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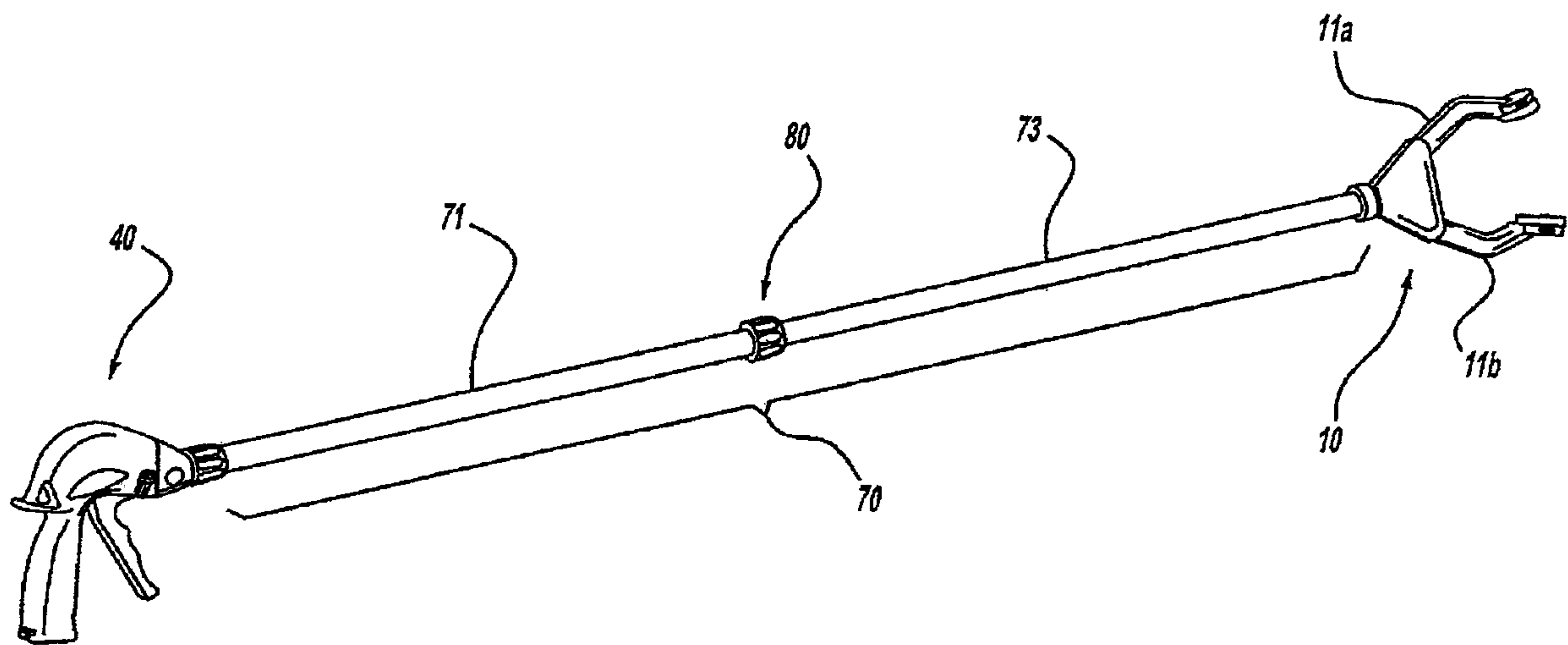
(71) Demandeurs/Applicants:
MCCOY, CODY, US;
BRUNI, GREGORY J., US

(72) Inventeurs/Inventors:
MCCOY, CODY, US;
BRUNI, GREGORY J., US

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : PINCE LONGUE EXTENSIBLE

(54) Title: EXTENDIBLE REACHER



(57) Abrégé/Abstract:

A hand-held reacher, comprising a jaw portion having a pair of jaws movable relative to each other between fully clamped and fully opened positions thereof, and a handle portion spaced apart from the jaw portion by a selectively extendible central portion. The handle portion comprises a manually-actuatable trigger operatively connected to the jaw portion by a selectively extendible pull member at least substantially disposed within the central portion, whereby actuation of the trigger is operative to move the pull member to thereby selectively position the pair of jaws between the fully clamped and fully opened position thereof. The selectively extendible central portion comprises a first tubular member slidably telescopically received within a second tubular member, a first coupling for selectively fixing the relative positions of the first and second tubular members, and a second coupling for selectively fixing the length of the pull member, the second coupling being characterized by a first, engaged condition in which the length of the pull member is fixed, and a second, disengaged condition in which the length of the pull member may be varied.



ABSTRACT

A hand-held reacher, comprising a jaw portion having a pair of jaws movable relative to each other between fully clamped and fully opened positions thereof, and a handle portion spaced apart from the jaw portion by a selectively extendible central portion. The handle portion comprises a manually-actuatable trigger operatively connected to the jaw portion by a selectively extendible pull member at least substantially disposed within the central portion, whereby actuation of the trigger is operative to move the pull member to thereby selectively position the pair of jaws between the fully clamped and fully opened position thereof. The selectively extendible central portion comprises a first tubular member slidably telescopically received within a second tubular member, a first coupling for selectively fixing the relative positions of the first and second tubular members, and a second coupling for selectively fixing the length of the pull member, the second coupling being characterized by a first, engaged condition in which the length of the pull member is fixed, and a second, disengaged condition in which the length of the pull member may be varied.

EXTENDIBLE REACHER

CROSS-REFERENCE TO RELATED APPLICATIONS

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This application is related to, and claims the benefit of priority from, United States Provisional Patent Application Serial No. 61/108295, filed 24 October 2008, the disclosure of which application is incorporated herein by reference in its entirety.

10

FIELD OF THE INVENTION

The present invention pertains generally to hand-held devices used for gripping or picking up objects, commonly referred to as "reachers," and more particularly to a reacher having the handle and jaw portions spaced apart from each other by an extendible central portion.

15

BACKGROUND OF THE INVENTION

In their most elemental form, comprising a jaw portion and a handle portion spaced apart by a central portion, hand-held reachers for picking up and gripping objects have been known for years. In the past, reachers have been largely
20 characterized by fixed-length central portions. More recently, however, there have been disclosed reachers with adjustable-length central portions whereby a reacher's overall length is extendible. The disclosures of Hsu, US Patents No. 6,513,844, No. 6,520,556, and No. 6,739,637, all of which are incorporated herein by reference in their entirety, are exemplary in these regards. While providing for adjustments in the overall length of
25 the reacher, these known extendible reachers could be improved upon.

SUMMARY OF THE DISCLOSURE

The specification describes a hand-held reacher, comprising a jaw portion having a pair of jaws movable relative to each other between fully clamped and fully opened positions thereof, and a handle portion spaced apart from the jaw portion by a selectively extendible central portion. The handle portion comprises a manually-actuable trigger operatively connected to the jaw portion by a selectively extendible pull member at least substantially disposed within the central portion. Actuation of the trigger is operative to move the pull member to thereby selectively position the pair of jaws between the fully clamped and fully opened position thereof. The selectively extendible central portion comprises a first tubular member slidably telescopically received within a second tubular member. A first coupling selectively fixes the relative positions of the first and second tubular members, and a second coupling selectively fixes the length of the pull member. The second coupling is characterized by a first, engaged condition in which the length of the pull member is fixed, and a second, disengaged condition in which the length of the pull member may be varied.

A user-actuable trigger is, in one embodiment, positioned remotely from the second coupling and operatively connected to the second coupling permits selective variation of the second coupling between the first and second conditions thereof.

According to this embodiment, the pull member may comprise a first pull tube slidably telescopically received within a second pull tube, and the second coupling comprises a selectively radially expandable mandrel disposed within the second pull tube, the mandrel being characterized by a first, engaged condition in which the mandrel is radially expanded into engagement with the interior surface of the second pull tube to thereby fix the length of the pull member, and a second, disengaged

condition in which the mandrel is radially contracted out of engagement with the interior surface of the second pull tube to thereby permit the length of the pull member to be varied. Per one feature, the user-actuatable trigger may comprises a manually operable release trigger positioned on the second tubular member proximate the handle, the
5 release trigger being operatively connected to the expanding mandrel via a connecting rod. According to another feature of the first embodiment, the radially expandable mandrel comprises a mandrel body having a tapered interior passageway, a plurality of radially-moveable elements disposed about the exterior circumference of the mandrel body, and a tapered wedge dimensioned for movement within the tapered interior
10 passageway of the mandrel body. Per another aspect of this embodiment, the connecting rod of the user-actuatable trigger is connected to the tapered wedge, and actuation of the user-actuatable trigger is operative to move the tapered wedge within the interior passageway of the mandrel body.

Per a another form of this first embodiment of the present inventive reacher, the
15 pull member comprises first and second pull rods, and the second coupling comprises a cam body supporting a cam. The first pull rod is fixedly connected to the cam support body, and the second pull rod is slidingly associated with the cam support body. The cam is characterized by a first, engaged condition in which the cam is in contact with the second pull rod to thereby fix the length of the pull member, and a second, disengaged
20 condition in which the cam is out of contact with the second pull rod to thereby permit the length of the pull member to be varied. According to one aspect, the user-actuatable trigger comprises a manually operable release trigger provided on the handle portion, the release trigger being operatively connected to the cam via a connecting rod. Per another feature, the cam body includes a first passageway through which is slidingly

received the second pull rod. The cam is pivotally mounted on the cam body, and the passageway includes an opening through which the cam can be brought into engagement with the second pull rod in the first, engaged position of the first coupling. Per still another feature, the cam is biased toward engagement with the second pull rod
5 via the opening in the cam body, and actuation of the user-actuatable trigger is operative to move the cam out of the passageway opening in the cam body and out of engagement with the second pull rod.

According to another embodiment of the invention, selective positioning of the second coupling between the first and second conditions thereof is effected by
10 rotational movement of one of the first or second tubular members of the central portion. Per this embodiment, the pull member may comprise a pull rod and a toothed gear rack, and the second coupling comprises a toothed lock member. The pull rod is fixedly connected to the toothed lock member. In the first, engaged condition of the second coupling the toothed lock member is in contact with the toothed gear rack to
15 thereby fix the length of the pull member, and in the second, disengaged condition of the second coupling the toothed lock member is out of contact with the toothed gear rack to thereby permit the length of the pull member to be varied. According to one feature of this embodiment, the pull rod is operatively connected to the manually-actuatable trigger, and the gear rack is operatively connected to the jaw portion. Per still
20 another feature of this embodiment of the invention, the gear rack is slidably received in, and rotatably fixed relative to, a housing disposed within, and rotatably fixed relative to, one of the first or second tubular members of the central portion. Rotational movement of one of the first or second tubular members of the central portion in a first direction is operative to rotate the housing and carry toothed gear rack out of

engagement with the toothed locking member to thereby define the second condition of the second coupling, and rotational movement of the said one of the first or second tubular members of the central portion in a second direction is operative to rotate the housing and carry toothed gear rack into from a position of disengagement with the toothed locking member back into engagement with the toothed locking member to thereby define the first condition of the second coupling. Per yet another aspect of this embodiment, the locking member is positioned within the housing.

According to one feature of the invention, the first coupling for selectively fixing the relative positions of the first and second tubular members comprises a collet disposed proximate an end of the first tubular member, and a collet nut threadingly engageable thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered with the accompanying drawings, wherein:

FIG. 1 comprises a lateral perspective view of an extendible reacher according to the present invention;

FIG. 2 is an exploded view of the jaw portion of the inventive reacher;

FIG. 3 is a lateral cut-away view of the jaw portion;

FIG. 4 comprises an exploded view of the handle portion of the inventive reacher according to a first form of a first embodiment thereof;

FIG. 5 is a lateral cut-away view of the handle portion according to the form of **FIG. 4**;

FIG. 6 is an exploded view of the central portion of the inventive reacher according to the a first form thereof;

FIG. 7 comprises a lateral cut-away view of the central portion according to the form of **FIG. 6**;

5 **FIG. 7a** depicts, in a detailed, partially exploded view, an alternative embodiment of means to selectively fix the relative positions of the first and second tubular members;

FIG. 8 comprises a lateral, cut-away view of an extendible reacher according to a second form of the first embodiment of the present invention;

10 **FIG. 9** is a lateral cut-away view of the handle portion according to the second form;

FIG. 10 comprises a perspective view of the second coupling and user-actuatable trigger according to the second form of the present invention;

15 **FIG. 11** comprises a detailed, cut-away perspective view of the second coupling of the second form of the present invention;

FIG. 12 comprises a detailed perspective view of the second coupling of **FIG. 11**;

FIG. 13 is a perspective view showing a portion of the second coupling of **FIGS. 11 and 12**;

20 **FIG. 14** comprises a lateral, cut-away view of an extendible reacher according to a second embodiment of the present invention;

FIG. 15 is a perspective view of the locking member of the exemplary form of the second embodiment of the invention;

FIG. 16 is a perspective view of the gear rack which comprises the pull member of the second embodiment of the present invention;

FIG. 17 is an exploded perspective view of the locking sleeve of the embodiment of **FIG. 14**;

FIG. 18 is a cross-sectional view of the second tubular member;

FIG. 19 is a cross-sectional view of the tubular member of the locking sleeve;

5 **FIG. 20a** is a perspective view showing the second coupling member of the second embodiment of the invention in the engaged condition thereof;

FIG. 20b is a perspective view showing the second coupling member of the second embodiment of the invention in the disengaged condition thereof; and

FIGS. 21a and **21b** depict in cross-section an alternative embodiment of a
10 handle portion in two operational states (jaws fully open and jaws fully closed).

WRITTEN DESCRIPTION

As required, detailed embodiments of the present invention are disclosed herein. However, it is to be understood that the disclosed embodiments are merely exemplary
15 of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale, some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

20 Referring to the drawings, wherein like numerals indicate like or corresponding parts throughout the several views, the present invention will be seen to generally comprise a hand-held reacher having a jaw portion (indicated generally at 10) comprising a pair of jaws 11a, 11b and a handle portion (indicated generally at 40) spaced apart by a selectively extendible central portion (indicated generally at 70). **FIG.**

1. In order to permit actuation of the jaw portion **10** in the plurality of possible lengths of the extendible central portion **70**, the handle portion **40** comprises a manually-actuable trigger **41** operatively connected to the jaws of the jaw portion by a telescopingly adjustable pull member (not shown in **FIG. 1**). Actuation of the trigger **41**
5 is operative to move the pull member to thereby selectively position the pair of jaws **11a**, **11b** between fully clamped and fully opened positions thereof.

Referring also to **FIGS. 2** and **3**, both of which detail the construction of an exemplary jaw portion, the same may be seen to be generally of conventional construction and include, according to the illustrated embodiment, a housing that may
10 be made in two mateable halves **12a**, **12b** secured together by fasteners, adhesive, etc. Housing halves **12a**, **12b** are, except as otherwise noted, essentially mirror-images of one another, and each is generally comprised of a jaw-housing portion **13a**, **13b** and a neck portion **14a**, **14b**. Using the housing half **12a** as exemplary of both halves, the neck portion **14a** defines an interior channel **15a** terminating at opposite ends in stop
15 surfaces **16a** and **17a**. Stop surfaces each have a channel **18a** and **19a** defined therethrough, these channels being coaxial. In the assembled housing, formed by mating the housing halves **12a**, **12b**, channels **15a**, **15b** in each of the housing halves collectively define a generally cylindrically-shaped internal passageway communicating with smaller-diameter openings through opposite end walls defined by the channels
20 **18a**, **18b** and **19a**, **19b** defined through the stop surfaces.

Furthermore, in the assembled housing the neck portions **14a**, **14b** of each housing half **12a**, **12b** collectively define a generally cylindrically-shaped stem dimensioned to be received within and interconnected to the central portion **70** as hereafter described.

Still referring to jaw-housing half **12a** as exemplary of both housing halves, openings **20a**, **20b** at the corners of the jaw housing portions **13a**, **13b** provide clearance for the jaws **11a**, **11b** to protrude therefrom. Referring particularly to **FIG. 3**, which details the housing half **12b**, pivot posts **21** are mounted near each of the corners
5 **20b** of only the mateable half **12b**, and the jaws **11a**, **11b** are each provided with bores **22a**, **22b** therethrough dimensioned for the jaws to be mounted one upon each post **21**.

Portions of jaws **11a**, **11b** extend away from the jaw housing, terminating in end effectors **23a**, **23b** having gripping portions **24a**, **24b**.

Portions of jaws **11a**, **11b** also extend into the jaw housing defined by housing
10 halves **12a**, **12b**, these interior portions being, as shown, reduced in thickness relative to the remainder of the jaws and interleaved to achieve an overlapping configuration. Each such interior portion is provided with a slot **25a**, **25b**, which slots also overlap to define a communicating opening. In order to effect simultaneous movement of the jaws **11a**, **11b**, a carriage assembly is disposed within the slots **25a**, **25b** and between the
15 interior portions of the jaws.

As shown best in **FIG. 2**, the carriage assembly comprises a pull rod end boss **26**, rack **27**, and a lug comprised of portions **28a**, **28b**. End boss **26** is disposed on an end of a carriage assembly pull rod **29**. Rack **27** contains a central recessed portion to accommodate the rod **29** and lug portion **28a**, **28b**. A rectangular aperture is provided
20 through the center of this recessed portion to accommodate end boss **26**. Each lug portion **28a**, **28b** is also provided with a substantially rectangular aperture to accommodate end boss **26**. The apertures in rack **27** and lug portions **28a**, **28b**, as well as the recessed portion in rack **27** to accommodate rod **29**, should be sized to allow the free rotation of end boss **26** and rod **29** when fully assembled. Assembled, lug portions

28a, 28b cooperate with one of the slots **25a, 25b** in jaws **11a, 11b**, respectively, to complete the mechanical connection between jaws **11a, 11b** and rod **29**.

Still referring to **FIG. 2**, a second boss **30** is attached to rod **29** at a sufficient distance away from end boss **26** to dispose second boss **30** within the generally cylindrical chamber defined in the assembled housing by the channels **15a, 15b** of the neck portions of the housing halves **12a, 12b**. A helical spring **31** is disposed within this chamber coaxial with rod **29** and abutting second boss **30** on one end and the end wall defined by the stop surfaces **17a, 17b** of the housing halves **12a, 12b** at its other end.

It will be understood that the foregoing jaw portion construction is intended as exemplary only, and that those of skill in the art are free to adapt the jaw portion construction as desired, consistent only with facilitating operation of the extendible nature of the reacher as hereinafter described.

Referring now to **FIGS. 1, 4 and 5**, the exemplary handle portion **40** is shown to comprise mateable housing halves **42a, 42b** which movably support the manually-actuable trigger **41**. The mateable housing halves **42a, 42b** are, except as otherwise noted, essentially mirror-images of one another, and may be secured together with fasteners, adhesive, or other known means to define an unitary housing for the trigger **41**.

Trigger **41** is pivotally mounted to trigger pivot shaft **43** provided on one of the housing halves (**42a** as shown). Trigger **41** includes an opening **44** therethrough to accommodate a trigger-connecting pull rod **45**, a locking tab **46** secured in place by pin **47**, and a lock lever **48** which requires free movement within the opening **44**. Trigger-connecting pull rod **45** includes an eyelet **49** by which the rod is connected to the trigger with a pin **50** as shown.

In order to selectively fix the pivotal position of the trigger **41**, and thereby fix the relative positions of the jaws **11a**, **11b** between the fully open and fully closed positions thereof, the reacher may, as desired, be provided with a locking mechanism. The mechanism as shown in the exemplary embodiment includes lock lever **48** mounted on
5 lock arm pivot pin **51**. The proximal end of lock lever **48** is attached by way of spring **52** to a post **53** provided on one of the housing halves (**42a** as shown).

The lock lever **48** features a first end having a variable geometry interface comprising first **54** and second **55** cam surfaces. Opposite the cam surfaces **54**, **55**, lock lever **48** is provided with a plurality of locking teeth **56** which are selectively
10 engageable with the locking tab **46** disposed on trigger **41** within the opening **44**. Interfacing with cam surfaces **54**, **55** is a cam roller assembly comprising a cam roller support **57** mounting a cam roller **58**. Cam roller support **57** is pivotally captured between housing halves **42a**, **42b**. Manually-actuatable toggle levers **59** disposed on the exterior of each of the handle mateable halves **42a**, **42b** are connected to the cam
15 roller support **57** through the walls of the housing halves **42a**, **42b**, such as by means of screws **60**, as shown. By this interconnection, selective pivotal movement of either toggle lever **59** effects corresponding pivotal movement of cam roller support **57** to bring cam roller into engagement with one or the other of cam surfaces **54**, **55**. More particularly, when cam roller **58** is brought into engagement with the first cam surface
20 **54**, the lock lever **48** is urged by the biasing action of spring **52** into a position where the locking teeth **56** are successively engageable by the locking tab **46** as the trigger **41** is moved rearwardly away from the jaw portion. Conversely, when the cam roller **58** is brought into engagement with the second cam surface **55**, the lock lever **48** is urged away from its spring-biased position and into a position where the locking teeth **56** are

positioned out of the path of travel of, and so cannot be engaged by, the locking tab **46** as the trigger **41** is moved rearwardly. In this configuration, it will be appreciated that the trigger **41** is free to move both rearwardly and forwardly without interference.

It will be understood that the foregoing handle portion construction is intended
5 as exemplary only, and that those of skill in the art are free to adapt the handle portion construction as desired, consistent only with facilitating operation of the extendible nature of the reacher as hereinafter described.

With reference next being had to **FIGS. 1, 6 and 7**, the central portion **70** in all embodiments of the invention herein described comprises a first tubular member **71**
10 with opposite first **72a** and second **72b** ends, the first end connected to the handle portion **40** (see also **FIGS. 4 and 5**), and a second tubular member **73** having opposite first **74a** and second **74b** ends. As shown in **FIG. 3**, the stem of jaw portion **10** defined by the neck portions of housing halves **12a, 12b** is received within the first end **74a** of the second tubular member **73**, being retained thereon by the interconnection of an
15 eyelet end of carriage assembly pull rod **29** with a mount **75** secured in an end of second pull tube **95**. As desired, the jaw portion **10** may be rotatably connected to the second tubular member **73** in a manner such as described in US Patent 7,344,171, which disclosure is incorporated herein by reference in its entirety.

With continuing reference to **FIGS. 1, 6 and 7**, the first **71** and second **73** tubular
20 members are connected to one another in a telescoping manner. As such, one of the tubular members (in the illustrated embodiment, the second tubular member **73**) is slightly smaller in diameter than the other (in the illustrated embodiment, first tubular member **71**), allowing insertion of the one into the other for sliding adjustment. In order to fix the relative positions of the first **71** and second **73** tubular members, a collet

assembly **80** is provided. Collet assembly **80** includes an externally threaded collar **81** attached to the proximal end of the first tubular member **71**, and a corresponding collet nut **82** seated thereon (**FIGS. 6 and 7**). As shown best in **FIG. 7**, collet nut **82** is characterized by an internal surface which tapers toward one end to define an increasingly smaller internal diameter of the collet nut **82**. Provided over the end of the second tubular member **73** and captured by the collet nut **82** are a cylindrical wedge **83** and an O-ring **84**. By tightening the collet nut **82** onto collar **81**, the wedge **83** is increasingly urged by the tapered internal surface into engagement with the second tubular member **73** to thereby restrain the second tubular member **73** against sliding with respect to the first tubular member **71**. Conversely, loosening the collet nut **82** will correspondingly disengage the wedge **83** from the second tubular member **73** and so permit sliding movement of the second tubular member with respect to the first tubular member **71**.

According to an alternative embodiment, shown in **FIG. 7a**, the first **71'** and second **73'** tubular members may be connected to one another in a telescoping manner by means of a manually-operated cam lever. As is known to those skilled in the art, this mechanism comprises a collar member **86** disposed at the first end of the first tubular member **71'**, the collar member pivotally supporting a manually actuated lever **87** having a cam surface **88**. Cam surface selectively acts against a wedge **89** provided on the collar member **86** to effect frictional engagement between wedge **89** and the outer surface of second tubular member **73'**. More specifically, when the lever **87** is in a first, lowered position (shown in **FIG. 7a**), cam surface **88** acts to urge wedge **89** into engagement with the outer surface of the second tubular member **73'**, thereby fixing the relative positions of the first **71'** and second **73'** tubular members. When the lever **87** is

manually pivoted into its raised position (not shown), cam surface **88** is rotated out of engagement with wedge **89**, which in turn moves out of engagement with the outer surface of the second tubular member **73'**.

Referring again to **FIGS. 6** and **7**, the construction and operation of the telescoping pull member according to a first exemplary form will be better understood.

According to this form, pull member generally comprises first **90** and second **95** pull tubes, one of the pull tubes (in the illustrated embodiment, the first **90** pull tube) being of smaller diameter than the other so as to be slidably telescoping receivable therein.

Pull member is interconnected with the jaw and handle portions such that manual actuation of the trigger **41** effects movement of the jaws **11a**, **11b**. As described above, interconnection of carriage assembly pull rod **29** with a mount **75** secured in a first end **96a** of second pull tube **95** operatively interconnects the pull member with the jaw portion **10** (see **FIG. 3**). Oppositely, the second end **91a** of the first pull tube **90** is interconnected with the trigger **41** via the trigger-connecting pull rod **45**, which is associated at one end thereof with the mount **92** secured in the second end **91a** of the first pull tube **90** (see **FIG. 5**).

Concurrently with any adjustment in the length of the telescoping central portion **70**, the telescoping pull member must be correspondingly adjusted in length. To this end, there is provided a second coupling for fixing the overall length of the pull member, the second coupling being characterized by a first, engaged condition in which the length of the pull member is fixed, and a second, disengaged condition in which the length of the pull member may be varied. This second coupling, in this first exemplary form of the invention, comprises an expanding mandrel assembly including a cone-

shaped wedge **100** moveably disposed within a mandrel body **101** having a complimentary cone-shaped internal passageway (see **FIGS. 6** and **7**). The mandrel body **101** is secured at one end thereof to a second end **91a** of the first pull tube **90**. In the illustrated embodiment in particular, the mandrel body **101** includes a stem portion **102** having a pair of radially oriented bores **103** therein, each bore aligned with a radial opening **93** provided through the first pull tube **90**. Pins, set screws, or the like pass through each such opening **93** and into the bores **103**.

Disposed about the circumference of the mandrel body **101** are a plurality of radiused members **104** each having a plurality of teeth defined on the exterior surfaces thereof, as shown. An elastic O-ring **105** surrounds these radiused members **104** to maintain the same in place about the mandrel body **101**.

Referring specifically to **FIG. 7**, it will be appreciated that when the cone-shaped wedge **100** is urged into the complimentary-shaped internal passageway of the mandrel body **101**, the mandrel body is forced to expand radially outward, thereby urging the radiused members **104** radially outwards and into engagement with an interior surface of the second pull tube **95**. In this first, engaged condition, the first **90** and second **95** pull tubes of the pull member are fixed in position relative to each other. Conversely, movement of the cone-shaped wedge **100** in a direction out of the passageway of mandrel body **101** permits the mandrel body to contract radially inward (being urged by the elastic O-ring **105**), thereby withdrawing the radiused members **104** from engagement with the interior surface of the second pull tube **95**. In this second, disengaged condition, the first **90** and second **95** pull tubes of the pull member are telescopingly moveable relative to each other to adjust the overall length of the pull member.

To effect changes in the second coupling between the first and second conditions thereof, there is provided a user-actuable release mechanism positioned remotely from, but operatively connected to, the second coupling. More particularly, and with continuing reference being had to **FIGS. 6 and 7**, this release mechanism according to the first embodiment of the invention comprises a bayonet cam **110** moveably disposed within the first pull tube **90**. The bayonet cam **110** mounts one or more radially extending pins **111**, each of which is dimensioned to be slidingly received in its own helical slot **112** defined in the circumferential wall of the first pull tube **90**. A connecting rod **113** interconnects the bayonet cam **110** and the wedge **100** at its narrow end. To this end, the connecting rod **113** may be threaded, being threadingly received in a correspondingly threaded passageway in the wedge **100**. Of course, other interconnecting means are possible.

At its opposite end, the connecting rod **113** is connected to the bayonet cam **110**. As shown, the connecting rod **113** includes an eyelet **114** received within the bayonet cam **110** and dimensioned to receive therethrough one of pins **111** to thus secure the connecting rod in place. Of course, other interconnecting means are possible.

A helical spring **115** interconnects the bayonet cam **110** and the trigger pull-rod mount **92**. As shown, the spring terminates at opposite ends in bosses **116** and **117**, each slidingly received in correspondingly-shaped, radially-oriented openings of the bayonet cam and trigger pull-rod mount, respectively. Being secured at one end to the fixed-position trigger pull-rod mount **92** and at the other end to the moveable bayonet cam **110**, the spring **115** biases the wedge **100** into the mandrel body **101** passageway and, thus, biases the second coupling to the first, engaged condition thereof defined above.

A rotatable sleeve **120** is positioned over the first pull tube **90** proximate the location of the bayonet cam **110** within the first pull tube **90**, as shown in **FIG. 7**, the rotatable sleeve **120** defining a pair of longitudinal slots **121** for slidably receiving therein each of the pins **111**. The sleeve **120** is fixedly connected to a user-rotatable collar **125** disposed on the exterior surface of the first tubular member **71** by a pin, set-screw, etc. which passes through the circumferential wall of the first tubular member. By user rotation of the collar **125**, the sleeve **120** is correspondingly rotated. This, in turn, rotates the associated pins **111**, causing them to be driven forward in their respective helical slots **112** and, simultaneously, longitudinally forward in the slots **121** in sleeve **120**. This motion drives the connecting rod **113** forward, thereby pushing wedge **100** out of the passageway of mandrel body **101**. Conversely, when a user releases collar **125** after rotation thereof, helical spring **115** urges bayonet cam **110** rearwardly, which motion correspondingly causes the sleeve **120** and, by association, the collar **125**, to rotate back to their original positions. Relatedly, this motion draws the connecting rod **113** rearward, thereby urging the wedge **100** further into the passageway of mandrel body **101** and so causing radial outward expansion of the radiused members **104** to return the second coupling to its engaged condition.

Turning next to **FIGS. 8** through **13**, there is shown another alternative form of the present inventive reacher. As this form is comparable in numerous respects to the previously-described form in respect of the exemplary configuration of the handle, jaw and central portions, these are not reiterated here except to the extent that they differ from the aforescribed embodiment.

Referring specifically to **FIG. 8**, the selectively extendible central portion **170** comprises, as with the other forms of the invention, telescopingly interrelated first **171**

and second **173** tubular members. Also as with the other forms, a first coupling in the form of a collet assembly **180** is provided for fixing the relative positions of the first and second tubular members.

Referring also to **FIGS. 9** and **10**, the selectively-extendible pull member comprises first **190** and second **195** pull rods, the first pull rod **190** being connected at one end thereof directly to the trigger **141**, and the second pull rod **195** being connected at one end thereof to the jaw portion in the manner described previously.

Turning now to **FIGS. 11** through **13**, the second coupling for fixing the length of the pull member in a manner corresponding to the selected length of the central portion **170** is, according to the second embodiment, a cam-action linkage assembly comprising a body **200** that has a fixed connection with the first pull rod **190** and a sliding connection with the second pull rod **195**. The body **200** supports a toothed cam **210** which is selectively engageable with the surface of the second pull rod **195** by means of teeth **211** in order to fix the position of the same relative to the body **200**.

More particularly, body **200** has a generally rectangular base portion with a passageway **201** extending longitudinally therethrough. Passageway **201** is slightly larger in diameter than the second pull rod **195**, so that the second pull rod may be slidingly received therein. A stop **196** defined at an end of the second pull rod **195** prevents the same from being completely withdrawn from the passageway **201**. As shown, a slot **202** is formed through an upper surface of the body **200**, the slot being in communication with the passageway **201** so as to expose a portion of the length of the second pull rod **195**. The first pull rod **190** is fixedly connected to the body **200**. For instance, at one end of the body **200** there is provided an aperture **203** is sized to receive an end of the first pull rod **205**, the first pull rod being held in place within the aperture **203** by any

conventional means such as epoxies or glues, one or more screws, pins, friction fit, etc.

The cam **210** includes a plurality of teeth **211** opposite an ear **212**. The plurality of teeth **211** are formed on the radial surface of the cam **210**, near the largest diameter thereof, to enhance engagement between the cam **210** and the second pull rod **195**.

5 The ear **212** protrudes from the radial surface of the cam **210** and is connected to a tension spring **220**. The opposite end of the tension spring **220** is connected to a mounting member **213** provided on the body **200**.

In order to support the cam **210** with respect to the body **200**, a pair of fins **214** extend outwardly from and substantially perpendicular to the body **200**. The fins **214** are located on opposite sides of the slot **202** and spaced parallel to one another at a distance slightly larger than the width of the cam **210** so that the cam may be disposed between the fins **214** and above the slot **202**. To this end, corresponding holes **215** extend through each fin **214**, and are aligned with one another along a common axis, so that a shaft **216** may extend through the holes **215**. The cam **210** is seated on the shaft **216** in the area between the fins **214**, and the shaft **216** extends beyond at least one of the fins for connection to a crank arm **225** extending substantially perpendicular to the shaft **216** for rotational movement in unison therewith.

Cam **210** is rotatable on the shaft **216** between an engaged position, wherein the cam **210** extends at least partially into the slot **202** to engage the second pull rod **195** with the teeth **211** of the cam and thereby restrain motion of the second pull rod **195** with respect to the body **200**, and a disengaged position, wherein the cam **210** does not engage the second pull rod **195** which is therefore free to slidably move in the passageway **201** with respect to the body **200**.

As best seen in **FIGS. 9, 10 and 12**, the user-actuable release trigger of this form of the present invention comprises a release button **142** disposed on the trigger **141** of the handle portion **140**. Release button **142** is located at the free end of a release lever **143**, which is mounted on a pivot post **144** located inside the trigger **141**.

5 Opposite the release button **142**, the release lever **143** is pivotally connected to a release rod **145** which extends to the adjustable linkage assembly where it is pivotally connected to the crank **225**. Depression of the release button **142** is resisted by a spring **150** which exerts a biasing force on the release lever **143**. However, when the release button **142** is depressed, the release lever **143** pivots with respect to the pivot

10 post **144** and urges the release rod **145** toward the handle portion **140**. This linear motion of the release rod **145** is converted into rotational motion by the crank **225** and the shaft **216**, and the cam **210** is thus rotated from a default position wherein the cam teeth **211** are engaged with the surface of the second pull rod **195** and into to a disengaged position. Upon release of the button **142**, the biasing forces exerted by the

15 springs **220** and **150** move the cam from the disengaged position and back into the engaged position.

In either of the foregoing forms of the extendible reacher, in the event that the distance between the jaw portion and the handle portion is not appropriate in light of the task contemplated by the user, the user may adjust the length of the central portion by

20 first unscrewing the collet nut of the collet assembly, which disengages the wedge from the second tubular member to thus permit telescoping movement of the first and second tubular members. The user next actuates the release trigger, either by depressing the release button or turning the collar (depending on the form of the invention), which actions cause the second coupling to move from the engaged to the

disengaged position. At this point, the pull member may be lengthened or shortened concurrently with telescoping movement of the first and second tubular members. Thus, while depressing the release trigger, the user grasps the second tubular member and changes the distance between the handle portion and the gripping portion as
5 desired. After the desired length is obtained, the user releases release trigger and tightens the collet nut to thereby fix the lengths of each of the central portion and the pull member.

Referring next to **FIGS. 14** through **20a**, there is shown another embodiment of the inventive reacher wherein selective positioning of the second coupling between the
10 first and second conditions thereof is effected by rotational movement of one of the first or second tubular members of the central portion. Further according to this embodiment, the pull member as shown in the figures comprises a pull rod **350** and a toothed gear rack **330** (**FIG. 14**). In the first, engaged condition of the second coupling the toothed lock member is in contact with the toothed gear rack to thereby fix the
15 length of the pull member, and in the second, disengaged condition of the second coupling the toothed lock member is out of contact with the toothed gear rack to thereby permit the length of the pull member to be varied.

As this embodiment is comparable in numerous respects to the previously-described forms of the inventive reacher in respect of the exemplary configuration of the
20 handle (shown generally at **340**), jaw (shown generally at **310**) and central (shown generally at **370**) portions (**FIG. 14**), these are not reiterated here except to the extent that they differ from the aforescribed embodiment.

As noted, the second coupling for fixing the length of the pull member in a manner corresponding to the selected length of the central portion **370** is, according to

this embodiment, a locking member **320** with a plurality of teeth **321** formed along its length, the teeth of the locking member **320** being selectively engageable with teeth **331** disposed along the length of longitudinal gear rack **330** (see **FIGS. 15** and **16**). Locking member **320** is fixed to one end of pull rod **350**, the second end of the pull rod **350** being secured to trigger **341** so as to be moveable therewith (**FIGS. 14, 20a** and **20b**). Gear rack **330** is operatively connected at one end thereof to the jaw assembly, which may be constructed, for instance, as more particularly shown and described in relation to **FIG. 2**. More particularly, a carriage assembly pull rod **329** is secured at one end thereof to an end of gear rack **330** (**FIG. 14**). The opposite end of the gear rack **330** is unattached, extending freely into a locking-member support sleeve **390** comprised of a tubular member **391** having disposed at opposite ends thereof lock rings **395** (**FIG. 17**). Lock rings **395** are fixed in place at opposite ends of tubular member **381**. To this end, each lock ring **395** in the embodiment shown includes a projection **396** extending radially therefrom which is receivable in a correspondingly dimensioned opening **392** provided through the tubular member **391**. As shown, each lock ring **395** is characterized by an overall "C"-shape, the terminal ends thereof defining angled surfaces **397**. The angled surfaces **397** of each lock ring **395** and the adjacent inner surface of the tubular member **391** collectively define a path for the sliding movement of gear rack **330** relative thereto, and further serve to restrain gear rack **330** in that path.

Referring specifically to **FIG. 15**, locking member **320** is characterized by a semi-circular cross-section the radial surfaces **322, 323** of which are disposed at an obtuse angle relative to each other. A first one of these surfaces **322** is wider than the other and bears the plurality of teeth **321** that, as depicted, project upwardly from that surface **322**.

As with the other forms of the inventive reacher, the reacher of this embodiment comprises a selectively extendible central portion **370** including a first tubular member **371** slidably telescopically received within a second, larger-diameter tubular member **373**. In order to fix the relative positions of the first **371** and second **373** tubular members, there is provided a collet assembly **380** as previously described.

The tubular member **373** has a smaller diameter than tubular member **371**, and includes a longitudinally extending, U-shaped groove **374** formed in the outer surface and which forms an inwardly projecting, longitudinally extending rib **375** on the inner surface (FIG. 18). As shown best in FIG. 19, tubular member **391** includes a longitudinally extending, U-shaped groove **393** formed in the outer surface thereof, the groove **393** being dimensioned to slidably receive therein the longitudinally extending rib **375** of the tubular member **373** when tubular member **391** is disposed coaxially within tubular member **373**. By the foregoing construction, it will be appreciated that tubular member **373** is capable of sliding movement relative to tubular member **391** while rotational alignment is maintained.

Telescopic adjustment according to this embodiment of the invention is achieved by loosening the collet nut of collet assembly **380** (or, according to the alternative embodiment, the cam lever **XX**), following which the tubular member **373** is rotated in a first direction about its longitudinal axis. By reason of the engagement between the rib **375** projecting inwardly from tubular member **373** and the channel **393** in tubular member **391**, rotation of tubular member **373** simultaneously rotates tubular member **391** and the associated lock rings **395**. This motion carries the gear rack **330** (which is captured in the path defined by the inner wall of tubular member **391** and the locking rings **395** as heretofore described) out of engagement with the locking member **320**

(FIG. 20b), thereby permitting subsequent telescoping movement of the tubular members 371, 373 relative to each other to a desired length. When the desired overall length is reached, tubular member 373 is rotated in the opposite direction about its longitudinal axis, this motion carrying the gear rack 330 back to its original position and so bringing teeth 331 into engagement with the teeth 321 of locking member 320 (FIG. 20a) to thereby fix the length of the pull member. By thereafter tightening the collet nut of the collet assembly 380, the reacher is fixed at its new length until further adjustments are desired.

Referring next to FIGS. 21a and 21b, there is shown in cross-section an alternative embodiment of a handle portion 40' that is, except as otherwise described hereinbelow, essentially as the handle of FIGS. 1, 4 and 5. This embodiment of handle portion 40' is particularly, though not exclusively, suited to employment in an extendible reacher incorporating mechanism of FIGS. 14 through 20b, and provides means for augmenting rearward movement of the pull rod 350' in response to actuation of the manually-actuable trigger 41' to thus permit a larger distance between the jaws in the fully opened position thereof.

Though not depicted in FIGS. 21a and 21b, a locking mechanism such as heretofore described may be provided to fix the pivotal position of the trigger 41', and thereby fix the relative positions of the jaws (not shown) between the fully open and fully closed positions thereof.

The means for augmenting rearward movement of the pull member more particularly include a fulcrum lever 65 pivotally disposed on the handle 41' and connected to the pull rod 350'. Fulcrum lever 65 is, as depicted, characterized by a pair of arms 65a and 65b extending oppositely from a central opening where the lever 65 is

rotatably mounted on a pivot **66** disposed on the trigger **41'**. Arms **65a** and **65b** define, as shown, an angle α that may be of any measurement suitable to achieving the ends herein described. Angle α may, for example, be an obtuse angle of approximately 165° , as shown. Arm **65a** terminates at end **67** that is connected to an end of the pull rod **350'** by a ferrule **351'** so that the lever **65** is rotatable relative thereto during pivotal movement thereof. Oppositely, at the end of arm **65b**, there is provided a projection **68** directed inwardly toward the body of handle **40'**.

Trigger **41'** is pivotally mounted to trigger pivot shaft **43'**. Trigger **41** includes an opening **44'** therethrough to accommodate pull rod **350'**. Proximate the bottom of opening **44'** there is defined a stop surface **44's** for abutting an opposing surface **69** defined at the end **67** of arm **65a**.

Further according to this embodiment, it may be seen that a spring **250** is secured at opposite ends to the pull member (at **251**) and an end of the first tubular member **71**. As described below, spring **250** serves to bias the pull rod (and, by association, the trigger **41'**) in the position thereof corresponding to the fully opened position of the jaws.

With continuing reference to both **FIGS. 21a** and **21b**, operation of the foregoing means may be better understood. From the position wherein the jaws are fully opened (**FIG. 21a**), a user manually depresses trigger **41'** to retract the pull rod **350'** and thereby move the jaws toward each other. More specifically, trigger **41'** pivots rearwardly about pivot shaft **43'**, carrying with it the fulcrum lever **65** and pull member **350'** associated therewith. As trigger **41'** is moved rearwardly, the projection **68** comes into contact opposing wall **240** of the handle housing half **42a'**. At this limit of the rearward movement of the projection **68**, further rearward movement of trigger **41'**

causes rotation of the fulcrum lever **65** about pivot **66** so that the arm **65a** is driven rearwardly along with the pull rod **350'** (**FIG. 21b**). In this condition, it will be seen that spring **250** is in tension, such that the pull rod is urged forwardly upon release of trigger **41'**.

5 As with the other embodiment, it will be understood that the foregoing handle portion construction is intended as exemplary only, and that those of skill in the art are free to adapt the handle portion construction as desired, consistent only with facilitating operation of the extendible nature of the reacher as hereinafter described.

10 A variety of materials may be used in constructing present invention. Except where otherwise indicated in this disclosure, the materials used for the pieces in the present embodiments are generally of a substantially rigid nature. Whether these materials be hardened plastic polymers or any of various substantially non-malleable metals is a matter of design choice and cost effectiveness.

15 It will be appreciated from the above disclosure that the present invention improves upon the prior art by providing an extendable reacher that is robust yet simple in design, and that allows easy adjustment of the distance between the handle assembly and the gripping assembly.

20 While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in this specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention

CLAIMS

The invention in which an exclusive property or privilege is claimed is defined as follows:

1. A hand-held reacher, comprising:

A jaw portion comprising a pair of jaws movable relative to each other between fully clamped and fully opened positions thereof;

A handle portion spaced apart from the jaw portion by a selectively extendible central portion, the handle portion comprising a manually-actuatable trigger operatively connected to the jaw portion by a selectively extendible pull member at least substantially disposed within the central portion, whereby actuation of the trigger is operative to move the pull member to thereby selectively position the pair of jaws between the fully clamped and fully opened position thereof;

The selectively extendible central portion comprising a first tubular member slidably telescopically received within a second tubular member;

A first coupling for selectively fixing the relative positions of the first and second tubular members; and

A second coupling for selectively fixing the length of the pull member, the second coupling being characterized by a first, engaged condition in which the length of the pull member is fixed, and a second, disengaged condition in which the length of the pull member may be varied.

2. The hand-held reacher of claim 1, further comprising a user-actuatable trigger positioned remotely from the second coupling, the trigger being operatively connected

to the second coupling to selectively vary the second coupling between the first and second conditions thereof.

3. The hand-held reacher of claim 2, wherein the pull member comprises a first pull tube slidably telescopically received within a second pull tube, and the second coupling comprises a selectively radially expandable mandrel disposed within the second pull tube, the mandrel being characterized by a first, engaged condition in which the mandrel is radially expanded into engagement with the interior surface of the second pull tube to thereby fix the length of the pull member, and a second, disengaged condition in which the mandrel is radially contracted out of engagement with the interior surface of the second pull tube to thereby permit the length of the pull member to be varied.

4. The hand-held reacher of claim 3, wherein the user-actuatable trigger comprises a manually operable release trigger positioned on the second tubular member proximate the handle, the release trigger being operatively connected to the expanding mandrel via a connecting rod.

5. The hand-held reacher of claim 4, wherein the radially expandable mandrel comprises a mandrel body having a tapered interior passageway, a plurality of radially-moveable elements disposed about the exterior circumference of the mandrel body, and a tapered wedge dimensioned for movement within the tapered interior passageway of the mandrel body.

6. The hand-held reacher of claim 5, wherein the connecting rod of the user-actuable trigger is connected to the tapered wedge, and wherein further actuation of the user-actuable trigger is operative to move the tapered wedge within the interior passageway of the mandrel body.

7. The hand-held reacher of claim 6, wherein the first coupling for selectively fixing the relative positions of the first and second tubular members comprises a collet disposed proximate an end of the first tubular member, and a collet nut threadingly engageable thereon.

8. The hand-held reacher of claim 2, wherein the pull member comprises first and second pull rods, and the second coupling comprises a cam body supporting a cam;

wherein the first pull rod is fixedly connected to the cam support body, and the second pull rod is slidingly associated with the cam support body; and

wherein further the cam is characterized by a first, engaged condition in which the cam is in contact with the second pull rod to thereby fix the length of the pull member, and a second, disengaged condition in which the cam is out of contact with the second pull rod to thereby permit the length of the pull member to be varied.

9. The hand-held reacher of claim 8, wherein the user-actuable trigger comprises a manually operable release trigger provided on the handle portion, the release trigger being operatively connected to the cam via a connecting rod.

10. The hand-held reacher of claim 9, wherein the cam body includes a first

passageway through which is slidably received the second pull rod, wherein the cam is pivotally mounted on the cam body, and wherein further the passageway includes an opening through which the cam can be brought into engagement with the second pull rod in the first, engaged position of the first coupling.

11. The hand-held reacher of claim 10, wherein the cam is biased toward engagement with the second pull rod via the opening in the cam body, and wherein further actuation of the user-actuatable trigger is operative to move the cam out of the passageway opening in the cam body and out of engagement with the second pull rod.

12. The hand-held reacher of claim 8, wherein the first coupling for selectively fixing the relative positions of the first and second tubular members comprises a collet disposed proximate an end of the first tubular member, and a collet nut threadably engageable thereon.

13. The hand-held reacher of claim 1, wherein selective positioning of the second coupling between the first and second conditions thereof is effected by rotational movement of one of the first or second tubular members of the central portion.

14. The hand-held reacher of claim 13, wherein the pull member comprises a pull rod and a toothed gear rack, and the second coupling comprises a toothed lock member;

wherein the pull rod is fixedly connected to the toothed lock member; and

wherein in the first, engaged condition of the second coupling the toothed lock

member is in contact with the toothed gear rack to thereby fix the length of the pull member, and in the second, disengaged condition of the second coupling the toothed lock member is out of contact with the toothed gear rack to thereby permit the length of the pull member to be varied.

15. The hand-held reacher of claim 14, wherein the pull rod is operatively connected to the manually-actuatable trigger, and the gear rack is operatively connected to the jaw portion.

16. The hand-held reacher of claim 13, wherein the gear rack is slidably received in, and rotatably fixed relative to, a housing disposed within, and rotatably fixed relative to, one of the first or second tubular members of the central portion; and

wherein rotational movement of one of the first or second tubular members of the central portion in a first direction is operative to rotate the housing and carry toothed gear rack out of engagement with the toothed locking member to thereby define the second condition of the second coupling, and rotational movement of the said one of the first or second tubular members of the central portion in a second direction is operative to rotate the housing and carry toothed gear rack into from a position of disengagement with the toothed locking member back into engagement with the toothed locking member to thereby define the first condition of the second coupling.

17. The hand-held reacher of claim 16, wherein the locking member is positioned with the said housing.

18. The hand-held reacher of claim 17, wherein the first coupling for selectively fixing the relative positions of the first and second tubular members comprises a collet disposed proximate an end of the first tubular member, and a collet nut threadingly engageable thereon.

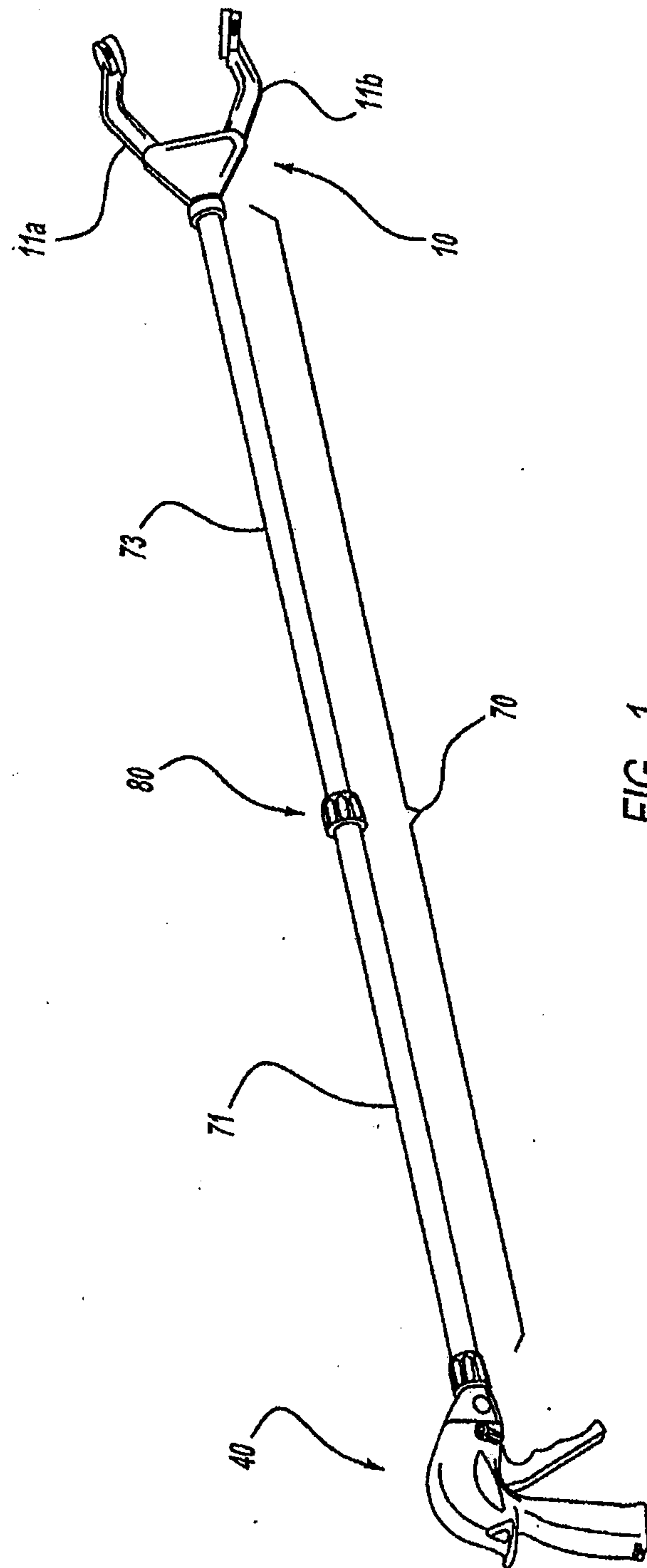
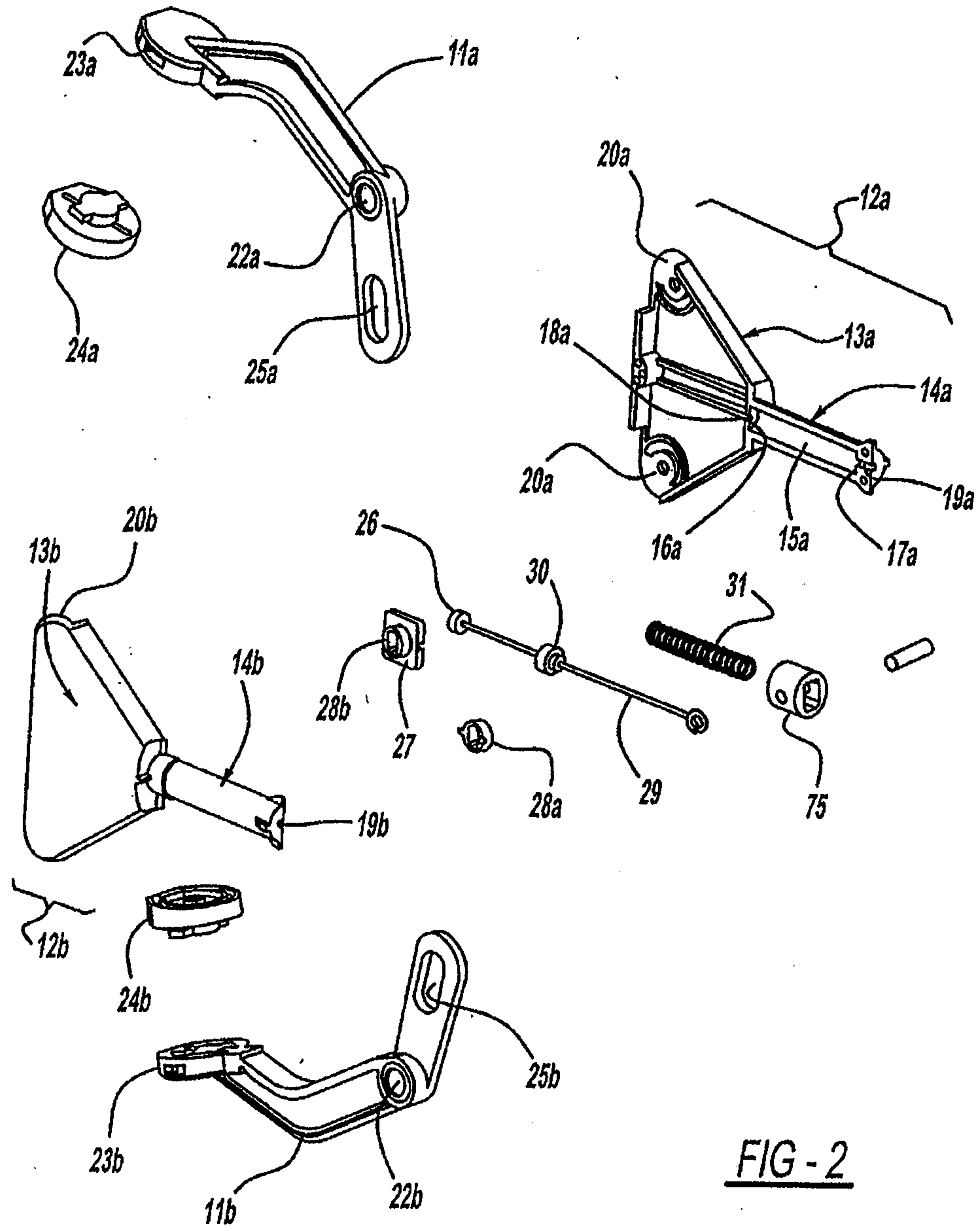
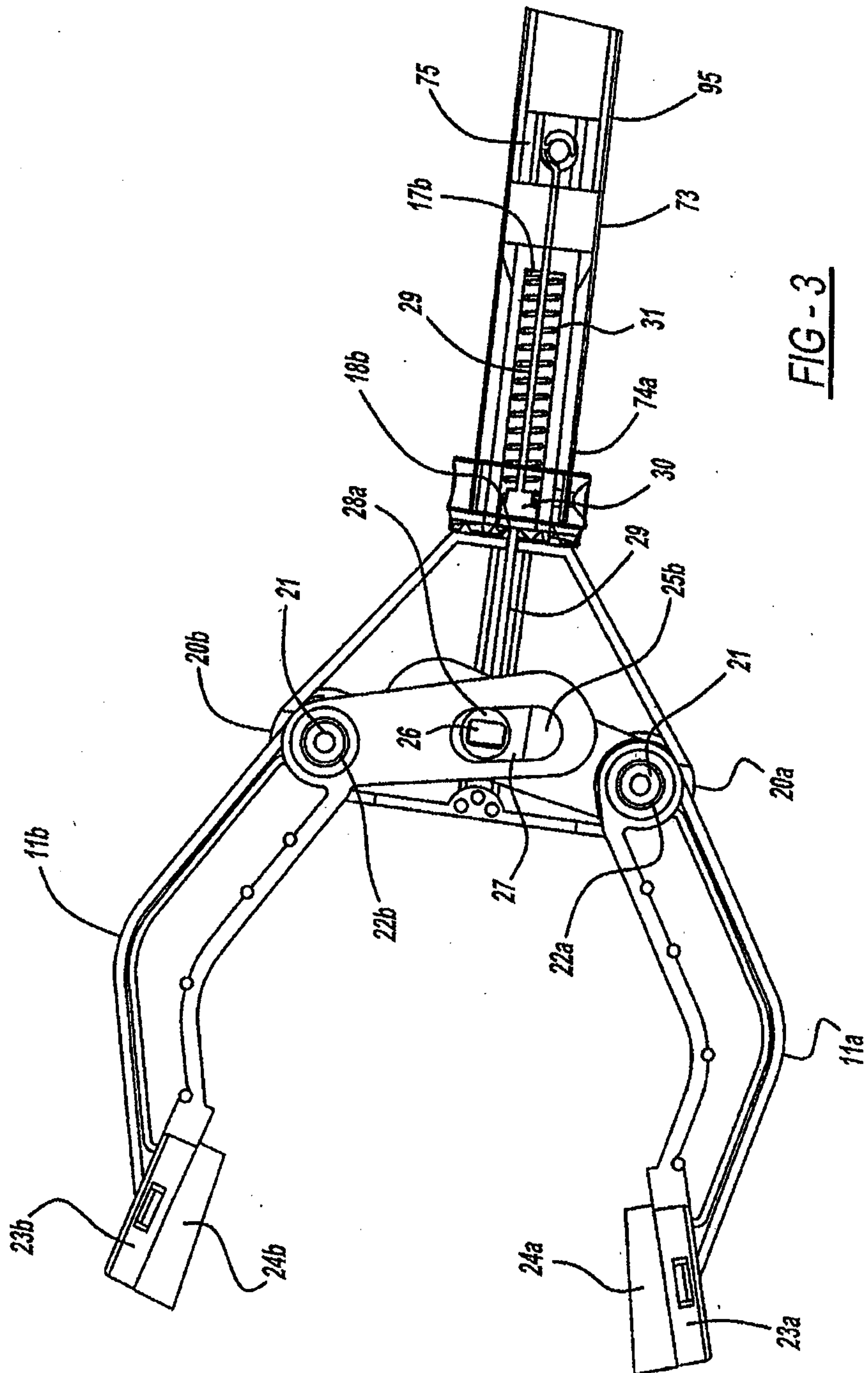
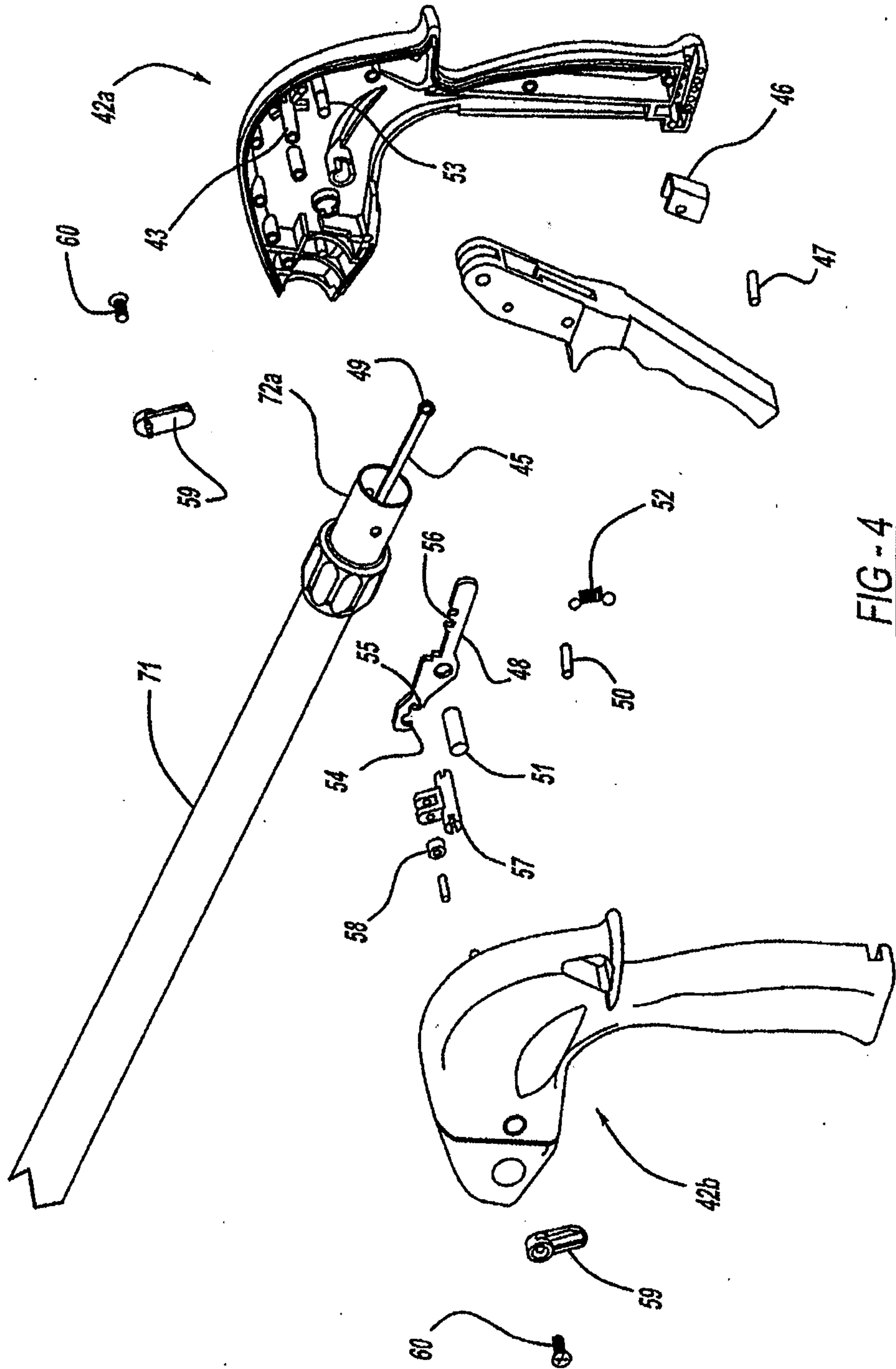


FIG-1







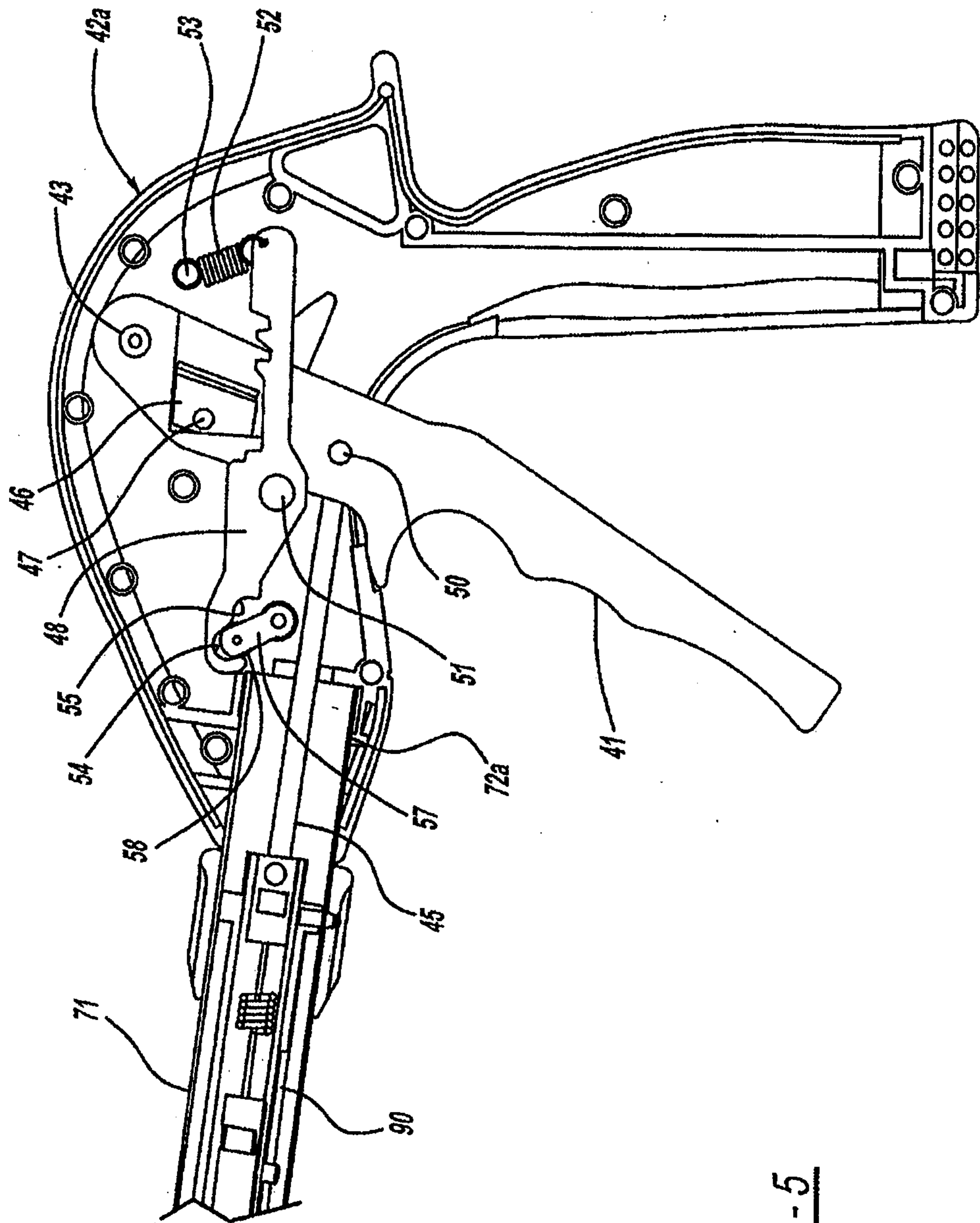


FIG - 5

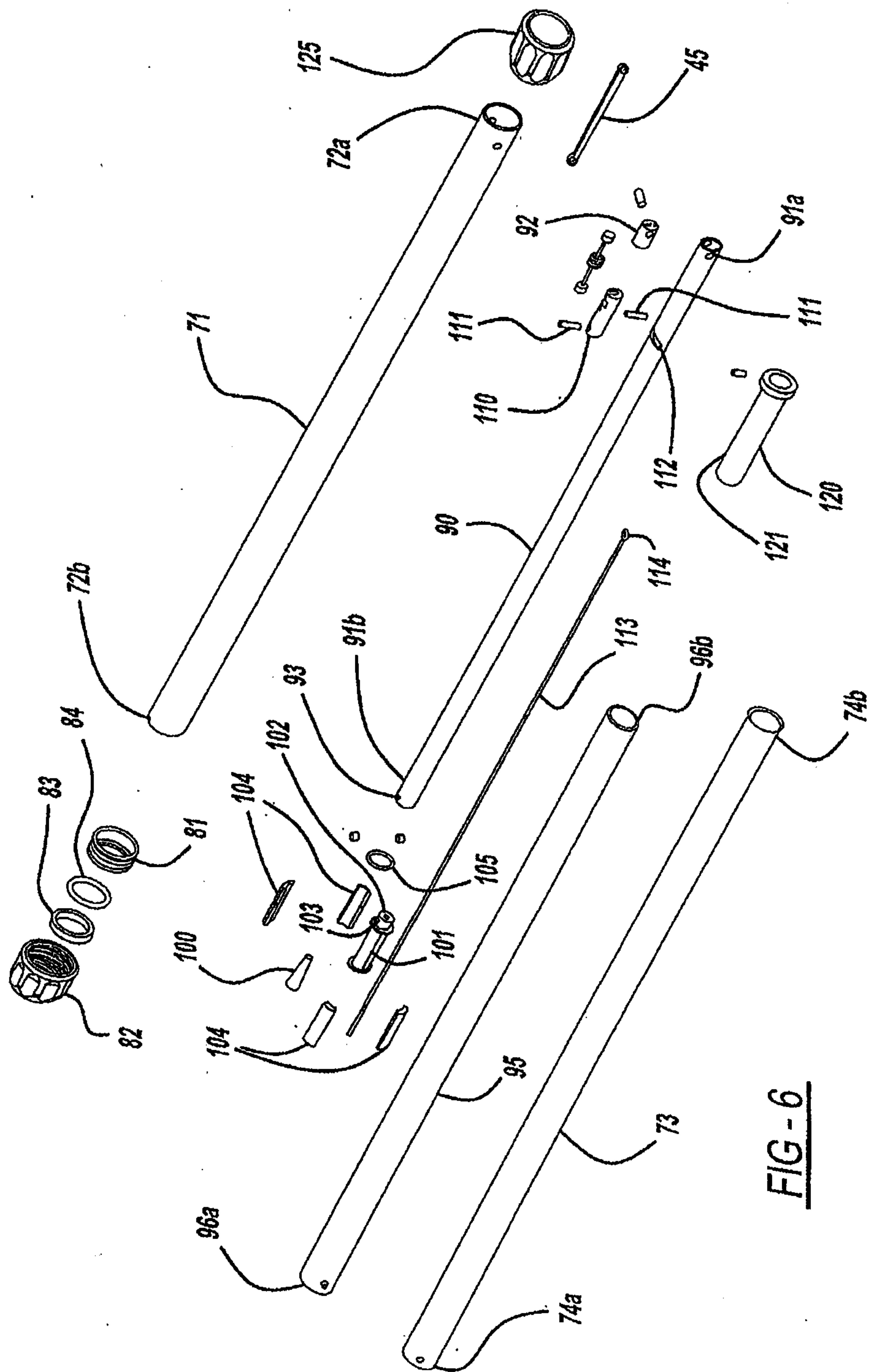


FIG - 6

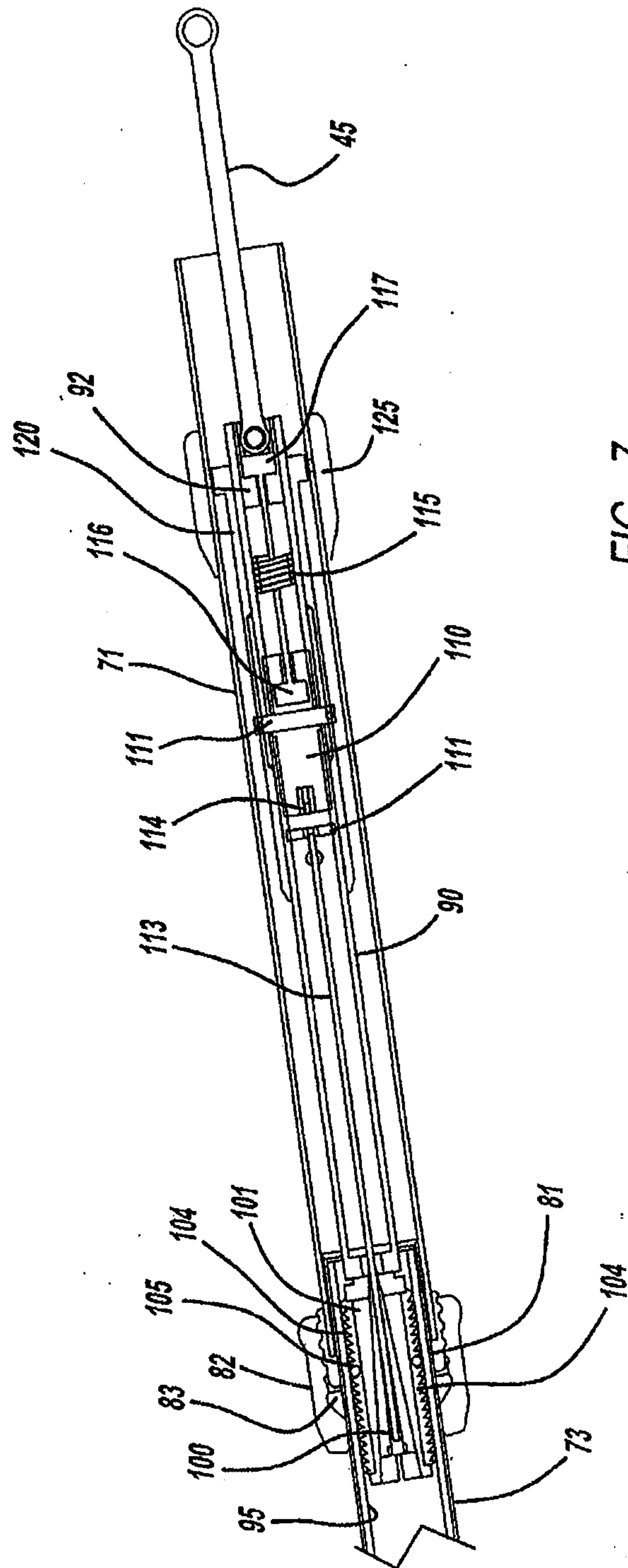


FIG-7

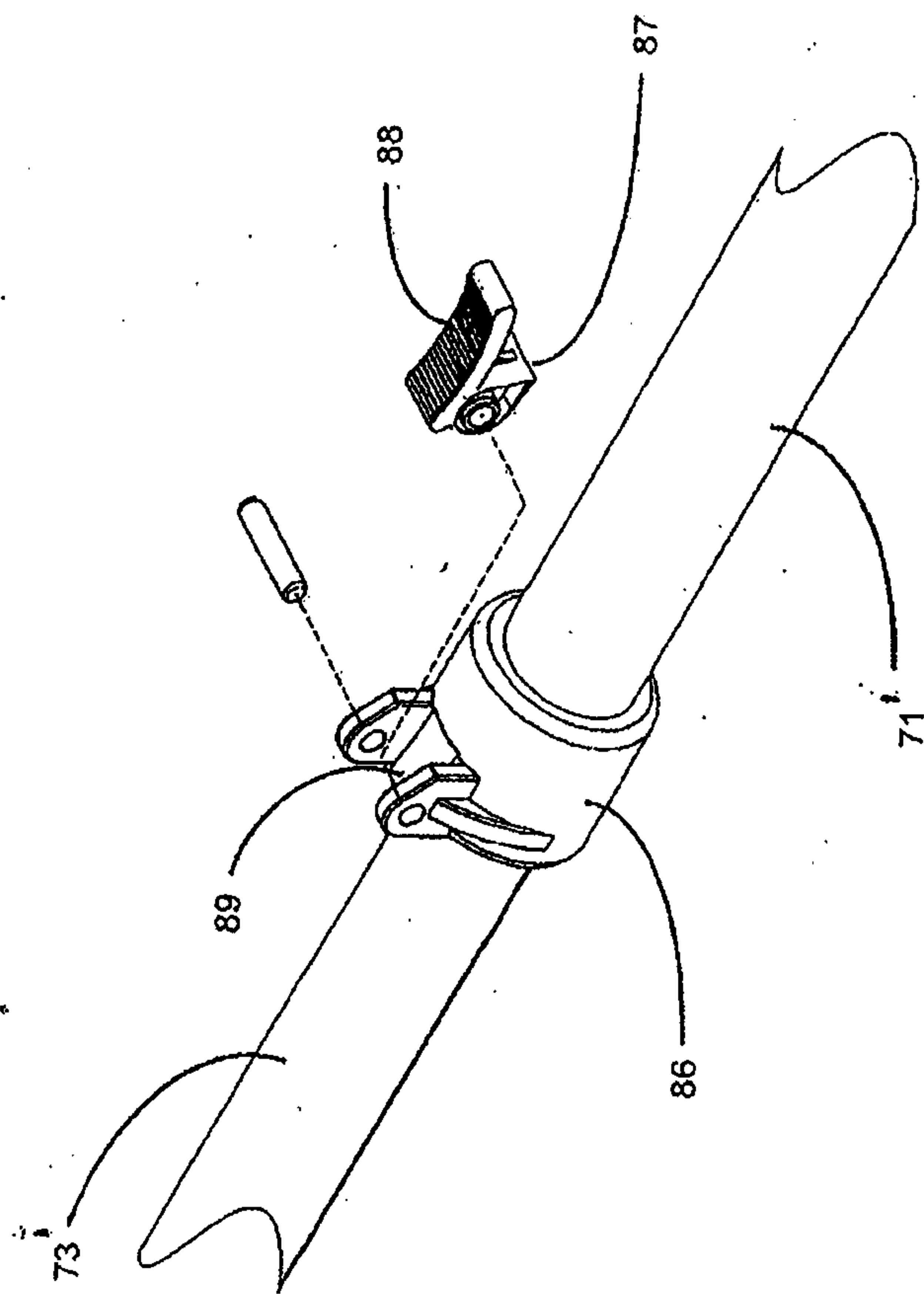


FIG-7a

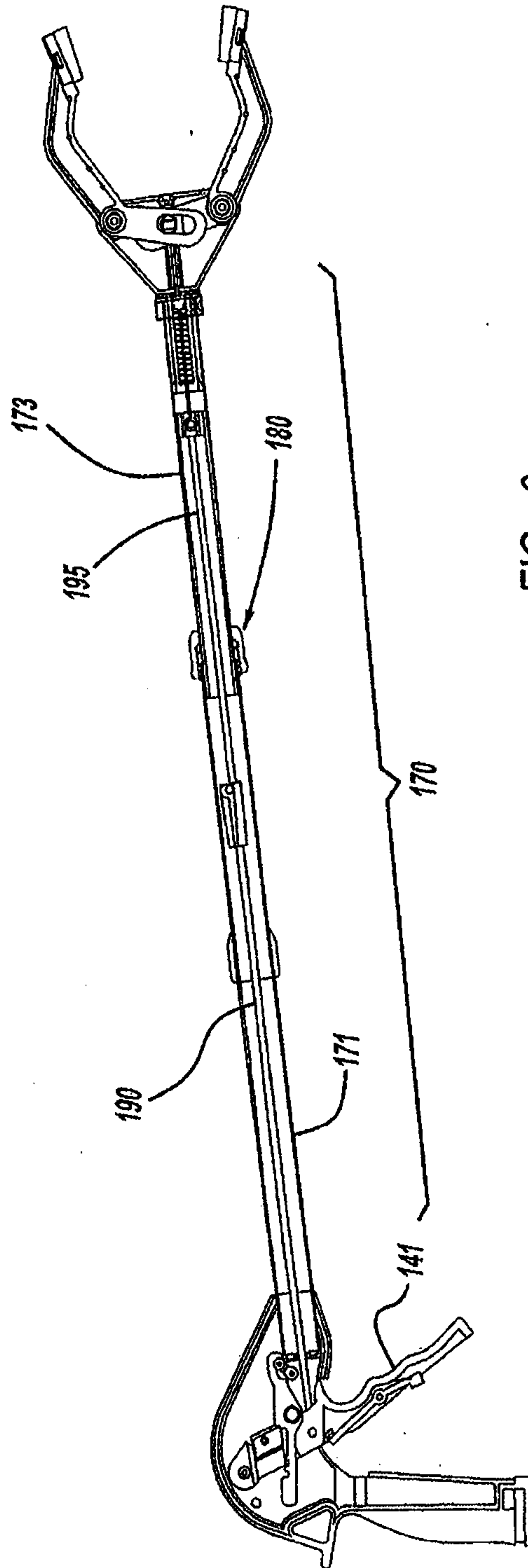


FIG - 8

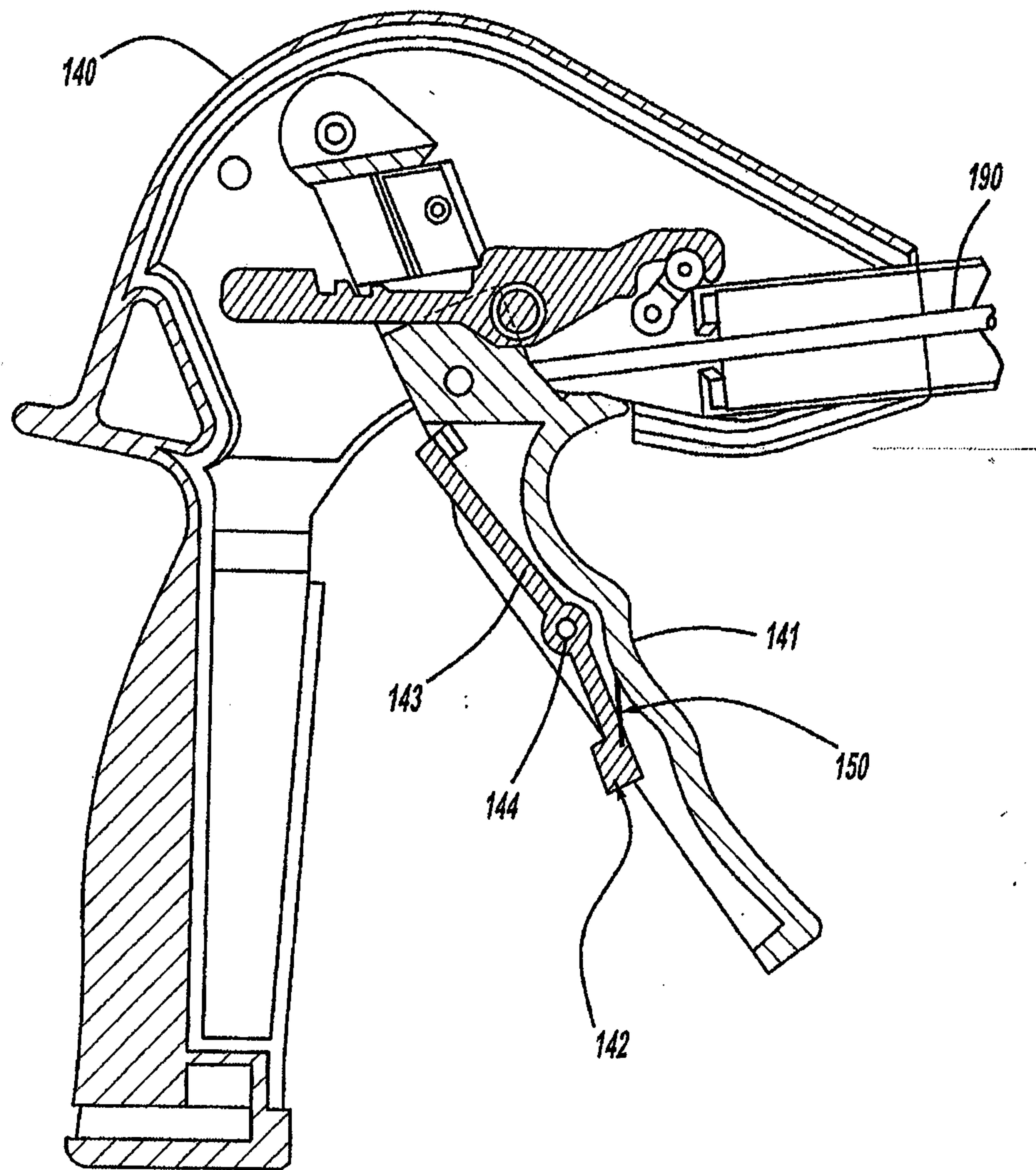


FIG - 9

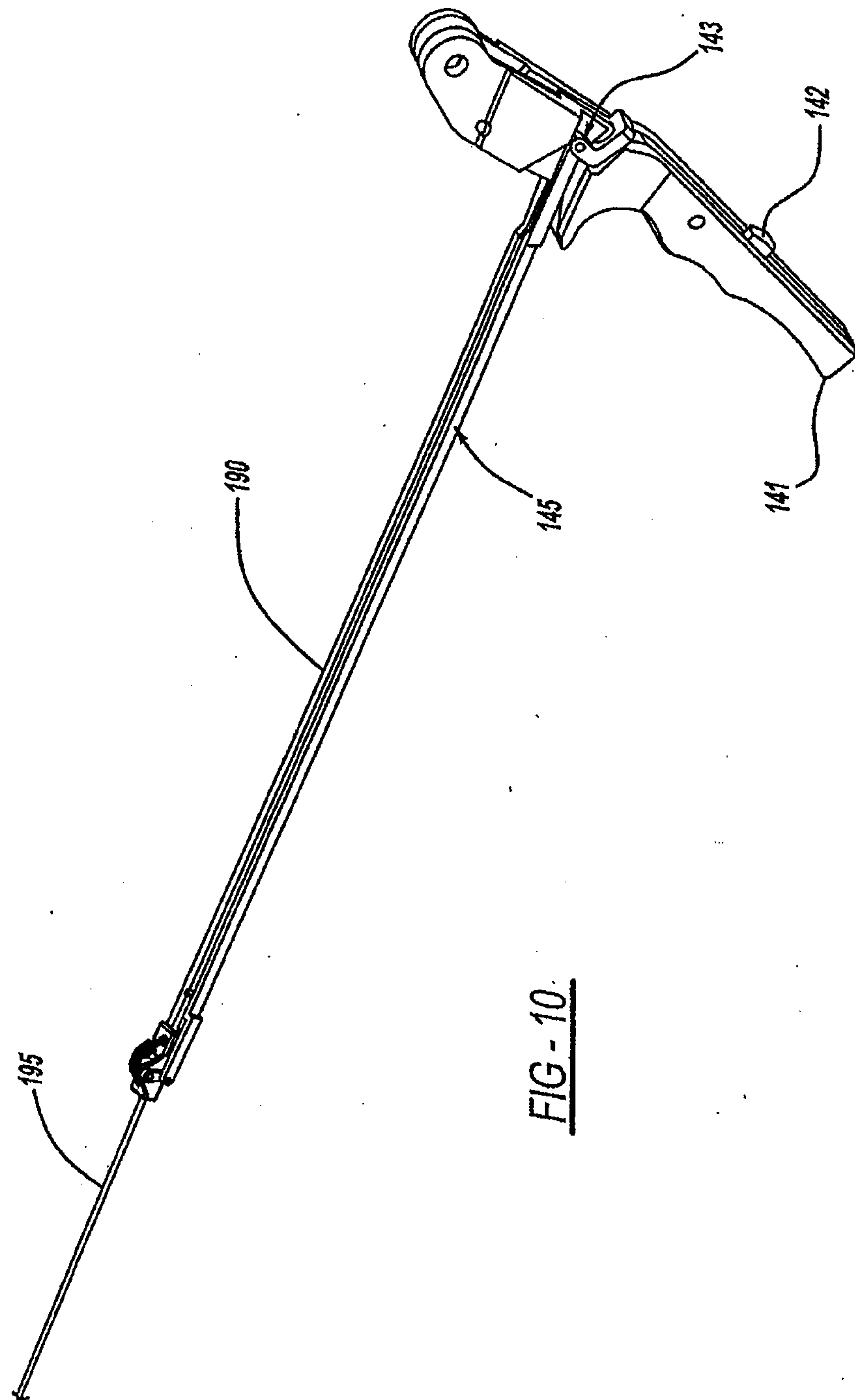
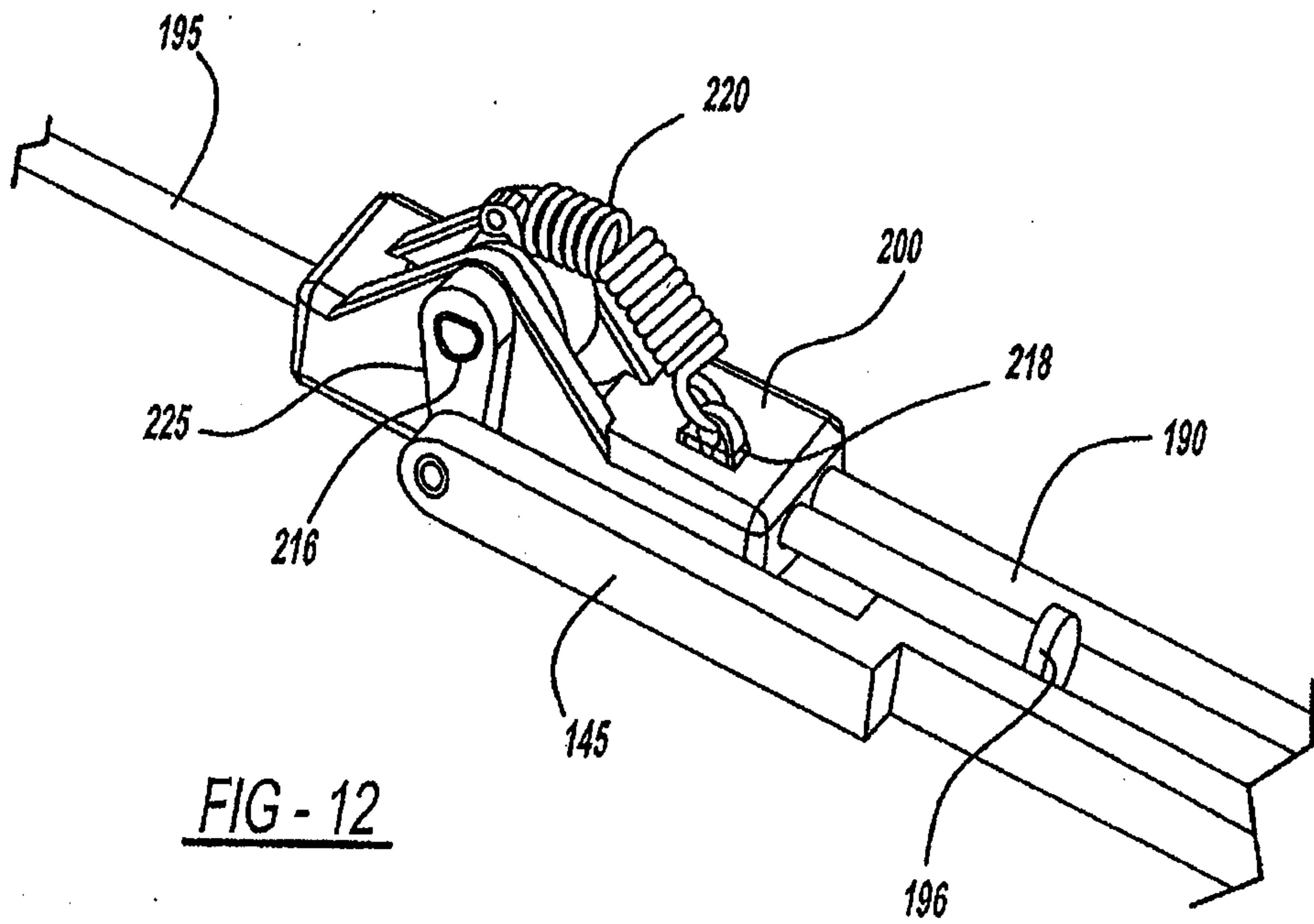
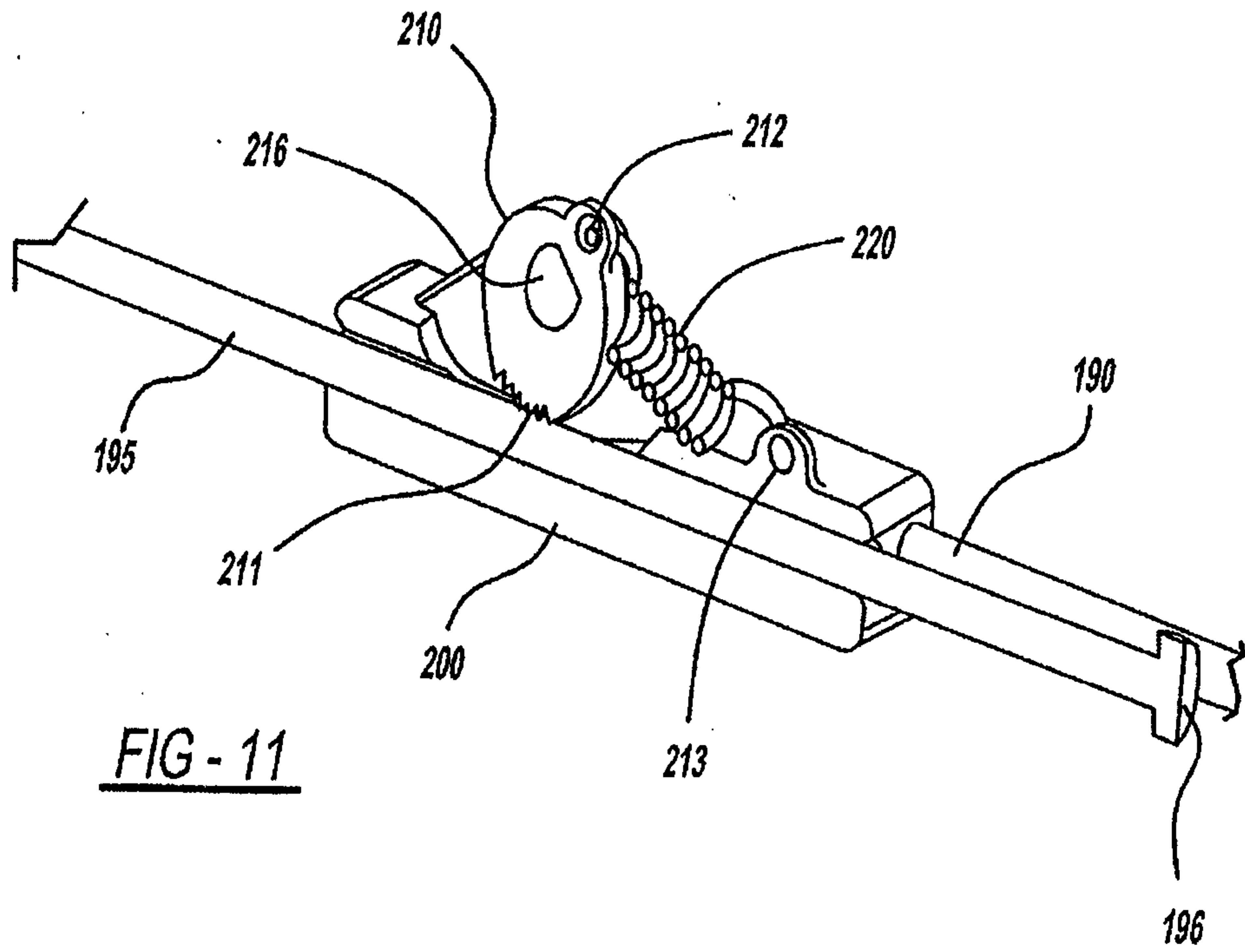
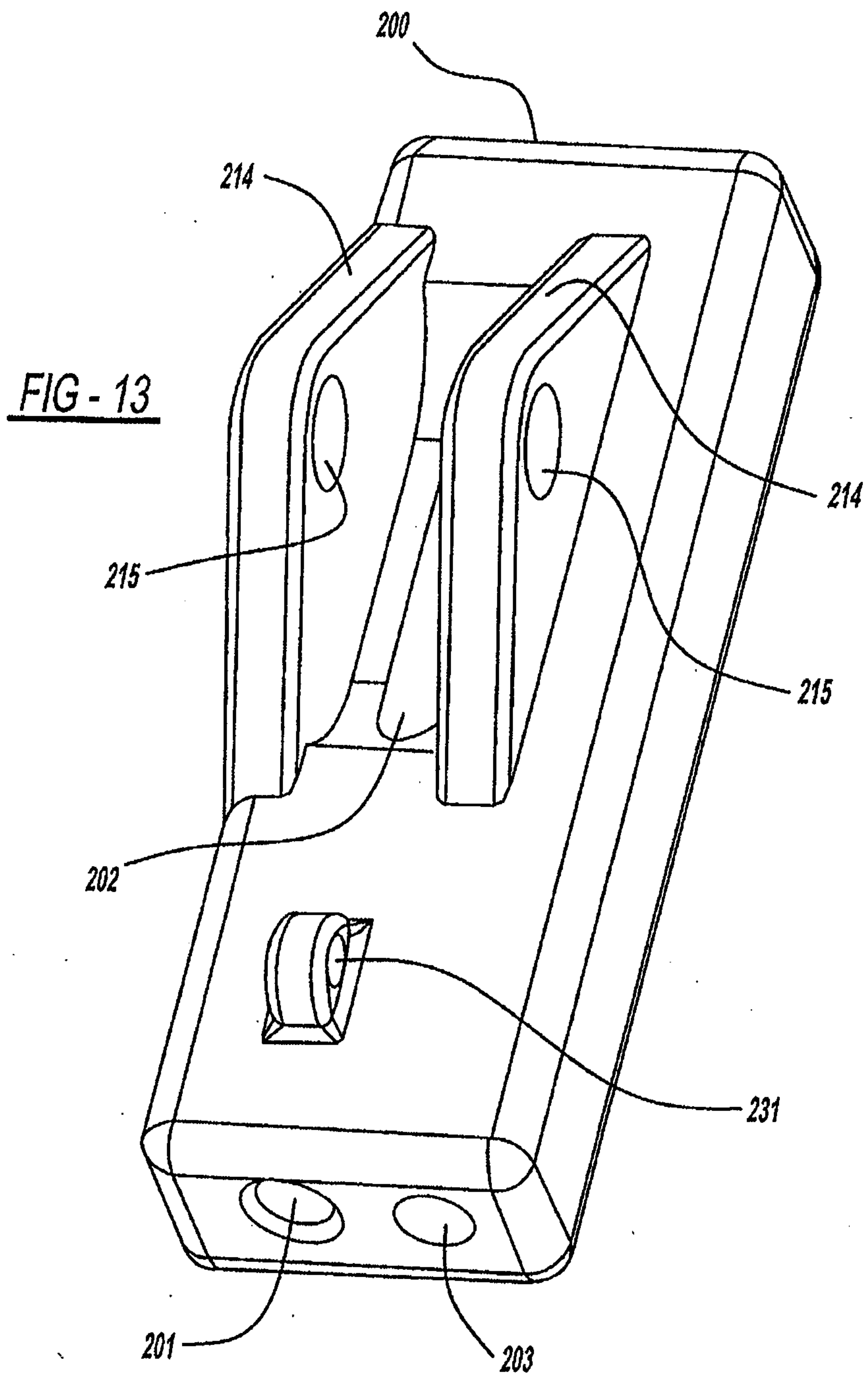


FIG - 10





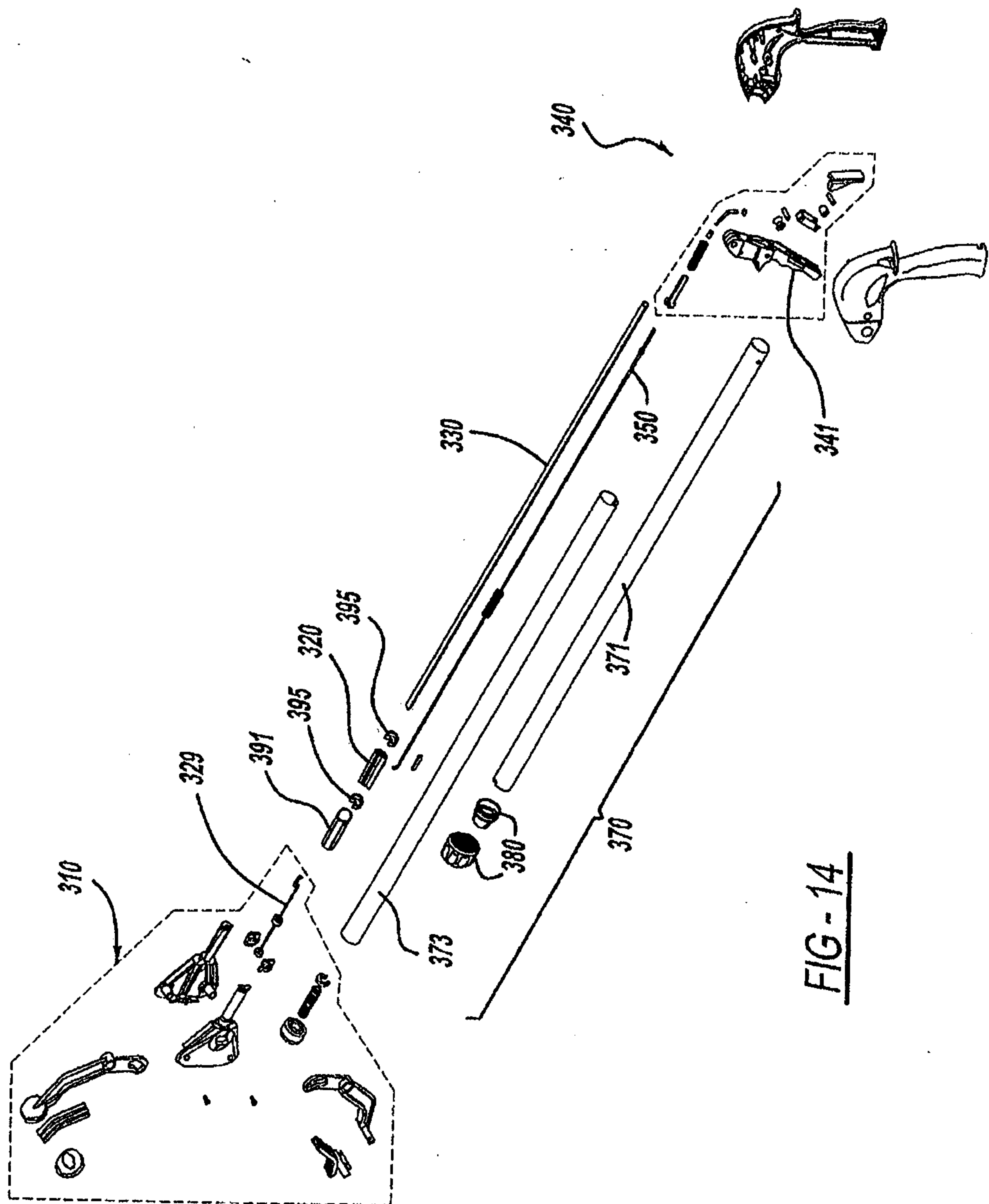


FIG - 14

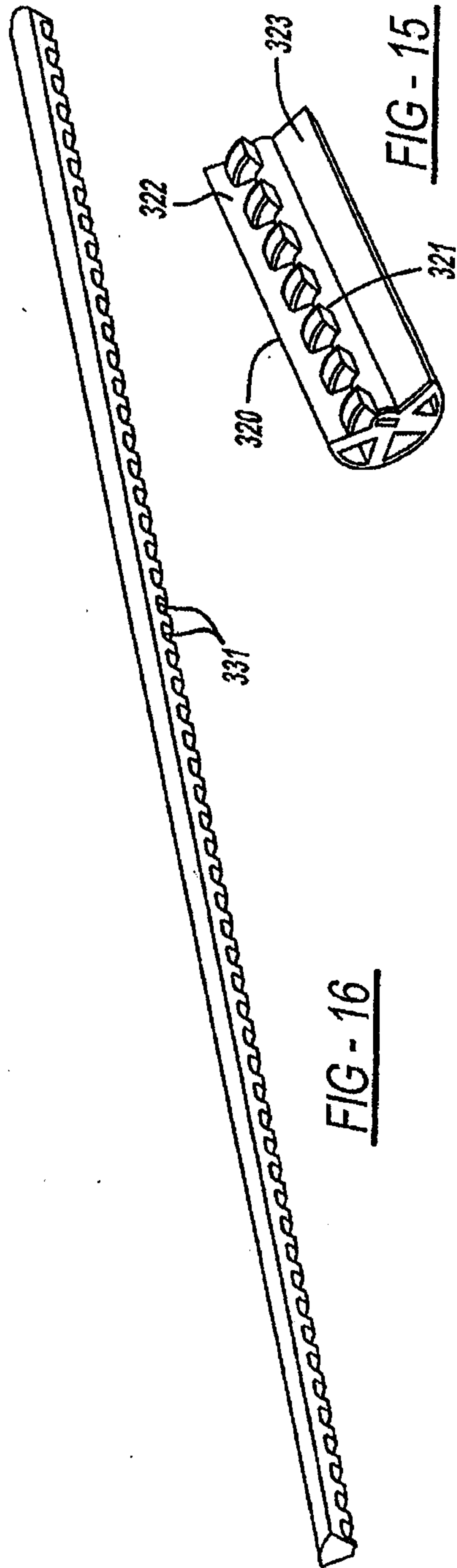
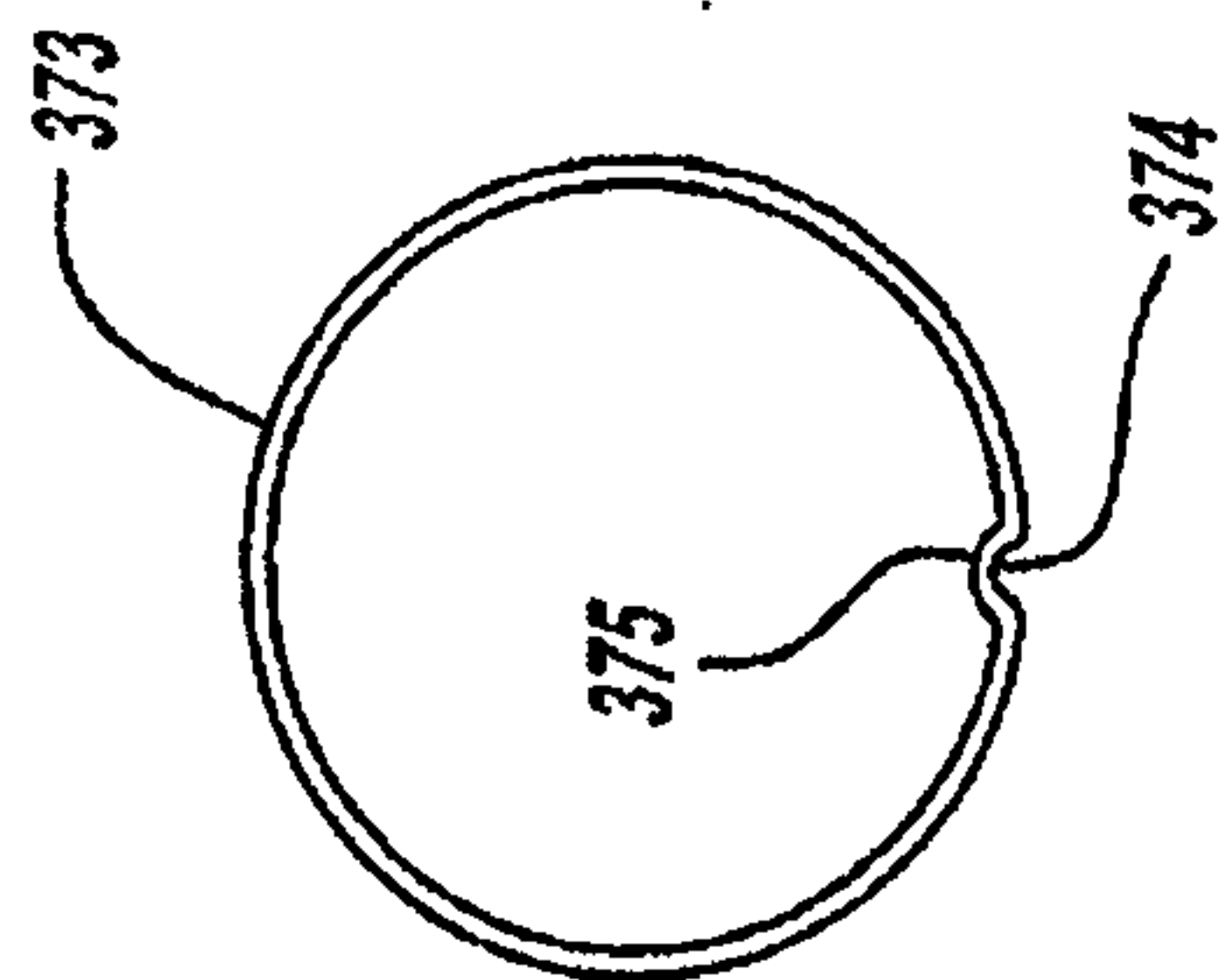
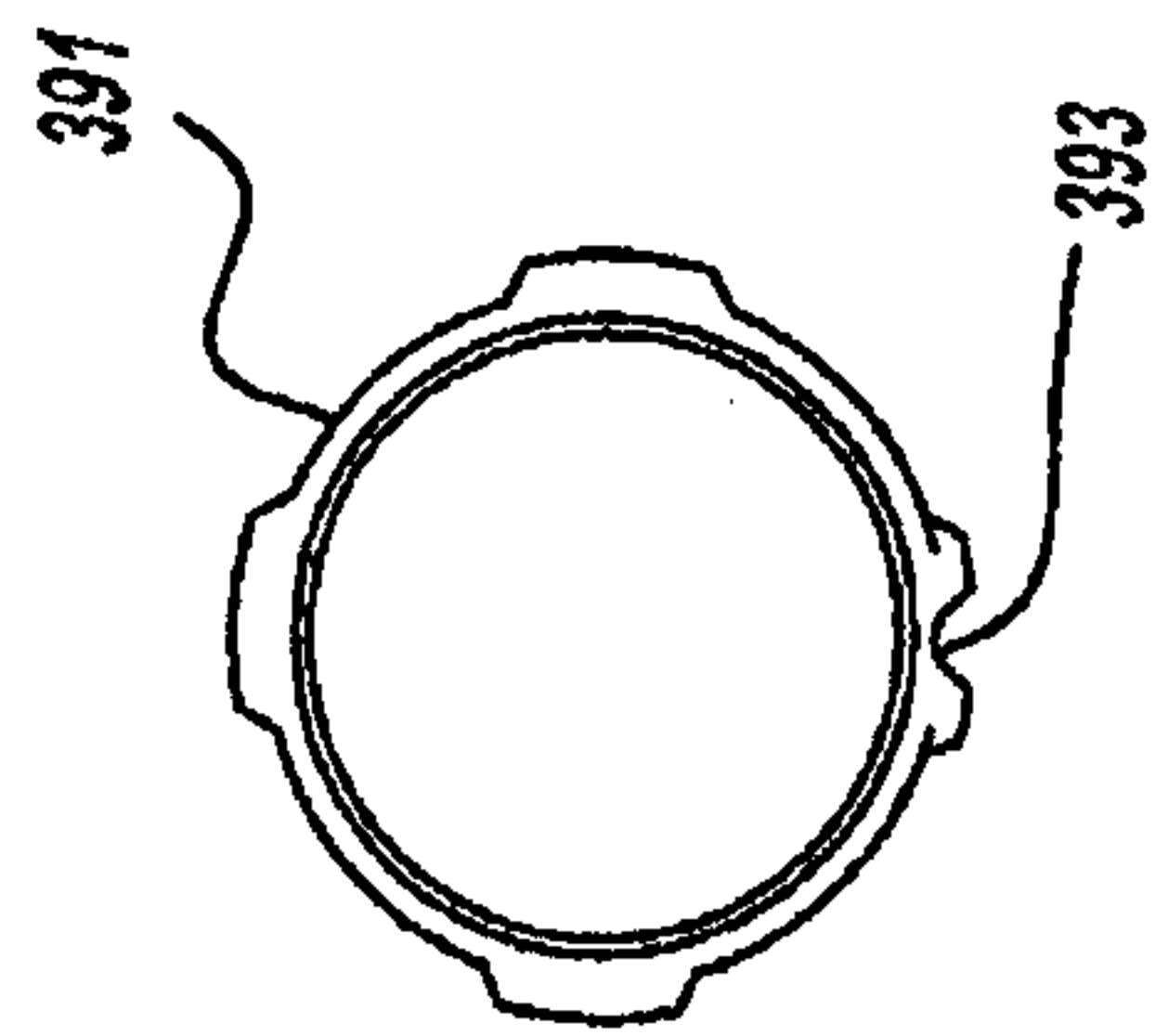
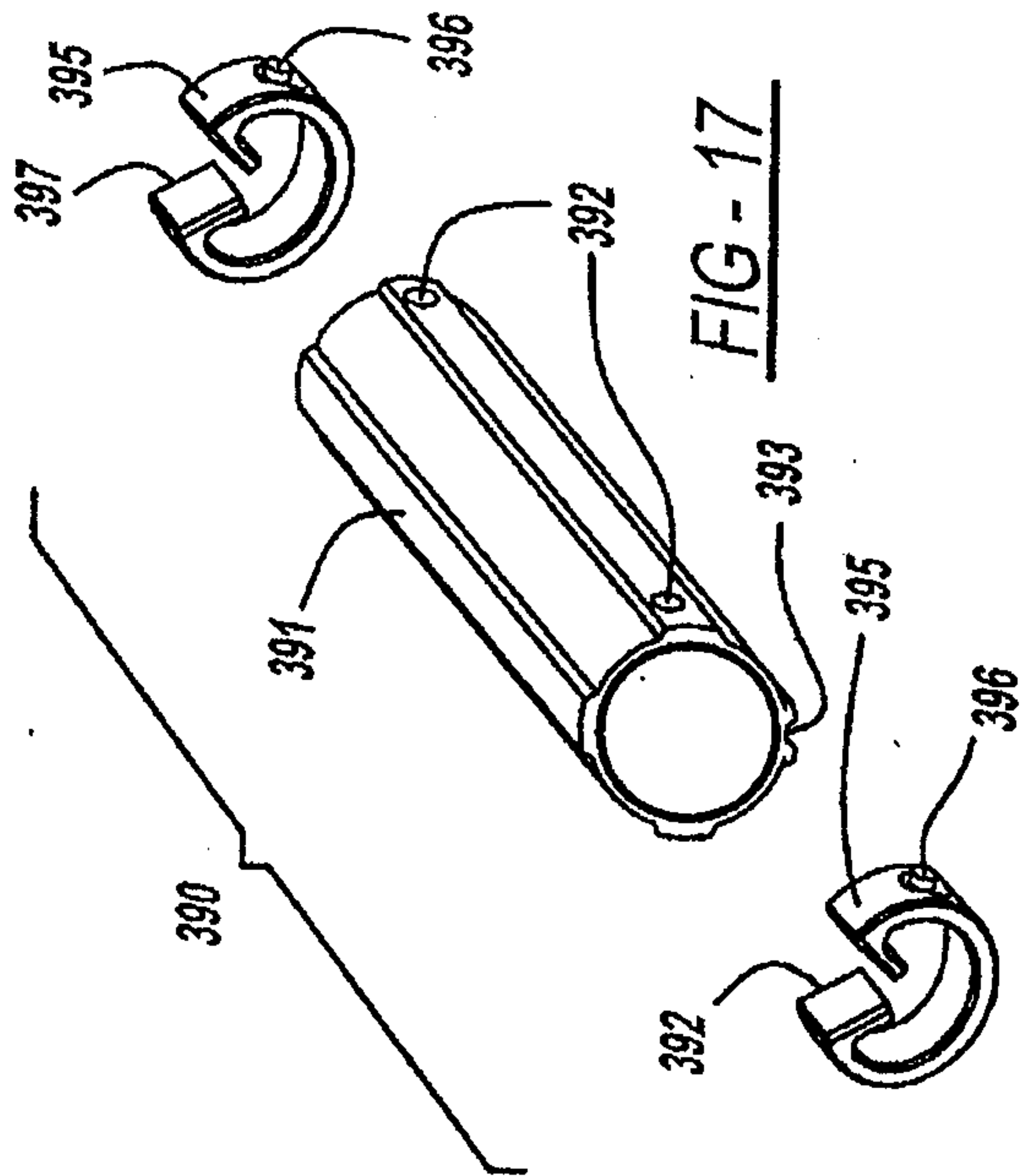
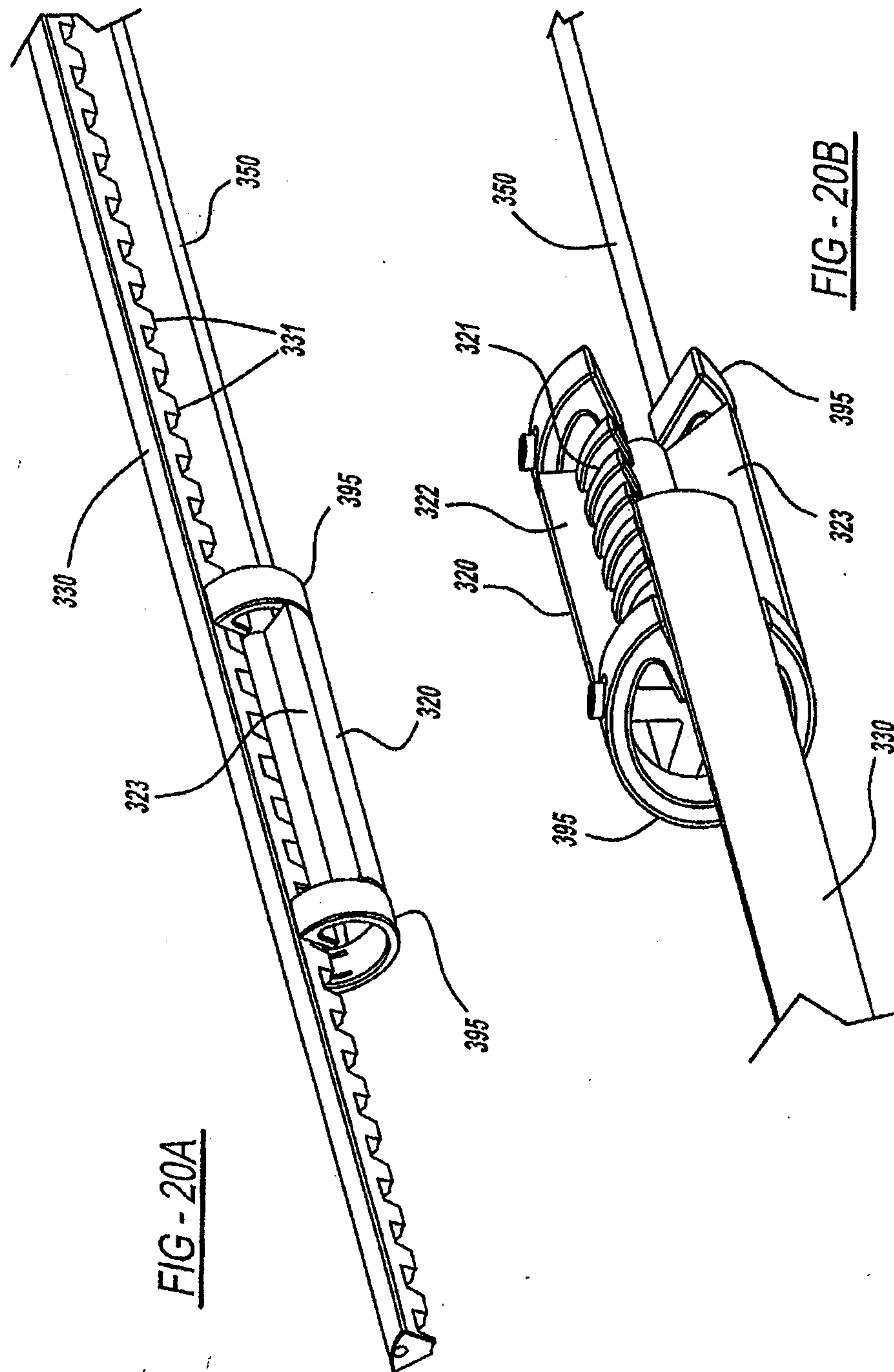


FIG - 16



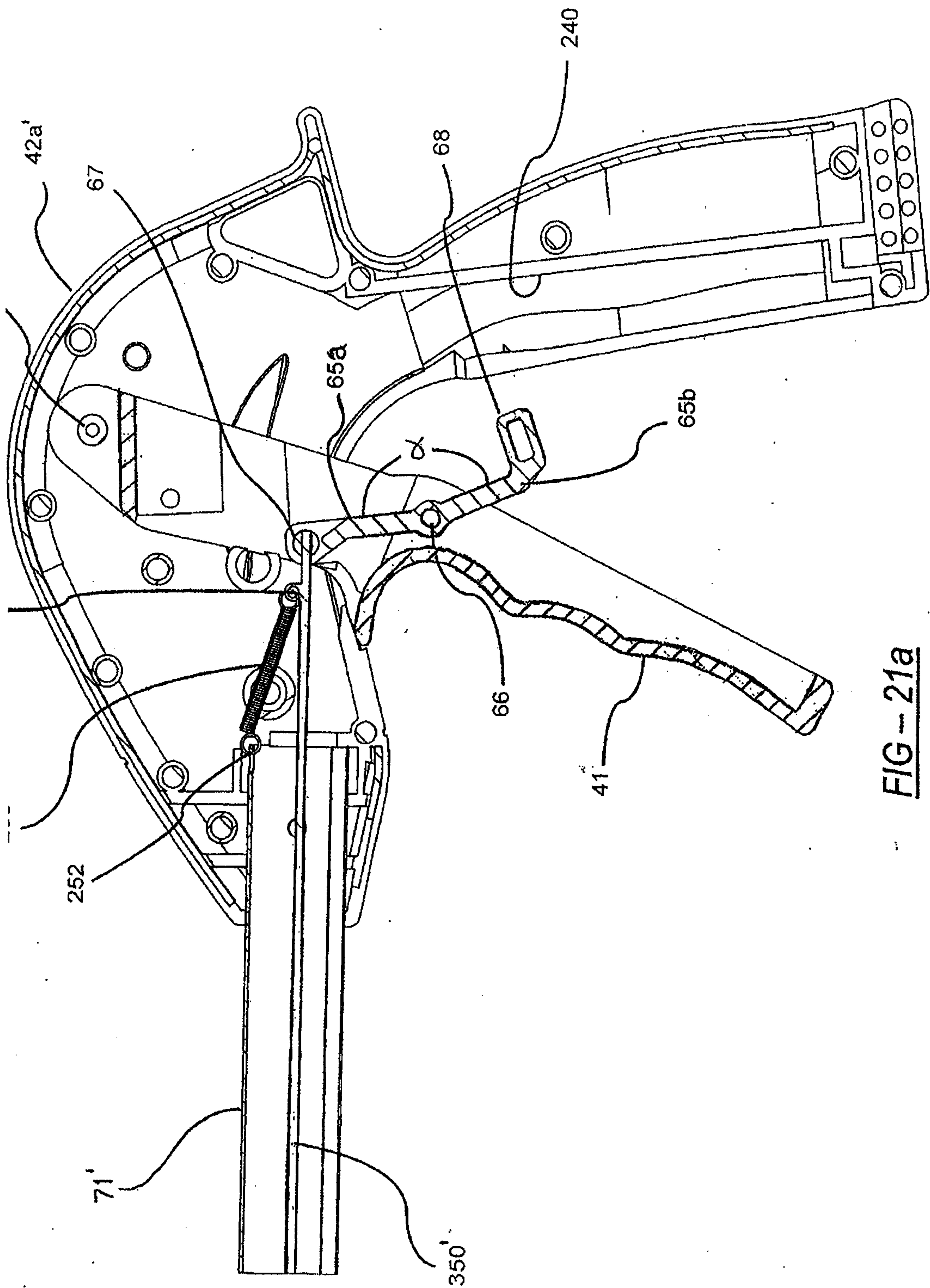


FIG-21a

