechanism on the topside of the base support unit.
7. The retractor according to any of claims 1 to 6, wherein the securing mechanism of the topside of the base support unit comprises any one of an adhesive and a hook and a loop fastener strip.
8. The retractor of claim 7, wherein the base support unit further comprises an opening that surrounds the incision thereby providing access to the tissue beneath the base support unit.
9. The retractor of claim 8, wherein the opening is formed by at least one of a perforation and a cut-out that extends from the topside through to the underside of the base support unit.
10. The retractor according to any of claims 7 – 9, wherein the securing mechanism of the topside of the base support unit adapted to secure any one of a hook and a loop fastener strip comprises a shape selected from the group consisting of a continuous strip, a discrete element and a combination thereof.
11. The retractor of claim 10, wherein the surface of the topside adapted to secure any one of a hook and a loop fastener strip is proximate to the opening.
12. The retractor of claim 10, wherein the surface shape of the at least one continuous fastener strip and the at least one discrete element is selected from the group consisting of rectangular shapes, triangular shapes, elliptical shapes and any combination thereof.
13. The retractor of claim 1, wherein the securing mechanism comprises an adhesive.
14. The retractor of claim 1, wherein the retractable member is a plastic strap.

15. The retractor of claim 14, wherein the securing mechanism on the topside of the base support unit comprises a releasable pawl.
16. The retractor of claim 15, wherein the plastic strap comprises a plurality of ratchet teeth adapted to releasably engage the pawl as the plastic strap is retracted away from the incision.
17. The retractor of claim 16, wherein the mounting portion comprises at least one of a sleeve and a flexible cord adapted to be mountable on an end of the plastic strap.
18. The retractor according to any of claims 14 – 17, wherein the base support unit further comprises an opening that surrounds the incision thereby providing access to the tissue beneath the base support unit.
19. The retractor of claim 18, wherein the at least one securing mechanism comprising a releasable pawl is proximate to the opening.
20. The retractor according to any of claims 1 – 19, wherein the underside of the base support unit is adapted to be removably attachable to said surface using an adhesive.
21. The retractor of claim 20, wherein the adhesive used is a medical grade adhesive.
22. The retractor of claim 21, wherein the medical grade adhesive is selected from the group consisting of acrylic adhesives, silicone-based adhesives, urethane adhesives, synthetic rubber adhesives and natural rubber adhesives.
23. The retractor according to any of claims 1 – 19, wherein the underside of the base support unit comprises at least one suction cup adapted to be removably attachable to said surface.
24. The retractor according to any of claims 1 – 23, wherein the base support unit is an incision drape.

25. The retractor of claim 24, wherein the incision drape is a medical grade plastic.
26. The retractor according to any of claims 24 or 25, wherein the incision drape is adapted to be antimicrobial and to adhere to the wound edge, thereby providing a sterile surface.
27. A base support unit of a tissue retractor that retracts tissue opened by an incision comprising:
a topside; and
an underside being adapted to be conformable and to be removably attachable to a surface proximate to the incision;
wherein said base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds the incision thereby providing access to the tissue surface opened by the incision beneath the base support unit.
28. The base support unit of claim 27, further comprising at least one securing mechanism removably attachable to the topside.
29. The base support unit of claim 28, wherein the at least one securing mechanism is arranged proximate to the opening.
30. The base support unit according to any of claims 27 – 29, wherein the opening is formed by at least one of a perforation and cut-out that extends from the topside through to the underside of the base support unit.
31. The base support unit according to any of claims 28 – 30, wherein the securing mechanism of the topside comprises a surface adapted to secure a hook or a loop fastener strip.
32. The base support unit according to any of claims 28 – 30, wherein the securing mechanism comprises a releasable pawl.

33. The base support unit according to any of claims 27 – 32, wherein the base support unit is an incision drape.
34. The base support unit according to any of claims 27 – 33, wherein the underside of the base support unit is adapted to be removably attachable to said surface using an adhesive.
35. The base support unit of claim 34, wherein the adhesive used is a medical grade adhesive.
36. The base support unit of claim 35, wherein the medical grade adhesive is selected from the group consisting of acrylic adhesives, silicone-based adhesives, urethane adhesives, synthetic rubber adhesives and natural rubber adhesives.
37. The base support unit according to any of claims 27 – 33, wherein the underside of the base support unit is adapted to be removably attachable to said surface using suction cups.
38. The retractor of claim 33, wherein the incision drape is a medical grade plastic.
39. The retractor of claim 38, wherein the incision drape adapted to be antimicrobial and to adhere to the wound edge, thereby providing a sterile surface.
40. A tissue retractor kit comprising:
at least one base support unit, said base support unit comprising:
a topside; and
an underside being adapted to be conformable and to be removably attachable to a surface proximate to an incision; wherein said base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds the incision thereby providing access to the tissue surface opened by the incision beneath the base support unit;

at least one securing mechanism removably attachable to the topside and proximate to the opening; and

at least one tissue hook and a corresponding retractable member, wherein each tissue hook comprises:

a tissue engagement portion and a mounting portion, said tissue engagement portion being capable of engaging at least a portion of the periphery of tissue opened by the incision; and wherein each retractable member is at least substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, said retractable member being adapted to receive the tissue hook at its mounting portion, wherein said retractable member is adapted to be removably attachable to said securing mechanism, and wherein said retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged.

41. A tissue retractor kit comprising:

in a first part,

at least one base support unit, said base support unit comprising:

a topside; and

an underside being adapted to be conformable and to be removably attachable to a surface proximate to the incision; wherein said base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds an incision thereby providing access to the tissue surface opened by the incision beneath the base support unit;

at least one securing mechanism removably attachable to the topside and proximate to the opening; and

at least one retractable member; and

in a second part,

at least one tissue hook adapted to attach to the retracting member; wherein each tissue hook comprises:

a tissue engagement portion and a mounting portion, said tissue engagement portion being capable of engaging at least a portion of the periphery of tissue opened by the incision; and

wherein each retractable member in the first part is at least substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, said retractable member being adapted to receive the tissue hook at its mounting portion, wherein said retractable member is adapted to be removably attachable to said securing mechanism, and wherein said retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged.

42. The kit of claim 40 or 41, wherein the opening of the base support unit is formed by at least one of a perforation and a cut-out that extends from the topside through to the underside of the base support unit.
43. The kit of claim 40 or 41, wherein the securing mechanism of the topside of the base support unit comprises a surface adapted to secure a hook or a loop fastener strip.
44. The kit of claim 40 or 41, wherein the securing mechanism comprises a releasable pawl.
45. The kit of claim 40 or 41, wherein the base support unit is a surgical grade clear plastic.
46. The kit of claim 40 or 41, wherein the underside of the base support unit is adapted to be removably attachable to said surface using an adhesive.
47. The kit of claim 46, wherein the adhesive used is a medical grade adhesive.
48. The kit of claim 46, wherein the medical grade adhesive is selected from the group consisting of acrylic adhesives, silicone-based adhesives, urethane adhesives, synthetic rubber adhesives and natural rubber adhesives.

49. The kit of claim 40 or 41, wherein the underside of the base support unit is adapted to be removably attachable to said surface using suction cups.
50. A method of retracting tissue opened by an incision with a tissue retractor comprising a base support unit having a topside and an underside, wherein the topside comprises at least one securing mechanism and the underside is adapted to be conformable and to be removably attachable to a surface proximate to the incision; at least one tissue hook having a tissue engagement portion and a mounting portion, wherein the tissue engagement portion is capable of engaging at least a portion of the periphery of the tissue opened by the incision; and at least one retractable member substantially inelastic in its central longitudinal axis and flexible in at least one axis deviating from said central longitudinal axis, wherein the retractable member is adapted to receive the tissue hook at its mounting portion, wherein said retractable member is adapted to be removably attachable to said securing mechanism on the topside of the base support unit, and wherein said retractable member is retractable away from the incision, such that the tissue engagement portion retracts tissue to which it is engaged, said method comprising:
- attaching the base support unit on the surface proximate to the incision;
 - connecting the retractable member to the mounting portion of the tissue hook;
 - engaging the tissue hook with at least the periphery of the incision;
 - retracting the retractable member away from the incision, such that the tissue engagement portion of the tissue hook retracts tissue it is engaged with to a predetermined distance; and
 - securing the retracted retractable member to the securing mechanism on the topside of the base support unit.
51. The method of claim 50, wherein the attaching of the base support unit is at least is such that the securing mechanism on the topside is at least substantially parallel to the direction of the incision.
52. The method of claim 50, wherein the securing mechanism comprises a hook or loop fastener.

53. The method of claim 50, wherein the retractable member comprises a hook and loop fastener strip.
54. The method of claim 50, wherein the securing mechanism comprises a pawl.
55. The method of claim 53, wherein the retractable member comprises a plastic strap including a plurality of ratchet teeth adapted to releasably engage the pawl.
56. A method of retracting tissue opened by an incision comprising:
attaching a base support unit on the surface proximate to the incision, wherein the base support unit comprises:
a topside; and an underside being adapted to be conformable and to be removably attachable to a surface proximate to the incision; wherein said base support unit is adapted to form an opening, which extends from the topside through to the underside, and said opening surrounds the incision thereby providing access to the tissue surface opened by the incision beneath the base support unit,
wherein the base support unit is positioned such that the opening surrounds the incision and provides access to the tissue surface beneath the base support unit;
and
attaching at least one securing mechanism onto the topside of the base support unit.

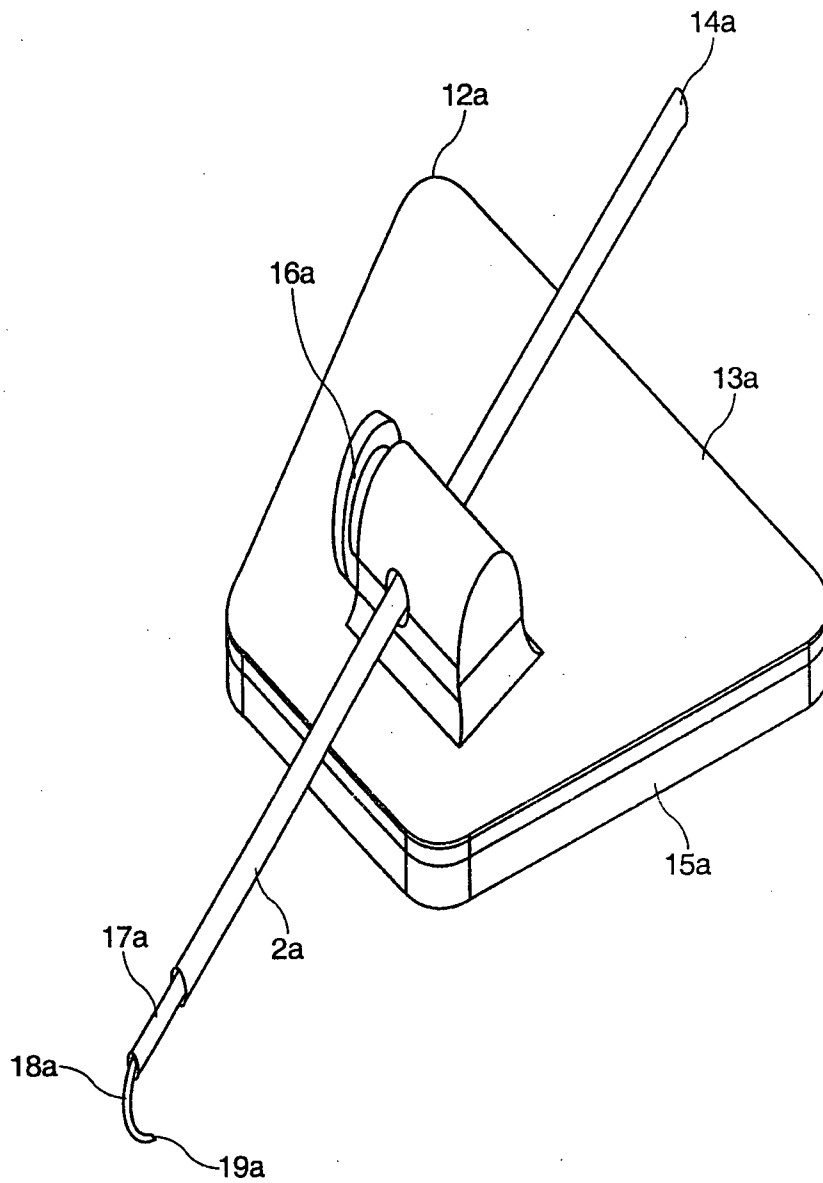


FIGURE 1A

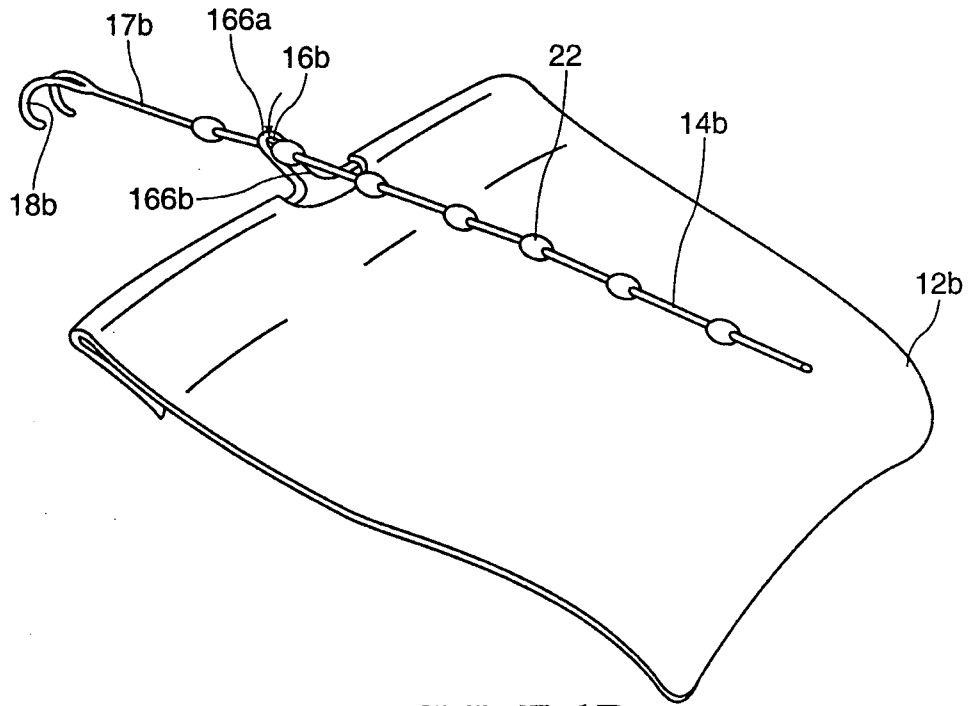


FIGURE 1B

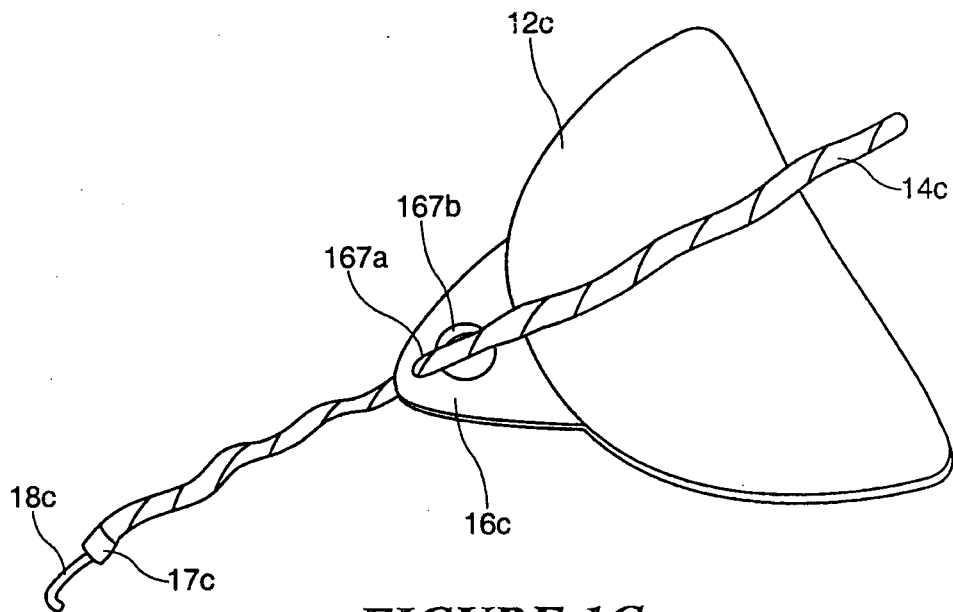


FIGURE 1C

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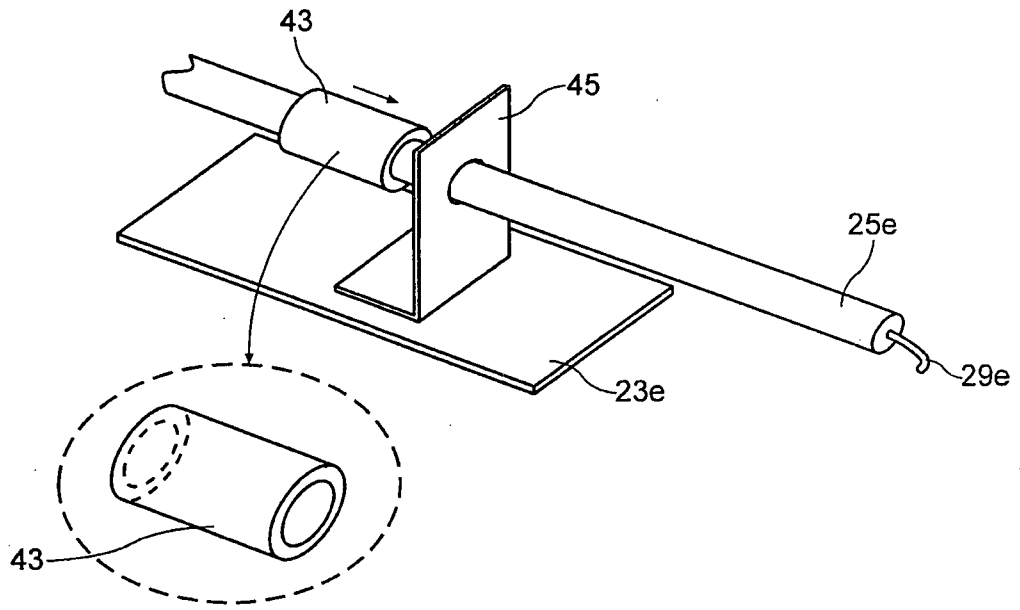


FIGURE 1D

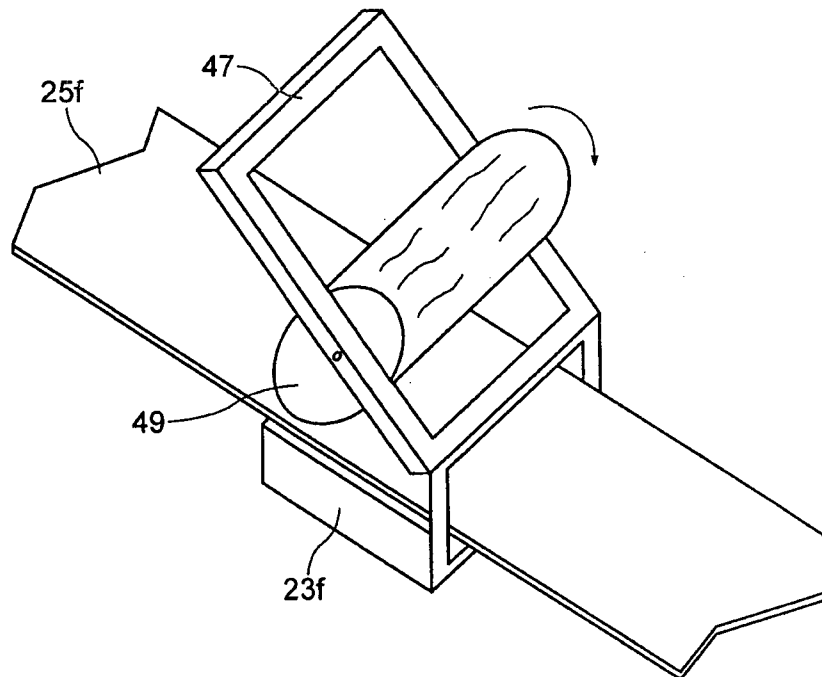


FIGURE 1E

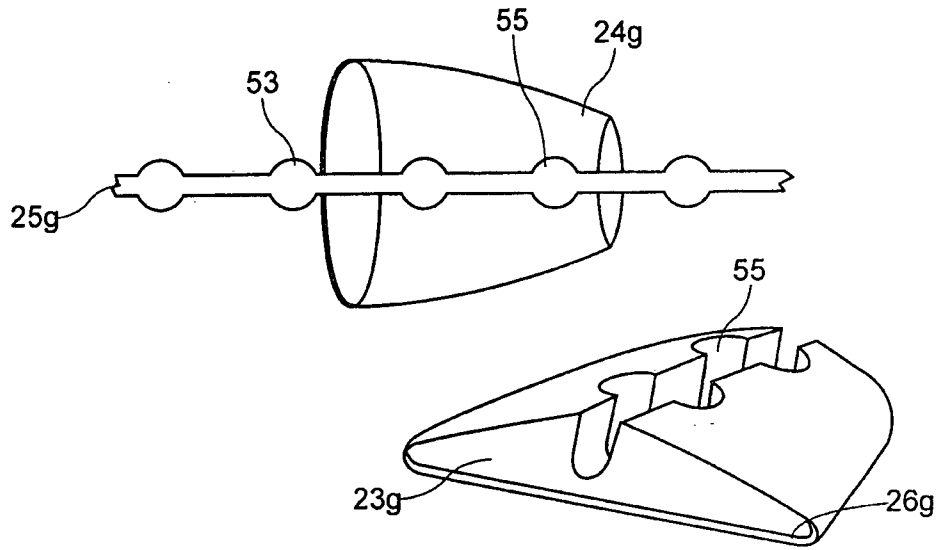


FIGURE 1F

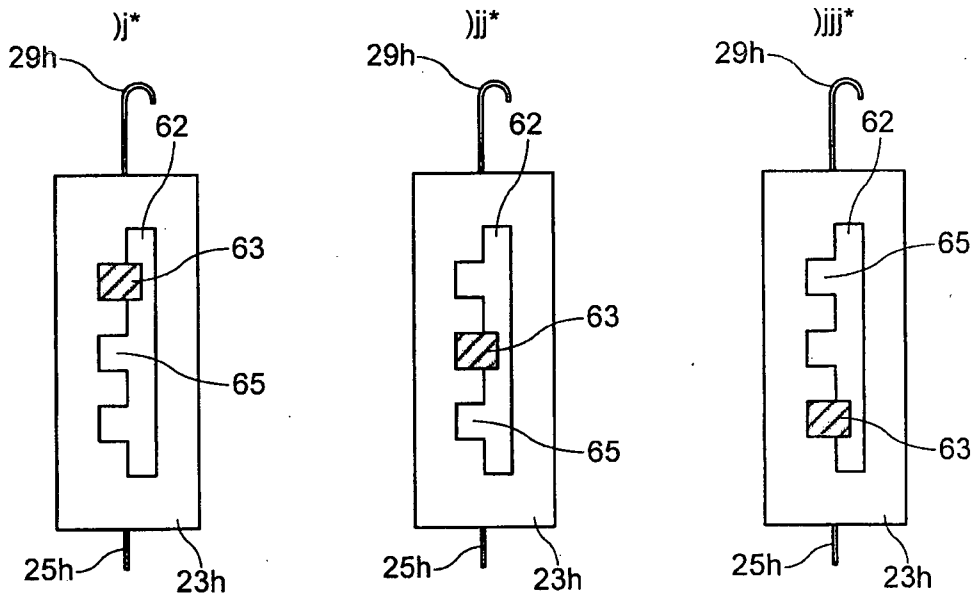


FIGURE 1G

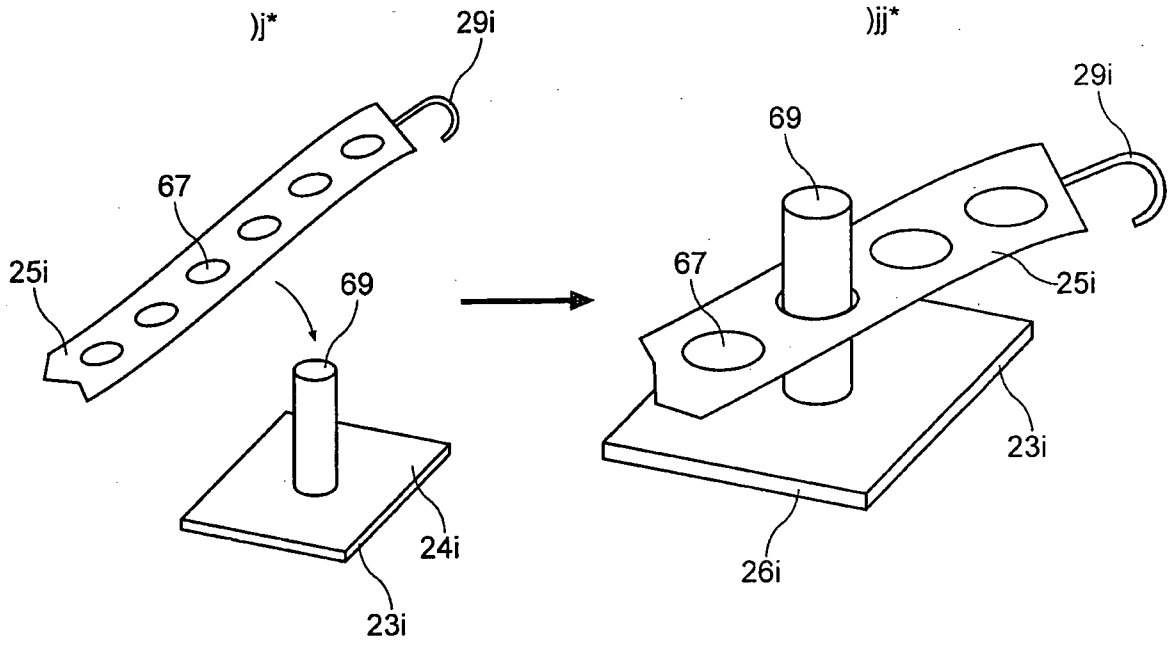


FIGURE 1H

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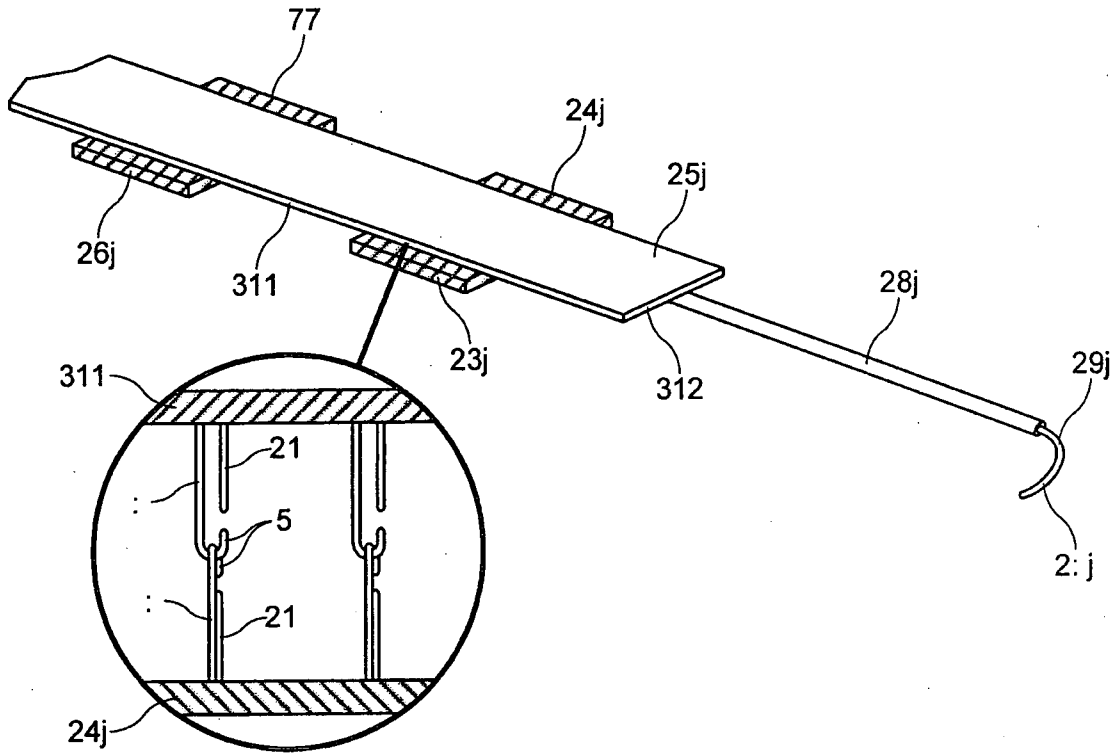


FIGURE 2A

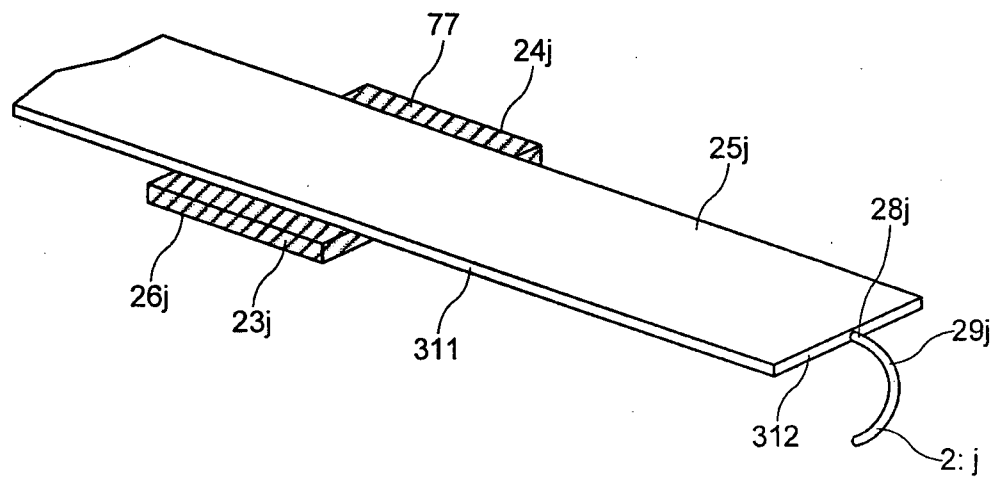


FIGURE 2B

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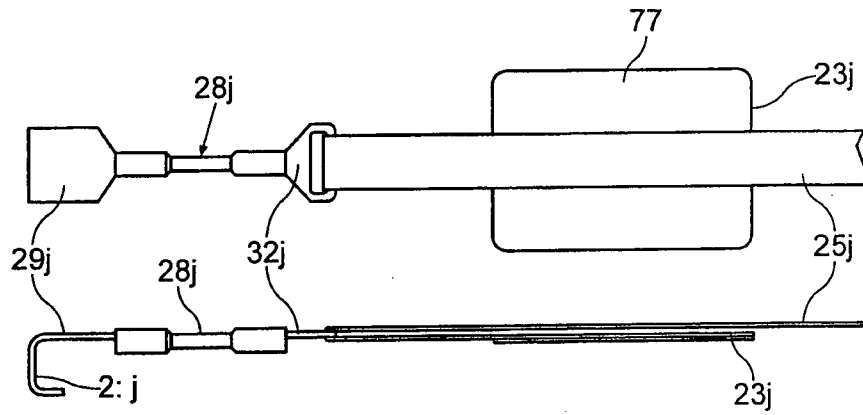


FIGURE 2C

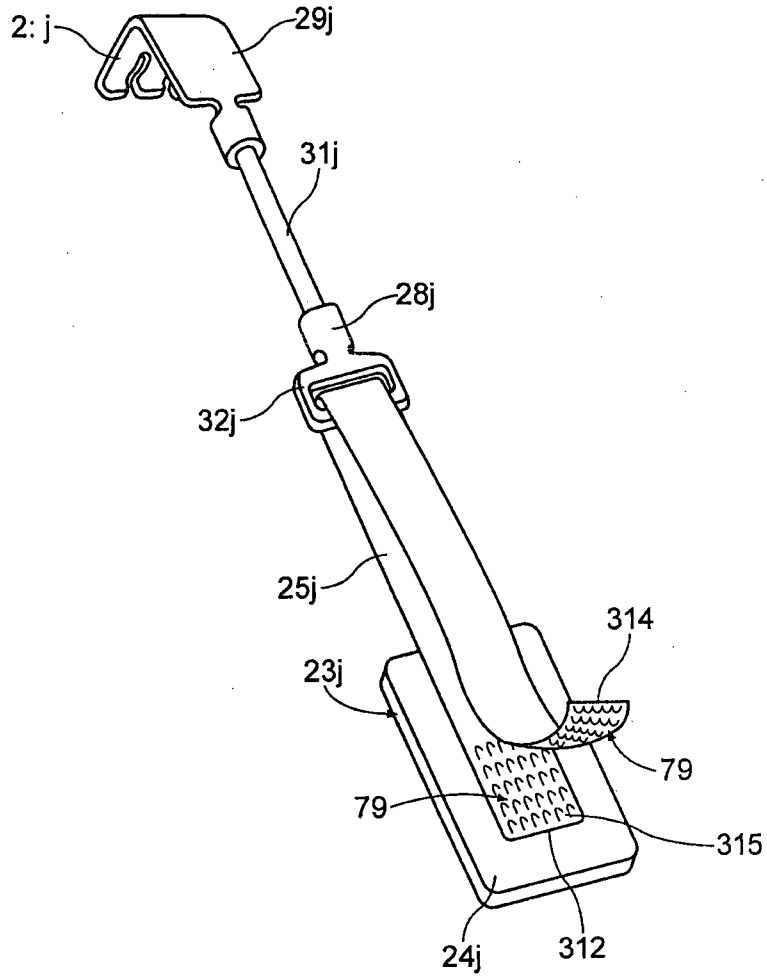


FIGURE 2D

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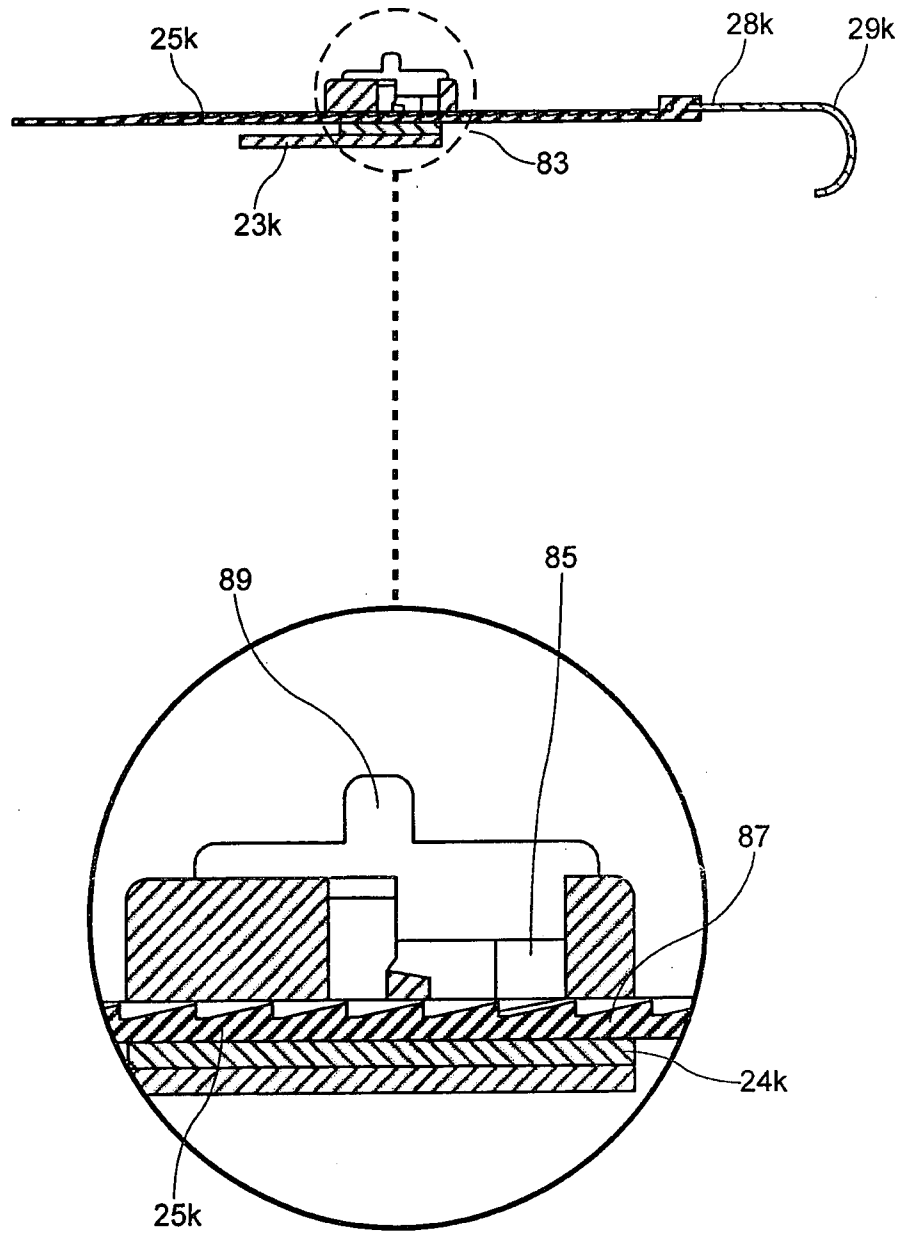


FIGURE 3A

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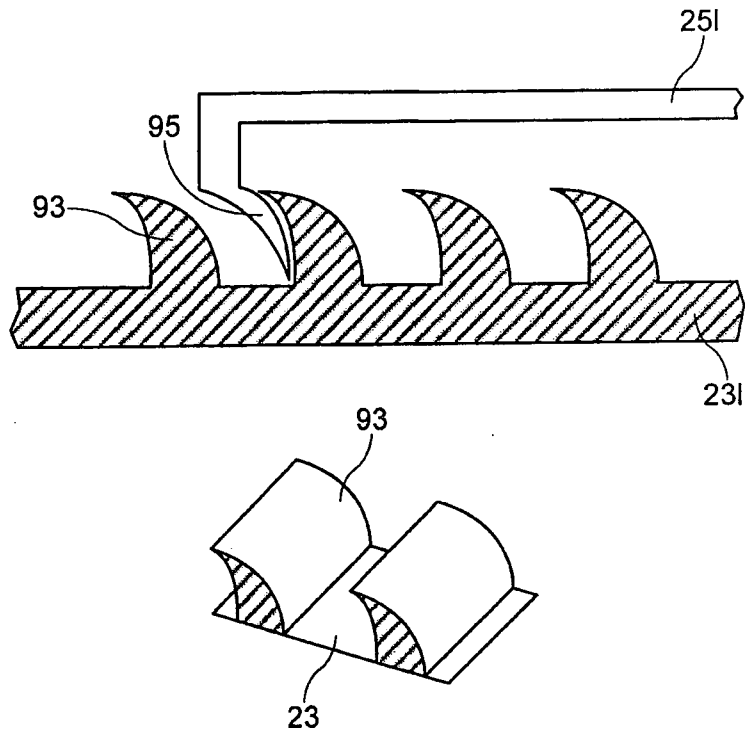


FIGURE 3B

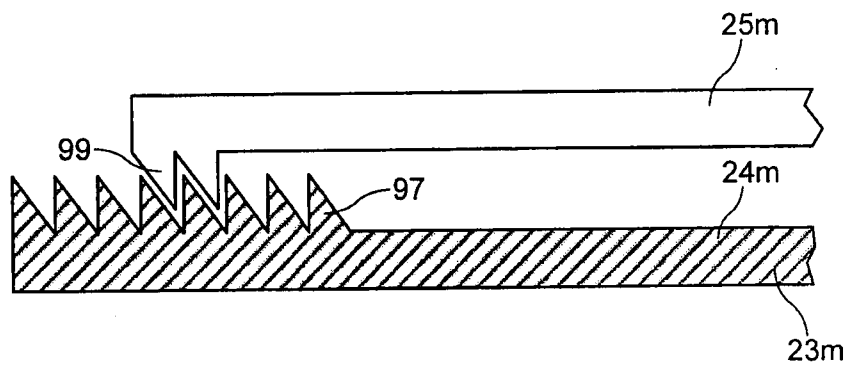


FIGURE 3C

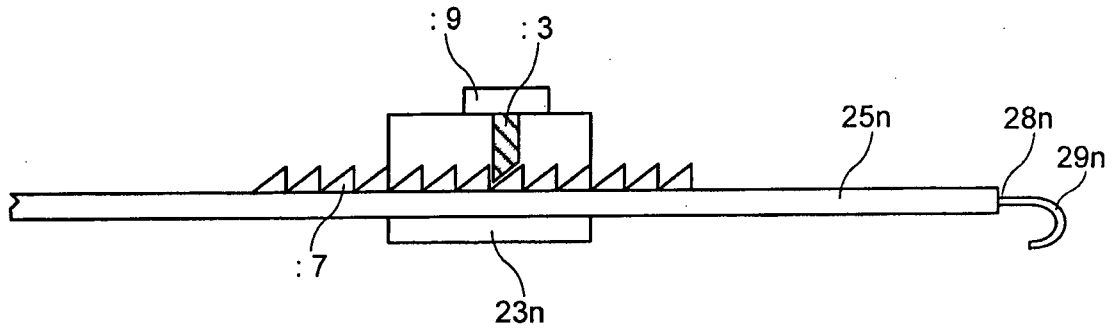


FIGURE 3D

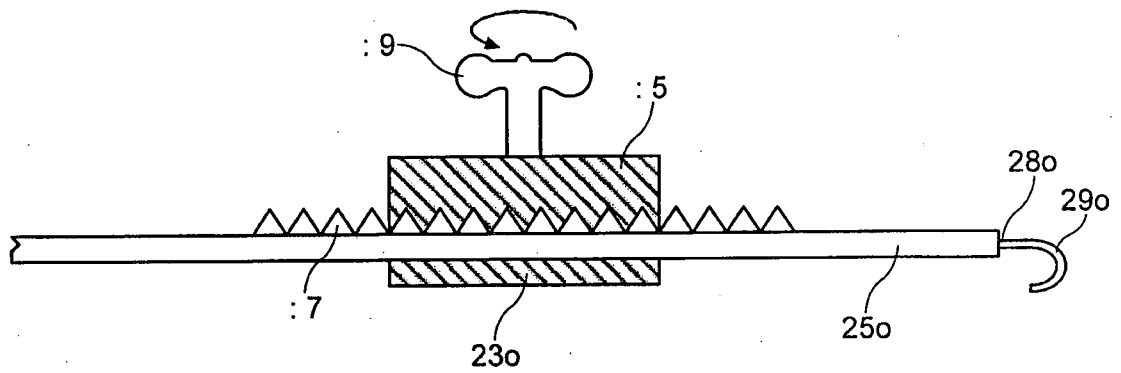


FIGURE 3E

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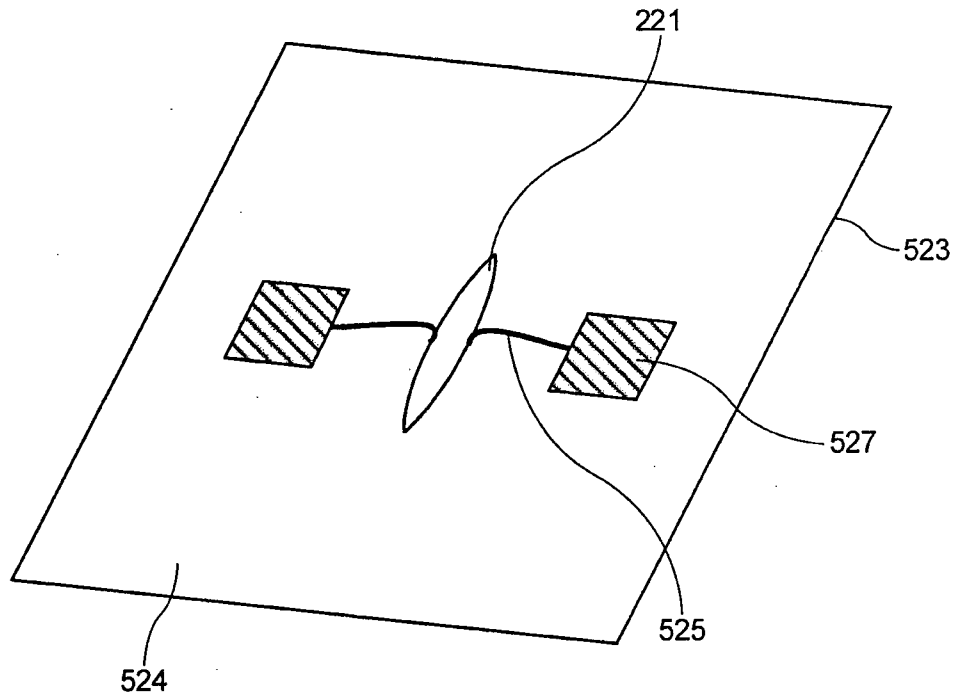


FIGURE 4A

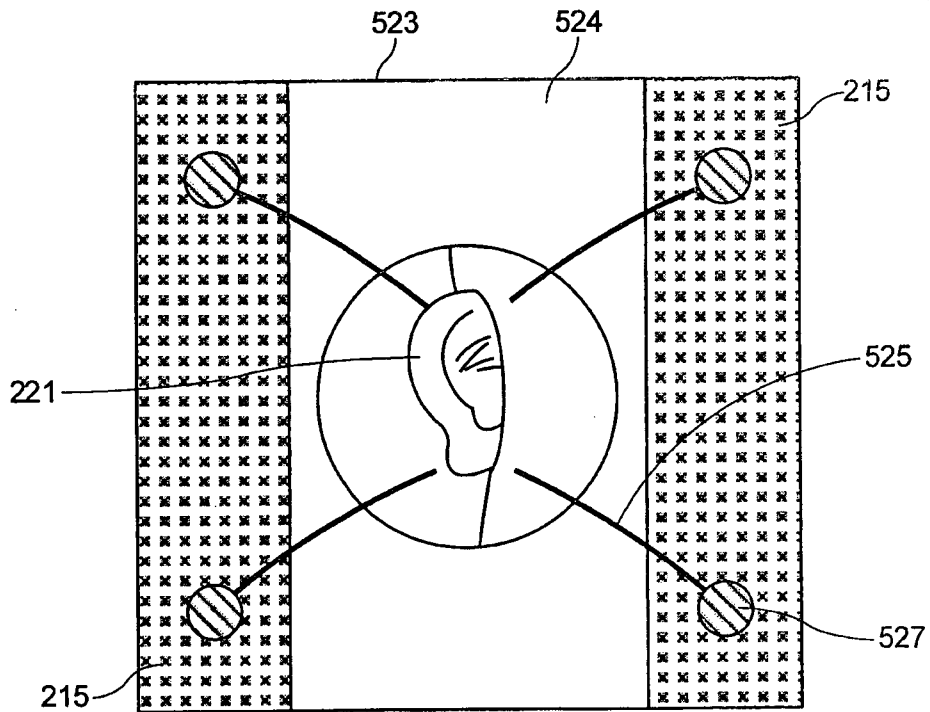


FIGURE 4B

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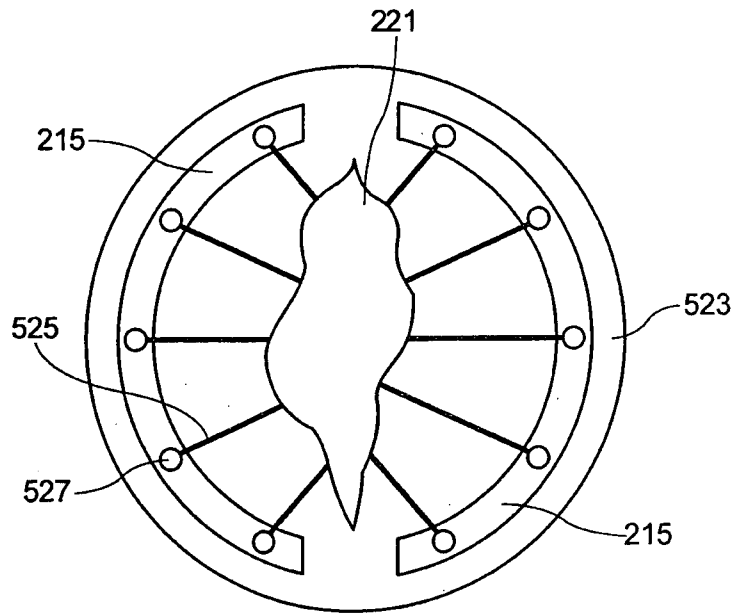


FIGURE 4C

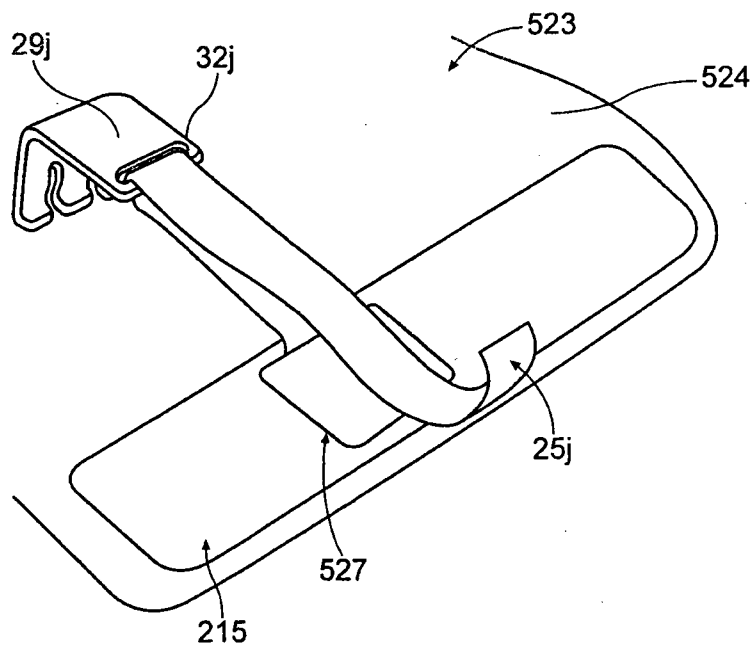


FIGURE 4D

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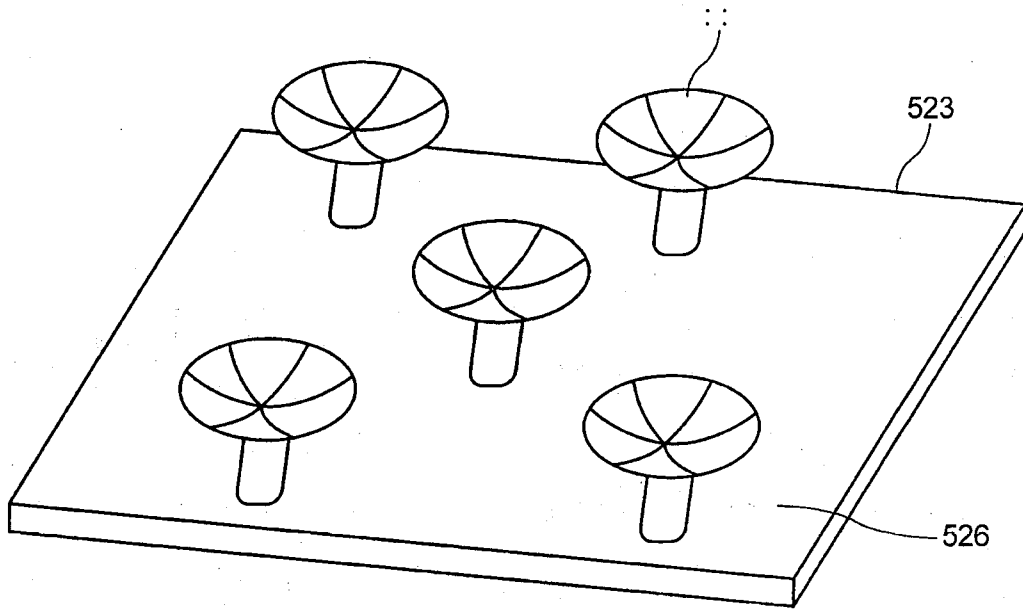


FIGURE 5

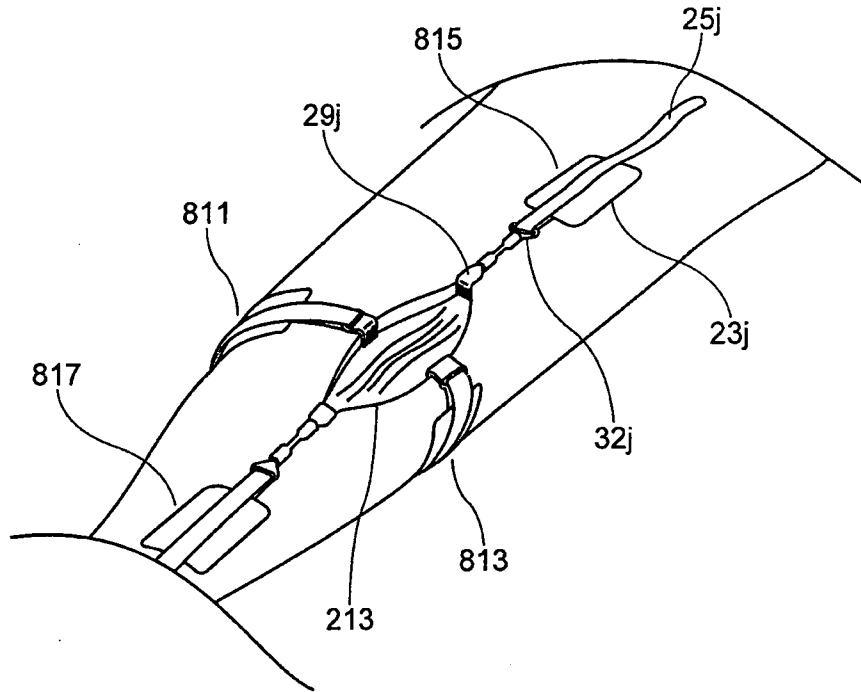


FIGURE 6A

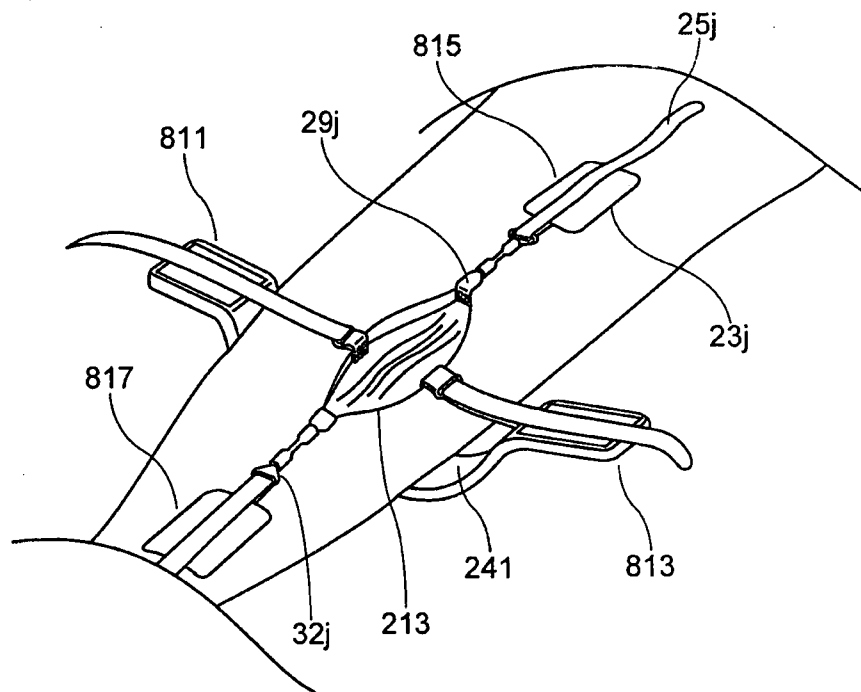


FIGURE 6B

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/062609

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/02

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)
A61B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 493 598 A (ROZEK) 3 January 1950 (1950-01-03)	1-3, 7-12, 15, 23, 27, 30, 32, 37
Y	the whole document	4-6, 20-22, 24-26
X	----- US 2004/186356 A1 (O'MALLEY ET AL.) 23 September 2004 (2004-09-23) cited in the application	1, 2, 7-13, 15-24, 27-32, 40-49
Y	the whole document	14
	----- -/--	

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

8 June 2007

Date of mailing of the international search report

15/06/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

GIMENEZ BURGOS, R

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/062609

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/25693 A (PETERSVIK) 11 May 2000 (2000-05-11) page 3, line 15 - page 4, line 28; figures 4-6	27-30, 33-36, 38,39
Y		20-22, 24-26
Y	----- WO 2005/070283 A (MINNESOTA SCIENTIFIC, INC.) 4 August 2005 (2005-08-04) abstract page 6, lines 12-26 page 7, lines 18-25	4-6
Y	----- US 2003/092969 A1 (O'MALLEY ET AL.) 15 May 2003 (2003-05-15) cited in the application abstract; figures paragraphs [0016], [0050], [0073], [0088], [0101]	14
A	----- WO 96/29013 A (COLOPLAST A/S) 26 September 1996 (1996-09-26) abstract; figures page 10, lines 15-20 -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/062609

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: 50-56
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/062609

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2493598	A	03-01-1950	NONE
US 2004186356	A1	23-09-2004	NONE
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