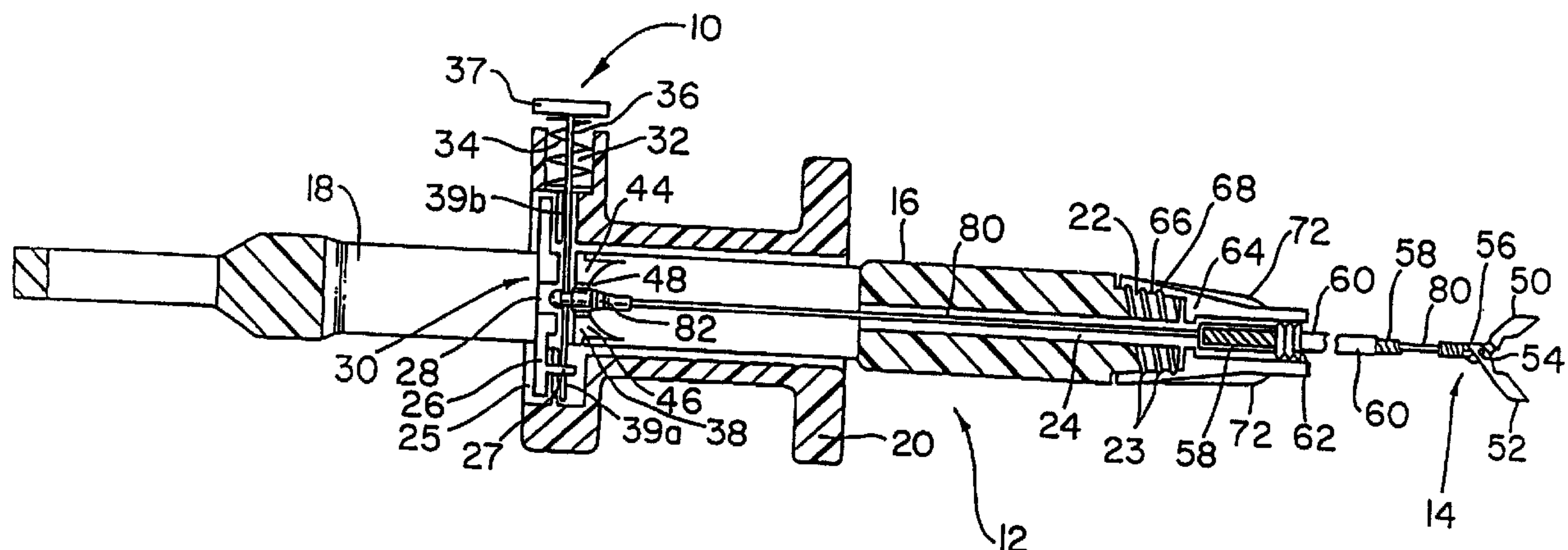




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(54) Titre : FORCEPS DE BIOPSIE POSSEDANT UNE POIGNEE DETACHABLE ET DES MACHOIRES DISTALES  
(54) Title: BIOPSY FORCEPS HAVING DETACHABLE HANDLE AND DISTAL JAWS



(57) **Abrégé/Abstract:**

An endoscopic biopsy forceps instrument includes a distal jaws assembly detachable from a proximal handle assembly. The proximal handle assembly includes a centrally slotted shaft and a spool having a laterally seated cross block which passes through the central slot. The distal jaws assembly includes jaws mounted on a clevis at the distal end of a coil and coupled to a pull wire which extends through the coil to its proximal end. The proximal end of the coil is provided with a connecting sleeve provided with a frustoconical portion having double-helical threads for removably coupling the coil to a shaft having a distal frustoconical portion having double-helical threads. The proximal end of the pull wire is provided with a grooved mating member and the spool is provided with a locking assembly having a spring-biased push button latch for releasably engaging the grooved mating member. The grooved mating member has an elongate cylindrical distal portion, a central cylindrical portion having a relatively larger diameter, a proximal cylindrical grooved portion, and a proximal conical portion having a rounded apex. The elongate distal portion has a bore into which the pull wire is secured. The mating member end of the pull wire can be snapped into the locking assembly and the coil can be quickly and securely coupled to the shaft.



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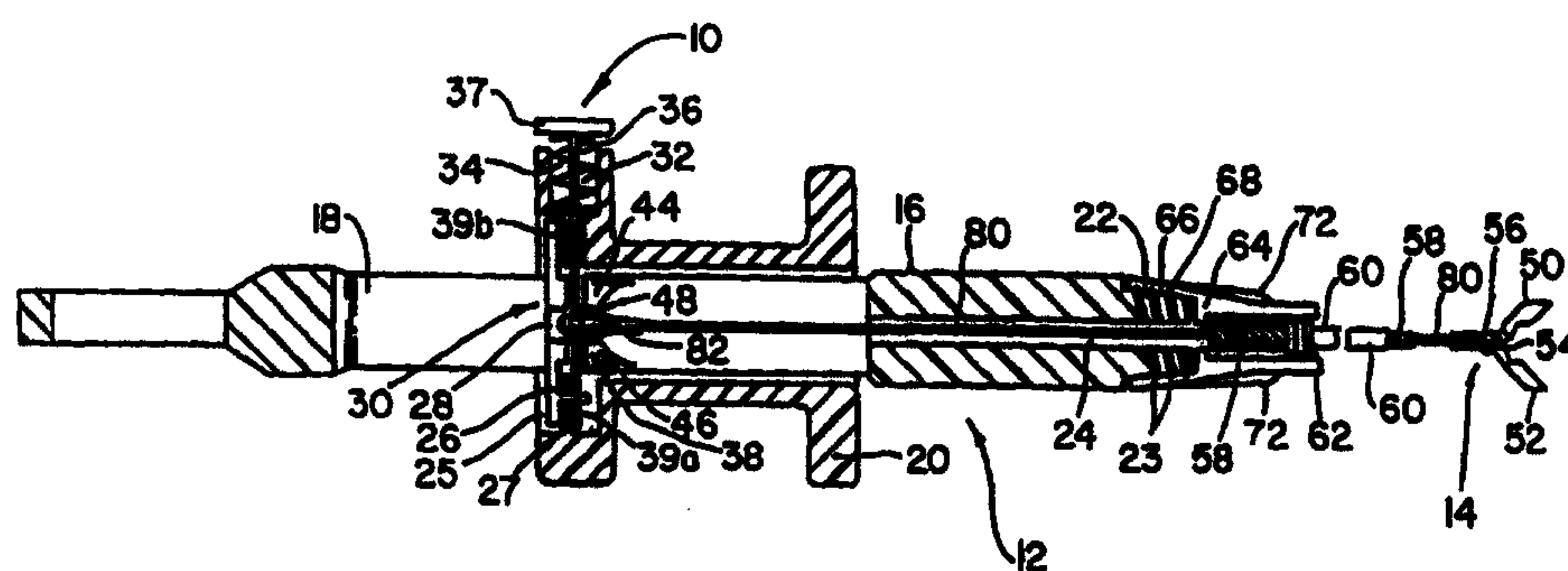
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(54) Title: BIOPSY FORCEPS HAVING DETACHABLE HANDLE AND DISTAL JAWS



## (57) Abstract

An endoscopic biopsy forceps instrument includes a distal jaws assembly detachable from a proximal handle assembly. The proximal handle assembly includes a centrally slotted shaft and a spool having a laterally seated cross block which passes through the central slot. The distal jaws assembly includes jaws mounted on a clevis at the distal end of a coil and coupled to a pull wire which extends through the coil to its proximal end. The proximal end of the coil is provided with a connecting sleeve provided with a frustoconical portion having double-helical threads for removably coupling the coil to a shaft having a distal frustoconical portion having double-helical threads. The proximal end of the pull wire is provided with a grooved mating member and the spool is provided with a locking assembly having a spring-biased push button latch for releasably engaging the grooved mating member. The grooved mating member has an elongate cylindrical distal portion, a central cylindrical portion having a relatively larger diameter, a proximal cylindrical grooved portion, and a proximal conical portion having a rounded apex. The elongate distal portion has a bore into which the pull wire is secured. The mating member end of the pull wire can be snapped into the locking assembly and the coil can be quickly and securely coupled to the shaft.



## BIOPSY FORCEPS HAVING DETACHABLE HANDLE AND DISTAL JAWS

This invention is related to co-owned U.S. Patent No. 5,454,378, entitled "Biopsy Forceps Having a Detachable Proximal Handle and Distal Jaws".

BACKGROUND OF THE INVENTIONField of the Invention

This invention relates broadly to surgical instruments. More particularly, this invention relates to endoscopic surgical instruments having detachable proximal handles.

State of the Art

Endoscopic surgery is widely practiced throughout the world today and its acceptance is growing rapidly. In general, endoscopic surgery involves the use of a camera or magnifying lens inserted through a tube, while a cutter, dissector, or other surgical instrument is inserted through another tube for purposes of manipulating and/or cutting an internal organ or tissue under view of the surgeon. In endoscopic biopsy procedures, typically, the camera is located in one lumen of a flexible endoscope while the biopsy cutter is placed through another lumen thereof. Most endoscopic instruments have similar configurations with a proximal handle, an actuation mechanism, and distal end effectors coupled by a flexible tube or coil through which the actuation mechanism extends. The end effectors take many forms such as grippers, cutters, forceps, dissectors and the like.

Initially, endoscopic surgical instruments were very expensive, partly because they must be very small but still durable and reliable and the materials and manufacturing methods necessary to provide these features are expensive. Recently, however, a number of "disposable" endoscopic instruments have been introduced and their use is now widely accepted. One of the advantages of disposable endoscopic instruments over reusable instruments is that because they are used only a single time, there are no sterilization problems,

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(i.e., no risk of cross-contamination between patients) and no concerns about the dulling or nicking of blades or wearing of parts. However, in order to justify disposing of instruments after a single use, the instruments have to be much less expensive than the reusable tools. In order to manufacture the instruments less expensively, the disposable instruments therefore use less expensive materials. As a result, the disposable instruments potentially are less durable than the reusable instruments. It is recognized, however, that the less durable components of the disposable instruments are most often parts of the distal end effectors and that the proximal handle portion of a disposable instrument is substantially as durable as the proximal handle portion of a reusable instrument. Moreover, the distal end effectors are not so fragile that they can only withstand a single use. Despite manufacturer's recommendations to the contrary, some surgeons will sterilize disposable instruments and reuse them a few times in order to reduce "per procedure costs". Ultimately, however, it is the distal portion of the instrument which wears or breaks and mandates disposal of the entire disposable instrument.

Among the disposable endoscopic instruments in use today are a number of different types of biopsy forceps devices. These devices most often include very sharp opposing jaws for grasping and tearing tissue for biopsy. The jaws are mated with one another about a clevis pin which is mounted in a clevis. The clevis extends into a housing which is crimped to the distal end of a relatively long flexible coil. The proximal end of the coil is coupled to a handle having means for articulating the jaws. The handle generally includes a central slotted shaft about which a spool is disposed. A pull wire from the jaws extends through the coil and is attached to the spool while the coil is attached to the central shaft of the handle. Movement of the spool relative to the central shaft moves the pull wire relative to the coil and thus articulates the jaws at the distal end of the coil. In use,

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the jaws and coil are inserted through a flexible endoscope which is already in place in the patient's body. The surgeon guides the coil and jaws to the biopsy site while a nurse holds the handle. When the surgeon has located the jaws at the appropriate place, the nurse is instructed to operate the handle to articulate the jaws and grasp a biopsy sample. At the conclusion of the biopsy procedure, the entire forceps apparatus is either disposed of or cleaned and sterilized for re-use.

The known endoscopic biopsy forceps devices of the art have the drawback that the jaws wear out long before the useful life of the handle has expired. Thus, the entire instrument must be discarded when it is only a small portion of the instrument which is inoperative.

An endoscopic biopsy forceps device with detachable proximal handle and distal portions is known and described in U.S. Patent No. 4,763,668 to Macek et al. It is a disadvantage of the Macek et al. detachable biopsy forceps device that attachment and detachment of the proximal and distal portions requires the screwing in and out of screws and an awkward rotation of a sleeve which makes the attachment and detachment procedures cumbersome.

Co-owned U.S. Patent No. 5,507,297 to Slater et al. discloses laparoscopic instruments having detachable proximal handle and distal portions. These instruments have a distal assembly insertable and removable from a proximal handle assembly in one step actions. The distal assembly includes a tube, end effectors coupled to the tube, and a push rod coupled to the end effectors and slidable through the tube. The proximal handle assembly includes a tube sleeve for receiving the tube, manually operable actuating means, and a latch for coupling the push rod to the actuating means. The tube sleeve is provided with a ball or blade lock for holding the tube securely in place and the tube is provided with a circumferential groove for engaging the ball or blade lock. The latch is spring loaded, hinged, and has an inclined

surface for quick coupling with the push rod and an unlatching surface which when biased by an unlatching member uncouples the push rod. The push rod is provided with a mating tip which engages the latch so that the manually operable actuating means causes reciprocal movement of the push rod within the tube to operate the end effectors. Coupling and uncoupling the proximal and distal assemblies is quick, one step, and substantially automatic. However, the coupling of the tube to the lock is complicated and expensive to manufacture.

Co-owned U.S. Patent No. 5,454,378 to Palmer et al. discloses endoscopic instruments also having one step coupling and uncoupling. The handle assembly of the instrument includes coupling devices for removably coupling the handle to a coil and to pull wires. The proximal end of the coil is provided with a mating sleeve having a circumferential groove, and the proximal ends of the pull wires are provided with a mating tip assembly. The handle assembly includes a central slotted shaft carrying a spool having a cross block which passes through the central slot of the shaft. The distal end of the shaft is provided with a spring biased latch for engaging the circumferential groove of the mating sleeve of the coil. The cross block of the spool is provided with a pair of spring biased sliders for engaging the mating tip assembly of the pull wires. The mating sleeve has a tapered proximal end so that when it is inserted into the distal end of the handle shaft, the biased latch is moved open until the sleeve is inserted to the point where the circumferential groove is engaged by the latch. The cross block is provided with an internally tapered guide and the mating tip assembly of the pull wires is tapered to be received and guided by the guide. The sliders have angled faces for receiving the mating tip and locking around it. The coil and pull wires are thus coupled to the handle in a single motion by inserting the proximal end of the coil and pull wires into the distal end of the handle shaft. The mating sleeve and mating tip assembly



automatically engage the latch and the sliders respectively and "snap" into place. During disengagement, the latch is operated by a push button at the distal end of the handle shaft. By pushing the push button, the latch releases the coil and the circumferential groove of the mating sleeve can be slid out of engagement with the latch by pulling the coil. Pulling the coil from the handle also pulls the pull wires which are coupled to the cross block containing the sliders, which in turn results in a pulling of the cross block of the spool. As the cross block moves proximally along the slotted shaft, a collar is engaged by a mechanism attached to the proximal end of the slotted shaft. The collar in turn engages angled extensions of the sliders, and forces the sliders apart, thereby releasing the mating tip assembly of the pull wires, and thus the handle from the distal assembly. While the instrument has proven effective in providing an endoscopic instrument having a handle separable from the distal assembly, the spool and shaft couplings each have a large number of parts and are expensive and complicated to manufacture. In addition, re-assembly of distal assembly into the handle requires precision alignment of the coil and pull wires relative to the spool and shaft couplings, which is time consuming.

In Europe, an endoscopic biopsy device having a detachable handle assembly is currently being marketed by Karl Schad. The device has a relatively simpler construction. The handle assembly includes a central slotted shaft carrying a spool having a cross block which passes through the central slot of the shaft and coupling devices for removably coupling the handle assembly to a coil and to a pull wire. The proximal end of the coil is provided with a substantially cylindrical connecting sleeve having internal threads and the distal end of the shaft is provided with external threads such that the connecting sleeve and the shaft are coupled together at their respective threads. The proximal end of the pull wire is provided with a mating tip assembly. The spool is

provided with a spring biased latch which engages the mating tip assembly. The mating tip assembly is engaged by depressing the latch, inserting the mating tip assembly into a hole provided in the latch, and releasing the latch. While the Karl Schad device presents a viable method of constructing an endoscopic instrument having detachable handle and distal assemblies, the device is not ideal. In order to couple the handle assembly to the pull wire and to the coil, a cumbersome two step operation is required. First, the spring biased latch must be depressed in order to receive the mating tip assembly and released to engage the mating tip assembly. This is an inconvenient manner of coupling the pull wire to the spool. Next, the connecting sleeve must be inserted over the shaft and rotated many times relative to the shaft so that a secure threaded coupling is accomplished between the connecting sleeve and the shaft. This coupling method is time consuming.

It is therefore desirable to provide an endoscopic biopsy forceps device where the proximal handle and the distal jaws are easily separable from each other so that the jaws may be discarded without disposing of the handle.

It is also desirable to provide an endoscopic biopsy forceps device where the proximal handle and the distal jaws are easily attachable to each other so that the handle may be re-used with a new set of jaws.

It is also desirable to provide an endoscopic biopsy forceps device where the proximal handle and the distal jaws of the device are quickly attachable.

It is also desirable to provide an endoscopic biopsy forceps device where the proximal handle and distal jaws of the device are easily alignable for attachment.



It is also desirable to provide an endoscopic biopsy forceps device which has a detachable proximal handle and distal jaws which is inexpensive and easy to manufacture.

#### SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided an endoscopic biopsy forceps instrument, comprising a tubular member having a proximal end and a distal end, the proximal end having a threaded connecting member, the threaded connecting member including one of a male and a female frustoconical threaded portion; a control member extending through the tubular member; a shaft member having a proximal end and a distal end, the distal end including an other of a male and a female frustoconical portions; a sliding member slidably mounted on the shaft member, the sliding member provided with means for detachably coupling to the control member; and an end effector coupled to the distal ends of the control member and tubular member such that movement of the sliding member relative to the shaft member moves the end effector from an open position to a closed position, wherein the male and female frustoconical threaded portions have double helical threads, wherein threading the threaded connecting member to the distal end of the shaft member couples the tubular member to the shaft member.

According to another aspect of the invention there is provided An endoscopic biopsy forceps instrument, comprising a tubular member having a proximal end and a distal end, the proximal end having a threaded connecting member, the threaded connecting member having one of a male and a female frustoconical double helically threaded portion and a throughbore; a control member extending through the tubular

member; a shaft member having a proximal end, a distal end, a central slot and a bore extending from the central slot through the distal end, the distal end having another of a male and a female frustoconical double helically threaded portion; a sliding member slidably mounted on the shaft member, the sliding member provided with means for detachably coupling to the control member; and an end effector coupled to the distal ends of the control member and tubular member such that movement of the sliding member relative to the shaft member moves the end effector from an open position to a closed position, wherein threading the threaded connecting member to the distal end of the shaft member couples the tubular member to the shaft member.

A biopsy forceps can be provided which includes a proximal handle assembly and a distal jaws assembly. The proximal handle assembly includes a centrally slotted shaft provided with a distal portion having double-helical threads, and a spool having a laterally seated cross block which passes through the central slot. The spool is provided with a locking assembly having a spring-biased push button latch. The distal jaws assembly has a pair of jaws mounted on a clevis at the distal end of a coil and coupled to a pull wire which extends through the coil to its proximal end. The proximal end of the coil is provided with a sleeve having double-helical threads. The proximal end of the pull wire is provided with a grooved mating member which has an elongate cylindrical distal portion coupled to the pull wire, a frustoconical portion, a cylindrical central portion having a relatively larger diameter, a cylindrical proximal grooved portion, and a conical proximal portion having a rounded apex.

In assembling the biopsy forceps the mating member on the pull wire can be inserted into the locking assembly, such that the spring-biased push button latch automatically engages the grooved portion of the mating member thereby coupling the pull wire to the spool. The



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threaded connecting sleeve on the coil is then coupled to the distal portion of the shaft by engaging the two and turning the sleeve one half turn. The proximal handle and distal jaw assemblies are detached from one another by unthreading the threaded connecting sleeve from the shaft and depressing the push button spring-biased latch.

Internal double helical threads on the connecting sleeve can be provided, as can external threads double helical threads at the shaft tip. In addition the threaded portion at the shaft tip can be frustoconical in shape and the internally threaded portion of the sleeve may have a frustoconical opening for receiving the shaft tip.

Additional objects and advantages of the invention will become apparent to those skilled in the art upon reference to the detailed description taken in conjunction with the provided figures.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a broken side elevation view in partial section of a biopsy forceps instrument according to the invention;

Figure 2 is a broken exploded perspective view of the proximal portion of the biopsy forceps instrument of Figure 1;

Figure 3 is side elevation in partial view of a spool of the biopsy forceps instrument of Figures 1 and 2;

Figure 4 is a transparent perspective view of the spool of Figure 3;

Figure 5 is an enlarged side elevation view of a push button latch of the biopsy forceps instrument of Figures 1 and 2;

Figure 6 is an enlarged transparent side elevation view of a threaded connecting sleeve of the biopsy forceps instrument of Figures 1 and 2;

Figure 7 is a proximal end view of the threaded connecting sleeve of Figure 3;

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Figure 8 is a distal end view of the threaded connecting sleeve of Figure 3;

Figure 9 is an enlarged side elevation view of the grooved mating member of the biopsy forceps instrument of the invention;

Figure 10 is a transparent perspective view of the grooved mating member of Figure 6;

Figures 11-13 are broken side elevation views in partial section of various stages of engagement of the assembly of the grooved mating member with the locking assembly; and



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Figure 14 is a broken-side elevation view in partial section of a second embodiment of the coil to the shaft mating portion of the biopsy forceps instrument of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to Figures 1 through 4, a biopsy forceps instrument 10 according to the invention generally includes a proximal handle assembly 12 and an end effector, which, in the illustrated embodiments, is a distal jaw assembly 14. The proximal handle assembly 12 includes a shaft 16 having a central slot 18 and a spool 20 slidable on the shaft 16. The distal end of the shaft 16 is provided with a frustoconical shaft tip 22 having external double-helical threads 23 and a throughbore 24. The spool 20 is provided with a cross block 26 having a distal nub 27 and a central hole 28. The cross block 26 is seated in a channel 25 in the proximal portion of the spool 20 and passes through the central slot 18 of the shaft 16. The nub 27 of the cross block 26 locks into a hole 29 in the floor of the channel 25 and extends into a latch receptacle, described below. The central hole 28 is sized to permit the proximal end of a mating member, described below, to enter therein.

Referring to Figures 1 through 5, the proximal end of the spool 20 is provided with a locking assembly 30 having a radially extending latch receptacle 32, a spring 34, and a push button latch 36. As seen best in Figure 3, the latch receptacle 32 includes a cylindrical portion 32a and a channel portion 32b. The spring 34 is seated in the cylindrical portion 32a of the latch receptacle 32 and the latch 36 extends through the spring and into the channel portion 32b. As seen best in Figure 4, the latch 36 includes a head 37, a distal side 39a, a proximal side 39b, a catch hole 40, and an interlock hole 42. The catch hole 40 is large enough to receive a mating member located on the pull wire, as described below, and preferably is provided with an approximately 600 chamfer around the catch hole 40 on the distal side 39a. The

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chamfer 41 facilitates movement of the mating member through the catch hole. The nub 27 on the cross block 26 extends

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through the interlock hole 42. The interlock hole 42 is larger than the nub 27, thereby permitting the latch 36 to move within the receptacle 32 relative to the nub 27. In addition, extension of the nub 27 through the interlock hole 42 prevents the latch 36 from being released from the receptacle 32. The spring 34 abuts the head 37 of the latch and biases the latch 36 in the receptacle 32 such that the catch hole 40 is in a partially overlapping alignment with a guide hole, as described below. Turning back to Figures 1, 2, and 3, the spool 20 is also provided with a guide 38 which has laterally and distally extending portions 44, 46 which taper to a guide hole 48. The guide 38 is located in the spool 20 distal of the latch 36 and guides a mating member on the pull wire into engagement with the latch 36 as described hereinafter.

As seen in Figure 1, the distal jaw assembly 14 includes a pair of sharp opposing jaws 50, 52 for grasping and tearing tissue for a biopsy sample. The jaws 50, 52 are preferably arranged about a clevis pin 54 which is mounted in a clevis 56 at the distal end of a relatively long flexible coil 58. The coil 58 is preferably covered in a substantially smooth wrap 60 which preferably has at its proximal end a plurality of barbs 62. As seen in Figures 1 and 2 and 6 through 8, a threaded connecting sleeve 64 having a frustoconical proximal opening 66 and internal threads 68 in a double-helical configuration is provided at the proximal end of the coil 58. The threaded connecting sleeve 64 is preferably provided with several internal distal ridges 70 which engage the barbs 62 during manufacture, and is also provided with a plurality of longitudinal external gripping ridges 72 and depressions 74 to facilitate twisting the threaded connecting sleeve 64 onto the threaded frustoconical tip 22 of the shaft 16.

A control member, which, in the illustrated embodiments, is a pull wire 80 is coupled at its distal end to the jaws 50, 52 and extends through the coil 58, the threaded connecting

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sleeve 64, the throughbore 24 of the shaft 16, and exits into the slot 18. A mating member 82 is

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provided at the proximal end of the pull wire 80. Referring to Figures 9 and 10, the mating member 82 generally has an elongate cylindrical distal portion 84, a frustoconical portion 85, a cylindrical central portion 86 having a relatively larger diameter, a cylindrical proximal grooved portion 88, and a conical proximal portion 90 preferably having a rounded apex 92. The elongate distal portion 84 has a bore 94 which receives the pull wire 80 so that the pull wire can be secured in the mating member by crimping. Preferably the distal portion 84 and the grooved portion 88 of the mating member have substantially the same outer diameter. The conical portion 90 tapers towards the apex 92 at an angle  $\alpha$  relative to a longitudinal axis of the mating member, wherein the angle  $\alpha$  is preferably approximately between 15°-25°. It is also preferable that the frustoconical portion 85 tapers towards the distal portion 84 at angle  $\alpha$  relative to the longitudinal axis of the mating member. In order to facilitate insertion and removal of the mating member into the locking assembly, as described below, it is also preferable that the proximal rim 86a of the cylindrical portion 86 and the distal rim 90a of the conical portion be beveled.

Turning to Figures 11 through 13, the latch 36 in the spool and the mating member 82 on the pull wire 80 are arranged such that the pull wire 80 is coupled to the spool 20 in a single motion. In particular, the mating member end of the pull wire 80 is inserted through the guide hole 48 so that the mating member 82 engages the latch 36 at the catch hole 40 (Figure 11) and enters the catch hole and causes the latch to ride up the conical portion 90 of the mating member (Figure 12). As the mating member is further inserted through the catch hole, the grooved portion 88 of the mating member intersects the latch, such that the latch engages the grooved portion and secures the mating member (Figure 13).

After the pull wire 80 is coupled to the spool 20, the threaded connecting sleeve 64 at the proximal end of the coil 58 is easily connected to the shaft 16 by moving the

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threaded connecting sleeve onto the shaft tip 22 and applying a simple twisting motion. It will be appreciated that the frustoconical shapes of both the shaft tip 22 and the proximal opening 66 of the threaded connecting sleeve allow the threaded connecting sleeve to be substantially placed over the shaft tip prior to any twisting motion, thereby enabling a rapid coupling. The combination of the frustoconical shapes and the double helical threads permit a coupling of the coil 58 to the shaft 16 using only one half a turn of the connection sleeve 64 relative to the shaft.

It will also be appreciated that the distal assembly can easily be removed from proximal handle. The connecting sleeve is first rotated relative to the shaft to release the coil from the shaft. The pull wire 80 is then uncoupled from the spool 20 by depressing the latch 36 until the latch releases the grooved portion 88 of the mating member 82. The mating member can then be pulled through the catch hole 40 and the guide hole 48 to release the pull wire from the spool. The proximal handle can then be reused with another distal assembly.

Turning to Figure 14, a second embodiment of a biopsy forceps instrument, substantially similar to the biopsy forceps instrument of the first embodiment (with like parts indicated by numbers incremented by 100), is shown. A shaft 116 is provided having a frustoconical distal opening 195 and further having internal double-helical threads 196 and a throughbore 124. A threaded connecting sleeve 164 is provided at the proximal end of a shrink-wrap 160 covered coil 158. The threaded connecting sleeve 164 has a frustoconical proximal end 197 and external threads 198 in a double-helical configuration. The threaded connecting sleeve 164 is preferably provided with several internal ridges 170 for engaging barbs 162 of the shrink-wrapped coil, and is also preferably provided with a plurality of longitudinal gripping ridges 172 and depressions to facilitate gripping by the practitioner. The threaded connecting sleeve 164 can be



connected to the shaft 116 by inserting the connector into the distal opening 195 of the shaft and by applying a simple twisting motion, such that the threaded connecting sleeve is rotated one half turn relative to the shaft. A pull wire 180 extends through the coil 158, the threaded connecting sleeve 164, the throughbore 124, and exits into the slot of the shaft where a mating member at the proximal end of the pull wire is engaged by a locking assembly provided in a spool on the shaft.

There have been described and illustrated herein embodiments of an endoscopic biopsy forceps instrument having a distal jaw assembly detachable from the proximal handle assembly. While particular embodiments of the invention have been described, it is not intended that the invention be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while a particular preferred shapes and angles have been disclosed for the mating member, it will be appreciated that other shapes and angles could also suffice. Furthermore, while the threaded connecting sleeve and shaft tip have been disclosed to have both frustoconical mating portions and double helical threads, it will be understood frustoconical mating portions and double helical threads can be used separately. Also, while crimping has been disclosed for coupling the pull wire to the mating member, it will be appreciated that soldering, welding, or gluing may also be used. Moreover, while the guide has been shown to have laterally and distally extending guide portions, it will be appreciated that the guide may also take the form of a rounded funnel. Furthermore, while the latch has been shown to be coupled to the cross block at the nub, it will be understood that other latch to cross block couplings can be similarly used. Moreover, while the end effectors have been shown to be forceps jaws, it will be appreciated that other end effectors may also be used, e.g., grippers, cutters, dissectors, and scissors. In addition, while one pull wire is

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disclosed to be connected to the distal jaws and to the mating member, it will be appreciated that two pull wires may also be used and similarly coupled. It will therefore be appreciated by those skilled in the art that yet other modifications could be made to the provided invention without deviating from its spirit and scope as so claimed.



## WE CLAIM:

1. An endoscopic biopsy forceps instrument, comprising:
  - a tubular member having a proximal end and a distal end, said proximal end having a threaded connecting member, said threaded connecting member including one of a male and a female frustoconical threaded portion;
  - a control member extending through said tubular member;
  - a shaft member having a proximal end and a distal end, said distal end including an other of a male and a female frustoconical portions;
  - a sliding member slidably mounted on said shaft member, said sliding member provided with means for detachably coupling to said control member; and
  - an end effector coupled to said distal ends of said control member and tubular member such that movement of said sliding member relative to said shaft member moves said end effector from an open position to a closed position,
  - wherein said male and female frustoconical threaded portions have double helical threads,
  - wherein threading said threaded connecting member to said distal end of said shaft member couples said tubular member to said shaft member.
2. The biopsy forceps instrument according to claim 1, wherein:
  - said threaded connecting member has a distal end ~~has~~ having at least one internal ridge, and said tubular member has at least one barb for interlocking with said internal ridge to secure said threaded connecting member to said tubular member.
3. The biopsy forceps instrument according to claim 2, wherein:
  - said threaded connecting member has at least one of a plurality of external ridges and external grooves.

4. The biopsy forceps instrument according to claims 1, 2 or 3 wherein:  
said means for detachably coupling said control member to said sliding member includes a mating member provided at said proximal end of said control member and a locking means provided in said sliding member.
5. The biopsy forceps instrument according to claim 4, wherein:  
unthreading said threaded connecting member from said distal end of said shaft member uncouples said tubular member from said shaft member, and said locking means is spring biased and movement of said locking means against said bias uncouples said mating member from said locking means.
6. The biopsy forceps instrument according to claim 5, wherein:  
said mating member has an elongate distal portion, a substantially cylindrical central portion having a relatively larger diameter, a substantially conical proximal portion, and a grooved portion between said central portion and said proximal portion, and said mating member defines a longitudinal axis.
7. The biopsy forceps instrument to claim 6, wherein:  
said proximal conical portion tapers at an angle of approximately  $15^{\circ}$  -  $25^{\circ}$  toward said longitudinal axis.
8. The biopsy forceps instrument according to claim 7, wherein:  
said proximal conical portion has a rounded apex.
9. The biopsy forceps instrument according to claim 6, wherein:  
said mating member is further provided with a frustoconical portion between said distal portion and said central portion.
10. The biopsy forceps instrument according to claim 9, wherein:  
said frustoconical portion tapers toward said distal portion at an angle approximately  $15^{\circ}$  -  $25^{\circ}$  relative to said longitudinal axis.



11. The biopsy forceps instrument according to any one of claims 4, 5, 6, 7, 8, 9 or 10 wherein:

said locking means includes

- i) a latch receptacle in said sliding member,
- ii) a latch seated in said latch receptacle and defining a catch hole adapted to receive said mating member,
- iii) a spring seated in said latch receptacle and biasing said latch radially outward, and
- iv) a guide hole for guiding said mating member generally toward said catch hole ,

wherein said catch hole and said guide hole partially overlap.

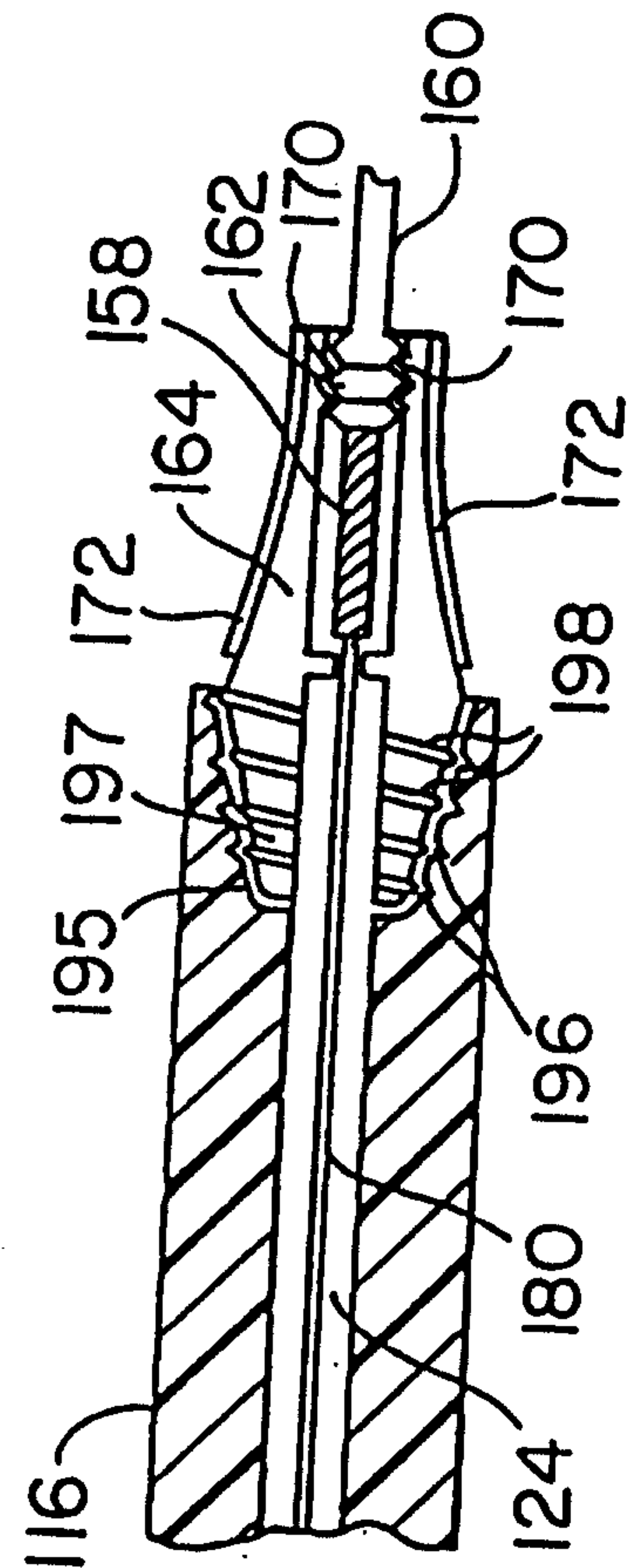
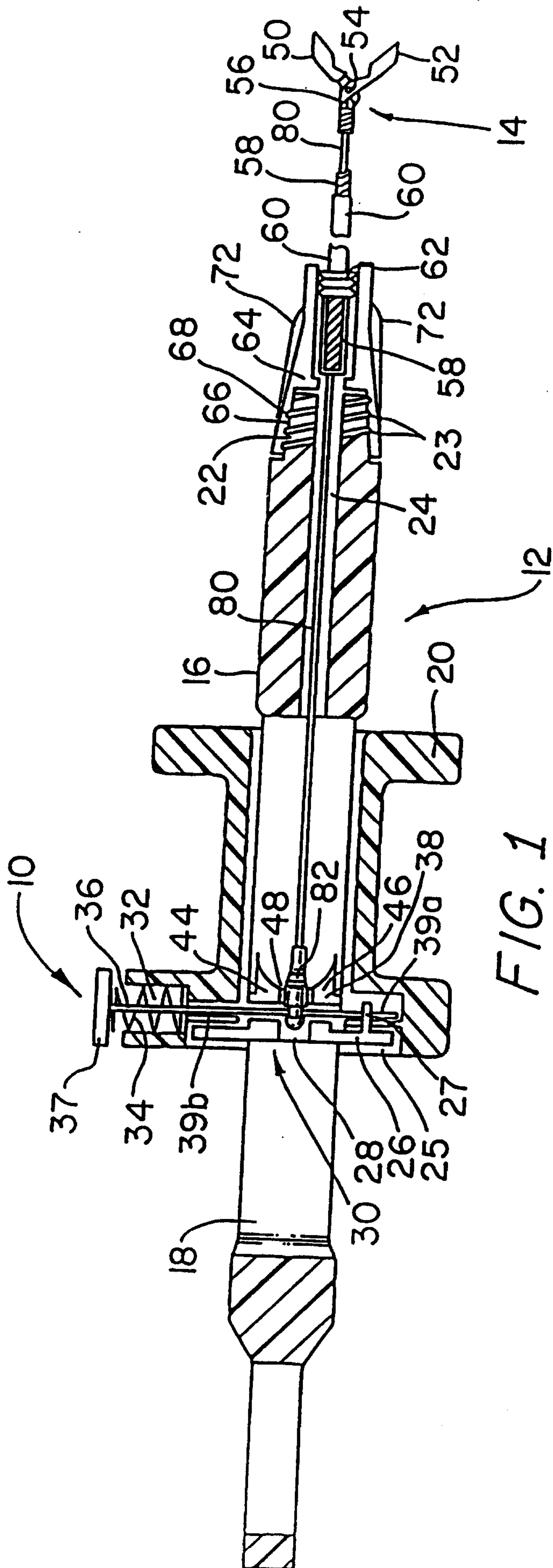
12. An endoscopic biopsy forceps instrument, comprising:

- a) a tubular member having a proximal end and a distal end, said proximal end having a threaded connecting member, said threaded connecting member having one of a male and a female frustoconical double helically threaded portion and a throughbore;
- b) a control member extending through said tubular member;
- c) a shaft member having a proximal end, a distal end, a central slot and a bore extending from said central slot through said distal end, said distal end having another of a male and a female frustoconical double helically threaded portion;
- d) a sliding member slidably mounted on said shaft member, said sliding member provided with means for detachably coupling to said control member; and
- e) an end effector coupled to said distal ends of said control member and tubular member such that movement of said sliding member relative to said shaft member moves said end effector from an open position to a closed position, wherein threading said threaded connecting member to said distal end of said shaft member couples said tubular member to said shaft member.

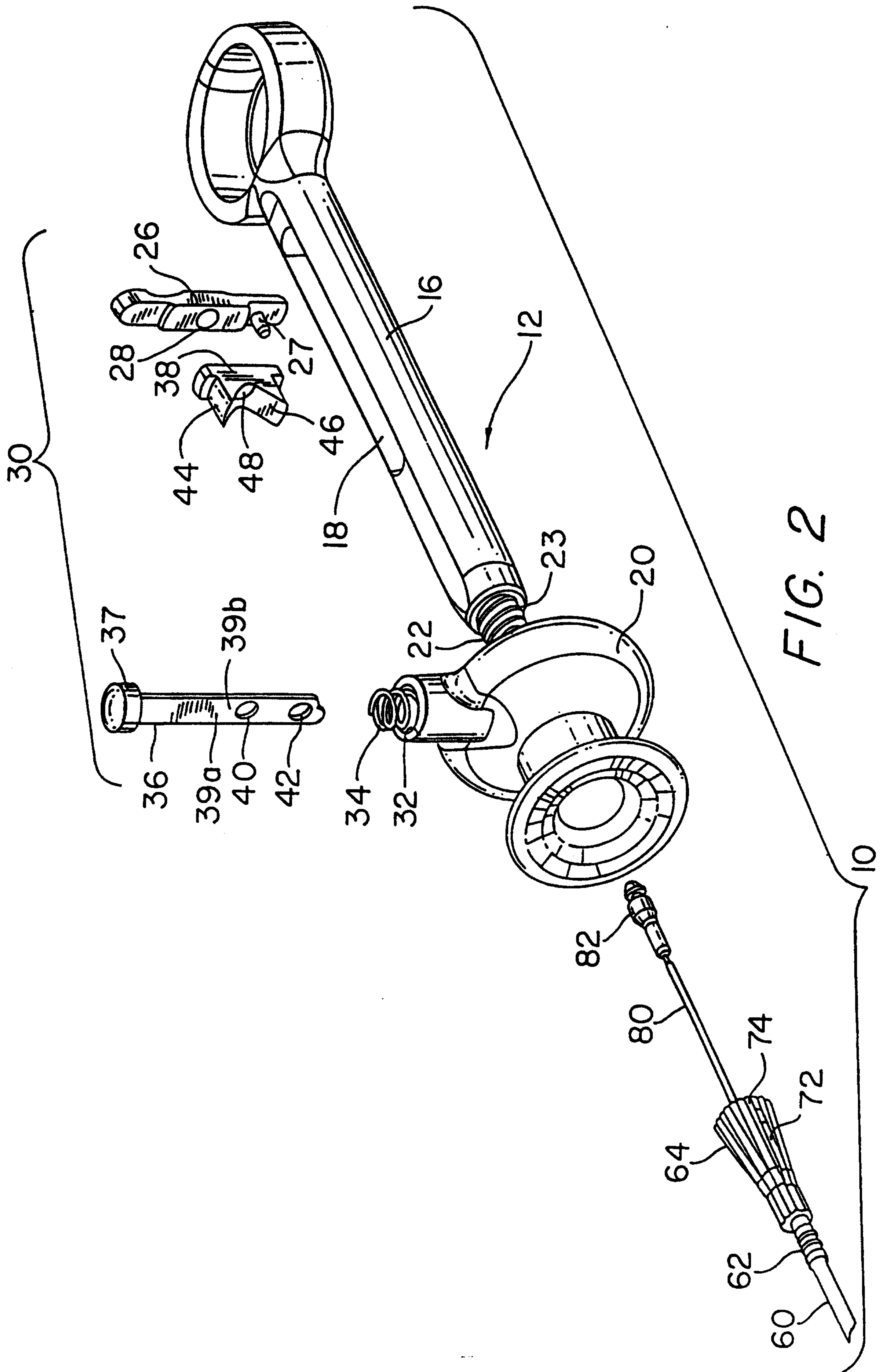
13. A biopsy forceps instrument according to claim 12, wherein:  
said threaded connecting member has a distal end having at least one internal ridge, and said tubular member has at least one barb for interlocking with said internal ridge to secure said threaded connecting member to said tubular member.
14. A biopsy forceps instrument according to claim 13, wherein:  
said threaded connecting member has at least one of a plurality of external ridges and external grooves.
15. A biopsy forceps instrument according to any one of claims 12 - 13, wherein:  
said means for detachably coupling said control member to said spool member includes a mating member provided at said proximal end of said control member and a locking means provided in said spool.
16. A biopsy forceps instrument according to claim 15, wherein:  
unthreading said threaded connecting member from said distal end of said shaft member uncouples said tubular member from said shaft member, and said locking means is spring biased and movement of said locking means against said bias uncouples said mating member from said locking means.
17. A biopsy forceps instrument according to claim 16, wherein:  
said mating member has an elongate distal portion, a substantially cylindrical central portion having a relatively larger diameter, a substantially conical proximal portion, and a grooved portion between said central portion and said proximal portion, and said mating member defines a longitudinal axis.
18. A biopsy forceps instrument according to claim 17, wherein:  
said proximal conical portion tapers at an angle of approximately  $15^{\circ}$  -  $25^{\circ}$  toward said longitudinal axis.



19. A biopsy forceps instrument according to claim 18, wherein:  
said proximal conical portion has a rounded apex.
20. A biopsy forceps instrument according to any one of claims 17, 18 or 19 wherein:  
said mating member is further provided with a frustoconical portion between  
said distal portion and said central portion.
21. A biopsy forceps instrument according to claim 20, wherein:  
said frustoconical portion tapers toward said distal portion at an angle  
approximately 15° 25° relative to said longitudinal axis.
22. A biopsy forceps instrument according to any one of claims 15, 16, 17, 18, 19, 20 or  
21 wherein:  
said locking means includes
  - i) a latch receptacle in said sliding member,
  - ii) a latch seated in said latch receptacle and defining a catch hole  
adapted to receive said mating member,
  - iii) a spring seated in said latch receptacle and biasing said latch  
radially outward, and
  - iv) a guide means for guiding said mating member generally toward  
said catch hole, wherein said catch hole and said guide hole  
partially overlap.







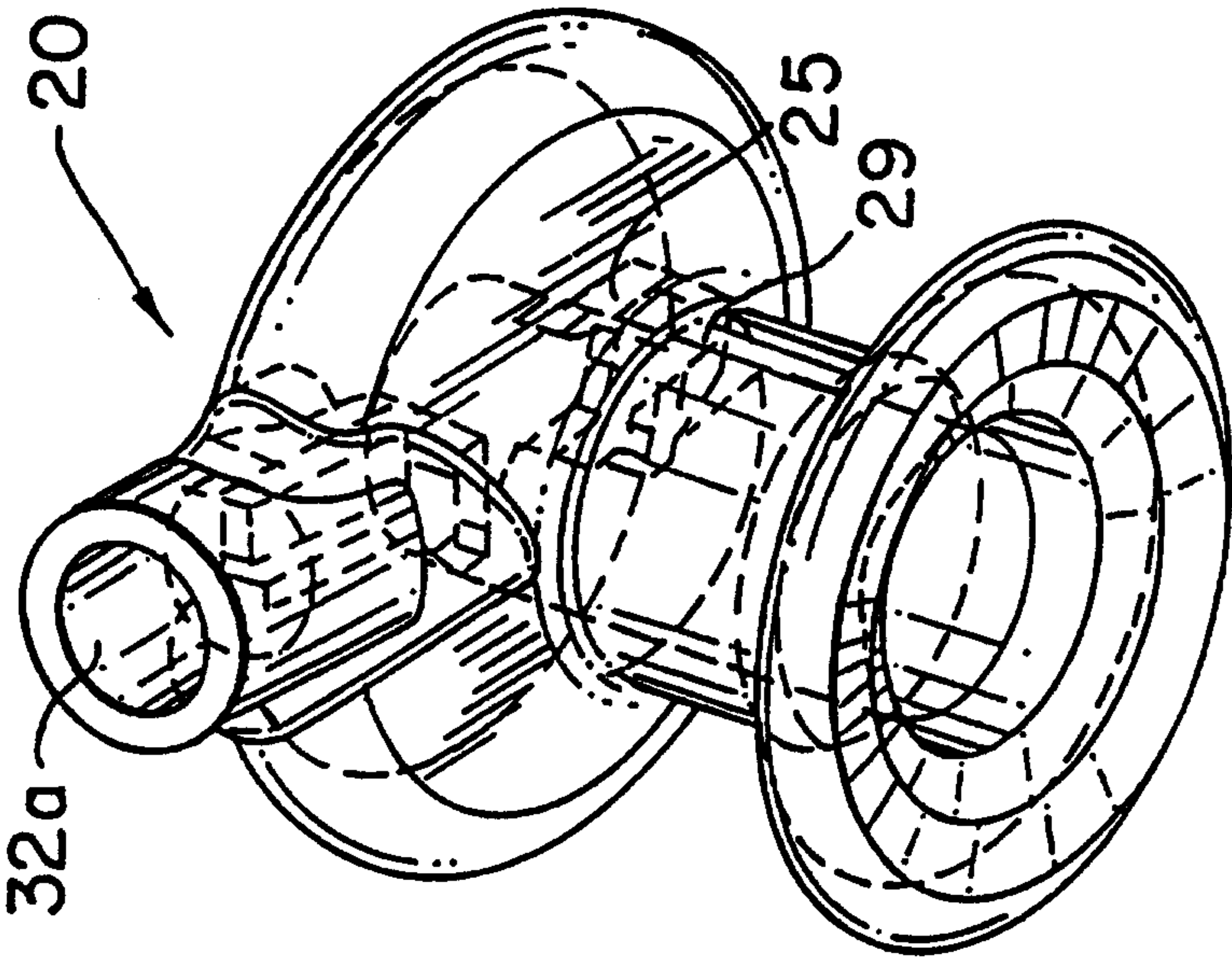


FIG. 4

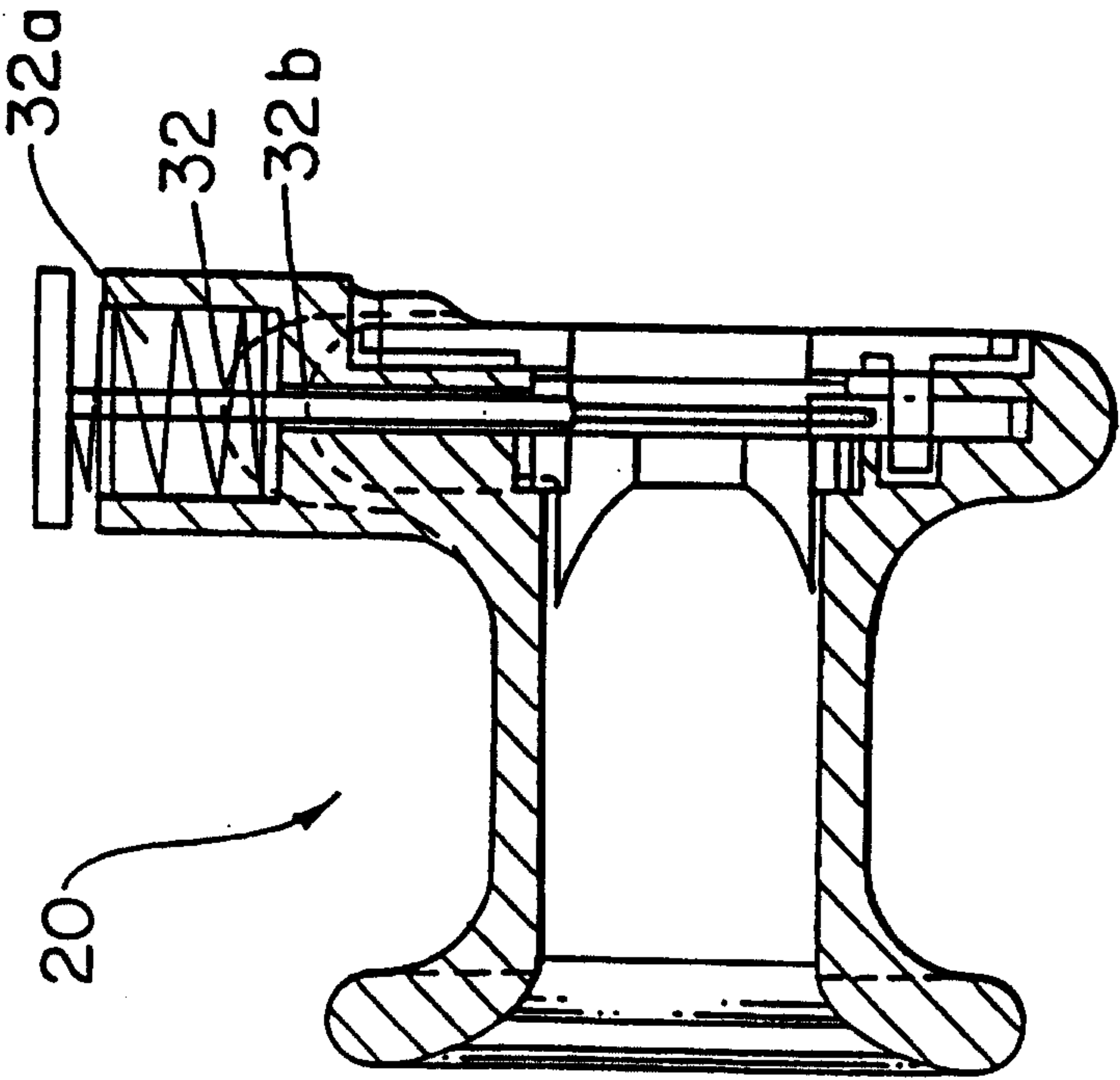


FIG. 3

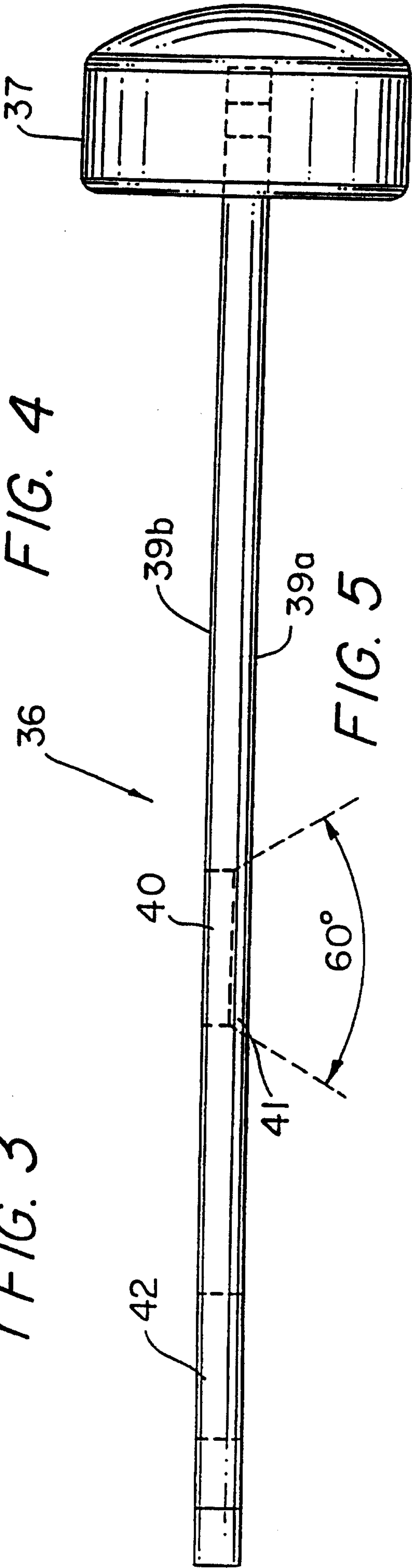
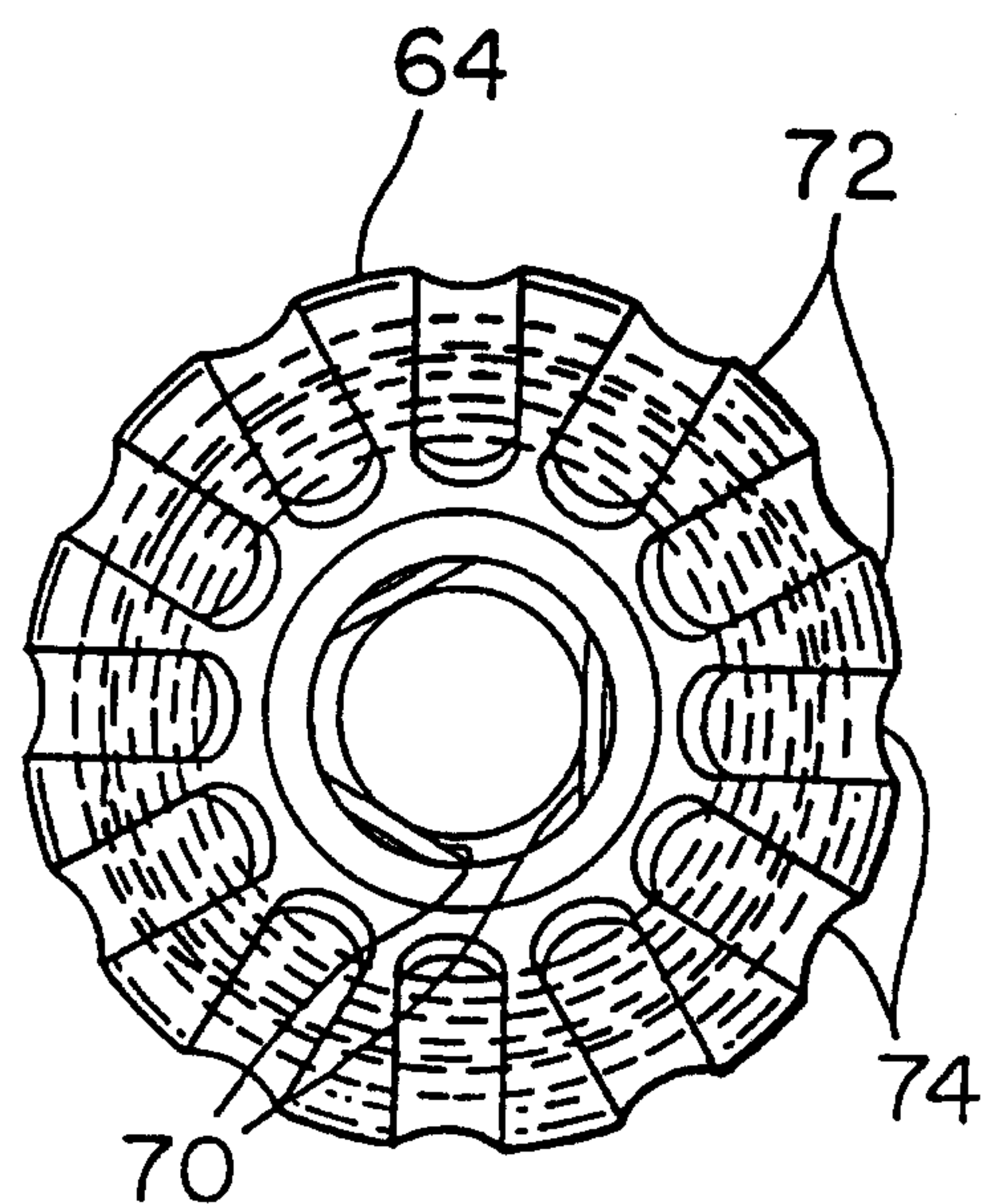
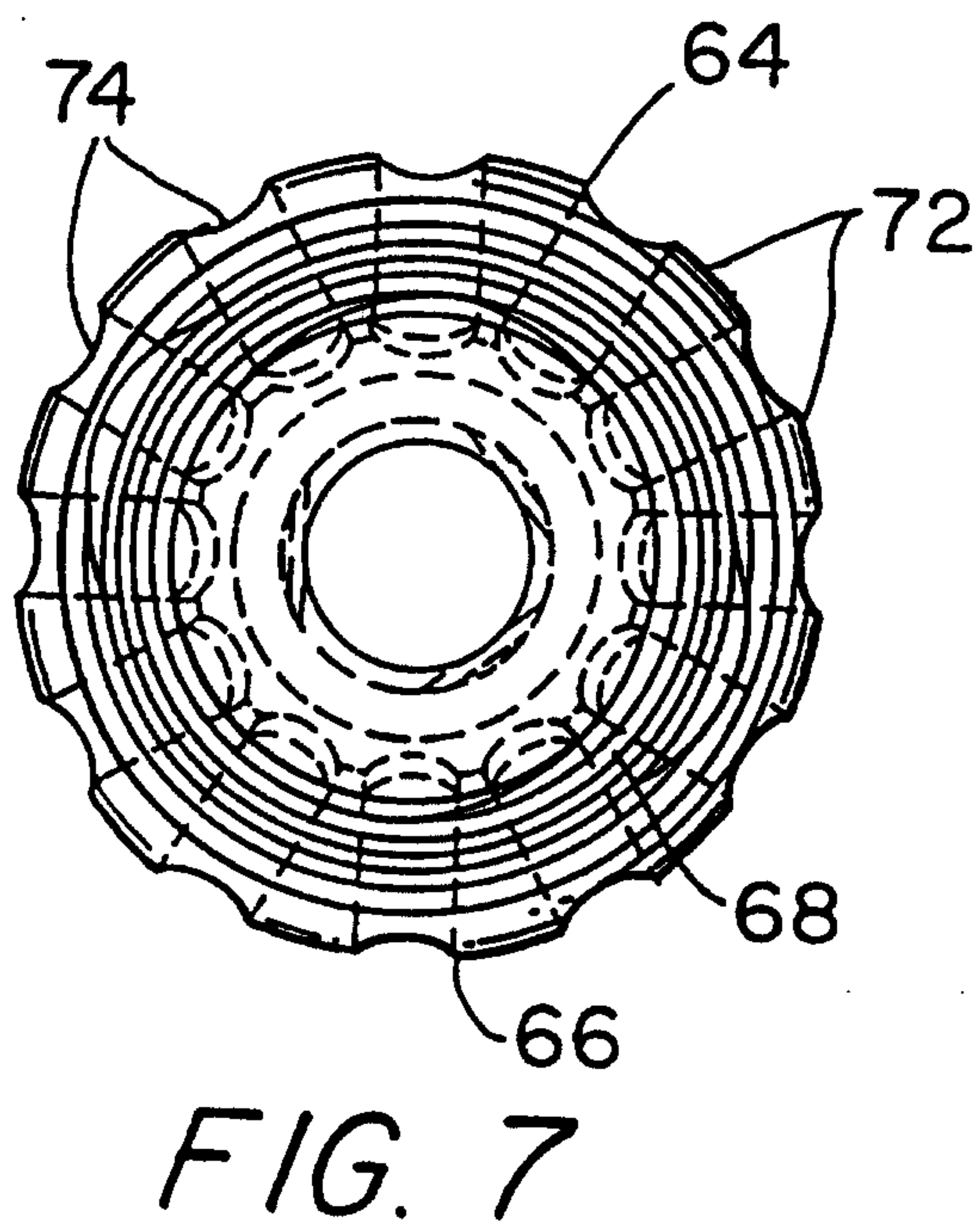
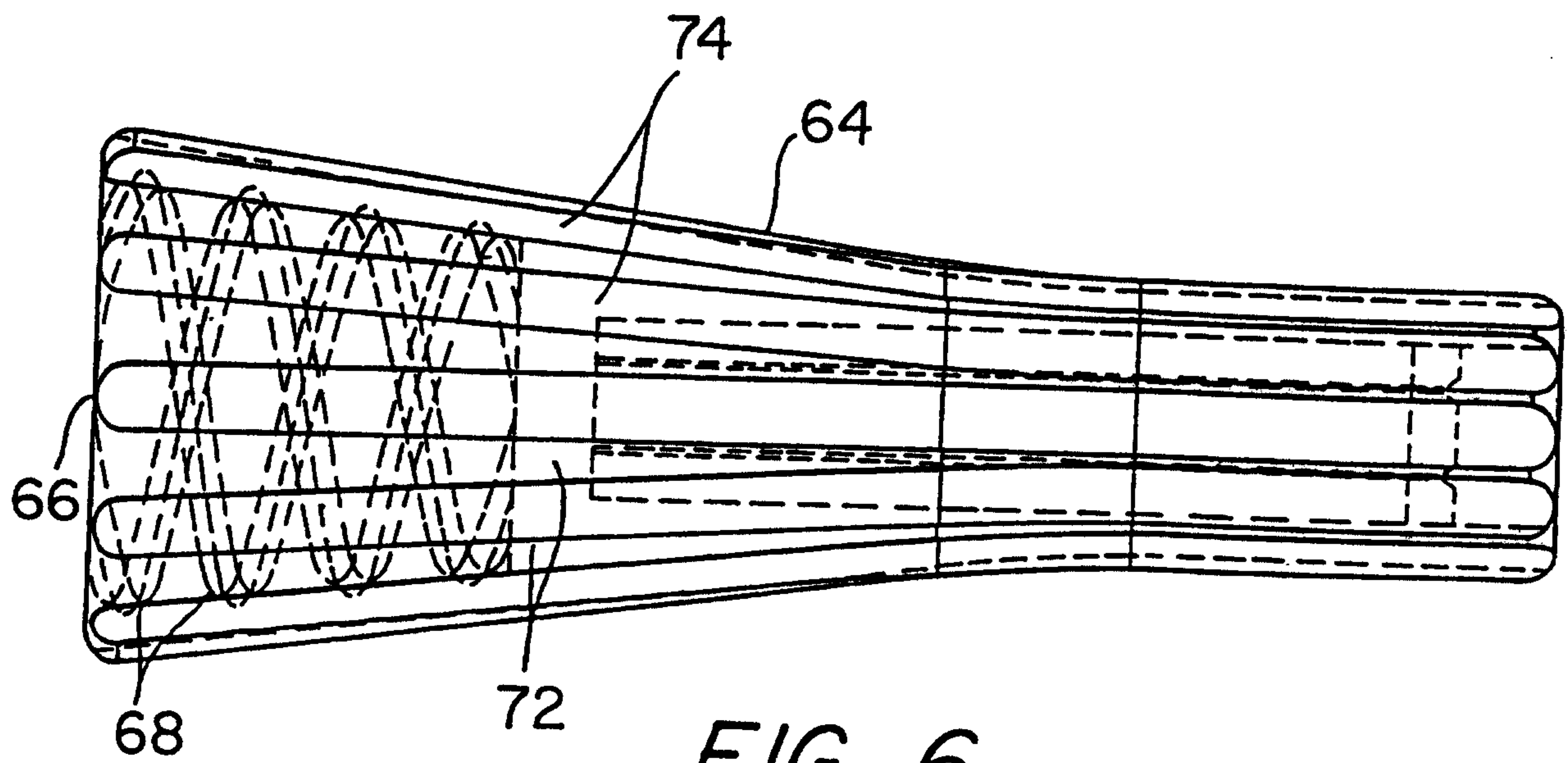


FIG. 5



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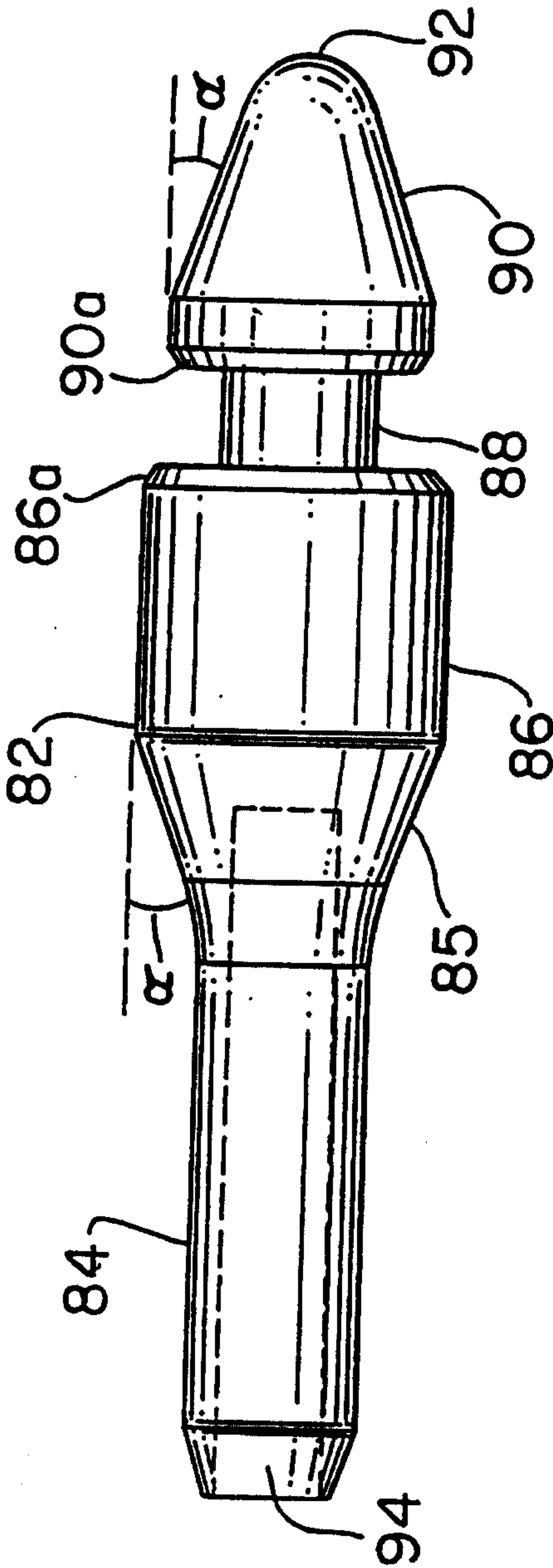


FIG. 9

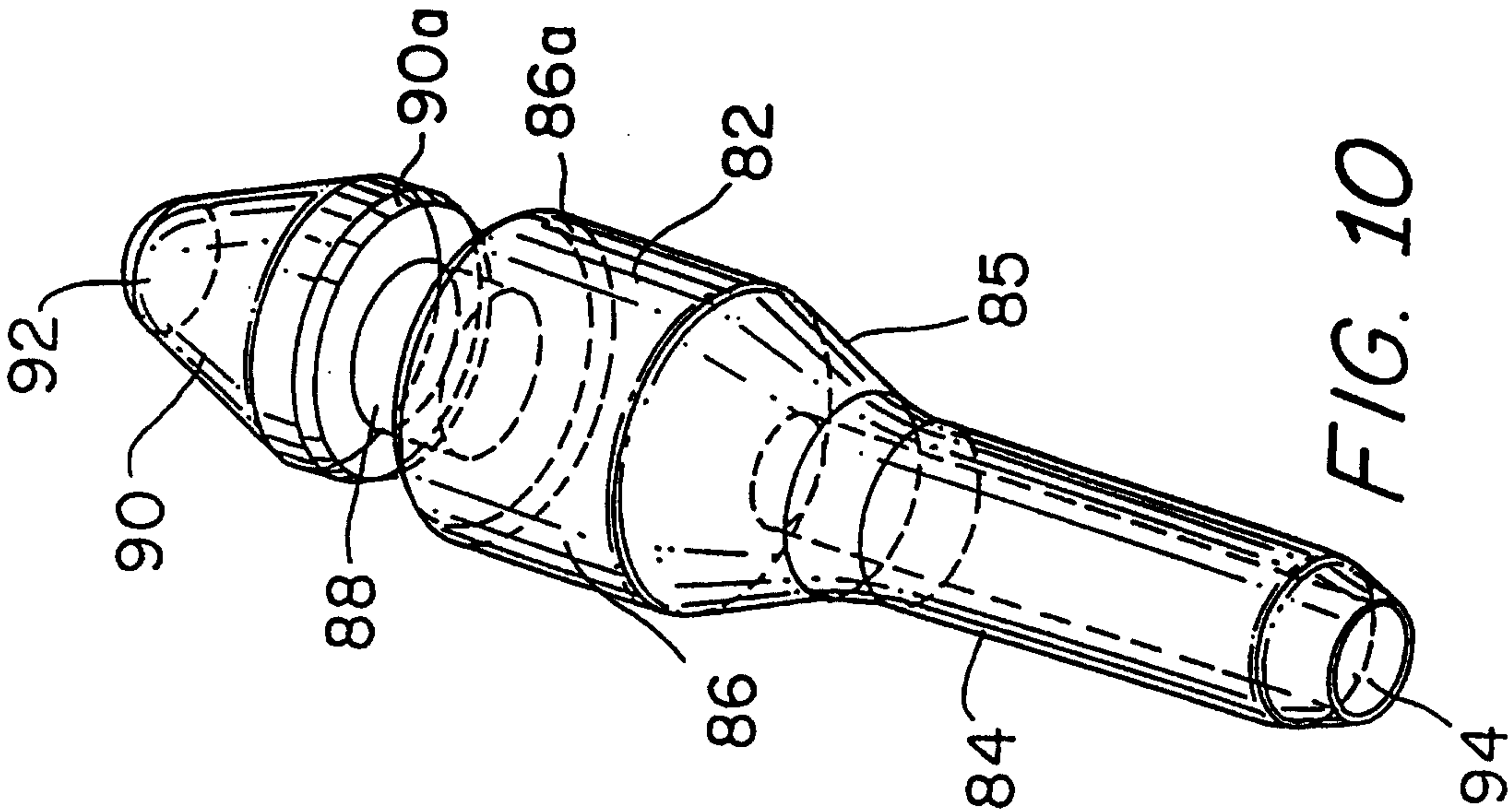


FIG. 10



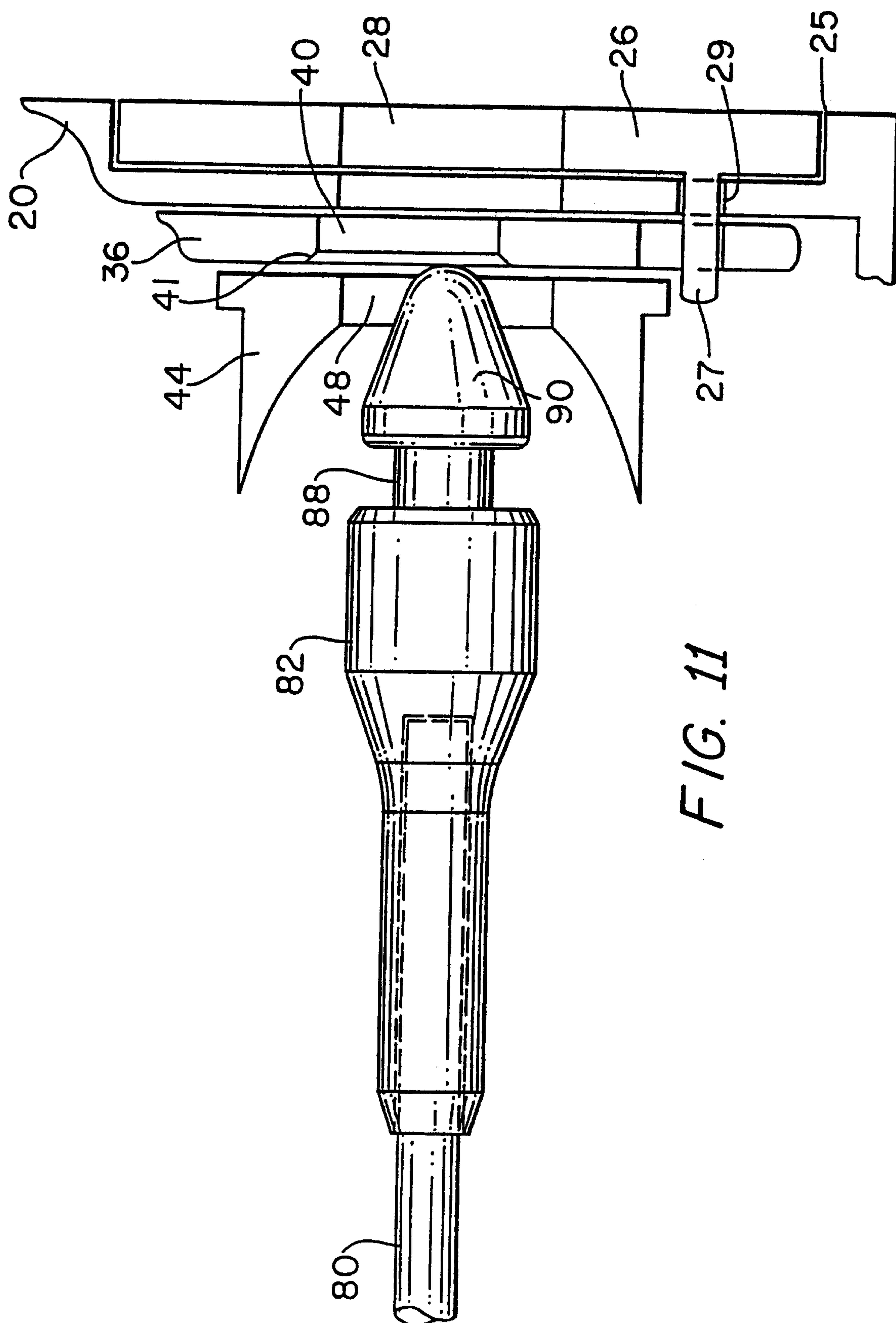
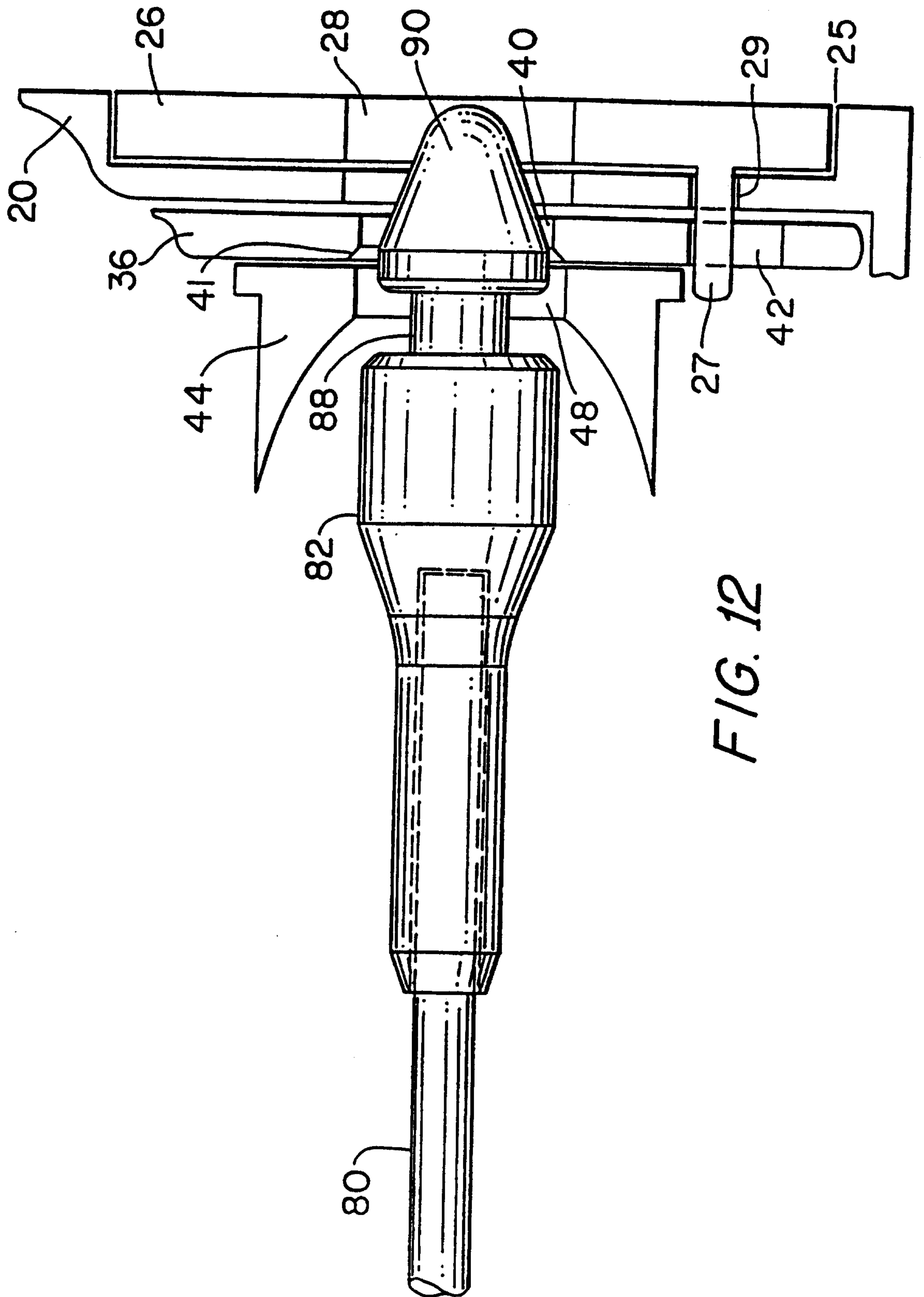


FIG. 11





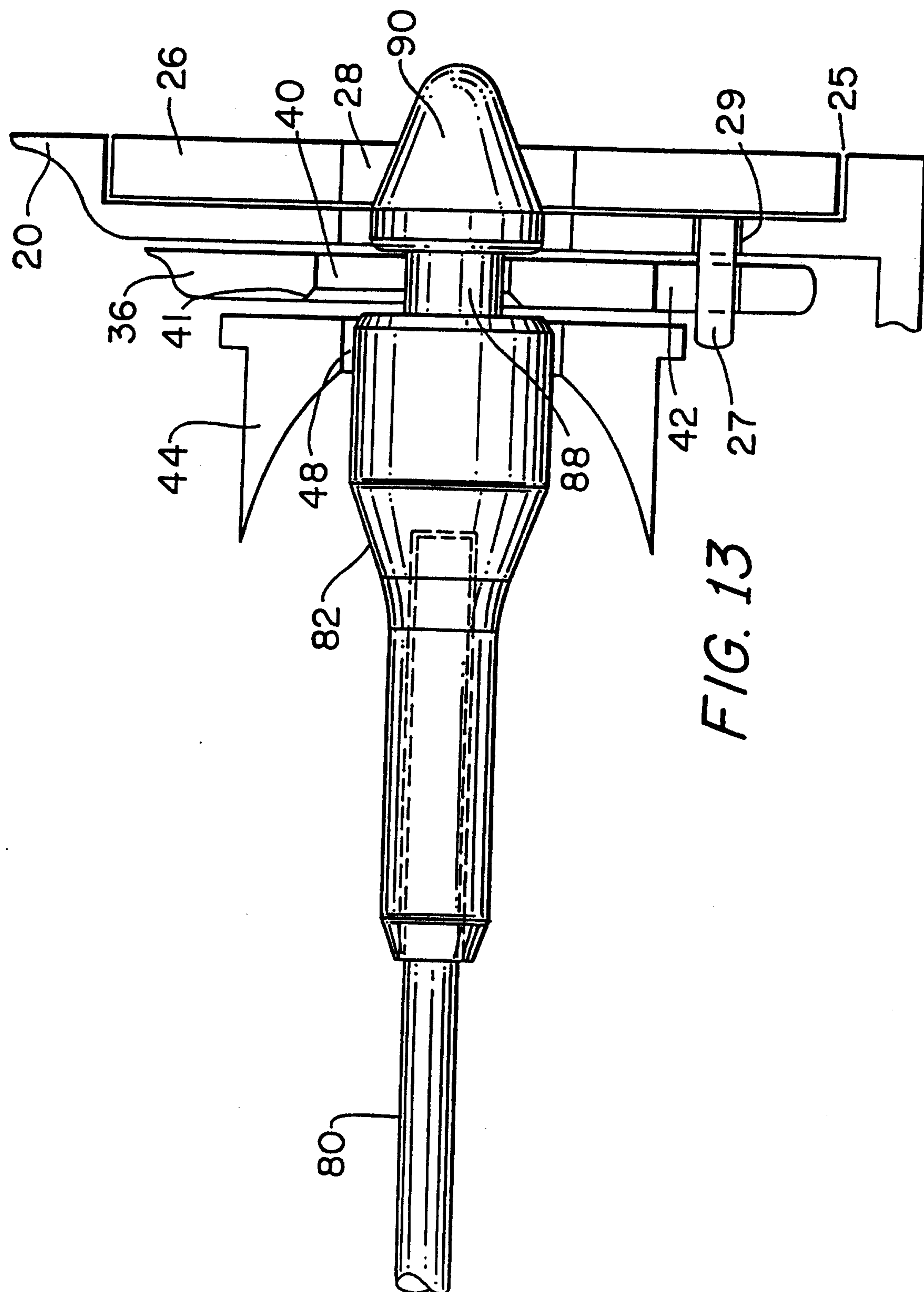


FIG. 13

