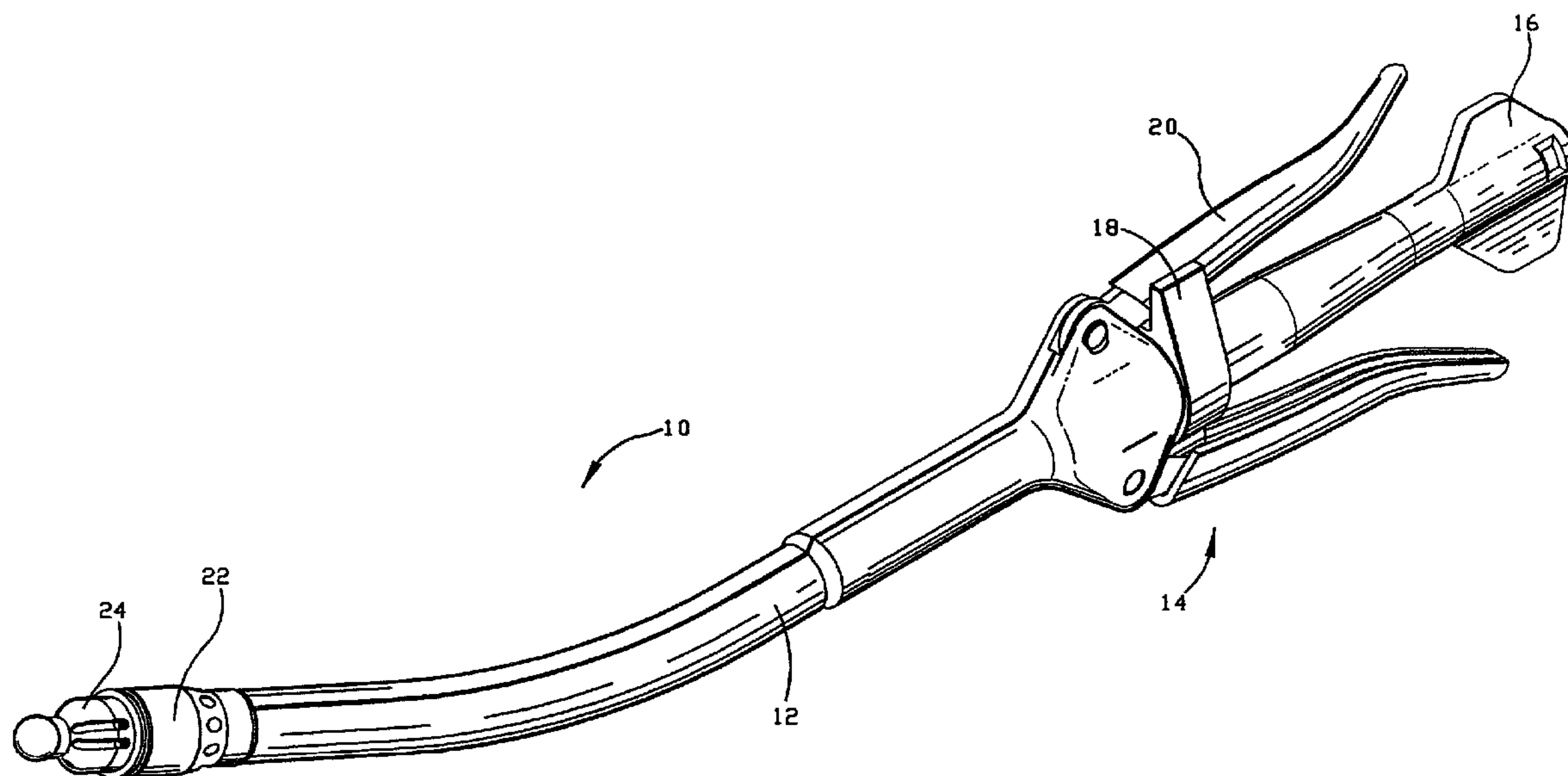




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(57) Abrégé/Abstract:

A surgical instrument is disclosed which includes a housing having proximal and distal end portions, a shaft extending from the housing distal end portion, the shaft having proximal and distal end portions, a fastener carrying cartridge positioned at the shaft distal end portion, the cartridge having a plurality of fasteners disposed therein, a fastener firing member operatively associated with the fastener carrying cartridge, at least one lever extending from the housing, the lever being adapted to move the fastener firing member to expel the fasteners from the cartridge, an anvil member disposed opposite the cartridge, an elongated member operatively associated with the anvil member for moving the anvil member relative to the cartridge, and locking means disposed within the housing for locking the elongated member, and, therefore the anvil member, the locking means being movable between at least a first position and a second position such that when the locking means is in the first position the elongated member is movable and when the locking means is in the second position the elongated member is prevented from moving.

ABSTRACT OF THE DISCLOSURE

A surgical instrument is disclosed which includes a housing having proximal and distal end portions, a shaft  
5 extending from the housing distal end portion, the shaft  
having proximal and distal end portions, a fastener carrying  
cartridge positioned at the shaft distal end portion, the  
cartridge having a plurality of fasteners disposed therein,  
a fastener firing member operatively associated with the  
10 fastener carrying cartridge, at least one lever extending  
from the housing, the lever being adapted to move the  
fastener firing member to expel the fasteners from the  
cartridge, an anvil member disposed opposite the cartridge,  
an elongated member operatively associated with the anvil  
15 member for moving the anvil member relative to the  
cartridge, and locking means disposed within the housing for  
locking the elongated member, and, therefore the anvil  
member, the locking means being movable between at least a  
first position and a second position such that when the  
20 locking means is in the first position the elongated member  
is movable and when the locking means is in the second  
position the elongated member is prevented from moving.

BACKGROUND OF THE INVENTION5           1. Field of the Invention

          This invention relates to a surgical fastener  
applying instrument. More particularly, this invention  
relates to an arrangement for a circular anastomosis  
10 surgical stapling instrument.

          2. Description of the Related Art

          Various types of surgical fastener applying  
15 instruments have been known for the application of surgical  
fasteners to tissue. For example, it has been known to use  
various types of surgical staplers in gastric and esophageal  
surgery in both classic or modified gastric reconstructions  
performed end-to-end, end-to-side or side-to-side. In many  
20 cases, instruments, such as described in U.S. Patent No.  
4,603,693, have been used where an anvil assembly mounted on  
the end of a center rod can be manipulated relative to a  
staple assembly on the end of a tubular housing of the  
instrument. In instruments of this nature, the center rod  
25 is connected with a mechanism, for example, which employs a  
wing nut at the proximal end of the instrument, so that the  
rod can be moved back and forth independently of the staple  
assembly so as to adjust the anvil assembly relative to the  
staple assembly. Likewise, a pusher tube is mounted within  
30 the instrument for movement via a handle mechanism so as to  
cause a firing of the staples from the staple assembly  
towards the anvil assembly.

In some instruments, such as described in U.S. Patent No. 4,351,466, these stapling instruments have been provided with a pair of handles in order to actuate the  
5 pusher tube to cause a firing of the staples. In such cases, each handle has been pivotally mounted so as to be moved toward the other handle during manual squeezing by a surgeon. Each handle also includes a lever arm within the instrument which engages against the pusher tube so as to  
10 move the tube in a proximal direction.

Stapling instruments of this type have also been provided with safety locks in order to prevent the squeezing together of the handles prematurely. That is, the safety  
15 locks have been provided in order to prevent the handles from moving towards each other before a surgeon has manipulated the anvil assembly into position for the firing of the staples. While these instruments have been used safely and effectively for years, it would be advantageous  
20 to provide the feature of preventing the anvil member from being able to be moved once a fastener firing safety lock has been released. Also a continuing need exists to develop these types of surgical stapling instruments which require fewer parts and materials to manufacture, thereby reducing  
25 costs of production and requiring less labor to assemble the parts. Additionally, if the instruments are disposable, i.e. single use only, use of less materials is desirable to decrease the amount of medical waste generated during a surgical procedure.

SUMMARY OF THE INVENTION

The present invention provides a surgical fastener applying instrument which includes a novel anvil lockout mechanism which works in cooperation with the safety release mechanism for the fastener firing member. The instrument of the present invention is lightweight and easy to manufacture. It requires fewer component parts than similar available instruments and, therefore, is less costly to produce.

The surgical instrument includes a housing having proximal and distal end portions, a shaft extending from the housing distal end portion, the shaft having proximal and distal end portions, a fastener carrying cartridge positioned at the shaft distal end portion, the cartridge having a plurality of fasteners disposed therein, a fastener firing member operatively associated with the fastener carrying cartridge, at least one lever extending from the housing, the lever being adapted to move the fastener firing member to expel the fasteners from the cartridge, an anvil member disposed opposite the cartridge, an elongated member operatively associated with the anvil member for moving the anvil member relative to the cartridge, and locking means disposed within the housing for locking the elongated member, and, therefore the anvil member, the locking means being movable between at least a first position and a second position such that when the locking means is in the first position the elongated member is movable and when the locking means is in the second position the elongated member is prevented from moving.

In a preferred embodiment the locking means is operatively associated with a safety mechanism for preventing movement of the at least one lever, the safety mechanism being movable between at least a first position  
5 and a second position.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are  
10 described hereinbelow with reference to the drawings wherein:

Fig. 1 is a perspective view of an instrument constructed according to the present invention for applying surgical fasteners to tissue;

15 Fig. 2 is an exploded perspective view of the instrument of an instrument in accordance with the present invention;

Fig. 3 is a top plan view of the fastener firing member of the present invention;

20 Fig. 4 is a side plan view of the fastener firing member;

Fig. 5 is an end view of the fastener firing member;

25 Fig. 6 is a top plan view of the elongated member for moving the anvil of the present invention relative to the stapling cartridge;

Fig. 7 is a side plan view of the elongated member of Fig. 6;

30 Fig. 8 is a cross-sectional view taken along section line 8-8 of Fig. 6;

Fig. 9 is a cross-sectional view taken along section line 9-9 of Fig. 7;

Fig. 10 is a plan view of the instrument showing the lever members in the unfired position;

Fig. 11 is a cross-sectional view taken along section line 11-11 of Fig. 10;

5 Fig. 11A is an enlarged view of the area indicated in Fig. 11;

Fig. 12 is a plan view of the instrument showing the lever members in the fired position;

10 Fig. 13 is a cross-sectional view taken along section line 13-13 of Fig. 12; and

Fig. 13A is an enlarged view of the area indicated on Fig. 13.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Referring now in specific detail to the drawings, in which like reference numerals identify similar or identical elements throughout the several views, and initially to Fig. 1, which shows one embodiment of the surgical instrument for applying a circular array of fasteners of the present invention illustrated in perspective view as instrument 10. Instrument 10 includes elongate body portion 12 and handle section 14. Handle section 14 includes anvil adjustment member 16, lever lockout or safety member 18 and fastener firing levers 20. Fastener head portion 22 and anvil member 24 are disposed at the distal end of body portion 12. Except where noted otherwise, the materials utilized in the components of the surgical instrument of the present invention generally include such materials as polycarbonate for housing sections and related components, and stainless steel for such components which transmit forces. One preferred

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polycarbonate material is LEXAN® brand polycarbonate available from General Electric Company. However, equivalent alternative materials will readily come to the mind of those skilled in the art.

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Referring now to Fig. 2, the various components of instrument 10 are shown in exploded view. Instrument 10 includes body or housing half sections 12a and 12b which are preferably molded and joined together by suitable fastening means such as rivets 28, or the like. To control axial movement of anvil member 24, elongated member 30 is slidably mounted within body portion 12, preferably by being securely mounted to helical cam member 32 by any suitable means such as, for example, welding or the like. Helical cam member 32 is slidably mounted within anvil adjustment member 16 by way of bushing 34 which is securely mounted in open end 36 of anvil adjustment member 16. Friction member 93 is disposed adjacent anvil adjustment member 16 to prevent relatively free rotation of the anvil adjustment member. In a preferred embodiment, both the mounting of bushing 34 and the camming of helical cam 32 is accomplished by compound pin 38 which has central portion 38a and extending portions 38b and 38c which are of reduced diameter. Portions 38a and 38b are press fitted into bores 40 and 42, respectively, located on bushing 34 and anvil adjustment member 16, respectively. Lower extending portion 38c serves as a camming pin and fits within the helical groove formed on the surface of helical cam 32. Anvil approximation indicator member 46 has extended portion 48 and is press fitted into proximal portion 50 of helical cam 32. Cap 51 is attached to proximal end 52 of anvil approximation indicator member 46. Cap 51 is preferably a colored piece which is easily



visible through opening 54 formed near the proximal end of anvil adjustment number 16 to provide indication to the user when the anvil member is in the proper position for firing of the instrument. The distal end of elongated member 30 is provided with means to retain anvil member 24, which will be described in more detail below.

The fastener firing mechanism of instrument 10 includes fastener firing member 56 which is slidably mounted within body portion 12 preferably such that fastener firing member 56 is disposed around elongated member 30. Fastener firing member 56 is preferably biased in a proximal direction by suitable biasing means such as spring 58. Fastener firing levers 20 are pivotably mounted to body portion 12 and have extended portions 60 which cross over each other in scissor-like fashion. Bearing block 62 is mounted on fastener firing member 56, for example, being held between flexible finger portions 64 and raised portions 66 which are formed in the side walls of fastener firing member 56, as best illustrated in Figs. 3 and 4. Fastener firing member 56 has bearing surfaces such as tabs 68 formed at the distal portion which serve to urge a pusher member within fastener head portion 22 in a distal direction in order to eject surgical fasteners 69, such as stainless steel or titanium staples, from fastener head portion 22.

Also disposed on instrument 10 are lever lockout member 18 and elongate member lockout member 70. Lever lockout member 18 is preferably spring biased to the locked out position by spring 67 in slot 91. Each of these lockout members are preferably mounted on instrument 10 in such a manner that they are fixed relative to each other and upon

pivoting of lever lockout member 18, elongate member lockout member 70 also pivots. With reference to Figs. 11A and 13A, elongate member lockout member 70 has shoulder portions 73 and 75 formed therein as well as inwardly extending tab 79.

5 The function of each of these portions of elongate member lockout member 70 will be described in further detail later herein.

Referring now to Figs. 3-9, the structural and

10 functional details of fastener firing member 56 and elongated member 30 will now be described in detail. In Figs. 3-5, fastener firing member 56 is shown as preferably being a generally U-shaped member formed from material which can transmit forces effectively and reliably such as

15 stainless steel. Fastener firing member 56 has side walls 72 and 74 which are connected by web 76. To fit fastener firing member 56 within the curved section of body portion 12, fastener firing member 56 has extended portions or flexible bands 72a and 74a which are preferably formed

20 integrally with walls 72 and 74, respectively. Band 72a is shorter than band 74a. The difference in the length of the two bands corresponds to the amount of curvature of body portion 12 so that when fastener firing member 56 is mounted in body portion 12, the surfaces of tabs 68 form a plane

25 parallel with the surface of the fastener pusher member (not shown).

Referring to Figs. 6-9, elongated member 30 is shown as a U-shaped member, similar to fastener firing member 56.

30 Elongated member 30 has side walls 78 and 80 which are joined by web 82. However, the cross-section dimensions of elongated member 30 are preferably such that elongated member 30 readily

fits within fastener firing member 56. This arrangement is desirable so that elongated member 30 and fastener firing member 56 can slide independent of each other. As with fastener firing member 56, elongated member 30 must also be formed to fit within the curved contour of body portion 12. To accomplish this curvature, elongated member 30 has extended portions or flexible bands 78a and 80a which are preferably formed integrally with walls 78 and 80, respectively. Similar to the construction of fastener firing member 56, bands 78a and 80a of elongated member 30 are of different length. Elongated member 30 terminates at a distal end in a pair of opposed anvil retaining portions 84 and 86. Preferably, structure can be provided within body portion 12 (not shown) that serves to retain the side walls and bands of both elongated member 30 and fastener firing member 56. Such structure can be of unitary construction and have grooves to direct longitudinal movement of the channels and bands. Additionally, one or more seals (not shown) can be disposed within body portion 12 to prevent the flow of gases therethrough.

To facilitate retaining anvil member 24, and in particular, the anvil shaft therein, anvil retaining portions 84 and 86 are preferably semi-circular in shape as best illustrated in the cross-section view of Fig. 8. To assist in retention of anvil 24, anvil retaining portions 84 and 86 are provided with flexible finger portions 88 and 90, respectively, each of which have a raised portion formed thereon, such as camming and retaining portions 92 and 94, respectively. Camming surfaces 96 and 98 formed by camming and retaining portions 92 and 94, respectively serve to cam flexible finger portions 88 and 90 radially outward upon

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insertion of the anvil into the distal end of instrument 10. Referring temporarily back to Fig. 2, once annular groove portion 100 of anvil shaft 102 passes between retaining portions 84 and 86, flexible finger portions 88 and 90  
5 return toward their initial or at rest state so that retaining portions 92 and 94 seat in annular groove 100.

In a preferred embodiment, extended portions 78a and 80a of elongated member 30 are preferably bent until the  
10 ends of anvil retaining portions 84 and 86 are aligned and are then permanently joined together (as shown in Fig. 2), by suitable bonding techniques, such as, by welding.

At the proximal end of elongated member 30, cut  
15 out portion 81 is formed to receive lever lockout member 18 when elongated member is properly positioned for firing the staples of instrument 10. As best illustrated in Figs. 6 and 7, cutout portion 81 is preferably formed through most of web 82 and continues partially up side wall 80.

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The basic steps of operation are set forth in several patents, such as U.S. Patents 4,576,167 issued to Noiles, 5,005,749 issued to Aranyi, and 5,119,983 to Green  
et al.

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With reference to the instrument of the present invention, the user positions the tissue to be joined between anvil 24 and fastener head portion 22. Anvil  
30 adjustment member 16 is rotated to move elongated member 30 and anvil 24 proximally until the user sees approximation indicator 46 appear in opening 54 of anvil adjustment member

16. During this step, elongate member 30 acts as a tension member as it pulls anvil 24 into position adjacent fastener head portion 22. Prior to alignment of cut out 83 in elongate member 30 and extended portion 79 of elongate member lockout 70, lockout 70 is prevented from pivoting by contact between extended portion 79 and elongate member 30. When cut out 83 is positioned adjacent extended portion 79 of elongate member lockout 70, as further describe below, lever lockout member 18 and elongate member lockout 70 are able to be pivoted by depressing, usually with the thumb, on lever lockout member 18. Once lever lockout member is pivoted by the user, fastener firing levers 20 are depressed to urge fastener firing member 56 in a distal direction. This motion is accomplished by the camming effect of extended portions 60 of fastener firing levers 20 on bearing block 62 the distal movement of fastener firing member 56 urges fastener pusher members to eject fasteners 69 from fastener head portion 22. During this step, fastener firing member 56 acts as a compression member as it ejects fasteners 69.

With the above operational description of instrument 10 as a general base of the overall operation, the operation of elongate member lockout 70 will now be described in detail with reference to Figs. 10-13. Once the user has instrument 10 inserted and the tissue to be joined is properly situated about the distal end of the instrument, anvil 24 is approximated to its proper position by rotation of anvil adjustment member 16, instrument 10 is positioned for firing, as shown in Fig. 10. In that position, however, fastener firing member is still blocked from movement due to lever lockout member 18 still being oriented in the "safety on"

position, i.e., lever locking extended portions 104 and 106 (Fig. 2) are aligned with the structure of levers 20 so that they cannot be depressed. Pivoting of lever lockout member 18 is prevented when elongated member 30 is out of the desired approximation range for firing the staples.

With reference to Figs. 2-7, 11 and 13, prevention of the ability to pivot lever lockout member member 18 is accomplished by the relative position of elongated member 30 and thus the approximation of anvil 24. When anvil 24 is not properly approximated, side wall 80 and web 82 of elongated member 30 prevent extended portion 79 of elongate member lockout 70 from moving further inward (Fig. 11). However, once elongated member 30 is properly positioned, i.e., cut out 83 is aligned with extended portion 79 of elongate member lockout 70, then lever lockout member 18 which is fixedly secured to elongate member lockout member 70, can be pivoted, as shown in Fig. 13. When lockout 70 is pivoted, shoulder portions 73 and 75 of lockout 70 are moved out of notches 77 of fastener firing member 56 (Figs. 3 and 4). This enables fastener firing levers 20 to be pivoted toward each other as shown in Fig. 12, thereby moving fastener firing member 56 distally and ejecting fasteners 69 from fastener head portion 22. As can be seen in Figs. 13 and 13A once lever lockout 18, and elongate member lockout 70 are pivoted by the user, inwardly extending portion 79 of lockout 70 enters into cut out 83 (Figs. 6 and 7) and blocks elongated member 30 from movement in either a proximal or distal direction.

While the invention has been particularly shown, and described with reference to the preferred embodiments, it will be understood by those skilled in the art that various

modifications and changes in form and detail may be made therein without departing from the scope and spirit of the invention. Accordingly, modifications such as those suggested above, but not limited thereto, are to be considered within  
5 the scope of the invention.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A surgical instrument for applying at least one circular array of fasteners, comprising:

a housing having proximal and distal end portions;

a shaft extending from said housing distal end portion, said shaft having proximal and distal end portions;

a fastener carrying cartridge positioned at said shaft distal end portion, said cartridge having a plurality of fasteners disposed therein;

a fastener firing member operatively associated with said fastener carrying cartridge;

at least one lever extending from said housing, said lever being adapted to move said fastener firing member to expel said fasteners from said cartridge;

an anvil, including an anvil shaft, disposed opposite said cartridge;

an elongated member operatively associated with said anvil for moving said anvil relative to said cartridge; and

a lockout member disposed within said housing adjacent the fastener firing member, the lockout member being movable between a first position blocking movement of said fastener firing member and a second position permitting movement of said fastener firing member.

2. A surgical instrument as recited in claim 1, further comprising a safety mechanism supported on said housing for preventing movement of said at least one lever, said safety mechanism being movable between at least a first position and a second position.

3. A surgical instrument as recited in claim 2, wherein said safety mechanism is fixed relative to said lockout member.



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4. A surgical instrument as recited in claim 1, wherein said lockout member includes at least one shoulder portion and said fastener firing member includes at least one notch, said at least one shoulder portion being positioned within said at least one notch when said lockout member is in said first position.

5. A surgical instrument as recited in claim 4, wherein said at least one shoulder portion includes two shoulder portions and said at least one notch includes two notches.

6. A surgical instrument as recited in claim 5, wherein said locking means is in said second position, said shoulder portions are moved out of said notches.

7. A surgical instrument as recited in any one of claims 1 to 6, wherein said shaft is tubular.

8. A surgical instrument as recited in any one of claims 1 to 6, wherein said shaft is curved.

9. A surgical instrument as recited in any one of claims 1 to 8, wherein said fasteners are surgical staples.

10. A surgical instrument as recited in any one of claims 1 to 9, wherein said lockout member is biased to remain initially in said first position.

11. A surgical instrument as recited in any one of claims 1 to 10, wherein said elongated member includes a pair of extended portions at a distal end thereof, said pair of extended portions adapted for retaining a shaft of said anvil assembly.

12. A surgical instrument as recited in claim 11, wherein said pair of extended portions are arcuately shaped.

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13. A surgical instrument as recited in claim 11, wherein said pair of extending portions include releasable retaining means disposed thereon for releasably retaining said anvil assembly.

14. A surgical instrument as recited in claim 13, wherein said releasable retaining means includes at least one resilient prong adapted to retain said anvil assembly.

15. A surgical instrument as recited in any one of claims 1 to 10, wherein a portion of said elongated member is U-shaped, having at least two side wall portions connected by a web portion.

16. A surgical instrument as recited in claim 15, wherein said at least two side wall portions are parallel.

17. A surgical instrument as recited in claim 15, wherein said elongated member includes at least two finger portions extending from a distal end thereof, said finger portions adapted to retain said anvil assembly.

18. A surgical instrument as recited in claim 17, wherein said at least two finger portions are flexible.

19. A surgical instrument as recited in claim 18, wherein said at least two finger portions are of a predetermined unequal length such that upon curving said at least two finger portions a predetermined amount of curvature end portions of said at least two finger portions become aligned with each other.

20. A surgical instrument for applying at least one circular array of fasteners, comprising:  
a body portion;  
a fastener head portion connected to said body portion and

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including a plurality of fasteners;

an elongate member longitudinally disposed within said body portion;

at least one movable lever member operatively associated with said body portion to fire said fasteners;

an anvil assembly, including an anvil head portion and an anvil shaft portion operatively associated with said elongate member, said anvil head portion adapted to form said plurality of fasteners;

a fastener firing member operatively associated with said fastener head portion and being movable to expel said fasteners from said fastener head portion; and

a lockout member positioned adjacent said fastener firing member and being movable between at least a first position and a second position wherein when said lockout member is disposed in said first position, said fastener firing member is permitted to move longitudinally within said body portion and when said lockout member is disposed in said second position, said fastener firing member is blocked from movement by said lockout member.

21. A surgical instrument as recited in claim 20, wherein said lockout member is pivotably disposed within said body portion.

22. A surgical instrument as recited in claim 20 or 21, wherein said lockout member is biased to remain initially in said first position.

23. A surgical instrument as recited in any one of claims 20 to 22, wherein said elongated member includes a pair of extended portions at a distal end thereof, said pair of extended portions adapted for retaining a shaft of said anvil assembly.

24. A surgical instrument as recited in claim 23, wherein said pair of extended portions are arcuately shaped.

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25. A surgical instrument as recited in claim 23, wherein said pair of extending portions include releasable retaining means disposed thereon for releasably retaining said anvil assembly.

26. A surgical instrument as recited in claim 25, wherein said releasable retaining means include at least one resilient prong adapted to retain said anvil assembly.

27. A surgical instrument as recited in any one of claims 20 to 22, wherein said elongated member is at least partially U-shaped having at least two side wall portions connected by a web portion.

28. A surgical instrument as recited in claim 27, wherein said at least two side wall portions are parallel.

29. A surgical instrument as recited in claim 27, wherein said elongated member includes at least two finger portions extending from a distal end thereof, said finger portions adapted to retain said anvil assembly.

30. A surgical instrument as recited in claim 29, wherein said at least two finger portions are arcuately shaped.

31. A surgical instrument as recited in any one of claims 20 to 30, wherein said fastener firing member is operatively associated with said fastener head portion and said at least one lever member.

32. A surgical instrument as recited in claim 31, wherein said fastener firing member is at least partially U-shaped having at least two side wall portions connected by a web portion.

33. A surgical instrument as recited in claim 32, wherein

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said at least two side wall portions are parallel.

34. A surgical instrument as recited in claim 31, wherein said fastener firing member is held in a fixed position when said locking member is in said first position.

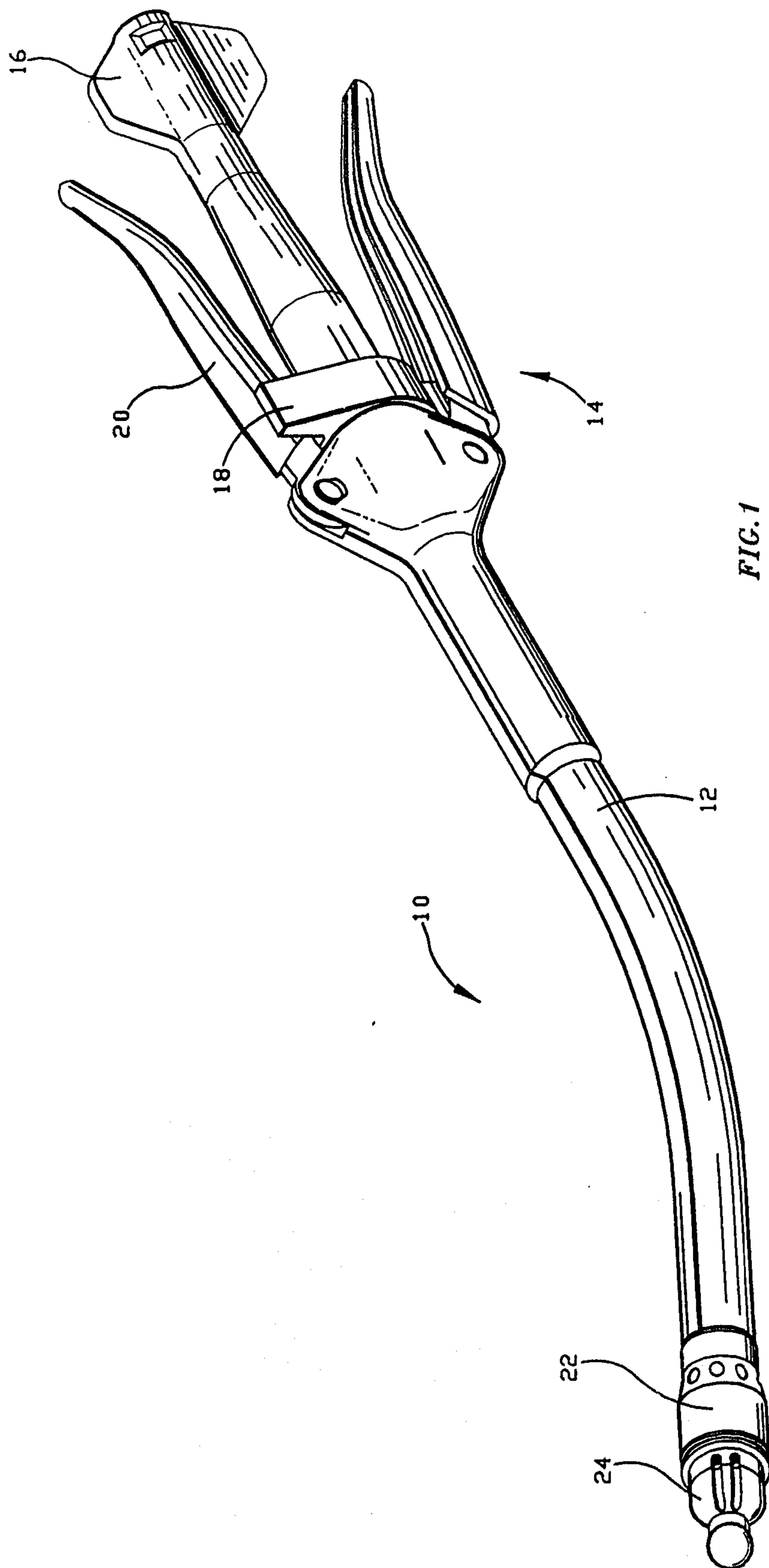


FIG. 1

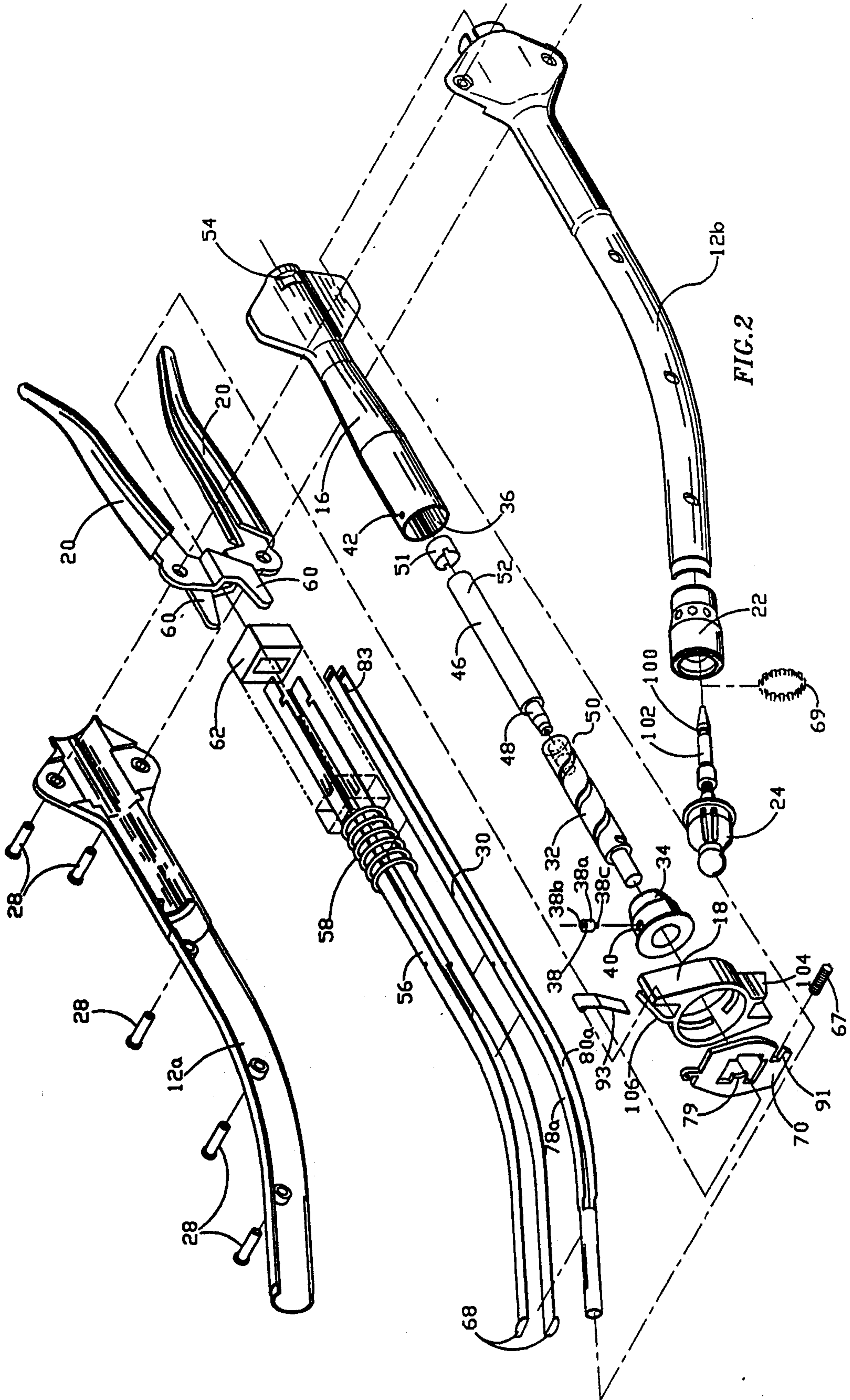


FIG. 2

