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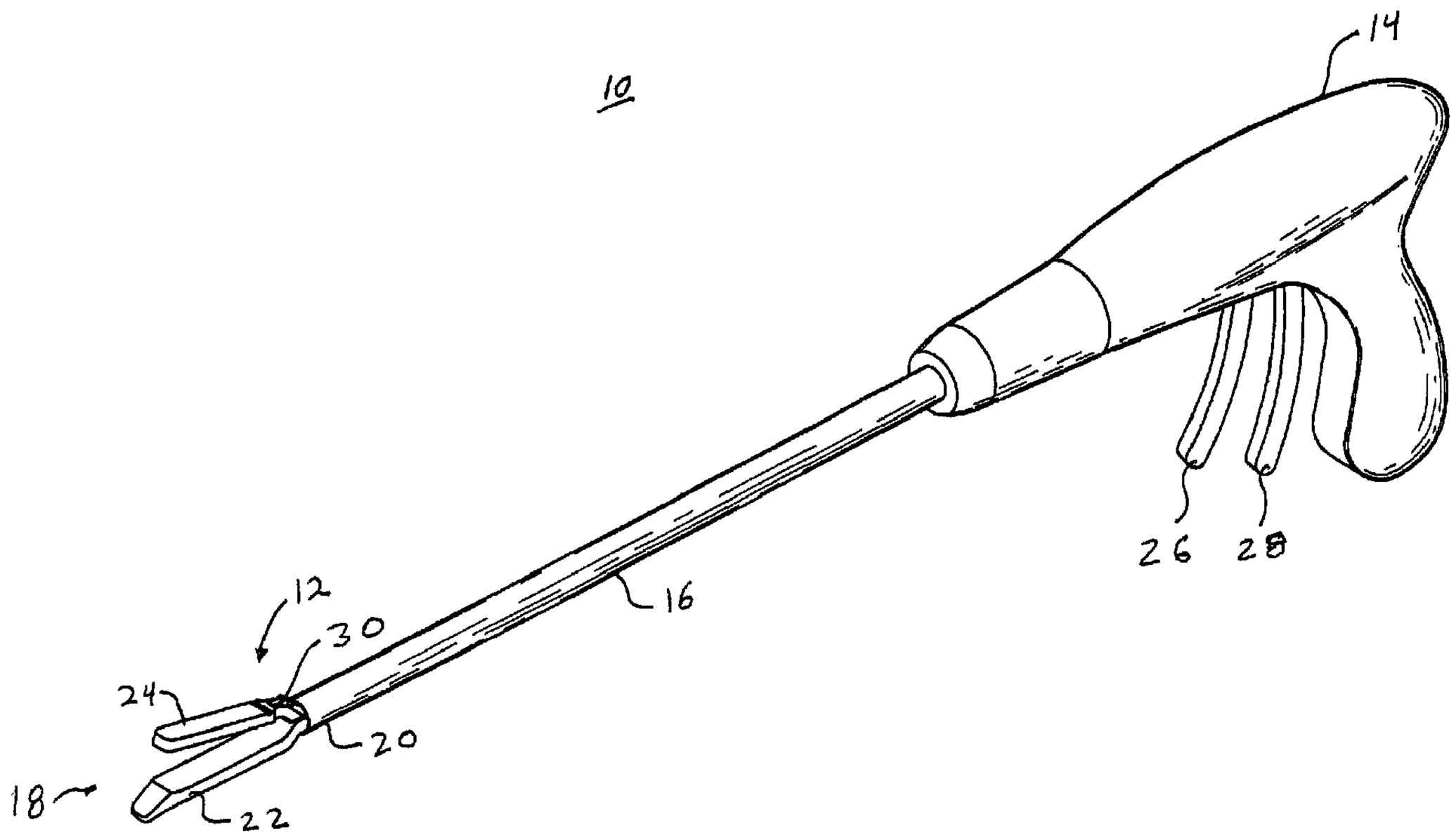
(54) **Titre : DETECTEUR DE POSITION D'ENCLUME POUR AGRAFEUSE CHIRURGICALE**
(54) **Title: ANVIL POSITION DETECTOR FOR A SURGICAL STAPLER**



(57) **Abrégé/Abstract:**
An anvil position detector is provided for use with a surgical stapling instrument. The anvil position detector includes a projection formed on a driving or jaw closure mechanism of the surgical instrument and a recess for a notch formed on the jaw or anvil of the surgical instrument. Engagement of the projection with the notch provides a tactile and/or audible indication to the operator of the surgical instrument that the anvil or jaw is in proper alignment with the remainder of the surgical instrument.

ABSTRACT

An anvil position detector is provided for use with a surgical stapling instrument. The anvil position detector includes a projection formed on a driving or jaw closure mechanism of the surgical instrument and a recess for a notch formed on the jaw or anvil of the surgical instrument. Engagement of the projection with the notch provides a tactile and/or audible indication to the operator of the surgical instrument that the anvil or jaw is in proper alignment with the remainder of the surgical instrument.

ANVIL POSITION DETECTOR FOR A SURGICAL STAPLER

BACKGROUND

1. Technical field

The present disclosure relates to a jaw position detector for use with a surgical instrument. More particularly, the present disclosure relates to an anvil position detector for use in a surgical stapling instrument.

2. Background Of Related Art

Various surgical instruments are used in surgical procedures to grasp and manipulate tissue. These instruments may include devices having relatively movable jaw structures such as, for example, graspers, cutters, etc.

Other types of surgical instruments having movable jaw structure include surgical staplers. Surgical staplers typically incorporate a staple containing cartridge and an anvil member movably mounted relative to the staple containing cartridge. Tissue is captured between the anvil member and the staple containing cartridge and the stapler is actuated to place one or more rows of staples through the captured tissue and, in some cases, cut the tissue between the rows of staples. In order to properly staple the tissue, it is often necessary that the anvil be moved to a predetermined position relative to the remainder of the surgical stapler and, in particular, relative to the elongate member upon which the anvil is mounted.

In specific instances, it is desirable to orient the anvil member relative to an elongate member of the surgical instrument such that a longitudinal axis of the anvil member is substantially parallel to a longitudinal axis of the elongate member. This may be necessary to ensure that staple pockets associated with the anvil member are in a proper position to fully crimp the staples closed about the tissue being stapled. When performing a procedure endoscopically, it is often difficult to tell when the longitudinal axis of the anvil member is in proper alignment with respect to the longitudinal axis of the elongate member.

Thus, it would be desirable to provide a surgical instrument having an indicator mechanism capable of ensuring proper alignment of a jaw or anvil of the surgical instrument with the remainder of the surgical instrument. It would be further desirable to provide an indicator mechanism which provides a tactile indication of the proper alignment. It would still further be desirable to provide an indicator mechanism which provides an audible indication of the proper alignment.

SUMMARY

There is disclosed a surgical instrument incorporating a jaw position detector. The surgical instrument generally includes a handle and a support or elongate member extending distally from handle. The elongate member defines a first longitudinal axis. A jaw assembly is mounted on a distal end of the elongate member and includes a staple cartridge and a movable jaw or anvil mounted relative to the staple cartridge. The anvil defines a second longitudinal axis. A drive mechanism is provided to move the anvil between an open position spaced apart from the staple cartridge to a closed position substantially adjacent the staple cartridge. A

position detector is associated with the drive mechanism and the anvil such that position detector provides an indication to an operator of the surgical instrument when the first longitudinal axis is in substantial alignment with the second longitudinal axis. The drive mechanism includes a driver movable within the elongate tubular member.

The position detector includes a notch formed in the jaw and a projection on the driver engageable with the notch on the jaw. The notch is a transverse notch formed in the jaw and the projection on the driver is a cross pin oriented transverse to the driver. In one embodiment, engagement of the cross pin with the notch provides a tactile indication to the operator or user that the first longitudinal axis is in substantial alignment with the second longitudinal axis. In an alternative embodiment, engagement of the cross pin with the notch provides an audible indication to the operator or user that the first longitudinal axis is in substantial alignment with the second longitudinal axis.

There is also provided an alternative surgical instrument incorporating a jaw position detector. The surgical instrument includes a support member having a first longitudinal axis and a jaw movably mounted on the support member and having a second longitudinal axis. A drive mechanism is movable over the support member and operable to move the jaw are relative to the support member. A position detector is associated with the jaw and a drive mechanism such that the position detector provides an indication to an operator of the surgical instrument when the first longitudinal axis is in substantial alignment with the second longitudinal axis.

In one embodiment, the drive mechanism includes an outer tubular member movable over the support member and engageable with the jaw to move the jaw relative to the support member. The position detector includes a notch formed in the jaw and a projection in the outer tubular member. In one embodiment, the notch is a transverse notch formed in the jaw and the projection in the outer tubular member is an inwardly directed projection. In one embodiment, engagement of the projection with the notch provides a tactile indication to the user or operator. In an alternative embodiment, engagement of the projection with the notch provides an audible indication to the user or operator.

There is also disclosed an indicator for use with a jaw closure mechanism incorporating a threaded inner member and a threaded outer member. The indicator provides an indication to a user or operator when the threaded inner member is in a predetermined position relative to the threaded outer member. The position indicator includes a notch formed in the threaded inner member and a projection, engageable with the notch, formed in the threaded outer member. In one embodiment, engagement of the projection with the notch provides a tactile indication to the user or operator, while in an alternative embodiment, engagement of the projection with the notch provides an audible indication to the user or operator.

DESCRIPTION OF THE DRAWINGS

Various embodiments of the presently disclosed anvil position detector for use in a surgical stapler are disclosed herein with reference to the drawings, wherein:

FIG. 1 is a perspective view of a surgical stapler incorporating one embodiment of an anvil position detector for use with a surgical stapler:

FIG. 2 is a side elevation view of the distal end of the surgical stapler of FIG. 1;

FIG. 3 is a perspective view of the distal end of a drive bar of the surgical stapler incorporating part of the anvil position detector;

FIG. 4 is an end view of the distal end of the surgical stapler of FIG. 1;

FIG. 5 is a top view of the distal end of the surgical stapler of FIG. 1;

FIG. 6 is a side elevation view of the distal end of the surgical stapler of FIG. 1 positioned about tissue;

FIG. 7 is a side elevation view of the distal end of the surgical stapler of FIG. 1 with the tissue captured between the jaws and the anvil position detector engaged;

FIG. 8 is a perspective view of a surgical stapler incorporating an alternative embodiment of an anvil position detector;

FIG. 9 is a side elevation view of the distal end of the surgical stapler of FIG. 8;

FIG. 10 is a cross-sectional view of the distal end of a drive tube of the surgical stapler of FIG. 8 incorporating part of the anvil position detector;

FIG. 11 is an end view of the distal end of the surgical stapler of FIG. 8;

FIG. 12 is a top view of the distal end of the surgical stapler of FIG. 8;

FIG. 13 is a side view of the distal end of the surgical stapler of FIG. 8 positioned about tissue;

FIG. 14 is a side elevation view of the distal end of the surgical stapler of FIG. 8 with the tissue captured between the jaws and the anvil position detector engaged;

FIG. 15 is a cross-sectional view of an alternate embodiment of an anvil position detector for use with the jaw closure mechanism of a surgical stapler;

FIG. 16 is a cross-sectional view of the anvil position detector of FIG. 15 in the engaged position, and

FIG. 17 is a perspective view of the distal end of a component of an anvil position detector.

DETAILED DESCRIPTION OF EMBODIMENTS

Embodiments of the presently disclosed anvil position detector for use in surgical staplers will now be described in detail with reference to the drawings wherein like numerals designate identical or corresponding elements in each of the several views. As is common in the art, the term 'proximal" refers to that part or component closer to the user or operator, i.e. surgeon or physician, while the term "distal" refers to that part or component further away from the user.

Referring to FIG. 1, there is illustrated as surgical stapler 10 incorporating one embodiment of an anvil position detector 12. Surgical stapler 10 is includes a handle 14 and an elongated tubular member 16 extending distally from handle 14. A jaw assembly 18 is provided on a distal end 20 of elongate tubular member 16. Jaw assembly 18 includes a staple cartridge 22 and an anvil 24 which is mounted for movement relative to staple cartridge 22. Staple cartridge 22 is of the type containing a plurality of staples (not shown) which are provided to be driven through tissue and into anvil 24 for crimping about the tissue. Staple cartridge 22 may be permanently mounted to elongate tubular member 16 or may be removable and therefore replaceable with a new staple cartridge 22. Anvil 24 is movable between an open position

spaced apart from staple cartridge 22 to a closed position substantially adjacent staple cartridge 22.

Surgical stapler 10 additionally includes a first trigger 26 and a second trigger 28 movably mounted on handle 14. First trigger 26 is provided to move anvil 24 between the open and closed positions. Actuation of first trigger 26 operates to move a driver 30 longitudinally relative to elongate tubular member 16 so as to cam anvil 24 from the open position to the closed position. Actuation of second trigger 28 operates to eject staples from staple cartridge 22 through tissue and into anvil 24 for crimping about the tissue.

Referring now to FIG. 2, as noted above, staple cartridge 22 is mounted on elongate tubular member 14. Elongate tubular member 14 has a first longitudinal axis A-A. Specifically, a proximal end 32 is mounted to distal end 20 of elongate tubular member 14. A proximal end 32 of anvil 24 is movably mounted to proximal end 32 of staple cartridge 22 at pivot 36. In order to move anvil 24 between the open and closed positions, a cross pin 38 is provided on driver 30 and is engageable with an angled edge 40 at proximal end 34 of anvil 24. As cross pin 38 is driven against angled edge 40, anvil 24 is moved from the open to the closed position.

Referring for the moment to FIG. 3, cross pin 38 is transversely mounted through a distal end of 42 of driver 30. Distal end 42 of driver 30 may additionally include an arcuate tissue stop 44 provided to prevent tissues from being pinched between anvil 24 and staple cartridge 22.

Referring back to FIG. 2, and as noted hereinabove, surgical stapler 10 includes anvil position detector 12 which is provided to give an indication to the operator of surgical stapler 10 when anvil 24 is in the proper position relative to elongate tubular member 14. Anvil position detector 12 includes a cross notch 46 formed in anvil 24 which cooperates with cross pin 38 on driver 30. Specifically, as anvil 24 is moved toward the closed position cross pin 38 moves toward and engages cross notch 46. When cross pin 38 engages cross notch 46, it does so in such a manner as to provide a tactile indication, such as the feeling of two parts snapping together, to the operator of surgical stapler 10. Additionally, the engagement of cross pin 38 with cross notch 46 may also provide an audible indication to the operator of surgical stapler 10 that cross pin 38 has engaged cross notch 46 and anvil 24 is properly oriented relative to elongate tubular member 14.

Referring now to FIGS. 4 through 7, and initially with respect to FIGS. 4 and 5, in the initial position, anvil 24 is in the open position spaced apart from staple cartridge 22 and driver 30, containing cross pin 38, is in a proximal position relative to cross notch 46 in anvil 24.

As best shown in the FIGS. 6 and 7, in use, jaw assembly 18 is positioned about a tubular tissue section T to be stapled. It should be noted that, while the discussion of anvil position detector 12 is being given relative to a surgical stapler 10 and an anvil 24, the operation of anvil position detector 12 is equally applicable to other surgical instruments having tissue engaging jaw structures such as, for example, graspers, cutters, etc. Once tissue T has been properly positioned within jaw assembly 18, first trigger 26 (FIG. 1) is actuated to move driver 30 distally relative to elongate tubular member 14. As driver 30 moves distally, cross pin 38 engages

angled edge 40 of anvil 24 and cams anvil 24 to the closed position relative to staple cartridge 22.

It should be noted that the location of cross notch 46 is configured to correspond to the situation where a longitudinal axis B-B of anvil 24 is parallel to longitudinal axis A-A of elongate tubular member 14. Specifically, cross pin 38 engages cross notch 46 at the point where longitudinal axis B-B is parallel to longitudinal axis A-A of elongate tubular member 14. As cross pin 38 engages cross notch 46, cross pin 38 snaps into engagement with cross notch 46 giving both a tactile and audible indication to the operator of surgical stapler 10 that anvil 24 is in the proper orientation relative to elongate tubular member 14. Thus, cross pin 38, in combination with cross notch 46, forms an anvil position detector enabling the operator of surgical instrument 10 to be confident that the anvil 24 is in the proper position to crimps staples. As shown, staple cartridge 22 may undergo a certain amount of deflection D due to the capture of tissue T between anvil 24 and staple cartridge 22. This has been found not to affect the efficacy of staples applied to tissue T and crimped in anvil 24. As such, it is not critical to the stapling of tissue T to exactly orient staple cartridge 22 relative to elongate tubular member 14.

Referring now to FIG. 8, there is disclosed an alternative surgical stapler 50 incorporating an alternative mechanism for indicating the proper position of an anvil associated with surgical stapler 50. Surgical stapler 50 generally includes a handle 52 having an inner member 54 extending distally from handle 52. A jaw assembly 56 is mounted on a distal end 58 of inner member 54. Jaw assembly 56 includes an anvil 60 and a staple cartridge 62. An outer tubular member 64 is mounted for longitudinal movement relative to inner member 54 and handle 52.

Outer tubular member 64 is provided to cam anvil 60 from an open position spaced apart from staple cartridge 62 to a closed position substantially adjacent to staple cartridge 62. A first trigger 66 is movably mounted on handle 52 and operates to move outer tubular member 64 longitudinally relative to inner member 54. A second trigger 68 is provided to eject staples (not shown) from staple cartridge 62 and into anvil 60 in order to staple tissue captured there between. As noted hereinabove, surgical stapler 50 incorporates an alternative anvil position detector 70 for providing an indication to the operator of surgical stapler 50 when anvil 60 has been properly oriented relative to the remainder of surgical stapler 50.

As best shown in FIG. 9, a proximal end 72 of staple cartridge 62 is affixed to distal end 58 of inner member 54. Anvil 60 is movably mounted with respect to staple cartridge 62. A proximal end 74 of anvil 60 is pivotally mounted to staple cartridge 62 at pivot 76. In order to move anvil 60 between the open and closed positions, anvil 60 includes an angled edge 78 at proximal end 74 of anvil 60. Outer tubular member 64 is provided with a distal or camming edge 80 which is configured to engage angled edge 78 to move anvil 60 from the open to the closed position. As noted hereinabove, surgical stapler 50 includes an anvil position detector 70 to give the operator an indication of the proper positioning of anvil 60. Similar to anvil 24 described hereinabove, anvil 60 includes a cross notch 82.

Referring for the moment to FIG. 10, and as noted hereinabove, outer tubular member 64 is hollow for movement over inner member 54. Outer tubular member 64 includes a distal end 84 and an inwardly directed projection 86, which forms part of anvil position detector 70, and which is configured to engage cross notch 82 in anvil 60 (FIG. 9).

Referring now to FIGS. 11 and 12, in the initial position, anvil 60 is in the open position spaced apart from staple cartridge 62 (FIG. 11). Outer tubular member 64, including camming edge 80, is in a proximal position relative to angled edge 78 on anvil 60 (FIG. 12). As best shown in FIG. 13, anvil 60 and staple cartridge 62 are initially positioned about a tubular tissue section T. Actuation of first trigger 66 (FIG. 8) causes outer tubular member 64 to move distally forcing camming edge 80 into engagement with angled edge 78. Engagement of camming edge 80 with angled edge 78 moves anvil 60 from the open position to the closed position relative to staple cartridge 62 as best shown in FIG. 14. As with surgical stapler 10 described hereinabove, engagement of anvil position detector 70, including cross notch 82 and inward projection 86, is configured to correspond to the condition where a longitudinal axis E-E of anvil six the is in the proper orientation, i.e. approximately parallel to, a longitudinal axis C-C of inner member 54. As inward projection 86 on outer tubular the member 64 engages cross notch 82 in anvil 60, the user is provided with an audible and tactile indication that anvil 60 is in proper alignment with respect to the remainder of surgical stapler 50. As shown, and as noted hereinabove, a certain amount of deflection D2 may occur in staple cartridge 62 without affecting the ability of anvil 62 properly crimps staples about tissue section T.

Referring now to FIGS. 15 and 16, there is disclosed a further alternative embodiment of an anvil position indicator 90. Anvil position indicator 90 is configured for use with an anvil closure mechanism that incorporates interengaging threaded members such as, for example, a jackscrew etc. An inner member 92 includes threads 94 and a hollow outer member 96 includes corresponding threads 98. Inner member 92 is provided with a notch 100 which is formed as an

enlarged or deepened area in threads 94. Similarly, outer member 96 includes an enlarged projection on inner threads 98 which is configured to engage notch 100. As with prior embodiments, engagement of projection 102 with notch 100 corresponds to the condition where a jaw and handle of a surgical instrument are in proper orientation for use. Likewise, similar to that disclosed hereinabove, engagement of projection 102 with notch 100 provides both an audible and tactile indication to the user that the proper alignment has been obtained.

Referring finally to FIG. 17, there is illustrated a distal end 110 of a hollow outer member 112. As with outer member 96 above, inner threads 114 include an enlarged projection or enlarged distal most thread 116. Distal end 110 of outer member 112 includes an L-shaped cutout 118 which allows distal end 110 to flex or act as a sprung member preventing enlarged distal most thread 116 from jamming with threads on a corresponding inner member until enlarged distal most thread 116 drops into a corresponding notch in the inner member.

While the above described anvil position indicator mechanisms have been disclosed as giving audible, and/or, tactile indications to the user of the proper alignment of a jaw associated with a surgical instrument, it is also within the contemplated scope of the invention to provide an audible or visual signal via electrical means to the user. This can be accomplished by a electrically insulating the disclosed March from the remainder of the anvil material and electrically insulating the disclosed projection from the remainder of the drive mechanism used to close the anvil member. The notch and projection may form contacts which, when engaged, provide an electrical signal to a mechanism associated with a surgical instrument which in turn

can provide a visual and/or audible indication to the user that the notch and projection have been properly engaged. In the alternative, a simple contact switch can be used.

It will be understood that various modifications may be made to the embodiments disclosed herein. For example, the materials used in the engaging components may be the same materials or dissimilar materials so as to enhance the audible and tactile signals given to the user. Further, the engagement of a projection into a notch may be provided in other jaw closure mechanism so as to give the operator an audible and tactile indication of proper functioning of the surgical instrument. Additionally, the disclosed position detectors may be used in other jaw structures such as, for example, tissue graspers, tissue cutters, clip appliers, etc. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. The scope of the claims should not be limited by the preferred embodiments set forth herein, but should be given the broadest interpretation consistent with the description as a whole.

The embodiments of the present invention for which an exclusive property or privilege is claimed are defined as follows:

1. A surgical instrument incorporating a jaw position detector comprising:

a support member having a first longitudinal axis;

a jaw movably mounted on the support member and having a second longitudinal axis, the jaw including a tissue engaging surface and an outer surface disposed in a directly opposite relation to the tissue engaging surface;

a drive mechanism associated with the support member and operable to move the jaw relative to the support member as the drive mechanism translates between proximal and distal positions; and

a position detector including a notch formed on a proximal region of the outer surface, a projection mounted to the drive mechanism wherein the projection is configured and dimensioned to move along the jaw with respect to the first longitudinal axis as the jaw moves from an open position to a closed position, wherein the projection snaps into the notch after the jaw is in the closed position to fix the jaw in the closed position, wherein the projection is located in the notch when the drive mechanism is in the distal position, and wherein when the notch and the projection are engaged, the position detector provides an indication to an operator of the surgical instrument when the first longitudinal axis is in substantial alignment with the second longitudinal axis.

2. The surgical instrument as recited in claim 1, wherein the support member is an elongate tubular member and the drive mechanism includes a driver movable within the elongate tubular member.

3. The surgical instrument as recited in claim 1 or 2, wherein the notch is a transverse notch formed in the jaw.

4. The surgical instrument as recited in any one of claims 1 to 3, wherein the projection on the driver is a cross pin oriented transverse to the driver.

5. The surgical instrument as recited in any one of claims 1 to 4, wherein the engagement of the projection with the notch provides a tactile indication to the user or operator.

6. The surgical instrument as recited in any one of claims 1 to 4, wherein the engagement of the projection with the notch provides an audible indication to the user or operator.

7. A surgical instrument incorporating a jaw position detector comprising:

a support member having a first longitudinal axis;

a jaw movably mounted on the support member and having a second longitudinal axis;

a drive mechanism movable over the support member and operable to move the jaw relative to the support member; and

a position detector associated with the jaw and the drive mechanism, the jaw having a notch and the drive mechanism having a projection that snaps into the notch when the jaw is moved to a closed position such that the position detector provides an indication to an operator of the surgical instrument when the first longitudinal axis is in substantial alignment with the second longitudinal axis.

8. The surgical instrument as recited in claim 7, wherein the drive mechanism includes an outer tubular member movable over the support member and engageable with the jaw to move the jaw relative to the support member.

9. The surgical instrument as recited in claim 7 or 8, wherein the notch is a transverse notch formed in the jaw.

10. The surgical instrument as recited in any one of claims 7 to 9, wherein the projection is in the outer tubular member and is an inwardly directed projection.

11. The surgical instrument as recited in claim 10, wherein the engagement of the projection in the outer tubular member with the notch formed in the jaw provides a tactile indication to the user or operator.

12. The surgical instrument as recited in claim 10, wherein the engagement of the projection in the outer tubular member with the notch formed in the jaw provides an audible indication to the user or operator.

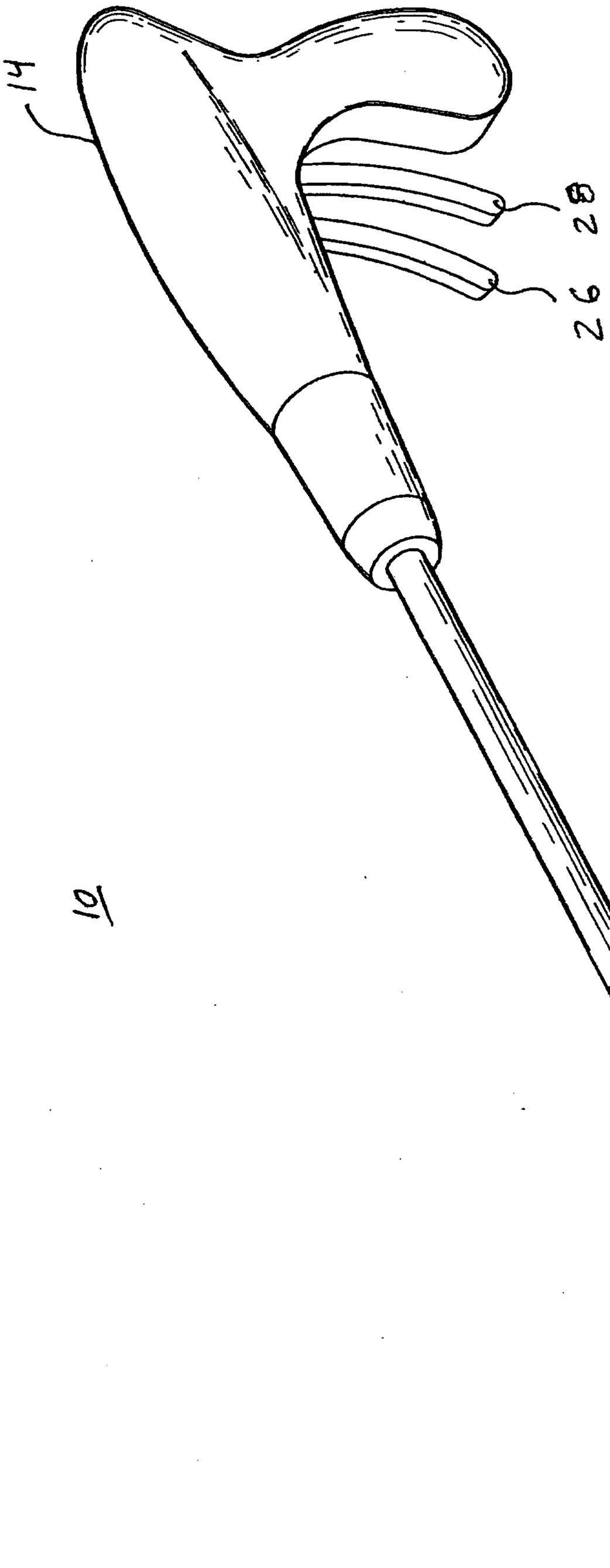


FIG. 1

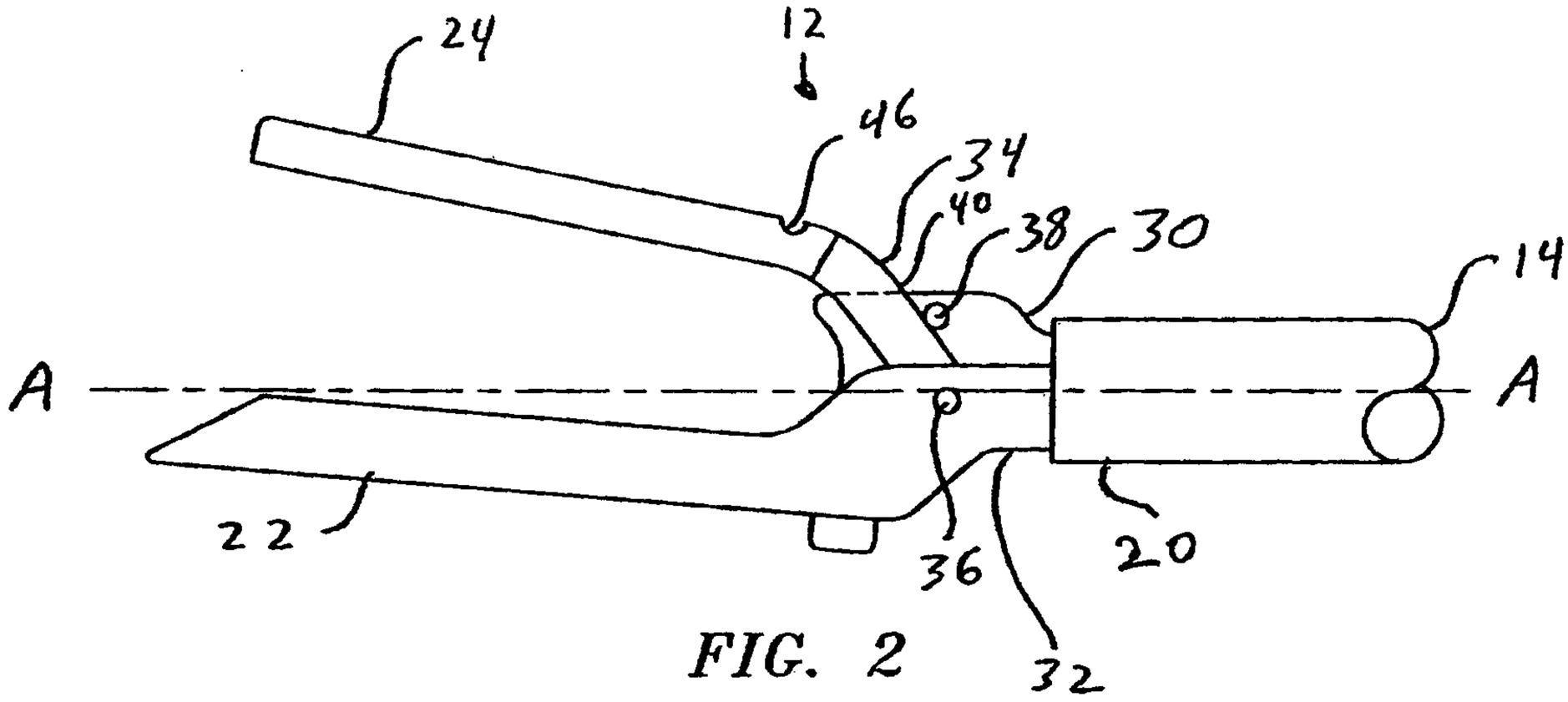


FIG. 2

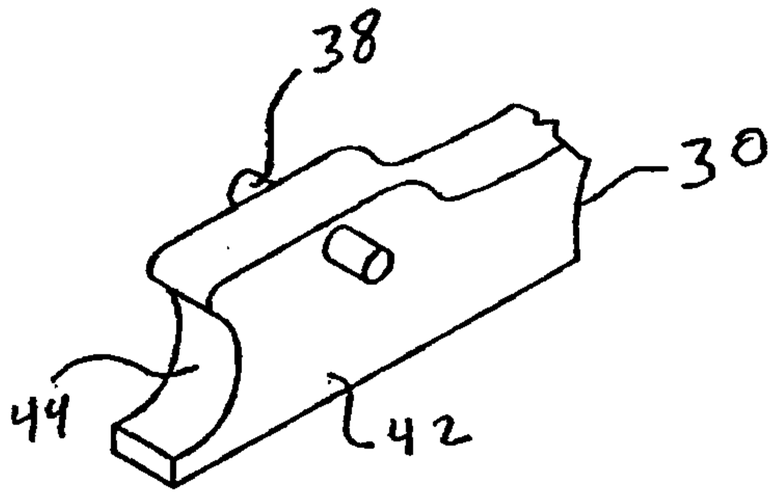


FIG. 3

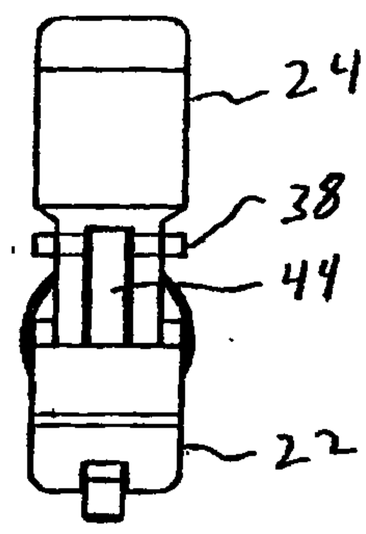


FIG. 4

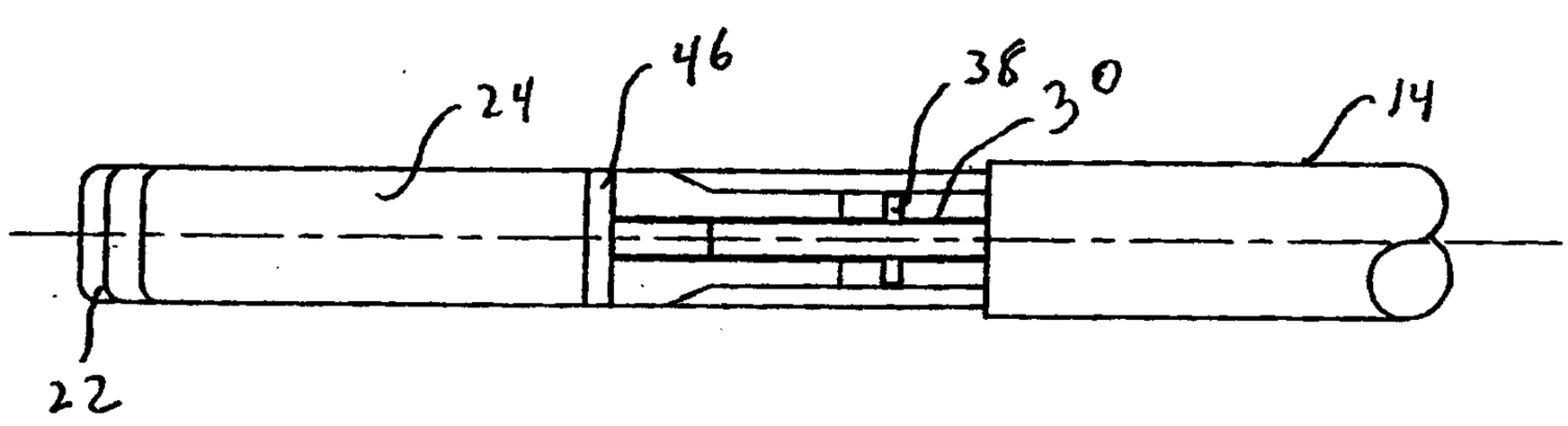


FIG. 5

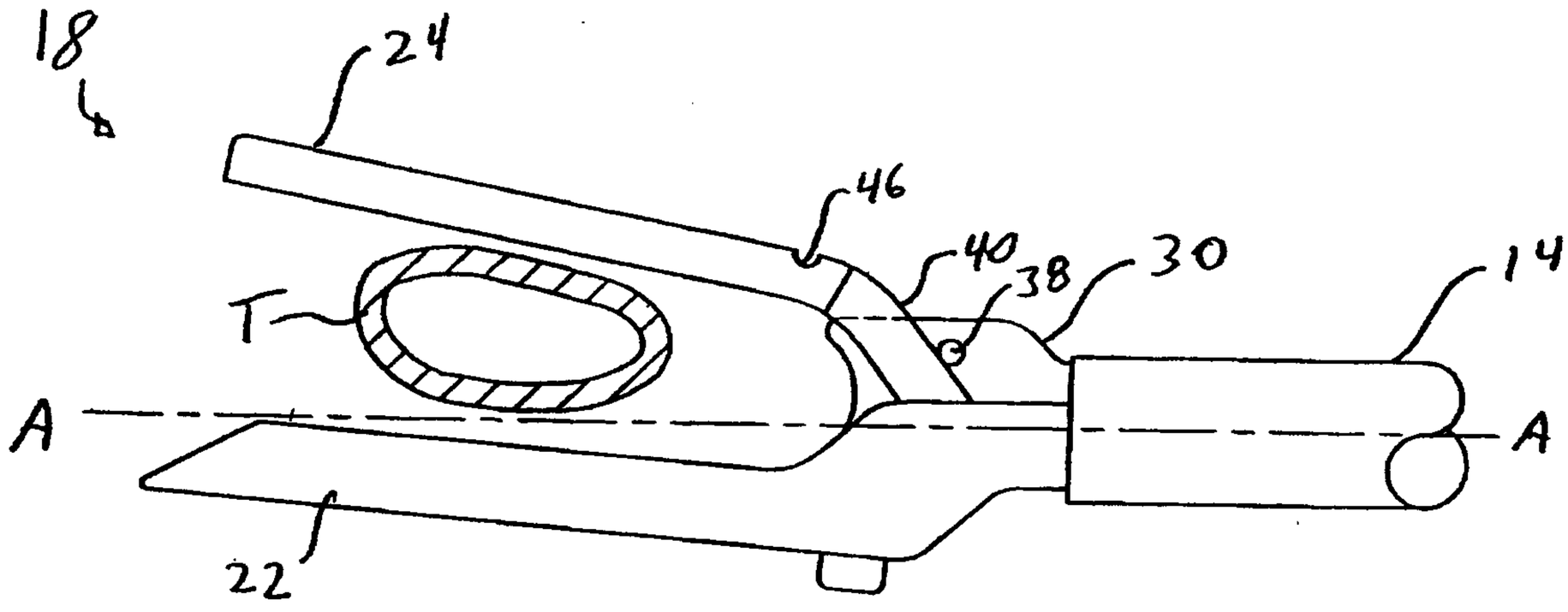


FIG. 6

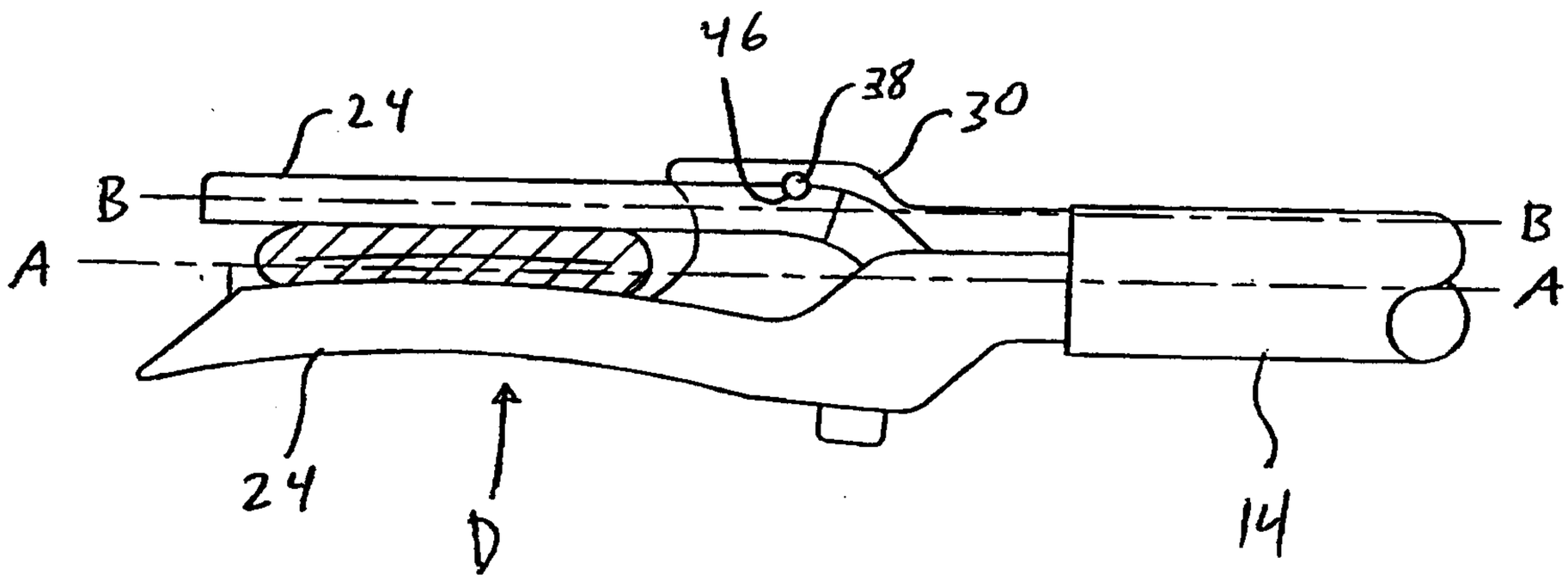


FIG. 7

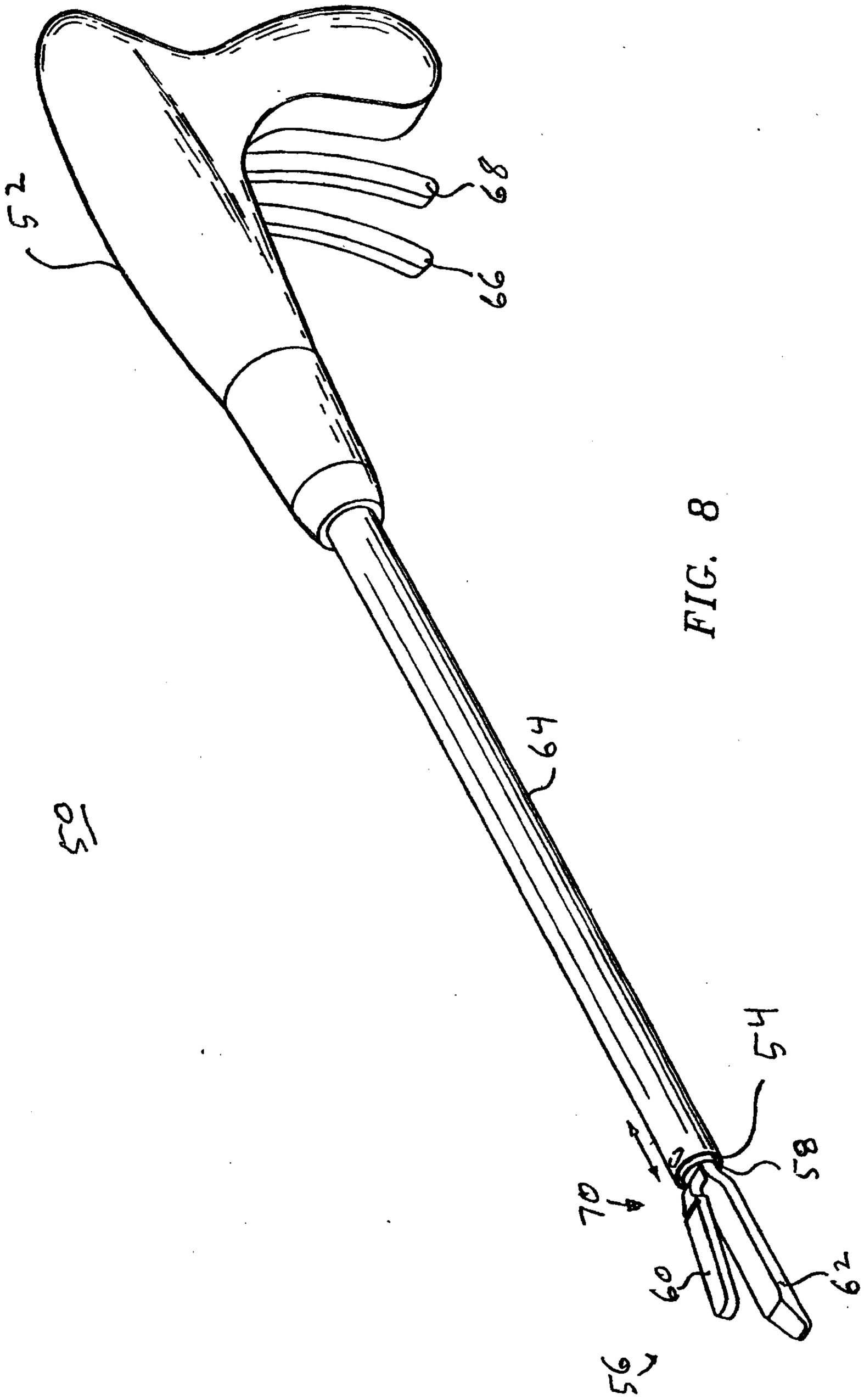


FIG. 8

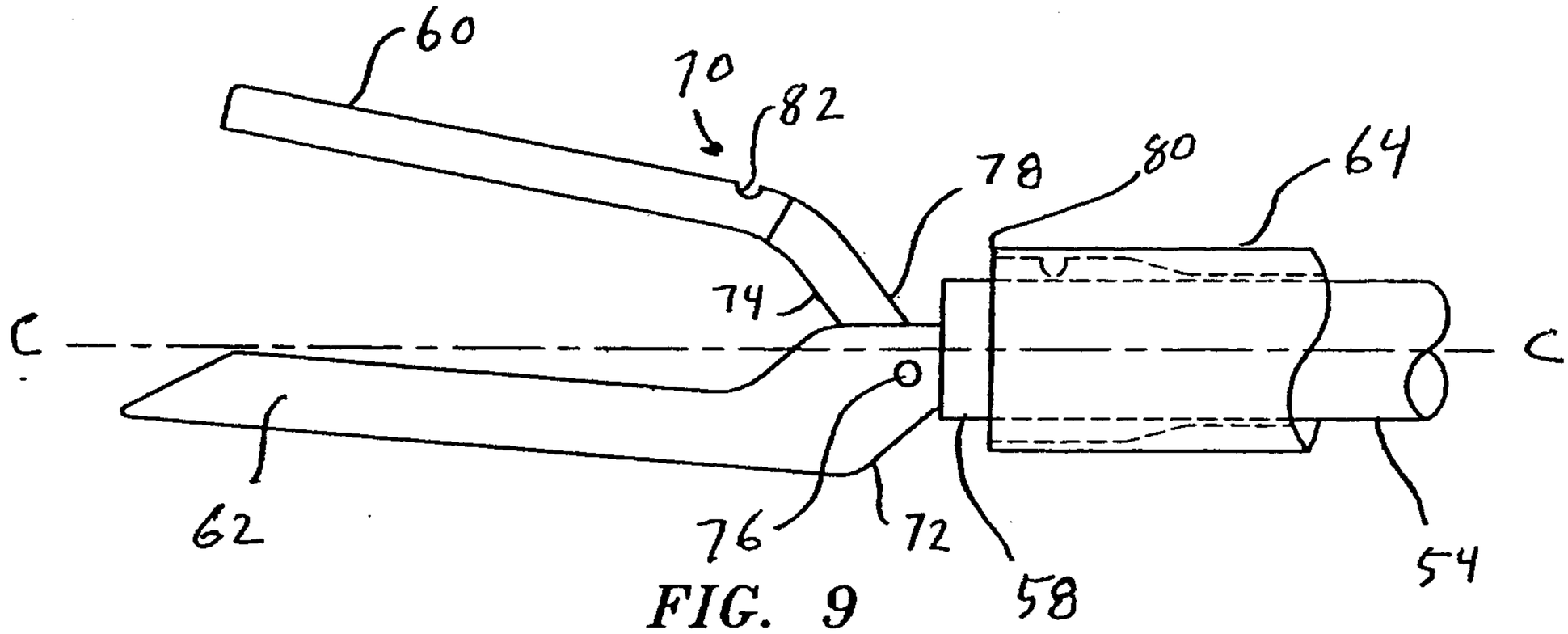


FIG. 9

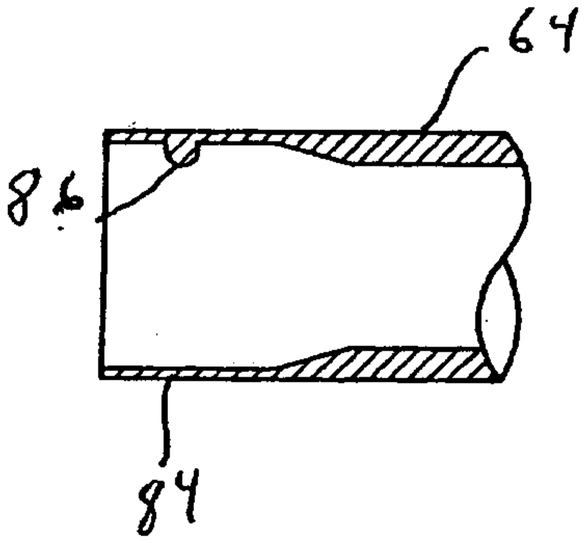


FIG. 10

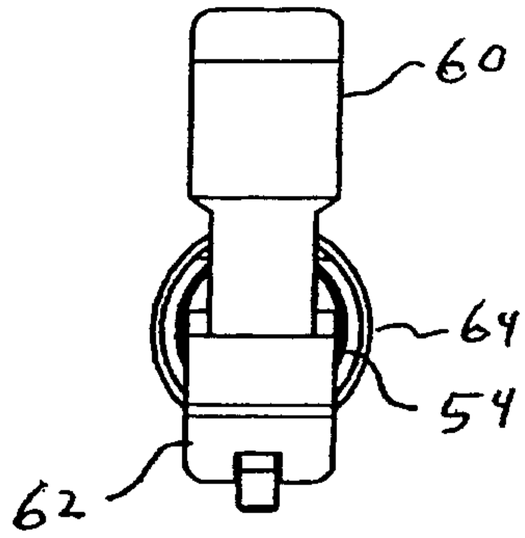


FIG. 11

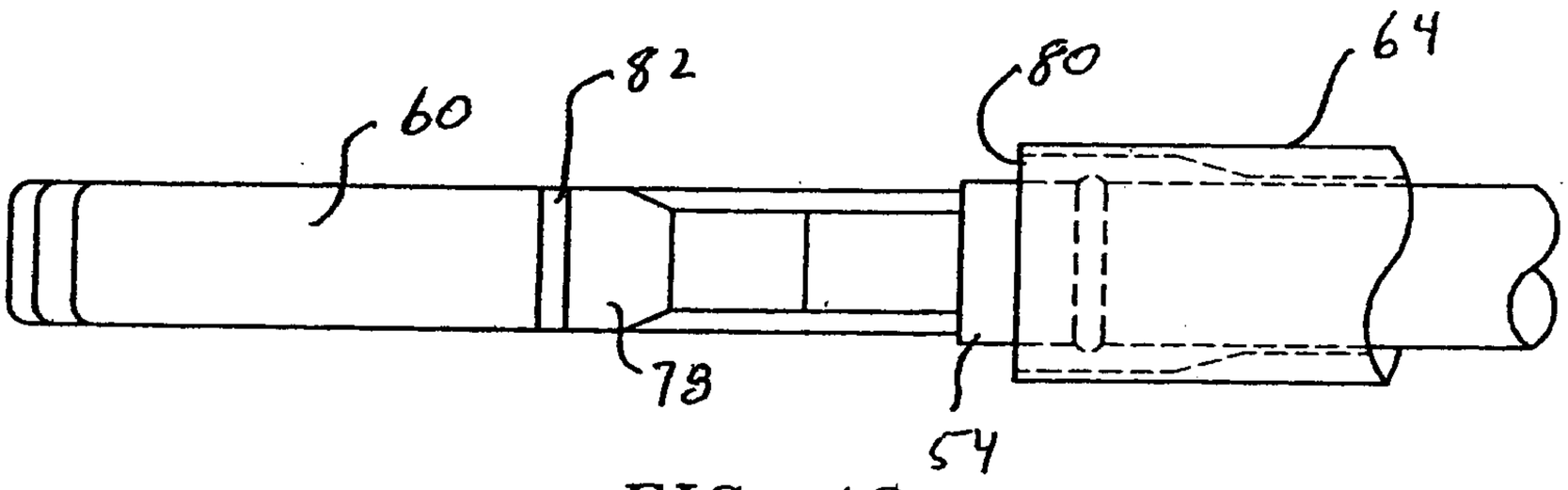


FIG. 12

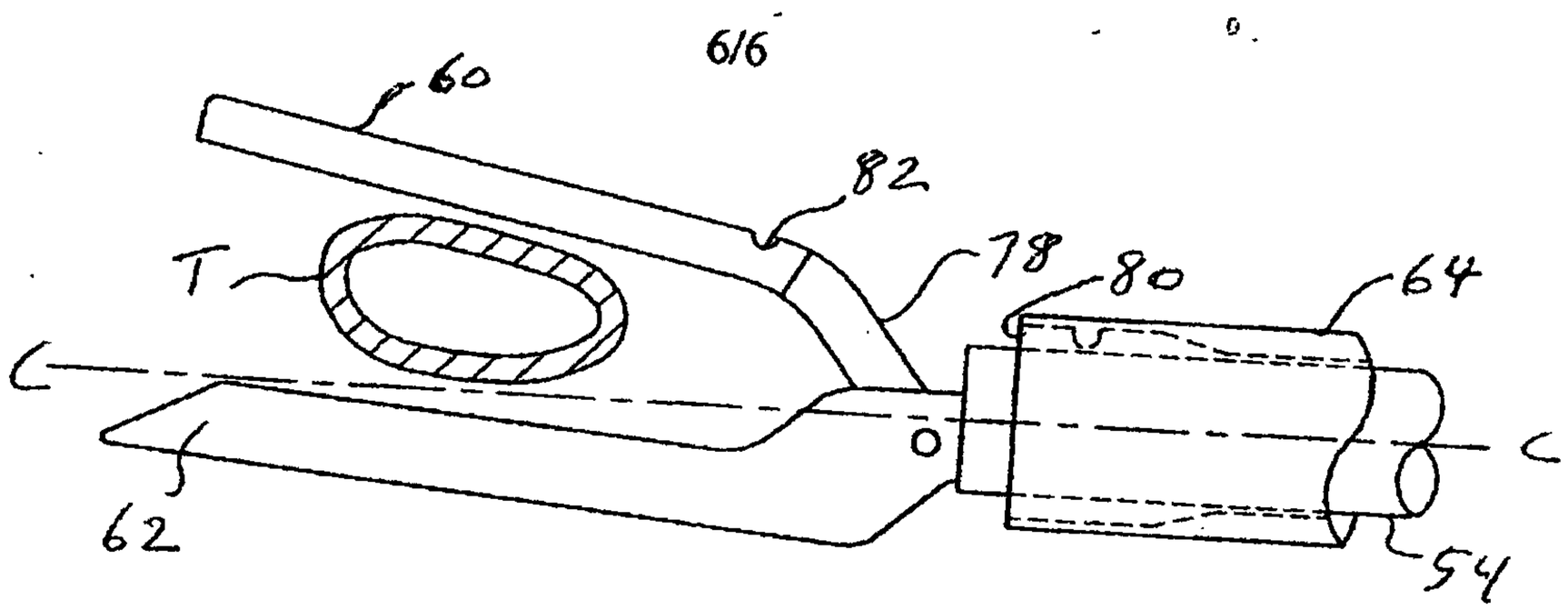


FIG. 13

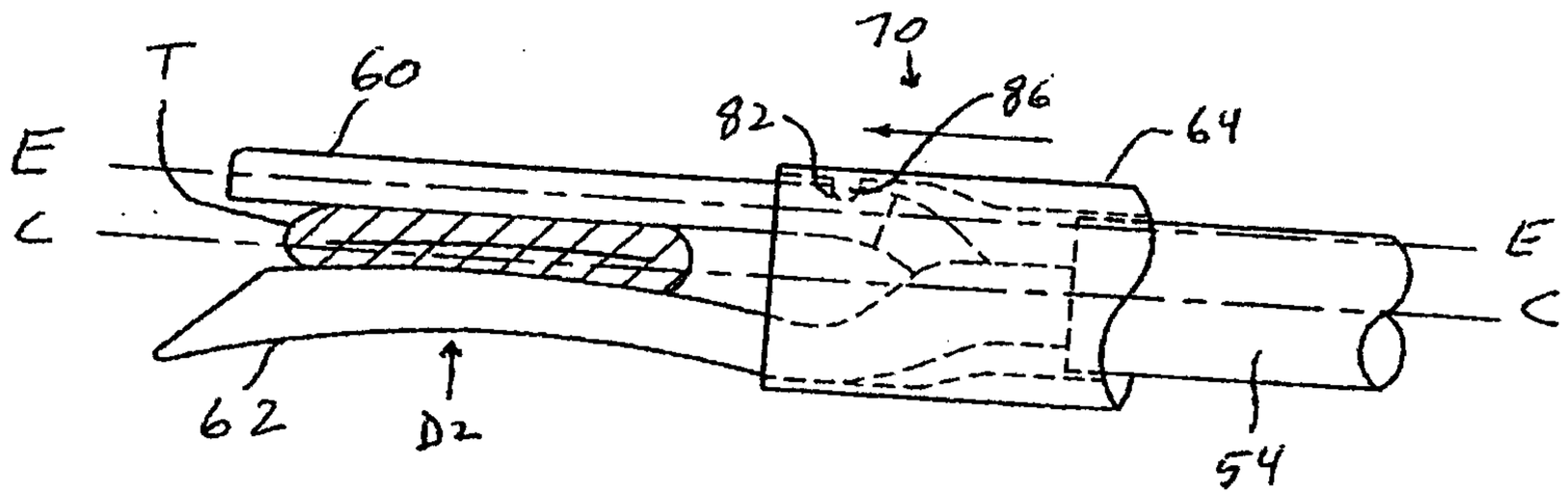


FIG. 14

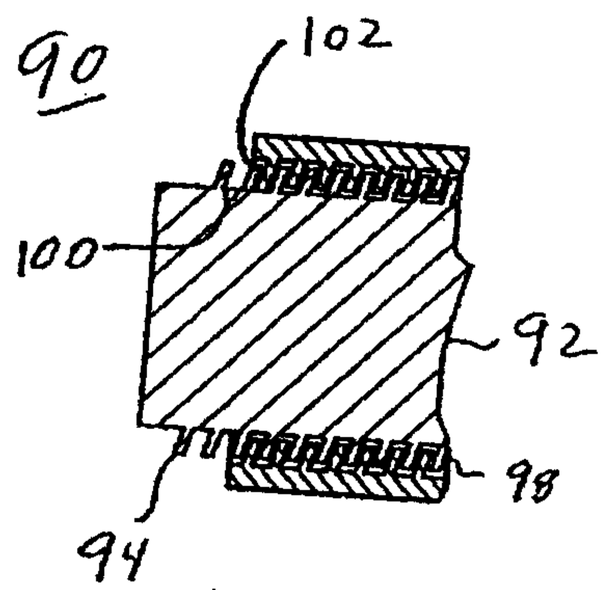


FIG. 15

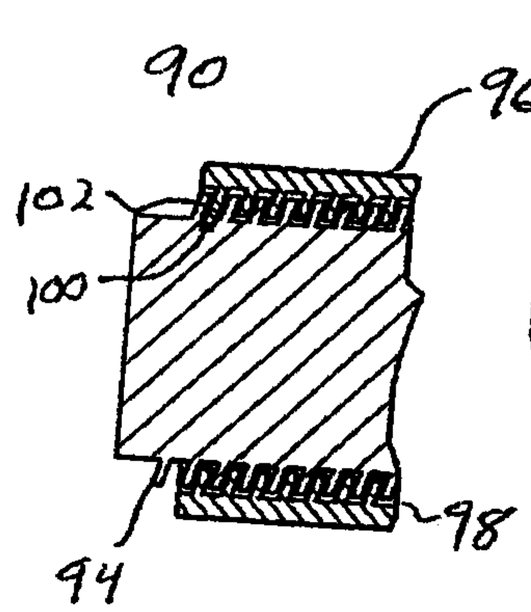


FIG. 16

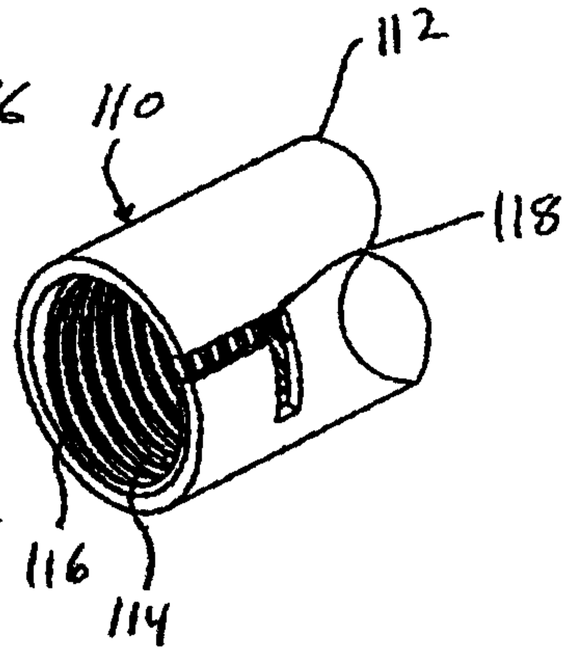
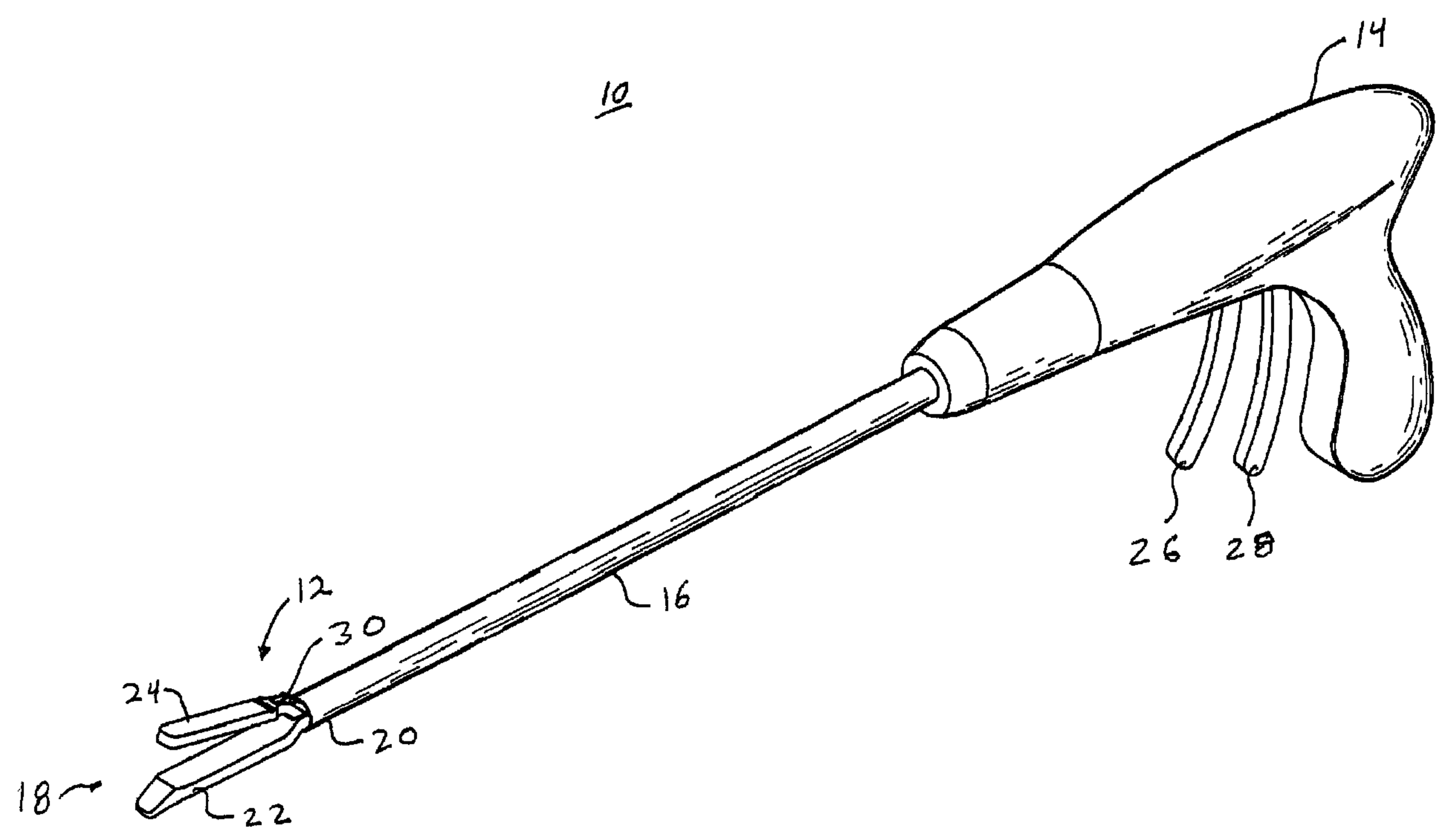


FIG. 17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