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(54) **SUTURE LOCK, LOCK APPLICATOR AND METHOD THEREFOR**

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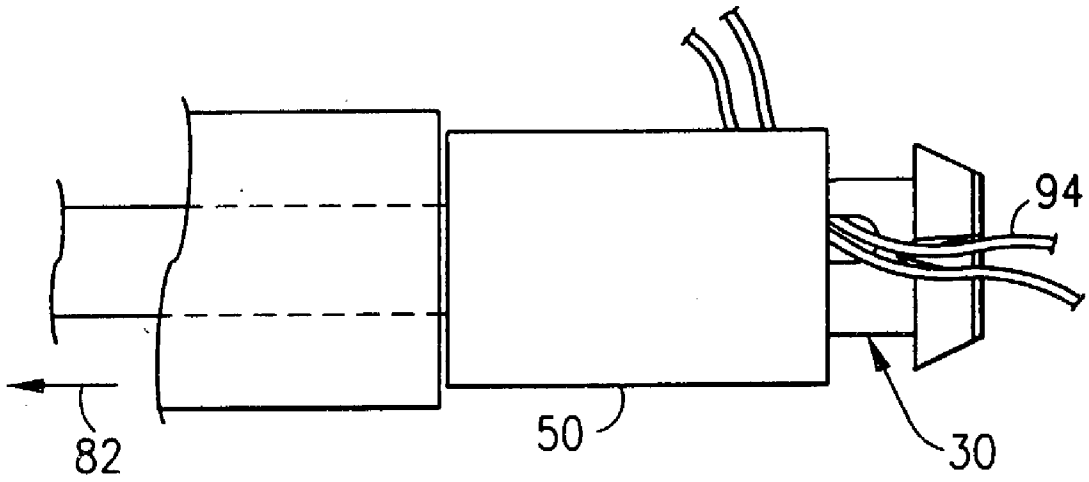
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(52) **U.S. Cl.** ..... **606/232**

(57) **ABSTRACT**

The suture lock or suture lock rivet for locking suture thread includes a lock head defining a cut-out, a first locking surface and a stem connected via a breakaway section. The lock also includes a lock base defining a second complementary locking surface. The locking surfaces trap the suture in the cut-out. The stem breaks away. A suture lock applicator is utilized to deliver and apply the suture lock to the surgical site. The system includes the lock loaded within the suture lock applicator. The applicator, or rivet gun, is designed to grip the stem body and coact with the lock base to cause the lock base to slide over the stem towards the lock head or rivet head, and subsequently, with the application of additional longitudinally directed force, to remove the stem from the lock head or first body part at the breakaway section.



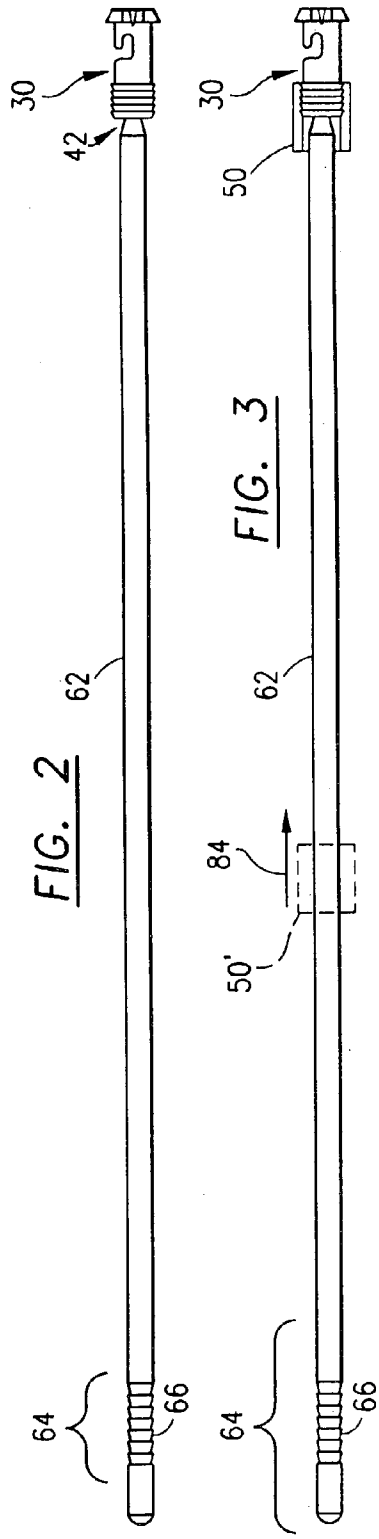



FIG. 2




FIG. 3

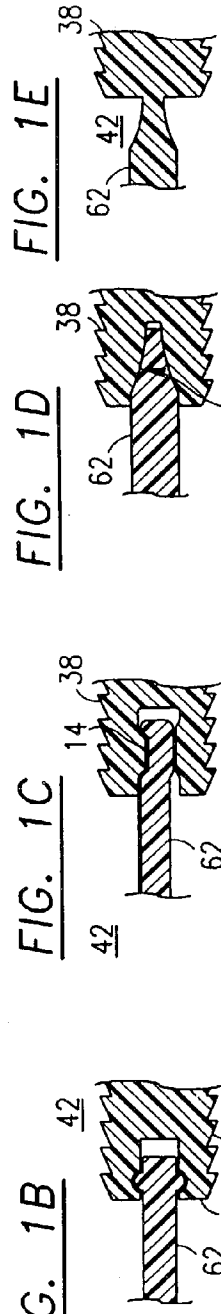



FIG. 1E

FIG. 1D

FIG. 1C

FIG. 1B

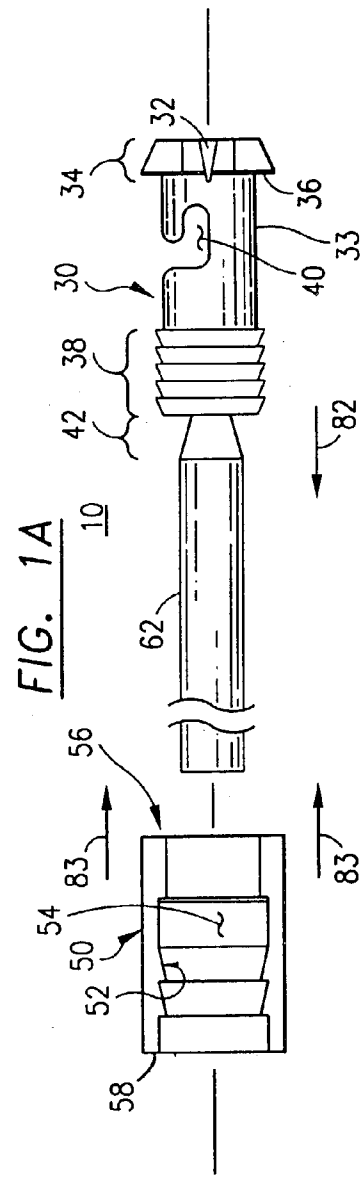



FIG. 1A

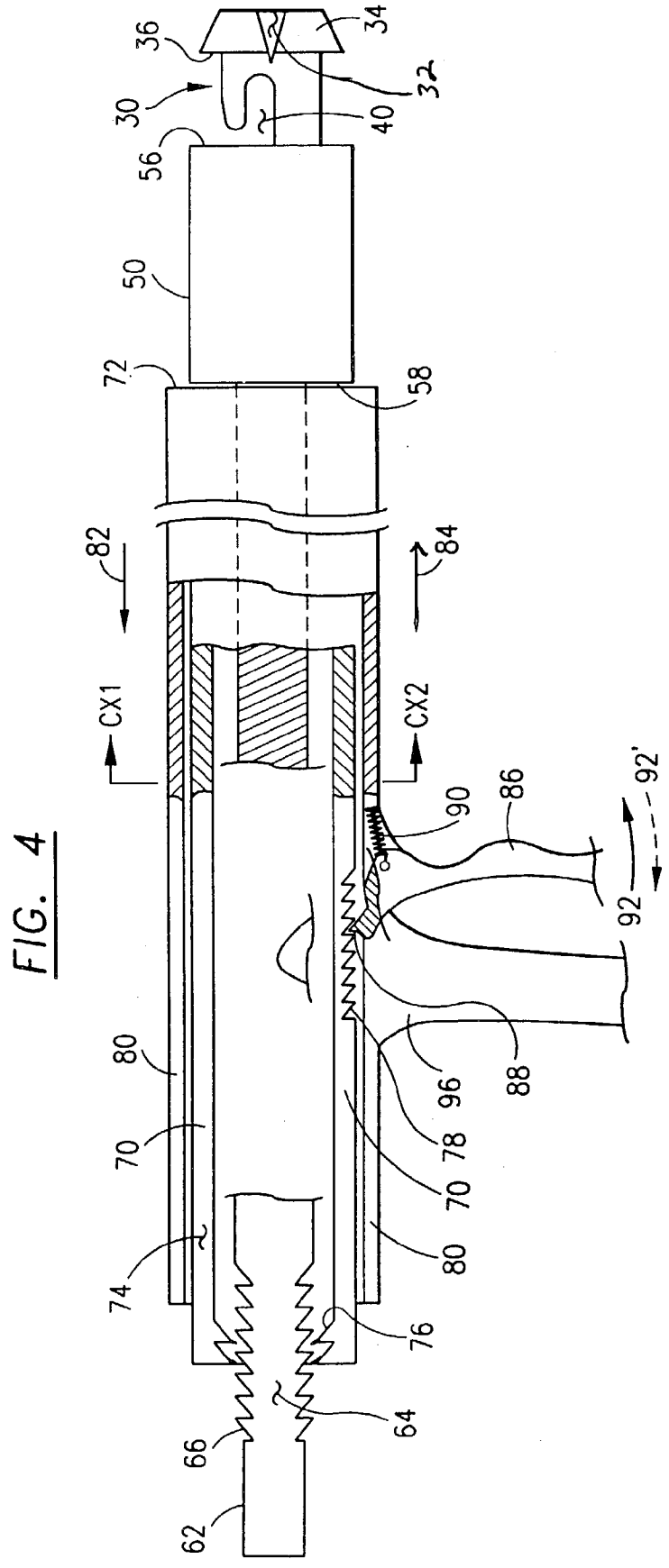

36
34
32
30
40
56
50
72
58
82
84
CX1
CX2
90
86
92'
92
80
70
96
88
78
70
80
74
76
64
66
62

FIG. 4

FIG. 5A

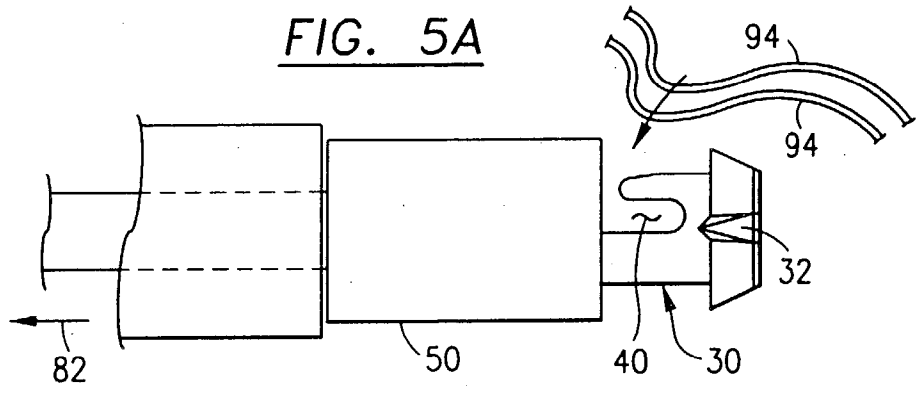



FIG. 5B

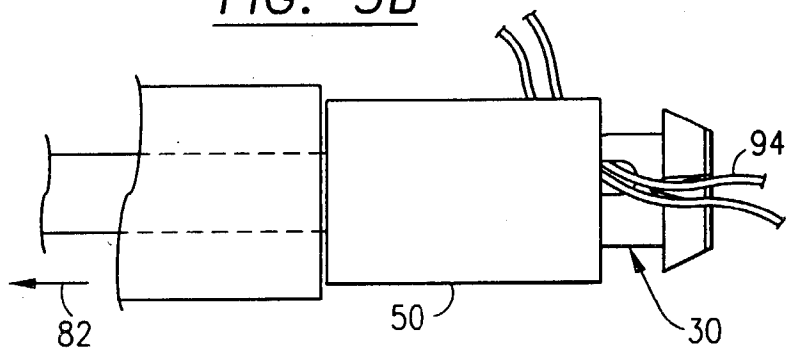



FIG. 5C

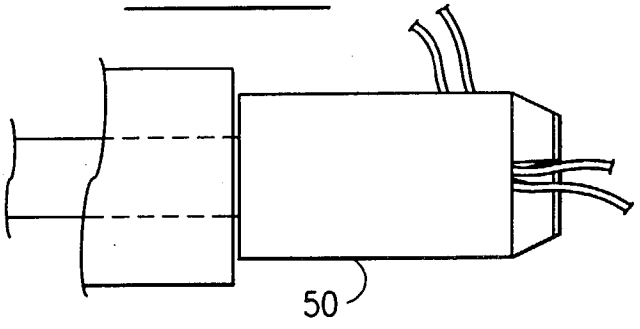



FIG. 5D

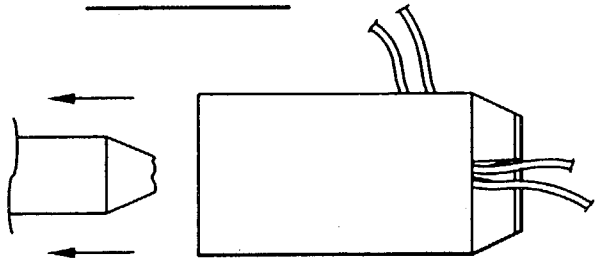


FIG. 6

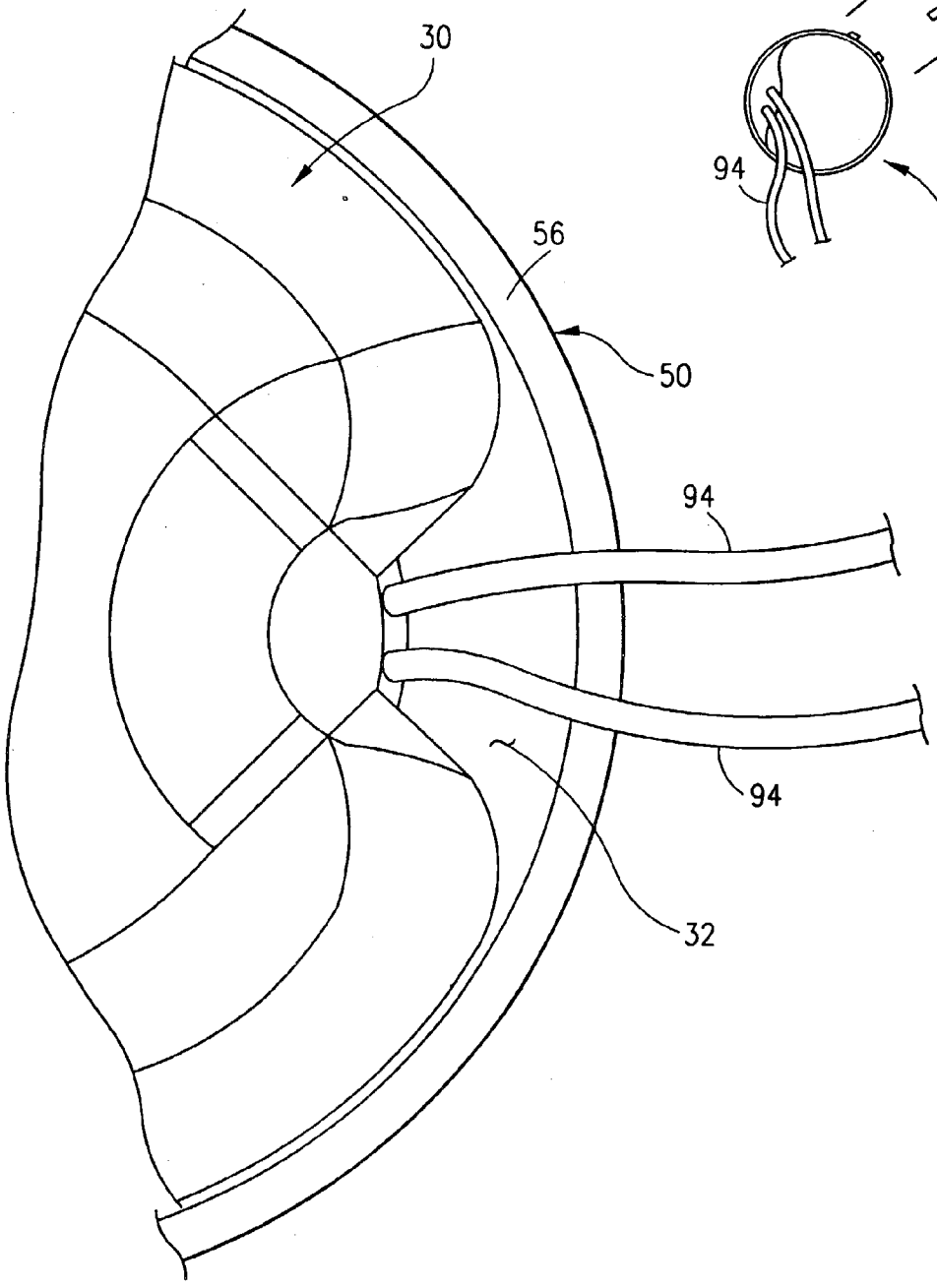



FIG. 7

# SUTURE LOCK, LOCK APPLICATOR AND METHOD THEREFOR

[0001] This is a continuation of patent application Ser. No. 09/833,910, filed Apr. 12, 2001, now pending. The present invention relates to a suture lock or suture lock rivet utilized to lock suture threads previously positioned at a surgical site. The suture lock or suture lock rivet and an associated suture lock applicator and rivet gun are designed to be inserted into a small size access port on a cannula. The present invention also relates to a method for locking suture threads drawn tight at a surgical site.

## BACKGROUND OF THE INVENTION

[0002] The current trend in minimally invasive surgery is to utilize smaller and smaller cannula (ports of access) to gain access to the surgical site. Currently, 5 mm ports are being used instead of the traditional 10 mm port for instrument access. Some access cannula are being utilized with a 2 or 3 mm orifice. Consequently, new instruments and new designs are required for surgical techniques accomplished through such restricted spaces.

[0003] During minimally invasive surgery, one of the tasks commonly involved is the suturing of the organ or body part being operated on. Because the cannula is so small, simple tasks such as suturing become difficult to accomplish using traditional methods. The present invention solves the problem of closing or "tying off" previously inserted suture threads.

## OBJECTS OF THE INVENTION

[0004] It is an object of the present invention to provide a specially designed suture lock or suture lock rivet capable of being utilized in minimally invasive surgery.

[0005] It is an object of the present invention to provide a specially designed suture lock or suture lock rivet utilized to "tie off" or lock suture threads previously inserted at a surgical site.

[0006] It is another object of the present invention to provide a system including a suture lock applicator capable of delivering a suture lock to a surgical site and capable of manipulating the suture lock such that it captures both sides of a single suture thread or the extending ends of multiple embedded suture threads in order to draw the suture threads tight, thus closing the surgical site, and then locking the drawn suture threads within the suture lock.

[0007] It is yet another object of the present invention to provide a system including a suture lock rivet gun capable of delivering a suture lock rivet to a surgical site and capable of manipulating the suture lock rivet such that it captures both sides of a single suture thread or the extending ends of multiple embedded suture threads in order to draw the suture threads tight, thus closing the surgical site, and then locking the drawn suture threads within the suture lock rivet.

[0008] It is another object of the present invention to provide a method for locking previously placed suture threads.

## SUMMARY OF THE INVENTION

[0009] The suture lock utilized for locking at least one suture thread includes an elongated lock head defining a cut-out adapted to capture the suture thread therein, the locking head also defining a first locking surface thereon and having a stem connected via a breakaway section to the locking head. The suture lock also includes a lock base defining a longitudinal passage adapted to mate with the elongated lock head. The lock base also defines a second locking surface complementary to the first locking surface on the lock head. The two locking surfaces are adapted to lock the lock base onto the lock head such that the suture thread is trapped in the cut-out by the base. The stem is adapted to break away from the lock head at the breakaway section. The lock head and lock base may also include respective intersecting edges adapted to cut a suture thread placed therebetween. The suture lock may be envisaged as a suture lock rivet including a rivet head and a two-part rivet stem. The first body part of the stem defining a cut-out adapted to capture the suture thread therein, and the second body part connected to the first body part via a breakaway section. The suture lock rivet also includes a lock base similar to the lock base of the suture lock. The suture lock rivet functions similar to the suture lock. A suture lock applicator is utilized to deliver and apply the suture lock or suture lock rivet to the surgical site. The system of the suture lock and suture lock applicator includes the suture lock loaded within the suture lock applicator. The suture lock applicator includes a stationary handle member and an elongated applicator tube attached thereto, the applicator tube having an end face adapted to abut the aforementioned lock base. The suture lock applicator also includes a movable handle member movably coupled to the applicator tube such that the movable handle member and the stationary handle member cooperate together. The movable handle member includes an actuator tooth which cooperates with a peripheral lock face on the aforementioned stem such that movement of the movable handle member causes the actuator tooth to engage the peripheral lock face which causes longitudinal movement of the stem with respect to the applicator tube. The movement causes the lock base to lock onto the lock head. Further excessive longitudinal movement causes the stem to detach from the lock head at the breakaway section.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Further objects and advantages of the present invention can be found in the detailed description of the preferred embodiments when taken in conjunction with the accompanying drawings in which:

[0011] **FIG. 1A** conceptually illustrates a suture lock or suture lock rivet prior to application at a surgical site;

[0012] **FIGS. 1B, 1C, 1D** and **1E** diagrammatically illustrate cross-sectional views of possible connections between a lock head or rivet and a corresponding stem;

[0013] **FIG. 2** diagrammatically illustrates a lock head or rivet head with a connected elongated stem or rivet stem;

[0014] **FIG. 3** diagrammatically illustrates a lock base partially fastened to the lock head or rivet stem;

[0015] **FIG. 4** diagrammatically illustrates a suture lock applicator with a suture lock or suture lock rivet loaded in the applicator;

[0016] **FIGS. 5A, 5B, 5C** and **5D** illustrate the use of the suture lock or suture lock rivet to capture and lock suture threads;

[0017] **FIG. 6** diagrammatically illustrates a top view of the suture lock head or rivet head with two suture threads captured thereat; and

[0018] **FIG. 7** diagrammatically illustrates the suture lock or suture lock rivet with the excess suture thread having been cut by the suture lock or suture lock rivet.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The present invention relates to a suture lock or suture lock rivet utilized to lock suture threads previously positioned at a surgical site, an applicator for delivery and utilization of the suture lock or suture lock rivet, and a method for locking suture threads at remote, minimally accessible surgical sites. The suture lock or suture lock rivet and applicator disclosed herein may be used to lock a single suture thread having either end of the suture thread embedded into a bodily structure, or may be used to lock more than one suture thread, each suture thread having been previously positioned at the surgical site.

[0020] For ease in understanding the present invention, the term "distal" shall refer to a direction or location near the surgical site and away from the physician or healthcare technician, and the term "proximal" shall refer to a direction or location closer to the physician or healthcare technician. Similar features are represented by the same reference number throughout the drawings.

[0021] **FIG. 1A** conceptually illustrates a suture lock or suture lock rivet **10**. Suture lock **10** includes elongated lock head **30** and lock base **50**. In **FIG. 1**A, lock head **30** is connected to the distal end of elongated stem **62** via break-away section **42**. Stem **62** is utilized in the delivery and application of suture lock **10**. Stem **62** is detachably coupled to head **30** such that it breaks away from head **30** when sufficient pulling force is applied along the longitudinal axis of stem **62** in the direction **82**. The connection between stem **62** and head **30** may be formed through a weak link between the two, as depicted in **FIGS. 1A, 1E, 2** and **3** or may be a detent coupling **12 (FIG. 1B)**, a latch **14 (FIG. 1C)**, or a friction lock **16 (FIG. 1D)**, established between the abutting surfaces of the two structures.

[0022] The distal end of head **30** includes a v-shaped cut-out, channel, cavity or groove **32** defined lengthwise along part of the head's longitudinal axis. Head **30** in **FIGS. 1, 2** and **3** includes a distal disc-shaped end piece or end cap **34** having beveled edges. Cap **34** may have other shapes but should be radially or peripherally larger than the body of head **30**. Cut-out **32** traverses end cap **34**. Cut-out **32** in the working embodiment is wide enough, typically 0.03 inches, to accommodate at least the thickness of a suture thread therein. End cap **34** includes a proximally facing surface **36**. Surface **36** can include a sharp edge utilized to cut a suture thread pressed against it. Surface edge face **36** ends at either side of cut-out **32** such that a suture thread placed in cut-out **32** is unaffected by the cutting properties of the edge.

[0023] Cut-out **32** may also include a cavity **40**, located proximal of the distal end of head **30**. Cavity **40** should be large enough to accommodate at least one suture thread therein. Cavity **40** is aligned such that if a suture thread were placed within cavity **40** it would extend outboard of cavity **40** and into cut-out **32**, i.e., the suture thread would extend proximally through cut-out **32** and into cavity **40**. Typically, cavity **40** is shaped such that a suture thread placed therein is trapped during fastening of suture lock **10**. Head **30** also includes a proximally located, locking surface **38**. In this specification, locking surface **38** will be referred to as first locking surface **38**. First lock surface **38** may be one continuously curved smooth surface, or include multiple ridges, as illustrated in **FIGS. 1A, 2** and **3**. First locking surface **38** is designed to interface with a corresponding, complementary second locking surface **52** defined within base **50**.

[0024] Lock base **50** cooperates with lock head **30** to trap and lock suture threads thereat. Base **50** defines a longitudinal passage **54** through which passes stem **62** and which is adapted to mate with the elongated, proximal end segment of lock head **30**. Although illustrated as cylindrical in the drawings, both head **30** and base **50** may define other shapes, including rectangular or any other polygonal structure. The interlocking and mating action by base **50** onto head **30**, or alternatively, head **30** into base **50**, is important. Base **50** includes a second locking surface **52**. Second locking surface **52** may be one continuously curved smooth surface, or include multiple ridges, as illustrated in **FIGS. 1A and 3**. As previously described, second locking surface **52** and first locking surface **38** are complementary and are adapted to lock base **50** onto head **30**. These surfaces define saw teeth in a preferred embodiment. The purpose of the ridges on either of the locking surfaces is to provide a locking mechanism such that base **50** will not be loosed during or after its application or fastening onto head **30**. Base **50** may also include a distal face surface **56**. Distal face surface **56** is complementary to proximal face surface **36** on end cap **34**. Distal face surface **36** may also include an edge which intersects with the edge on end cap **34** to form shearing or cutting surfaces. The two edges can be utilized to cut suture threads placed there between. Other designs may be substituted in order to form a cutting edge between base **50** and head **30**.

[0025] **FIG. 2** illustrates lock head **30** with detachably coupled, elongated, stem **62** attached at the head's proximal end. Stem **62** includes a proximal region **64** having multiple ridges or steps defining a peripheral lock face **66** thereat. The steps or ridges may also be teeth which are utilized in connection with the suture lock applicator.

[0026] **FIG. 3** diagrammatically illustrates lock base **50** partially fastened to head **30**. Prior to base **50** being fastened onto head **30**, base **50** travels over stem **62** in the direction indicated by arrow **84** (See base **50'** illustrated with dashed lines).

[0027] **FIG. 4** illustrates a suture lock applicator **60** with a suture lock loaded in the applicator or rivet gun. To the right of the CX1-CX2 line, applicator **60** is shown in cross-section. To the left of line CX1-CX2, applicator **60** is shown diagrammatically. **FIG. 4** does not show actual wall or structural thicknesses. The gaps shown in the drawing are not present in applicator gun **60** since the pieces inter-fit over each other.

[0028] Suture lock applicator or rivet gun **60** includes an elongated applicator tube **80** with a distal end **72**, and includes an optional inner sleeve **70** with a proximal end region **74**. Inner sleeve **70** defines a passage through which passes stem **62**. The distal end **72** of applicator tube **80** is

adapted to abut the proximal end **58** of base **50**. In **FIG. 4**, distal end **72** of applicator tube **80** is shown abutting proximal end **58** of base **50**. The proximal end region **74** of inner sleeve **70** has multiple ridges or steps defining a lock face **76** thereat. These steps or ridges may also be teeth which are designed to work in conjunction with the peripheral lock face **66** of stem **62** such that stem **62** is prevented from moving in direction **84** with respect to inner sleeve **70**.

[**0029**] Suture lock applicator or rivet gun **60** includes a stationary handle member **96** which is attached to applicator tube **80** and movably coupled to inner sleeve **70**. A movable handle member **86** is movably coupled to applicator tube **80**. Movable hand member **86** may also be movably coupled to stationary handle **96**. The size and shape of movable handle **86** and stationary handle **96** may differ from the illustrated embodiment in **FIG. 4**. In **FIG. 4**, movable handle member **86** interfaces with inner sleeve **70** such that movement of movable handle member **86** in the direction of arrow **92** causes longitudinal, proximal movement of inner sleeve **70** (see arrow **82**) with respect to applicator tube **80**. In the illustrated embodiment, actuator tooth or pin **88** on movable handle member **86** cooperates with the multiple teeth **78** on inner sleeve **70** such that movement of moveable handle member **86** causes the actuator tooth **88** to engage multiple teeth **78**, causing proximal longitudinal movement of inner sleeve **70** with respect to applicator tube **80**. The tooth **88** on movable member **86** may be different from that illustrated in **FIG. 4**. The number of teeth **78** on inner sleeve **70** may be increased as necessary to achieve the desired degree of longitudinal movement of inner sleeve **70** and stem **62** relative to applicator tube **80**. Movable handle **86** may be biased with respect to applicator tube **80** or stationary handle member **96** through the use of a spring or biasing member **90**. The following is an exemplary dimension table of the aforementioned components:

Exemplary Dimension Table

| | |
|---|---|
| Outside diameter of lock base | 0.14 inches |
| Axial length of lock base | 0.24 inches |
| Total axial length of lock base and lock head | 0.28 inches |
| V-channel or cut-out length | 0.04 inches |
| V-channel or cut-out span | 0.03 inches |
| Elongated stem member | |
| (short) | 0.9 inches |
| (long) | 4.0 inches |
| Typical number of ridges at proximal region of stem | 6 |
| Typical number of locking ridges at proximal end of lock head | 5 |
| Typical number of locking ridges or lock faces on lock base | 2 |
| Ratio of lock ridges on lock head vs. lock faces on lock base | 3 to 1 |

[**0030**] Operation of suture lock applicator or rivet gun **60** is as follows. The device is designed to be used during one procedure. However, a multiple-use device may also be constructed requiring sterilization between procedures. After the suture threads have been put in place or embedded at the target surgical site (not shown), the distal end of suture lock applicator gun **60** with a lock head **30**, and lock base **50** are inserted into a 5 mm trocar or cannula (for example). Suture lock applicator or rivet gun **60** is manipulated to grab both sides of a single suture thread or the proximal ends of two or more suture threads **94** imbedded into tissue at the surgical site. See **FIG. 5A**. The suture threads **94** are captured in head **30** by placing the extending ends of the threads within cavity **40**. Next, in cooperation with stationary handle member **96**, movable handle member **86** is moved in direction **92**. Such movement causes actuator tooth **88** to engage teeth **78** on inner sleeve **70**, which, in turn, causes proximal, longitudinal movement of inner sleeve **70** with respect to applicator tube **80**. Because stem **62** is prevented from moving distally in direction **84** with respect to inner sleeve **70** (due to the interface between lock face **76** of inner sleeve **70** and peripheral lock face **66** of stem **62**), stem **62** and connected lock head **30** move together with inner sleeve **70** in a proximal direction **82**. Biasing member **90** provides an assisting force to cause movable handle member **86** to move in the direction **92**. Alternatively, movable handle member **86** can be mounted proximal of stationary handle member **96**, such that squeezing the movable handle member and stationary handle member together causes proximal, longitudinal movement of inner sleeve **70** with respect to stationary, applicator tube **80**. In this alternative embodiment, biasing member **90** is also mounted proximal of movable handle member **86** such that upon release of movable handle member **86**, biasing member **90** causes movable handle member **86** to reset or move proximally.

[**0031**] Movable handle member **86** continues to be moved in direction **92** and then in direction **92'**, causing a ratchet action between actuator tooth **88** and teeth **78**. The continued proximal, longitudinal movement of stem **62** and attached lock head **30** causes the proximal end of lock head **30** to enter into the passage defined by lock base **50**. Lock base **50** is held stationary with respect to the proximal movement of lock head **30** because the proximal face **58** of lock base **50** abuts applicator tube **80**. Through this ratcheting action, the first lock face of lock head **30** and the second lock face of lock base **50** engage such that lock base **50** is locked onto lock head **30**. At the same time that lock head **30** is being drawn into lock base **50**, lock base **50** is covering suture thread **94** captured within cavity **40** of lock head **30**. See **FIG. 5B**.

[**0032**] As the distal end face **56** of lock base **50** approaches complementary, proximally facing surface **36** on end cap **34**, suture thread **94** becomes trapped within cavity **40** and cut-out **32**. See **FIG. 5C**. As the aforementioned movement of lock head **30** with respect to lock base **50** progresses, the cutting edge of end cap **36** on head **30** and corresponding distal edge **56** of base **50** move closer together trapping suture threads **94** therebetween. As the two edges intersect, the trapped suture threads **94** are cut or severed. See **FIG. 7** (distal end view of suture lock **10**). Because of cut-out **32**, the distal ends of suture threads **94** are uncut and remain locked or captured within suture lock **10**. See **FIGS. 5C and 6**. Finally, additional pulling force is applied in the direction **82** on stem **62** in order to detach the distal end of stem **62** from head **30**. See **FIG. 5C**. During the detaching of stem **62** from lock head **30**, end cap **34** provides the necessary stop to prevent lock base **50** from sliding over lock head **30** or sliding beyond its intended lock position. In another embodiment, end cap **34** is not utilized and instead, complementary lock surfaces **38**, **52** are designed such that lock base **50** will not slide distally over lock head **30** beyond a predetermined position. For example lock base **50** may include a proximal segment which defines a passage large

enough to accommodate stem **62**, but too small to accommodate lock head **30** thereby creating a stop thereat.

[**0033**] In an alternative embodiment, inner sleeve **70** of suture lock applicator **60** is eliminated. Instead, actuator tooth **88** of movable handle member **86** engages the peripheral lock surface of stem **62** directly.

[**0034**] The suture lock **10** illustrated in the drawings and discussed above may be envisaged as a suture lock rivet. The suture lock rivet **10** includes a rivet head **34**, illustrated as an end cap, and a rivet stem **33**,**62**. The rivet stem **33**,**62** has a first body part **33** and a second body part **62**. The first body part **33** is adjacent the rivet head **34**. The second body part is stem **62**. The first and second body parts of the rivet stem are separated by the breakaway section **42**. The suture lock rivet **10** also includes a cut-out **40** adapted to capture at least one suture therein, and the first body part **33** also defines a first locking surface **38**. The suture lock rivet **10** also includes a lock base **50**. The rivet lock base **50** has a second locking surface **52** complementary to the first locking surface **38** on the first body part **33** of the rivet stem. The suture lock rivet **10** functions substantially similar to suture lock **10** to capture and trap suture threads, thus locking the suture threads at a surgical site.

[**0035**] A rivet gun **60** is diagrammatically illustrated in **FIG. 4** Other rivet guns may be used which (a) grip stem body part **62** and (b) coact with lock base **50** to (c) move the base towards rivet head **34**. The first body part **33** and rivet head **34** captures suture thread **94** in cavity **40** (**FIGS. 5A through 5D**) and ultimately force rivet head **34** and first body part **33** to bread away from second body part **62** at break point **42**. Various guns or delivery systems can be utilized to create this relative axial movement in directions **82** and **83** (**FIG. 1A**).

[**0036**] The claims appended hereto are meant to cover modifications and changes within the scope and spirit of the present invention.

What is claimed is:

**1**. A suture lock for locking at least one suture thread, said lock comprising:

an elongated lock head having a proximal end, a distal end and a longitudinal axis, said lock head defining a cut-out adapted to capture said at least one suture thread therein, and said lock head defining a first locking surface thereon;

said lock head having a stem connected via a breakaway section to said proximal end of said lock head;

a lock base defining a longitudinal passage adapted to mate with said elongated lock head, said base defining a second locking surface complementary to said first locking surface; and

said first and second locking surfaces adapted to lock said base onto said head such that said at least one suture thread is trapped in said cut-out by said base and said stem is adapted to break away from said lock head at said breakaway section.

**2**. A suture lock as claimed in claim 1 wherein said elongated lock head defines an end cap at said distal end and at least a part of said cut-out traverses a part of said end cap.

**3**. A suture lock as claimed in claim 2 wherein said end cap includes a proximally facing surface adapted to interface with a complementary distally facing surface on said lock base.

**4**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**5**. A suture lock as claimed in claim 1 wherein said cut-out defined on said elongated lock head includes a cavity aligned within said head such that said at least one suture thread extends proximally through said cut-out and into said cavity.

**6**. A suture lock as claimed in claim 1 wherein said cut-out includes at least a partial longitudinal groove.

**7**. A suture lock as claimed in claim 1 wherein said lock head and said lock base are made of one of a biocompatible material and a tissue absorbable material.

**8**. A suture lock as claimed in claim 1 wherein said first and second locking surfaces define respective locking ridges adapted to interlock.

**9**. A suture lock as claimed in claim 4 wherein said cut-out defined on said elongated lock head includes a cavity aligned within said head such that said at least one suture thread extends proximally through said cut-out and into said cavity.

**10**. A suture lock as claimed in claim 9 wherein said head and said lock base are made of one of a biocompatible material and a tissue absorbable material.

**11**. A suture lock as claimed in claim 10 wherein said first and second locking surfaces define respective locking ridges adapted to interlock.

**12**. A suture lock rivet for locking at least one suture thread, said suture lock rivet comprising:

a rivet having a rivet head on a rivet stem, said stem having a first body part and a second body part separated by a breakaway section;

said first body part being adjacent said rivet head and defining a cut-out adapted to capture said at least one suture thread therein, and said first body part defining a first locking surface thereon;

a lock base defining a longitudinal passage adapted to mate with said rivet stem, said base defining a second locking surface complementary to said first locking surface; and

said base adapted to lock onto said rivet stem via said first and second locking surfaces such that said at least one suture thread is trapped in said cut-out and said second body part is adapted to break away from said first body part.

**13**. A suture lock rivet as claimed in claim 12 wherein the trapping of said at least one suture thread in said cut-out is via said base.

**14**. A suture lock rivet as claimed in claim 12 wherein said break away of said second body part from said first body part is via said breakaway section.

**15**. A suture lock rivet as claimed in claim 12 wherein at least a part of said cut-out is defined by said rivet head.

**16**. A suture lock rivet as claimed in claim 15 wherein said rivet head includes a proximally facing surface adapted to interface with a complementary distally facing surface on said lock base.

**17**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**18**. A suture lock rivet as claimed in claim 12 wherein said cut-out defined on said first body part of said rivet stem includes a cavity aligned within said first body part such that said at least one suture thread extends proximally through said cut-out and into said cavity.

**19**. A suture lock as claimed in claim 12 wherein said cut-out includes at least a partial longitudinal groove.

**20**. A suture lock rivet as claimed in claim 12 wherein said rivet head, rivet stem and said lock base are made of one of a biocompatible material and a tissue absorbable material.

**21**. A suture lock rivet as claimed in claim 12 wherein said first and second locking surfaces define respective locking ridges adapted to interlock.

**22**. A suture lock rivet as claimed in claim 13 wherein said break away of said second body part from said first body part is via said breakaway section.

**23**. A suture lock rivet as claimed in claim 22 wherein said rivet head includes a proximally facing surface adapted to interface with a complementary distally facing surface on said lock base.

**24**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**25**. A suture lock rivet as claimed in claim 24 wherein said cut-out defined on said first body part of said rivet stem includes a cavity aligned within said first body part such that said at least one suture thread extends proximally through said cut-out and into said cavity.

**26**. A suture lock rivet as claimed in claim 25 wherein said rivet head, rivet stem and said lock base are made of one of a biocompatible material and a tissue absorbable material.

**27**. A suture lock rivet as claimed in claim 26 wherein said first and second locking surfaces define respective locking ridges adapted to interlock.

**28**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**29**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**30**. (cancelled without prejudice to reinstate at a later time, i.e., without disclaimer).

**31**. A suture lock rivet and delivery gun system for locking at least one suture thread, the system comprising:

a rivet having a rivet head on a rivet stem, said stem having a first body part and an elongated second body part separated by a breakaway section;

said first body part being adjacent said rivet head and defining a cut-out adapted to capture said at least one suture thread therein, and said first body part defining a first locking surface thereon;

a lock base defining a longitudinal passage adapted to mate with said rivet stem, said base defining a second locking surface complementary to said first locking surface;

said base adapted to lock onto said rivet stem via said first and second locking surfaces such that said at least one suture thread is trapped in said cut-out and said second body part is adapted to break away from said first body part; and

a rivet gun gripping a proximal portion of said elongated second body part of said stem and coacting with said lock base to force said base over said second body part towards said rivet head thereby locking said head onto said base prior to said break away.

**32**. A system as claimed in claim 31 wherein said rivet gun includes a movably controlled, user actuated ratchet interface operable to move said base with respect to said elongated second body part.

**33**. A system as claimed in claim 32 wherein said breakaway section is one of a detent coupling, a weak link, a latch and a friction lock.

**34**. A method of locking at least one suture thread drawn tight at a surgical site comprising:

providing a lock head and a lock base;

capturing said at least one suture thread with said head;

fastening said lock base onto said head such that said at least one suture is trapped therebetween.

**35**. A method of locking sutures as claimed in claim 34 further comprising the step of cutting said sutures.

**36**. A method of locking at least one suture thread as claimed in claim 34 wherein said capturing step includes hooking said at least one suture thread with said head.

**37**. A method of locking at least one suture thread as claimed in claim 34 including the steps of sliding said lock base over a portion of said lock head; and fastening said lock base on said lock head by unidirectional movement of said base over said head.

**38**. A method of locking at least one suture thread as claimed in claim 34 where in said fastening step includes the step of drawing said at least one suture thread tight.

**39**. A method of locking at least one suture thread a surgical site comprising:

providing a lock head and a lock base;

capturing said at least one suture thread with said head;

cinching said at least one suture thread;

fastening said lock base onto said head such that said at least one suture thread is trapped therebetween.

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