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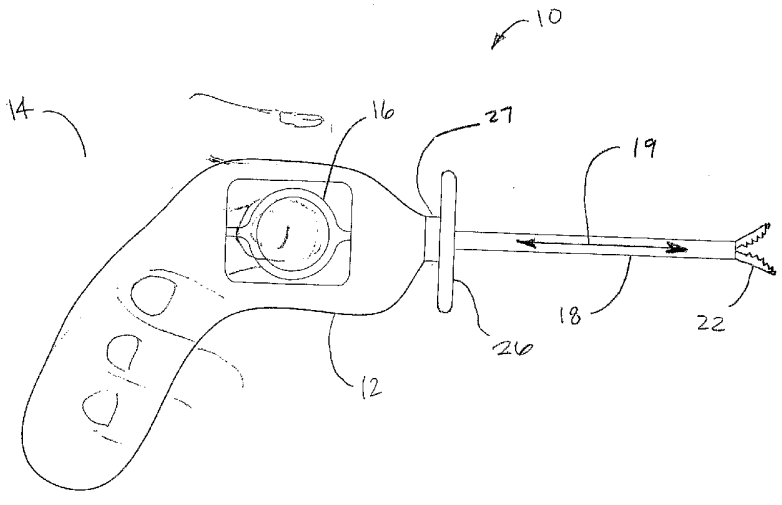
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(54) **Title:** SURGICAL INSTRUMENT WITH TRIGGER CONTROL



(57) **Abstract:** A surgical device 10 with an ergonomic handle 12 and, an elongated tubular portion 18 extending from the ergonomic handle 12 to a functional end 22. The elongated tubular portion 18 has a longitudinal axis 19, and a finger actuator 16 is positioned substantially in line with this axis. Furthermore, the surgical device 10 may also include a rod 20 functionally disposed within the tubular portion 18 along the longitudinal axis 19. The rod 20 may be coupled proximally to the finger actuator 16 and distally to the functional end 22, such that bidirectional pressure applied by the user's finger to the finger actuator 16 along the longitudinal axis 19 manipulates the functional end 22 in a bidirectional manner in response to or in a common direction to the bidirectional pressure. The surgical device 10 may further comprise a ratcheting mechanism 24 to lock the finger actuator 16 in a fixed position, thus locking the functional end 22 in a fixed position. Additionally, the functional end 22 may be free to rotate around the longitudinal axis 19, and the elongated tubular portion 18 may be detachable from the ergonomic handle 12.

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SURGICAL INSTRUMENT WITH TRIGGER CONTROL

BACKGROUND OF THE INVENTION

Field of Invention:

The present invention relates generally to medical devices. More particularly, the present invention relates to trigger controlled surgical instruments.

Description of Prior Art:

Handles for surgical instruments have traditionally been based on a paradigm of design that is decades old, a design that was adopted to facilitate their use in upper airway endoscopy. These instruments are bent such that their handles are as much as 90 degrees out of alignment with their functional ends. The original design was required to allow a user to have a direct line of vision down a sheath into the area where the surgery is performed. With the advent of fiber optics, the requirements for the bent handle design were eliminated. Surgeons today manipulate surgical instruments by means of a video screen, not a direct line of vision down a sheath. Given this change in technology regarding the visual aspects of surgery, it is surprising that the handles of a majority of surgical instruments have remained unchanged.

Surgical instruments with this bent-handle design can be troublesome to use. They require a user to hold their wrist awkwardly for long periods of time, in a position that encourages the development of Carpal Tunnel Syndrome and chronic joint stress. Many users have taken to holding the instruments in a manner not consistent with their design in an attempt to alleviate the pain and fatigue of long procedures.

Additionally, the bent-handle design does not efficiently translate force from the handle to the functional end of the instrument. Force applied to the handle of the instrument is translated to the functional end to perform the desired action. If the handle is bent out of line with the longitudinal axis of the functional end, a portion of the applied force will be translated to movement of the instrument in a direction that is essentially perpendicular to this axis. This undesirable movement may be translated along the instrument to the functional end, thus compromising stability.

In addition to the inefficient translation of force from the handle to the functional end of the instrument, the bent-handle design better facilitates surgeon use of the tool as a functional extension of a users hand.

SUMMARY OF THE INVENTION

The present invention may be described as a surgical device comprising an ergonomic handle having a finger actuator configured to receive a single finger of a user to control an attached, elongated tubular portion extending from the ergonomic handle. The elongated tubular portion may have a longitudinal axis, and the finger actuator may be positioned substantially in line with the longitudinal axis of the tubular portion. Furthermore, the surgical device may also include a rod functionally disposed within the tubular portion along the longitudinal axis. The rod may be coupled proximally to the finger actuator and may be coupled distally to a functional end, such that bidirectional pressure applied by the user's finger to the finger actuator along the longitudinal axis manipulates the functional end in a bidirectional manner in response to or in a common direction to the bidirectional pressure. The surgical device may further comprise a ratcheting mechanism to lock the finger actuator in a fixed position, thus locking the functional end in a fixed position. Additionally, the functional end may be free to rotate around the longitudinal axis, and the elongated tubular portion may be detachable from the ergonomic handle.

Additional features and advantages of the invention will be apparent from the detailed description which follows, taken in conjunction with the accompanying drawings, which together illustrate, by way of example, features of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a surgical device in accordance with an embodiment of the present invention;

FIG. 2 is perspective view of a surgical device in accordance with an embodiment of the present invention;

FIG. 3 is a cross-sectional view of the surgical device of FIG. 2;

FIG. 4 is a perspective view of examples of finger actuators in accordance with an embodiment of the present invention;

FIG. 5 is a perspective view of a roticulator attachment in accordance with an embodiment of the present invention;

FIG. 6 is a perspective view of a surgical device in accordance with an embodiment of the present invention; and

FIG. 7 is a flow chart of a method of manipulating a surgical instrument with a single finger according to an embodiment of the present invention.

DETAILED DESCRIPTION

Reference will now be made to the exemplary embodiments illustrated in the drawings, and specific language will be used herein to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Alterations and further modifications of the inventive features illustrated herein, and additional applications of the principles of the inventions as illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention.

The present invention may be embodied as a surgical device as shown in FIG. 1 and FIG. 2. The surgical device **10** may have an ergonomic handle **12**, shaped to conform to a user's hand **14** held in a relaxed functional position, thus reducing hand and wrist strain that ultimately leads to Carpal Tunnel Syndrome and chronic joint stress. The ergonomic handle may be in the shape of a pistol grip, or any other shape that allows the user's hand **14** to be held in a relaxed position. The surgical device may also include a finger actuator **16** configured to receive a single finger (ideally the index finger) of a user.

The surgical device **10** may further include an elongated tubular portion **18** extending from the ergonomic handle **12**, and having a longitudinal axis **19**. The finger actuator **16** may be positioned substantially in line with the longitudinal axis **19** of the elongated tubular portion **18**. Furthermore, a rod **20** may be functionally disposed within the tubular portion **18** along the longitudinal axis **19** that is coupled proximally to the finger actuator **16** and may be coupled distally to a functional end **22**. The functional end may be coupled to any surgical end piece known to one skilled in the art, such as, but not limited to, a grasper, scissors, a blade, a laser or a needle holder. The alignment of the user's finger, the elongated tubular portion **18**, and the functional end **22** along the same longitudinal axis **19** may allow the functional end **22** to act more as a functional extension of the user's finger than previous designs. Additionally, bidirectional pressure applied by the user's finger to the finger actuator **16** along the longitudinal axis **19** will manipulate the functional end **22** in a bidirectional manner. In other words, movement by the user's finger in one direction along the longitudinal axis **19** will operate the functional end **22** in

one direction, while movement by the user's finger in the opposite direction along the longitudinal axis **19** will operate the functional end **22** in the opposite direction.

The surgical device **10** may also include a ratcheting mechanism **24** to lock the finger actuator **16** in a fixed position, thus locking the functional end **22** in a fixed position. The ratcheting mechanism **24** may be positioned near the user's thumb in any position convenient on the handle (side, bottom, or top) for easy accessibility, and it may be operated by pushing, pulling, sliding, or any other functional means of actuation known to one skilled in the art.

It may be useful for the functional end **22** to be free to rotate around the longitudinal axis of the elongated tubular portion **18**. This can be accomplished by means of a roticulator **26**. The roticulator **26** may be attached to the ergonomic handle **12** by a rotateable connection **27**. The rotatable connection **27** may be any connection known to one skilled in the art that allows the roticulator **26** to be coupled to the ergonomic handle **12** and that allows rotation around the longitudinal axis **19**. As shown in FIG. 3, the roticulator **26** may be a generally disk-shaped structure attached to the elongated tubular portion **18**. The example embodiment in FIG. 3 shows a roticulator **26** with notches designed to allow easy rotation by the user's finger. The roticulator **26** may be of any shape, however, that allows rotation by the user's finger. This allows the user to rotate the roticulator **26**, which in turn rotates the elongated tubular portion **18** and the functional end **22**.

As shown in FIG. 4, the finger actuator **16** may be configured in a variety of ways. These configurations should not be seen as limiting the number of ways that the finger actuator **16** may be constructed, but as examples showing possible variations. Generally, they may consist of a rod **28** with a finger receiving section **30** a,b,c,d to allow the user to slide the rod **28** along the longitudinal axis **19** of the elongate tubular portion **18**. Configuration **30b** is deemed to be the preferred embodiment because the actuator **16** is fully symmetrical about axis **19.** In embodiments utilizing the ratcheting mechanism **24**, ratcheting teeth **32** may be disposed on one end of the rod **28** to engage the ratcheting mechanism **24**.

As shown in FIG. 5, it may also be useful for the elongated tubular portion **18** to be detachable from the ergonomic handle **12**. This would allow quick changes of instruments associated with the functional end **22**, and facilitate cleaning and autoclaving of the individual parts of the surgical device **10** to remove all biological matter after use. In one

example embodiment this may be accomplished by a detachable connection **34** between the elongated tubular portion **18** and the roticulator **26**. This detachable connection **34** may be by any detachment means known to one skilled in the art, including, but not limited to, a threaded connection or a ring lock connection.

As shown in FIG. 6, a portion of the ergonomic handle **12** that may be substantially out of line with the longitudinal axis **19** can be manipulated about a rotational axis **38** into a position that is substantially in line with the longitudinal axis **19**. As an example, this rotation may be accomplished by a means for rotation located at the rotational axis **38**, such as a pin, screw, grommet, hinge, or other means know to one skilled in the art. Care must be taken to avoid interference between the means for rotation and the finger actuator **16**. As an example, this may be accomplished by placing the rotation mean out of line with the longitudinal axis of the finger actuator **16**. It may also be accomplished by utilizing multiple rotational means attached to both sides of the ergonomic handle **12** at the position shown for the rotational axis **38** in FIG. 6 that do not extend through the ergonomic handle **12** to interfere with the finger actuator **16**. The rotational manipulation reduces tangling that may occur between the ergonomic handle **12** and other cables and cords in the surgical area. Additionally, a portion of the ergonomic handle **12** that may be substantially out of line with the longitudinal axis **19** can be removed, thus achieving the same tangling reduction result.

FIG. 7 is a flow chart of a method **40** of manipulating a surgical instrument with a single finger according to an embodiment of the present invention. The first step **42** of the method **40** may include grasping the surgical instrument with a hand of a user. Another step **44** of the method **40** may include inserting a single finger (ideally the index finger) of the user into a finger actuator of the surgical instrument. Yet another step **46** of the method **40** may include moving the single finger in a direction away from the hand, causing operation of a functional end. The method **40** may additionally or alternatively include the step **48** of moving the single finger in a direction toward the hand, causing operation of the functional end. Additionally, the method **40** may include the optional step **50** of rotating the functional end with the single finger.

It is to be understood that the above-referenced arrangements are illustrative of the application for the principles of the present invention. Numerous modifications and alternative arrangements can be devised without departing from the spirit and scope of the present invention while the present invention has been shown in the drawings and

described above in connection with the exemplary embodiments(s) of the invention. It will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth in the claims.

CLAIMS

What is claimed is:

1. A surgical device, comprising:

a) an ergonomic handle having a finger actuator configured to receive a single finger of a user;

b) an elongated tubular portion extending from the ergonomic handle and having a longitudinal axis, the finger actuator being positioned substantially in line with the longitudinal axis of the tubular portion; and

c) a rod functionally disposed within the tubular portion along the longitudinal axis, the rod being coupled proximally to the finger actuator and configured to be coupled distally to a functional end.

2. A surgical device as in claim 1, further comprising a functional end coupled to a distal end of the rod, such that bidirectional pressure applied by the single finger to the finger actuator along the longitudinal axis manipulates the functional end in a bidirectional manner in a common direction to the bidirectional pressure.

3. A surgical device as in claim 2, further comprising a ratcheting mechanism to lock the finger actuator in a fixed position, thus locking the functional end in a fixed position.

4. A surgical device as in claim 2, wherein the functional end is free to rotate around the longitudinal axis.

5. A surgical device as in claim 1, wherein the elongated tubular portion is detachable from the ergonomic handle.

6. A surgical device as in claim 1, wherein the ergonomic handle has a shape of a pistol grip.

7. A surgical device as in claim 6, wherein a portion of the pistol grip that is substantially out of line with the longitudinal axis can be manipulated into a position that is substantially in line with the longitudinal axis.

8. A surgical device as in claim 6, wherein a portion of the pistol grip that is substantially out of line with the longitudinal axis is detachable.

9. A surgical device as in claim 2, wherein the functional end is selected from the group consisting of a grasper, scissors, a blade, a laser and a needle holder.

10. A surgical device as in claim 2, wherein the functional end is a grasper.

11. A surgical device as in claim 2, wherein the functional end is scissors.

12. A surgical system operated by a single finger, comprising:

a) an ergonomic handle having a finger actuator configured to receive a single finger of a user;

b) an elongated tubular portion extending from the ergonomic handle and having a longitudinal axis, the finger actuator being positioned substantially in line with the longitudinal axis of the tubular portion; and

c) a rod functionally disposed within the tubular portion along the longitudinal axis, the rod being coupled proximally to the finger actuator and coupled distally to a functional end, such that bidirectional pressure applied by the single finger to the finger actuator along the longitudinal axis manipulates the functional end in a bidirectional manner in a common direction to the bidirectional pressure.

13. A surgical system as in claim 12, further comprising a ratcheting mechanism to lock the finger actuator in a fixed position, thus locking the functional end in a fixed position.

14. A surgical system as in claim 12, wherein the functional end is free to rotate around the longitudinal axis.

15. A surgical system as in claim 12, wherein the elongated tubular portion is detachable from the ergonomic handle.

16. A surgical system as in claim 12, wherein the functional end is selected from the group consisting of a grasper, scissors, a blade, a laser and a needle holder.

17. A surgical system as in claim 12, wherein the functional end is a grasper.

18. A surgical system as in claim 12, wherein the functional end is scissors.

19. A method of manipulating a surgical instrument with a single finger, comprising the following steps:

a) grasping the surgical instrument with a hand of a user;

b) inserting the single finger of the user into a finger actuator of the surgical instrument;

c) moving the single finger in a direction away from the hand, causing operation of a functional end; and

d) moving the single finger in a direction toward the hand, causing operation of the functional end.

20. A method of manipulating a surgical instrument with a single finger as in claim 19, further comprising the step of rotating the functional end with the single finger.

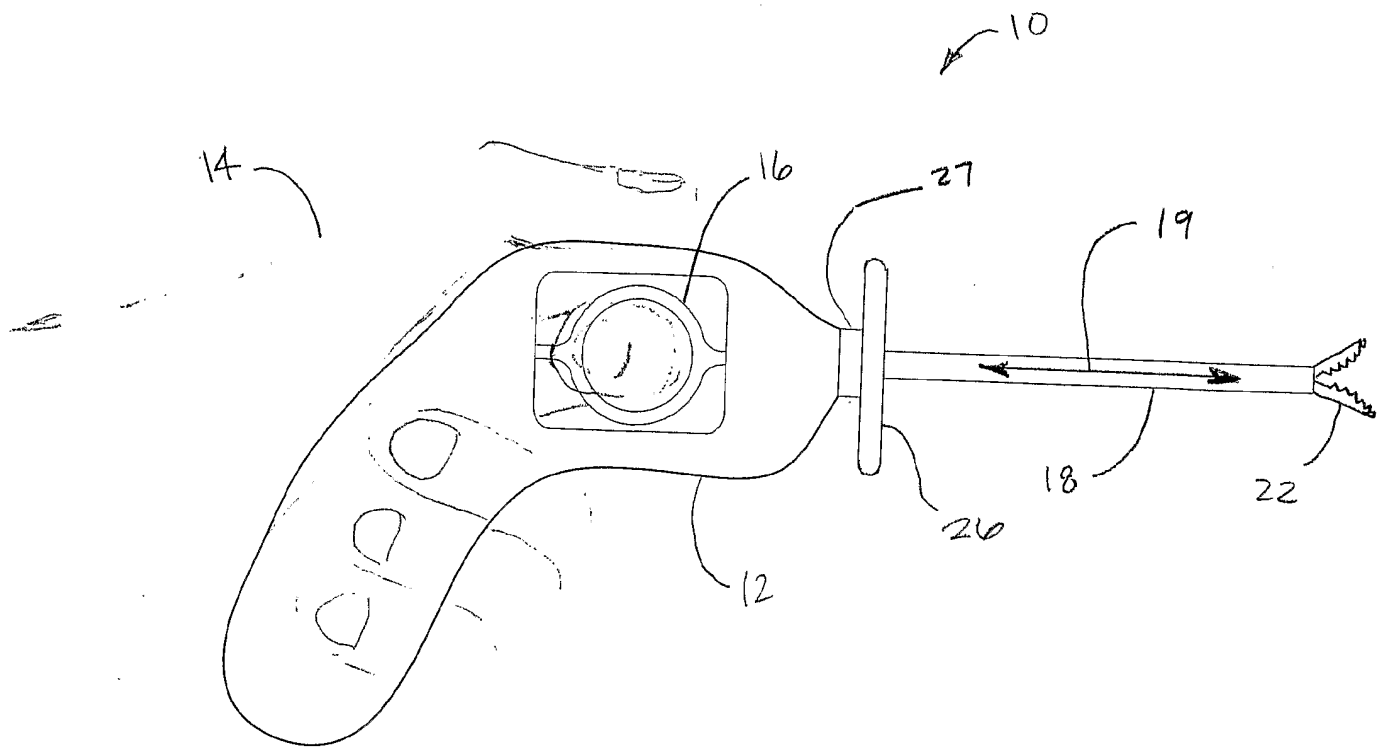


FIG 1

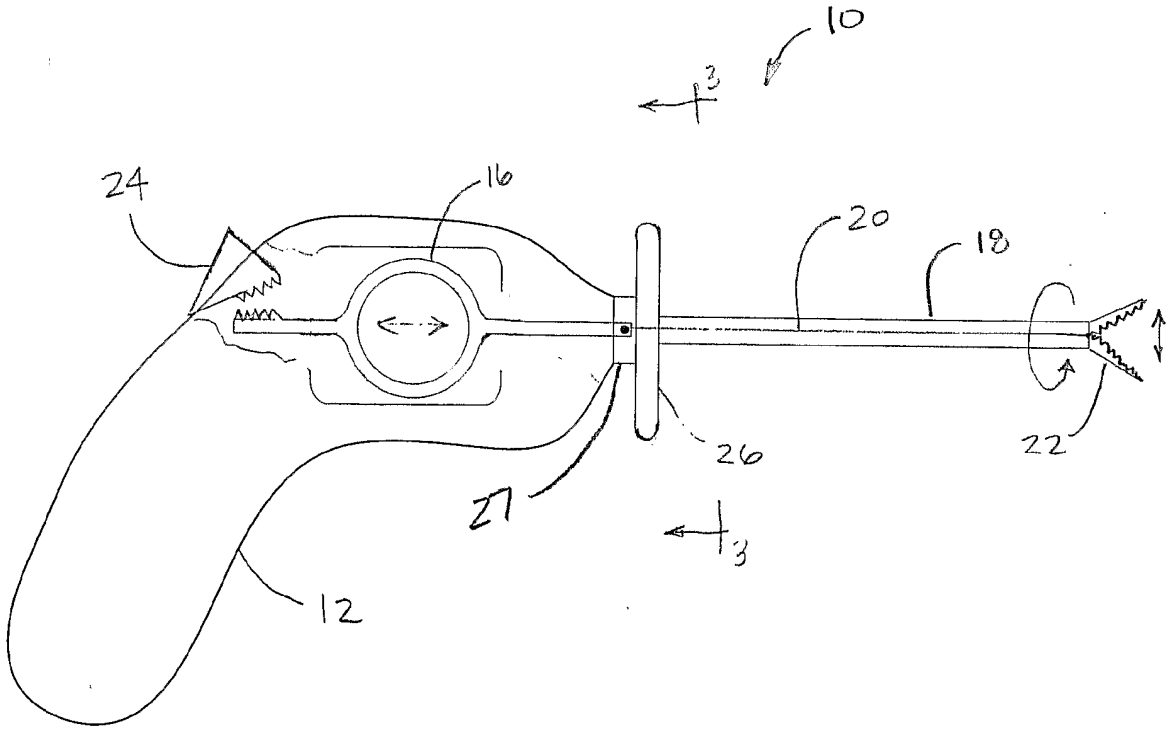


FIG 2

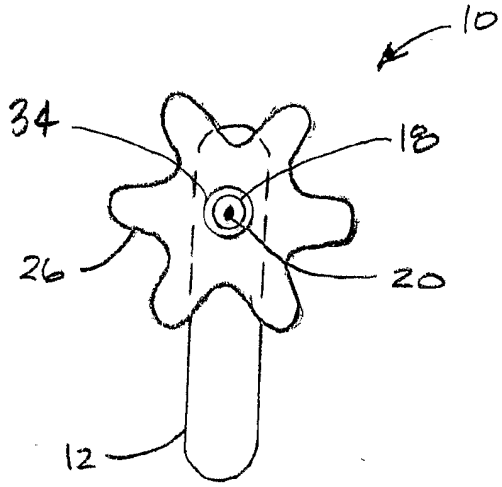


FIG 3

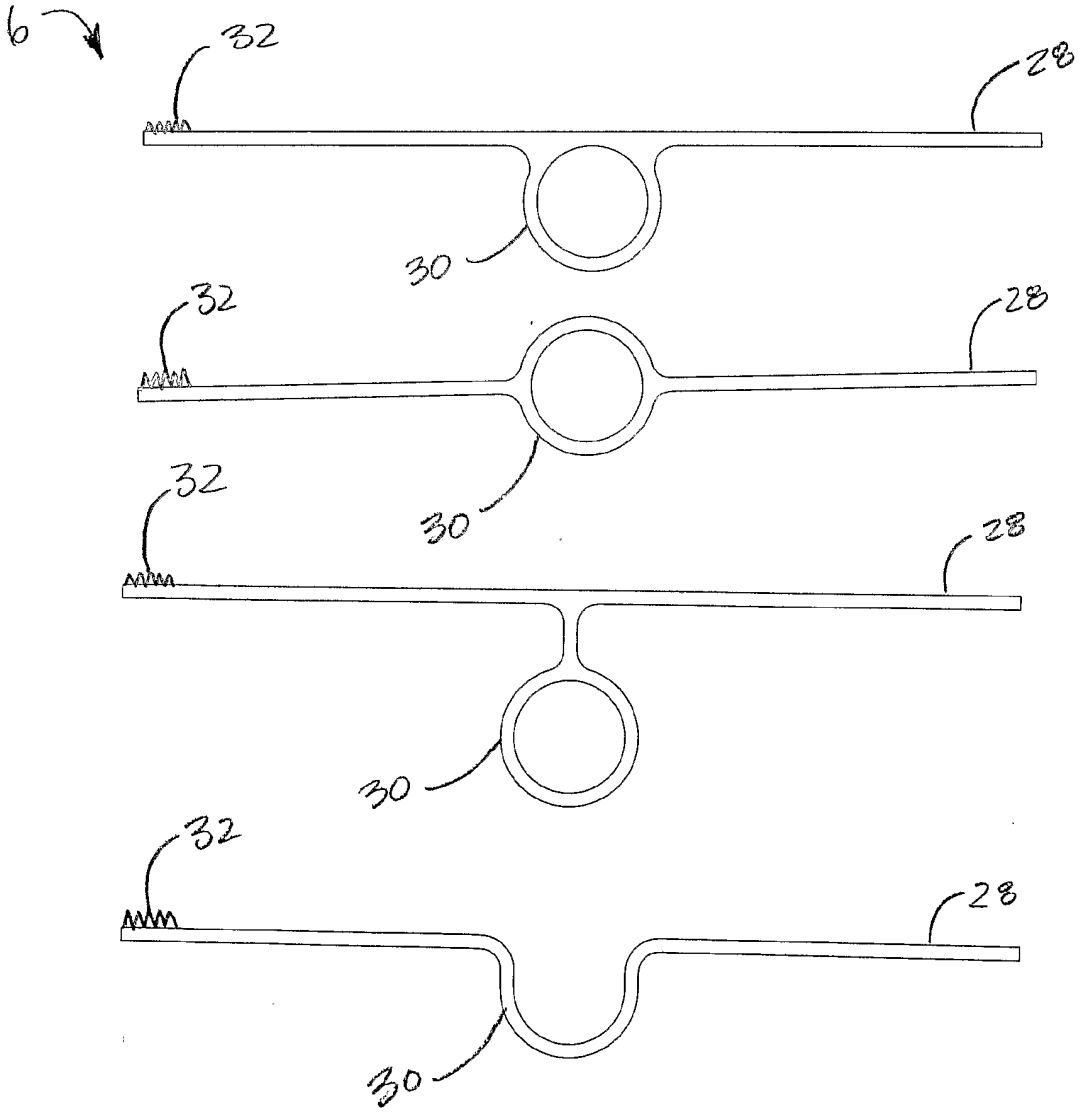


FIG 4

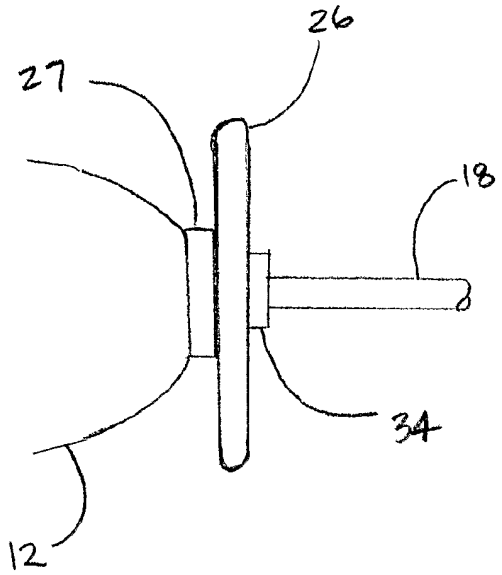


FIG 5

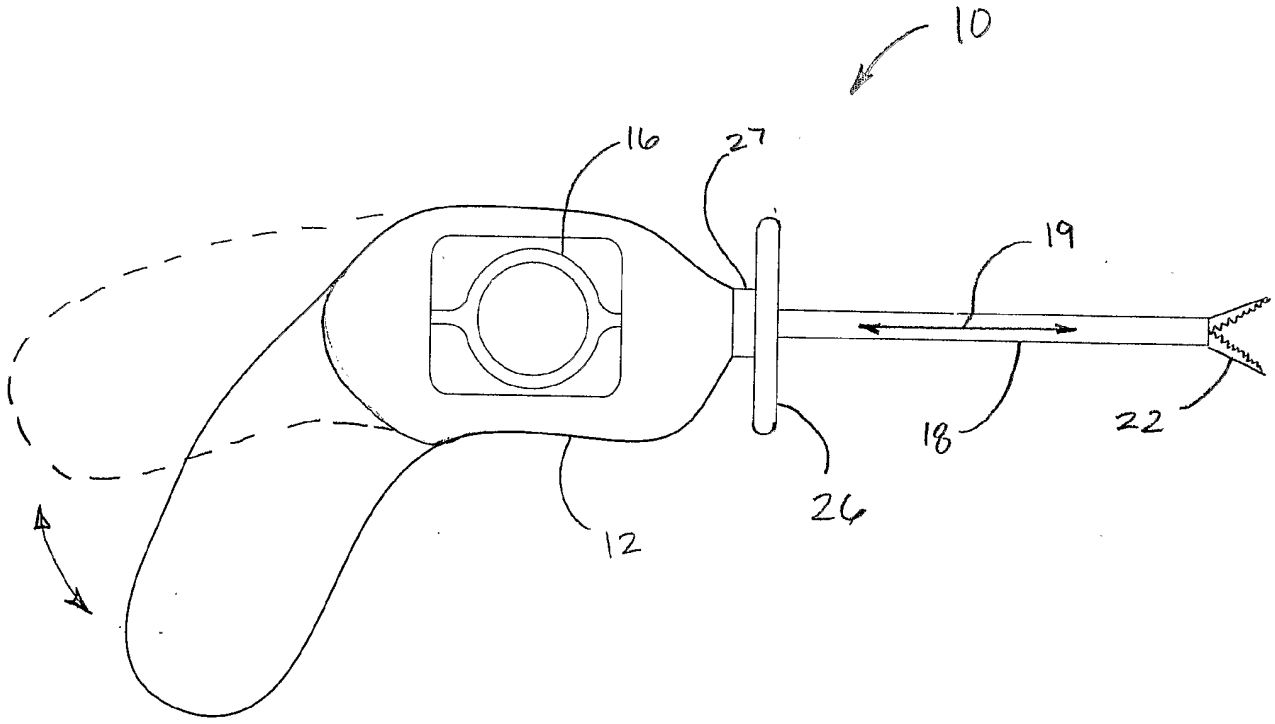


FIG 6

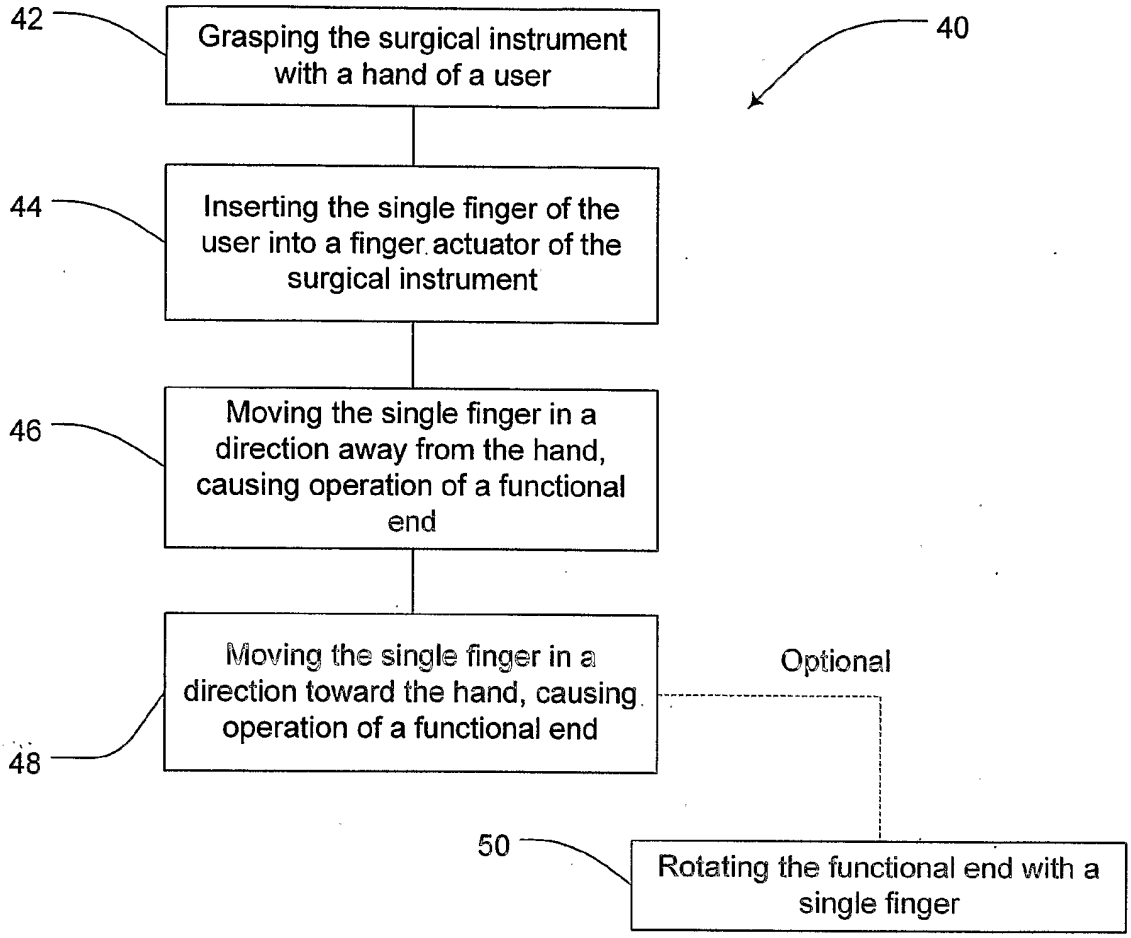

42
Grasping the surgical instrument with a hand of a user
40
44
Inserting the single finger of the user into a finger actuator of the surgical instrument
46
Moving the single finger in a direction away from the hand, causing operation of a functional end
Moving the single finger in a direction toward the hand, causing operation of a functional end
48
Optional
50
Rotating the functional end with a single finger

FIG. 7