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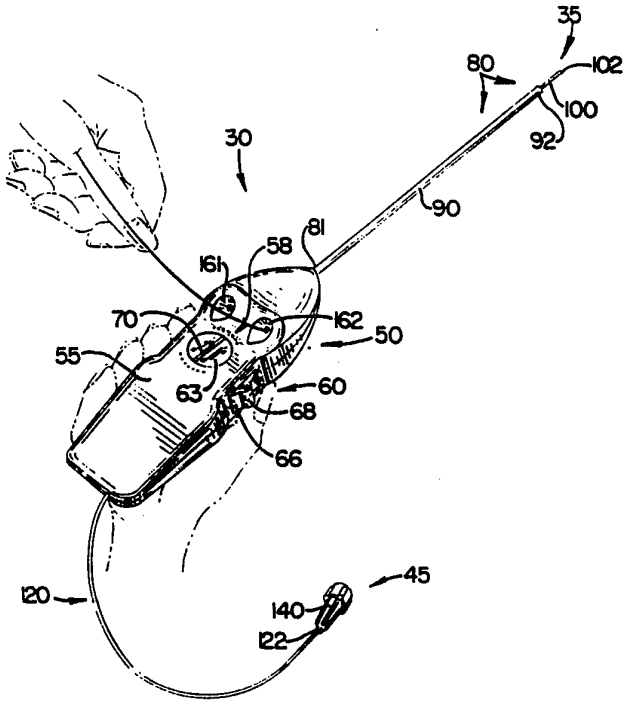
(54) Title: STEERABLE CATHETER

(57) Abstract

A catheter (30) for use in body vessels or cavities has a housing (50) of such size as to be readily held in the hand of a user and elongate tube means (80) having one end connected to the housing and extending outwardly therefrom and being formed of material of such a stiffness so as to maintain the elongate tube means in straight condition in the absence of an external force applied thereto, an outer end portion of the elongate tube means being flexible. Guide wires (202, 203) are connected to the housing by the inner ends thereof and extend outwardly therefrom through the elongate tube means. The outer ends of the guide wires are connected to the flexible outer end portion of the elongate tube means. Guide wire control means (60) is carried by the housing and cooperates with the inner end portions of the guide wires for controlling the angular attitude of the flexible outer end portion of the elongate tube means.



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STEERABLE CATHETER

Field Of Invention

This invention relates to medical catheters, and more particularly to steerable catheters for inserting into body vessels or cavities.

Background Of The Invention

Various commercially available catheters and endoscopes exist for introducing into the body vessels and cavities a variety of surgical tools, fluids, and other materials, such as radiographic contrast materials, angioplasty balloons, fiberoptic scopes, laser lights, and cutting instruments. Also, various techniques and systems have been developed for guiding or steering the catheters in the body vessels and cavities for use of these tools, fluids, and other materials.

Examples of such guiding or steering techniques and systems for catheters may be seen in U.S. Patent No. 4,983,165 to Loiterman entitled "*Guidance System For Vascular Catheter Or The Like,*" U.S. Patent No. 4,776,844 to Ueda entitled "*Medical Tube,*" U.S. Patent No. 4,934,340 to Ebling et al. entitled "*Device For Guiding Medical Catheters and Scopes,*" U.S. Patent No. 4,930,521 to Metzger et al. entitled "*Variable Stiffness Esophageal Catheter,*" U.S. Patent No. 3,470 to Barchilon entitled "*Dirigible Catheter,*" U.S. Patent No. 3,605,725 to Bentov entitled "*Controlled Motion Devices,*" and the Patent Cooperation

Treaty ("PCT") Patent Application No. PCTWO88/00810 of Tenerz et al. entitled "*Guide For Mechanical Guiding Of A Catheter In Connection With Cardio And Vessel Examination.*" These catheters, however, failed to give the physician or other operator sufficient control of the distal end of the catheter and made it difficult to manipulate the distal end for specific isolation on particular sections of the body vessel or cavity.

Other steerable catheters or systems have been made to try to give the physician control of the use of the catheter during surgical procedures wherein fluids and the various tools are needed for the operation by providing a flexible tube for controlling the direction of movement of the distal end of the catheter. Examples of these other attempts may be seen in the PCT Patent Application No. PCTWO91/11213 of Lundquist et al. entitled "*Catheter Steering Mechanism,*" *European Patent Application* No. 370,158 of Martin entitled "*Catheter For Prolonged Access,*" and U.S. Patent No. 4,737,142 to Heckele entitled "*Instrument For Examination And Treatment Of Bodily Passages.*" These devices, however, still failed to provide the control and manipulation of the catheter needed for use with the surgical tools and fluids required for an operation.

Therefore, there is still a need for a steerable catheter that provides the control and manipulation of the catheter for simultaneous use with the surgical tools, such as fiberoptic scopes or the like, and fluids needed for medical operations to thereby allow the physician to positionally locate and isolate problem areas within the body vessel or cavity.

Summary Of The Invention

It is therefore an object of the present invention to provide a catheter having improved steering.

It is also an object of the present invention to provide a catheter that allows the physician or operator to have more control over the distal end therein and provides feedback to the physician of the angular attitude of the distal end.

It is another object of the present invention to provide a catheter having a housing of such a size as to be readily held in the hand of the user for the physician or operator to control the steering of the catheter while simultaneously providing access to the lumen within the catheter for various surgical tools or fluids.

It is a further object of the present invention to provide a catheter having a fiberoptic scope sheath adapted to engage the housing of the catheter for inserting a fiberoptic scope into a lumen of the catheter.

These and other objects, features, and advantages of the present invention are provided in a catheter having more controlled movement in the distal end and having feedback on this movement to the catheter user the details of which are disclosed in the detailed description and the enclosed drawings.

In accordance with the present invention, a steerable catheter is provided for use in body vessels or cavities. The steerable catheter comprises a housing of such a size as to be readily held in the hand of the user. The catheter also has elongate tube means having one end connected to the housing and extending outwardly therefrom and being formed of material of such a stiffness so as to maintain the elongate tube means in a substantially straight condition in the absence of an external force applied thereto. An outer end portion of the elongate tube means is flexible. Guide wires are connected to the housing by the inner ends thereof and extend outwardly

therefrom through the elongate tube means. The outer ends of the guide wires are connected to the flexible outer end portion of the elongate tube means. Guide wire control means is carried by the housing and cooperates with the inner end portions of the guide wires for controlling the angular attitude of the flexible outer end portion of the elongate tube means. The guide wires and control means cooperate so as to limit the angular attitude of the flexible outer end portion of the elongate tube means to angular adjustments in a common plane extending generally parallel to the upper surface of the housing and wherein the angular adjustment of the flexible outer end portion of the elongate tube means in all other planes is obtained by rotation of the user's hand, so that more control of the attitude of the flexible outer end portion of the elongate tube means is obtained during use of the catheter.

At least one lumen extends longitudinally from the outer end of the elongate tube means and into the housing. The housing has at least one access port to the lumen. A fiberoptic sheath is adapted to be attached to the access port of the housing for inserting a fiberoptic scope or the like through the access port and into the lumen. A proximal tube is also provided which extends outwardly from the housing.

Brief Description Of The Drawings

FIG. 1 is an environmental view of the steerable catheter being held by the hand of the catheter operator while simultaneously having a fiberoptic scope inserted into an access port in the housing of the catheter according to a preferred embodiment of the present invention.

FIG. 2 is a top plan view of the steerable catheter with the top cover removed from the housing and with parts broken away for clarity.

FIG. 3 is a bottom plan view of the steerable catheter with the bottom cover removed from the housing and with parts broken away for clarity.

FIG. 4 is a side cross-sectional view of the steerable catheter according to the preferred embodiment of the present invention.

FIG. 5 is an exploded view of the control wheel of the housing according to the preferred embodiment of the present invention.

FIG. 6 is an enlarged view of the flexible outer end portion of the elongate tube means of the steerable catheter taken from the circled portion of FIG. 4 and rotated ninety (90) degrees.

FIG. 7 is an enlarged front view of the flexible outer end portion of the elongate tube means of the steerable catheter taken along line 7-7 of FIG. 6.

FIG. 8 is a top plan view of the steerable catheter with the top cover removed from the housing and with the control wheel rotated so as to move the flexible outer end portion of the elongate tube means of the steerable catheter to the right.

FIG. 9 is a top plan view of the steerable catheter with the top cover removed from the housing and with the control wheel rotated so as to move the flexible outer end portion of the steerable catheter to the left.

FIG. 10 is a side view of the steerable catheter having the fiberoptic scope sheath attached to an access port in the housing according to a preferred embodiment of the present invention.

FIG. 11 is an enlarged view of the circled portion of the steerable catheter having the fiberoptic scope sheath from FIG. 10 with parts broken away for clarity.

FIG. 12 is a cross-sectional view of the steerable catheter with the fiberoptic scope sheath taken along line 12-12 of FIG. 10 according to the preferred embodiment of the present invention.

FIG. 13 is a top plan view of the steerable catheter according to the present invention with the top cover removed from the housing and with parts broken away for clarity illustrating another embodiment of the control means for the catheter.

FIG. 14 is a bottom plan view of the steerable catheter according to the present invention with the bottom cover removed from the housing and with parts broken away for clarity illustrating another embodiment of the control means for the catheter.

FIG. 15 is a side view of the steerable catheter according to the present invention with parts broken away for clarity illustrating another embodiment of the control means for the catheter.

FIG. 16 is an exploded view of the control wheel according to another embodiment of the present invention.

FIG. 17 is an enlarged view of the flexible outer end portion of the elongate tube means of the steerable catheter according to another embodiment of the present invention taken from the circle portion in FIG. 15 and rotated ninety (90) degrees.

FIG. 18 is an enlarged front view of the flexible outer end portion of the elongate tube means of the steerable catheter according to another embodiment of the present invention taken along line 18-18 of FIG. 17.

FIG. 19 is a top view with the top cover of the housing removed therefrom according to another embodiment of the present invention and illustrating the movement to the flexible outer end portion of the elongate tube means of the steerable catheter.

FIG. 20 is a top view with the top cover of the handle member removed therefrom according to another embodiment of the present invention and illustrating the movement to the flexible outer end portion of the elongate tube means of the steerable catheter.

Description Of A Preferred Embodiment

The present invention now will be described more fully hereinafter with reference to the accompanying drawings in which a preferred embodiment of the invention is shown. Like numbers refer to like elements throughout.

Referring now to FIG. 1, shown is an environmental view of a preferred embodiment of the steerable catheter **30** having distal **35** and proximal **45** ends according to the present invention. The steerable catheter **30** is being held in the hands of a catheter operator, such as a physician. The steerable catheter **30** has a housing **50**, an elongate tube means **80**, and a proximal tube **120**. The elongate tube means **80** has a first tube and a second tube **100**. Two lumens **94**, **95** (FIG. 7) extend longitudinally from the distal end **35** of the catheter, through the first **90** and second **100** tubes of the elongate tube means **80** and into the housing **50**. The first tube **90** is formed of a material of such a stiffness so as to maintain the first tube **90** in a substantially straight condition in the absence of an external force applied thereto. It is understood that a substantially straight condition would generally mean that the tube in not generally bendable but a certain amount of arc may occur under some conditions or application of an external force as previously mentioned. The second tube **100** is generally more flexible than the first tube **90**. The elongate tube means **80** in this embodiment comprises the first tube **90**

and the second tube **100**, but this invention would include using one, two, or more tubes.

The housing **50** is of such a size as to be readily held in the hand of the catheter operator or other user. Access ports **161**, **162** are provided in the housing **50** for accessing the two lumens **94**, **95** within the elongate tube means **80**. One end **91** of the first tube **90** is connected to the housing **50** and then the first tube **90** extends outwardly therefrom. The second tube **100**, in turn, extends longitudinally from a second end **92** of the first tube **90**. An end **102** of the second tube **100** forms the distal end **35** of the steerable catheter **30**. The proximal tube **120** extends longitudinally through the housing **50** and extends longitudinally from the housing **50**. A first end **121** (not shown in this view) of the proximal tube **120** accesses the first end **91** of the tube within the housing **50**. The connector **140** attached to the second end **122** of the proximal tube **120** forms the proximal end **45** of the steerable catheter **30**.

A control wheel **60** is mounted to the housing **50** to aid in guiding and steering the distal end **35** of the steerable catheter **30**. The control wheel is generally circular in shape and has a front end **61**, a back end **62**, a top end **63**, a bottom end **64**, and two side ends **66**, **67**. Lobes **68**, **69** are located on the two side ends **66**, **67** of the control wheel. A tip direction indicator **70** is located on a top end **63** of the control wheel **60**. The tip direction indicator **70** lies in a longitudinal direction with respect to the upper surface **55** of the housing **50**. The distal end **35** of the steerable catheter **30** moves by rotating the control wheel **60** via the lobes **68**, **69** on the side ends **66**, **67** of the control wheel **60**. The tip direction indicator **70**, in turn, rotates clockwise and counter-clockwise to a position indicating the direction and

angular attitude of the distal end **35**. Position markers **58** are located on the upper surface **55** of the housing **50** around the top end **63** of the control wheel **60** to thereby mark the relative angular attitude of the distal end **35** of the steerable catheter **30** as it is being deflected and controlled.

FIGS. 2-7 illustrate the internal construction of the steerable catheter **30** according to the invention. In FIGS. 2 and 3, the top cover **56** and bottom cover **57** are each respectively removed from the housing **50** to clarify the construction therein. These views illustrate the attachment of the first end **121** of the proximal tube **120** to the first end **91** of the first tube **90**. These views also illustrate the placement of a portion of the proximal tube **120** within the housing **50**.

The side cross-sectional view of FIG. 4 further illustrates the connection of the ends of the proximal tube **120**, the first tube **90**, and the second tube **100** inside and outside the housing **50**. This view also illustrates the mounting of the control wheel **60** within the housing **50** and with respect to the proximal tube **120**.

Referring again to FIGS. 2 and 3, two guide wires **201, 202** longitudinally extend from the distal end **35** of the steerable catheter **30** through the second tube **100** and through the first tube **90**. The guide wires **201, 202**, in turn, extend from the first end **91** of the first tube **90**, around wire guide members **206, 207**, and attach to the control wheel **60**. Hence, when the control wheel **60** rotates, the guide wires **201, 202** move to thereby provide movement and control of the distal end **35** of the steerable catheter **30**.

FIG. 5 is an exploded perspective view of the control wheel **60** showing the connection of the guide wires **201, 202** therein. The inner ends of the guide

wires **201, 202** within the housing **50** wrap around a circular hub base **213** on the bottom end **64** of the control wheel **60**. The guide wires **201, 202** are secured to a wire receptacle **212** in the hub base **213** by a sleeve **214** and screw **216**. The outer ends of the guide wires **201, 202** are sonic welded to the second tube **100**. Plugs in the second tube **100** may also be used to connect the guide wires **201, 202** at outer ends.

This particular arrangement of the wires with the control wheel makes the wheel self-locking as the wheel rotates within the housing. Friction (f) is caused by the wire pull (W) acting as a normal force on the housing **50**. Since the desire of the user is that the wheel not freely rotate during use, this requirement can be satisfied if the moment due to the wire pull ($M1 = W \times r$, where r is the radius of the hub base) does not exceed the moment due to friction ($M2 = f \times R$, where R is the radius of the control wheel **60**). Since $f = \mu \times W$ (where μ is the coefficient of friction), then by substitution $M2 = \mu \times W \times R$. If the moment due to the wire pull (M1) is less than the moment due to friction (M2), then $W \times r < \mu \times W \times R$. So if $r/R < \mu$ then the wheel will not rotate by wire pull.

The control wheel **60** and the inner ends of the guide wires **201, 202** cooperate as described to control the angular attitude **220** of the second tube **100**. The control wheel **60** and guide wires **201, 202** cooperate to limit the angular attitude of the second tube **100** to angular adjustments in a common plane extending generally parallel to the upper surface of the housing **50**. The angular adjustments **220** in all other planes is obtained by rotation of the user's hand so that more control of the attitude of the second tube **100** is obtained during use of the catheter **30**. Detents are also located in the control wheel at zero (0),

fifteen (15), and thirty (30) degrees with respect to the angular attitude **220** of the distal end **35** of the catheter **30**. These detents, however, may not be used at all or be located at various angular attitude **220** positions.

FIGS. 6 and 7 illustrate the distal end **35** of the steerable catheter **30** and the construction of the guide wires **201, 202** and lumens **94, 95** therein. FIG. 6 is an enlarged view of the flexible tube portion **100** and the first tube **90** taken from the circled portion of FIG. 4. FIG. 7 is a front view of the distal end **35** of the steerable catheter **30** taken along line 7-7 of FIG. 6. Along with the guide wires **201, 202**, the second tube **100** and the first tube **90** of the elongate tube means **80** have two working lumens **94, 95** extending longitudinally from the distal end **35**, through the second tube **100**, through the first tube **90**, and into the housing **50**. The lumens **94, 95** provide access for a variety of surgical tools, fluids, and other materials, such as radiographic contrast materials, angioplasty balloons, fiberoptic scopes, laser lights, and cutting instruments. This access enables the physician or catheter operator to simultaneously steer the catheter while also using the various surgical tools, fluids, and other materials as needed in the procedure.

FIGS. 8 and 9 are shown to further illustrate the controlled movement of the distal end **35** of the steerable catheter **30** via rotation of the control wheel **60**. FIGS. 8 and 9, similar to FIG. 2, are taken from a top view with the top cover **58** of the housing **50** removed therefrom and with parts broken away for clarity. As can be seen from FIGS. 8 and 9, the distal end **35** moves horizontally toward the direction of the tip direction indicator **70** located on a top end **63** of the control wheel **60**. The hand of the operator rotates the control wheel **60** by movement of the lobes **68, 69** on

the side ends **66**, **67** thereof. The rotation of the control wheel **60** via the lobes **68**, **69** causes tension in one direction or the other to be place upon the guide wires **201**, **202** wrapped around the hub base **213** to thereby move the distal end **35** a controlled or limited amount. The construction of the control wheel **60** and the guide wires **201**, **202** is such that the angular attitude **220** of the distal end **35** is no greater than thirty (30) degrees.

Referring now to FIGS. 10-12, the fiberoptic scope sheath **250** of the preferred embodiment of the steerable catheter **30** will now be discussed. As shown in FIG. 10 with the fiberoptic scope sheath **250** enlarged for illustrative purposes, the fiberoptic scope sheath **250** connects to either of the access ports **161**, **162**. The fiberoptic scope sheath **250** provides feedback to the operator of the steerable catheter **30** on the positional location of a fiberoptic scope **290** or the like when the scope **290** extends into a lumens **94**, **95** of the catheter **30**. A fiberoptic scope **290** generally has a small diameter and may be fragile when pushed into the body cavity or vessel. Because the fiberoptic scope **290** is not radiopaque, the scope tip location in relation to the distal end **35** of the steerable catheter **30** may be undetectable to an imaging screen supplementing the fiberoptic scope image, such as that provided by a fluoroscope or the like. A fluoroscope or the like may be used to indicate the location of the distal end **35** of the catheter **30**. The fiberoptic scope sheath **250**, in turn, provides imaging indication, control, and protection for the fiberoptic scope **290** when the scope **290** is used with the steerable catheter **30**.

As shown in FIGS. 10 and 11, the fiberoptic scope sheath **250** essentially terminates at the access to the lumen **94** and provides the imaging indication,

control, and protection discussed above. FIG. 12 is a cross-sectional view of the elongate tube means **40** having the fiberoptic scope sheath **250** thereon taken along line 12-12 of FIG. 10. The fiberoptic scope sheath **250**, as seen in these views has a first sheath tube **255** with first **256** and second **257** ends, and inner **258** and outer **259** tube walls. The inner tube wall **258** of the first tube **255** longitudinally receives the fiberoptic scope **290** through the first end **256** of the first sheath tube **255**. A second sheath tube **260** having first **261** and second ends **262**, and inner **263** and outer **264** tube walls longitudinally receives the first sheath tube **255**. The inner tube wall **263** of the second tube **260** has ribs **270** which engage the outer tube wall **259** of the first sheath tube **255**. The second end **262** of the second sheath tube **260** engages a connector **280** which is adapted to connect to one of the access ports **161, 162** in the housing **50**. In turn, the fiberoptic scope **290** accesses one of the lumens **94, 95** of the steerable catheter **30** through the first sheath tube **255** and into one of the access ports **161, 162**. FIG. 11 also shows a cross-sectional enlargement of seals **165** in the access ports **161, 162**. The seals are formed of an elastomeric material such as silicone rubber and have a very small axial opening therethrough that permits a small object such as the fiberoptic scope **290** or the like to enter, but which otherwise prevents fluid flow in either direction, and thus protects the lumens **94, 95** from receiving contaminants or the like therein.

FIGS. 13-20 will now be discussed to illustrate the construction of another embodiment of the steerable catheter **30'** of the present invention. Similar elements in FIGS. 13-20 are labeled with prime notation corresponding to FIGS. 1-12 and are not described further herein. In FIG. 18, the front view

of the distal end 35' of the steerable catheter 30' taken along line 18-18 of FIG. 17 is shown. This view shows rectangular-shaped guide wires 501, 502 instead of the circular-shaped guide wires 201, 202 of the preferred embodiment of the steerable catheter 30. Although the overall construction of the other embodiment is generally the same as a preferred embodiment, the rectangular-shaped guide wires 501, 502 provide additional control for the movement of the distal end 35' of the catheter 30'.

FIGS. 13, 14 and 16 illustrate the engagement and connection of the guide wires 501, 502 of the other embodiment of the steerable catheter 335 to the control wheel 60' and housing 50'. The guide wires 501, 502 extend from the distal end 35', through the elongate tube means 40', and into the housing 50'. Inside the housing 50', the guide wires 501, 502 exit the elongate tube means 40', extend through the control wheel 60', and terminate into wire terminals 356, 357. The hub base 413 of the control wheel 60' of this embodiment is in the form of a cam which places tension on the guide wires 501, 502 when the control wheel 60' is rotated clockwise or counter-clockwise. The control wheel 60' is located within the housing 50' in a center portion thereof for laterally moving the guide wires 501, 502 to thereby control the flexible outer end portion of the tube means 80' by moving the guide wires 501, 502. The cam hub base 413 depending from a center portion of the control wheel 60' bears against and laterally displaces the portions of the guide wires 501, 502 adjacent the cam hub base 413 so that the guide wires 501, 502 are urged longitudinally and thereby move the flexible outer end portion.

FIGS. 19 and 20 illustrate the rotation of the control wheel 60' to thereby cause movement and adjustments in the angular attitude 220' of the distal

end **35'** of the steerable catheter **30'**. The engagement and connection of the guide wires **501**, **502** in the distal tube **40'** and the control wheel **360** provide the additional control for the distal end **35'** of the steerable catheter **30'**.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purposes of limitation, the scope of the invention being set forth in the following claims.

THAT WHICH IS CLAIMED IS:

1. A catheter for use in body vessels or cavities, comprising:

a housing of such a size as to be readily held in the hand of a user;

elongate tube means having one end connected to said housing and extending outwardly therefrom and being formed of material having sufficient stiffness to maintain said elongate tube means in a substantially straight condition in the absence of an external force applied thereto, said elongate tube means having a flexible outer end portion;

guide wires having inner ends connected to said housing and extending outwardly therefrom through said elongate tube means, outer ends of said guide wires being connected to said flexible outer end portion of said elongate tube means; and

guide wire control means carried by said housing and cooperating with inner end portions of said guide wires for controlling the angular attitude of said flexible outer end portion of said elongate tube means, said guide wires and control means cooperating to limit the angular attitude of said flexible outer end portion of said elongate tube means to angular adjustments in a common plane extending generally parallel to the upper surface of said housing and wherein the angular adjustment of said flexible outer end portion of said elongate tube means in all other planes is obtained by rotation of the user's hand, so that more control of the attitude of said flexible outer end portion of the elongate tube means is obtained during use of the catheter.

2. A catheter according to Claim 1, wherein said elongate tube means comprises a first tube extending outwardly from said housing and a second tube

connected to said first tube and extending outwardly therefrom, said first tube being more rigid than said second tube.

3. A catheter according to Claim 1, wherein said elongate tube means further comprises two lumens extending longitudinally through said elongate tube means and into said housing.

4. A catheter according to Claim 3, wherein said housing further comprises an access port within said housing for providing access to at least one of said lumens extending longitudinally through said elongate tube means.

5. A catheter according to Claim 3, further comprising an elongate proximal tube having one end connected to said housing and extending outwardly therefrom.

6. A catheter according to Claim 5, wherein said proximal tube further comprises a lumen extending longitudinally through said proximal tube and accessing at least one of said lumens in said elongate tube means.

7. A catheter according to Claim 6, wherein an outer end portion of said proximal tube further comprises a connector in fluid communication with said lumen of said proximal tube for connecting to an receiving fluid from a fluid source.

8. A catheter according to Claim 3, wherein one of said lumens extending longitudinally through said elongate tube means has a larger diameter the

other lumen extending longitudinally through said elongate tube means.

9. A catheter according to Claim 1, wherein said flexible outer end portion of said elongate tube means converges to form a tip of the catheter for ease of access into and through a body vessel or cavity, skin, or tissue.

10. A catheter according to Claim 1, further comprising a central axis extending longitudinally from said flexible outer end portion of said elongate tube means, through said elongate tube means, and into said housing.

11. A catheter according to Claim 10, wherein said control means comprises a rotating control wheel connected to said inner ends of said two guide wires so that rotation of said control wheel guides the flexible outer end portion of said elongate tube means in an angular attitude up to 30 degrees from said longitudinally extending central axis in a generally transverse direction therefrom.

12. A catheter according to Claim 1, wherein said control means comprises a control wheel located within said housing in a center portion thereof for laterally moving said guide wires to thereby control the flexible outer end portion by moving said guide wires and having a cam hub depending from a center portion of said control wheel for bearing against and laterally displacing the portions of said guide wires adjacent said cam hub so that said guide wires are urged longitudinally and thereby move said flexible outer end portion.

13. A catheter according to Claim 12, wherein said guide wires attach to a portion of said housing and have a non-circular cross-section.

14. A catheter for use in body vessels or cavities, comprising:

elongate tube means having at least one lumen extending longitudinally through said elongate tube means and being formed of material having sufficient stiffness to maintain said elongate tube means in a substantially straight condition in the absence of an external force applied thereto, said elongate tube means having a flexible outer end portion;

a housing of such a size as to be readily held in the hand of a user, and connected to said elongate tube means, said housing having at least one access port therein for providing access to said at least one lumen of said elongate tube means;

guide wires having inner ends connected to said housing and extending outwardly therefrom through said elongate tube means, outer ends of said guide wires being connected to said flexible outer end portion of said elongate tube means; and

guide wire control means carried by said housing and cooperating with inner end portions of said guide wires for controlling the angular attitude of said flexible outer end portion of said elongate tube means.

15. A catheter according to Claim 14, further comprising a proximal tube extending longitudinally from said housing.

16. A catheter according to Claim 14, wherein said housing further comprises a seal in said access port to prevent contaminants from entering said

access port and to prevent fluid from flowing out of said access port from said lumen.

17. A catheter according to Claim 15, wherein said proximal tube further comprises a lumen extending longitudinally through said proximal tube and accessing at least one lumen in said elongate tube means.

18. A catheter according to Claim 15, wherein an outer end portion of said proximal tube further comprises a connector in fluid communication with said lumen of said proximal tube for connecting to and receiving fluid from a fluid source.

19. A catheter according to Claim 14, wherein at least one of said lumens extending longitudinally through said elongate tube means has a larger diameter than any other lumens extending longitudinally through said elongate tube means.

20. A catheter according to Claim 14, wherein said flexible outer end portion of said elongate tube means converges to form a tip for ease of access into and through a body vessel or cavity, skin, or tissue.

21. A catheter for use in body vessels or cavities, comprising:

elongate tube means having at least one lumen extending longitudinally through said elongate tube means, said elongate tube means having a flexible outer end portion;

a housing of such size as to be readily held in the hand of a user, and connected to said elongate tube means, said housing having at least one access

port therein for providing access to said at least one lumen of said elongate tube means;

guide wires having inner ends connected to said housing and extending outwardly therefrom through said elongate tube means, outer ends of said guide wires being connected to said flexible outer end portion of said elongate tube means;

guide wire control means carried by said housing and cooperating with inner end portions of said guide wires for controlling the angular attitude of said flexible outer end portion of said elongate tube means; and

fiberoptic scope sheath means longitudinally extending from said access port of said housing and adapted to receive a fiberoptic scope or the like for inserting the fiberoptic scope or the like into at least one lumen of said elongate tube means.

22. A catheter according to Claim 21, wherein said fiberoptic scope sheath means comprises:

an elongate first sheath tube having first and second ends and inner and outer tube walls, said inner tube wall adapted to longitudinally receive the fiberoptic scope through said first end; and

an elongate second sheath tube having first and second ends and inner and outer tube walls, said inner tube wall of said second sheath tube having ribs and adapted to longitudinally receive said second end of said first sheath tube through said first end of said second tube, said ribs of said inner tube wall of said second sheath tube engaging said outer tube wall of said first tube, and said second end of said second sheath tube adapted to engage said access port of the catheter for longitudinally inserting the fiberoptic scope or the like into at least one lumen of said elongate tube means.

23. A catheter according to Claim 22, wherein said fiberoptic scope sheath means further comprises tube securing means for securing said first end of said first sheath tube to a portion of the fiberoptic scope.

24. A catheter according to Claim 23, wherein said tube securing means comprises shrink wrap.

25. A catheter according to Claim 21, wherein said fiberoptic scope sheath means further comprises connector means attached to said second end of said second sheath tube and adapted for connecting said second sheath tube to the catheter.

26. A catheter according to Claim 21, further comprising a proximal tube extending longitudinally from said housing and having first and second ends.

27. A fiberoptic scope sheath for receiving a fiberoptic scope or the like to be inserted into a lumen of a catheter, comprising:

an elongate first sheath tube having first and second ends and inner and outer tube walls, said inner tube wall adapted to longitudinally receive the fiberoptic scope or the like through said first end; and

an elongate second sheath tube having first and second ends and inner and outer tube walls, said inner tube wall of said second tube having ribs and adapted to longitudinally receive said second end of said first sheath tube through said first end of said second sheath tube, said ribs of said inner tube wall of said second sheath tube engaging said outer tube wall of said first tube, said second end of said second

sheath tube adapted to engage said access port of the catheter for longitudinally inserting the fiberoptic scope or the like into at least one lumen of the catheter.

28. A fiberoptic scope sheath according to Claim 27, further comprising tube securing means for securing said first end of said first sheath tube to a portion of the fiberoptic scope.

29. A fiberoptic scope sheath according to Claim 28, wherein said securing means comprises shrink wrap.

30. A fiberoptic scope sheath according to Claim 28, wherein the portion of the fiberoptic scope is at a predetermined distance from an end of the fiberoptic scope.

31. A fiberoptic scope sheath according to Claim 27, further comprising connector means attached to said second end of said second sheath tube and adapted for connecting said second sheath tube to the catheter.

32. A fiberoptic scope sheath according to Claim 27, wherein said first sheath tube is longer than said second sheath tube.

33. A fiberoptic scope sheath according to Claim 32, wherein said first sheath tube longitudinally inserts into said second tube a predetermined distance.

34. A fiberoptic scope sheath according to Claim 33, wherein said predetermined distance is the length of said second sheath tube.

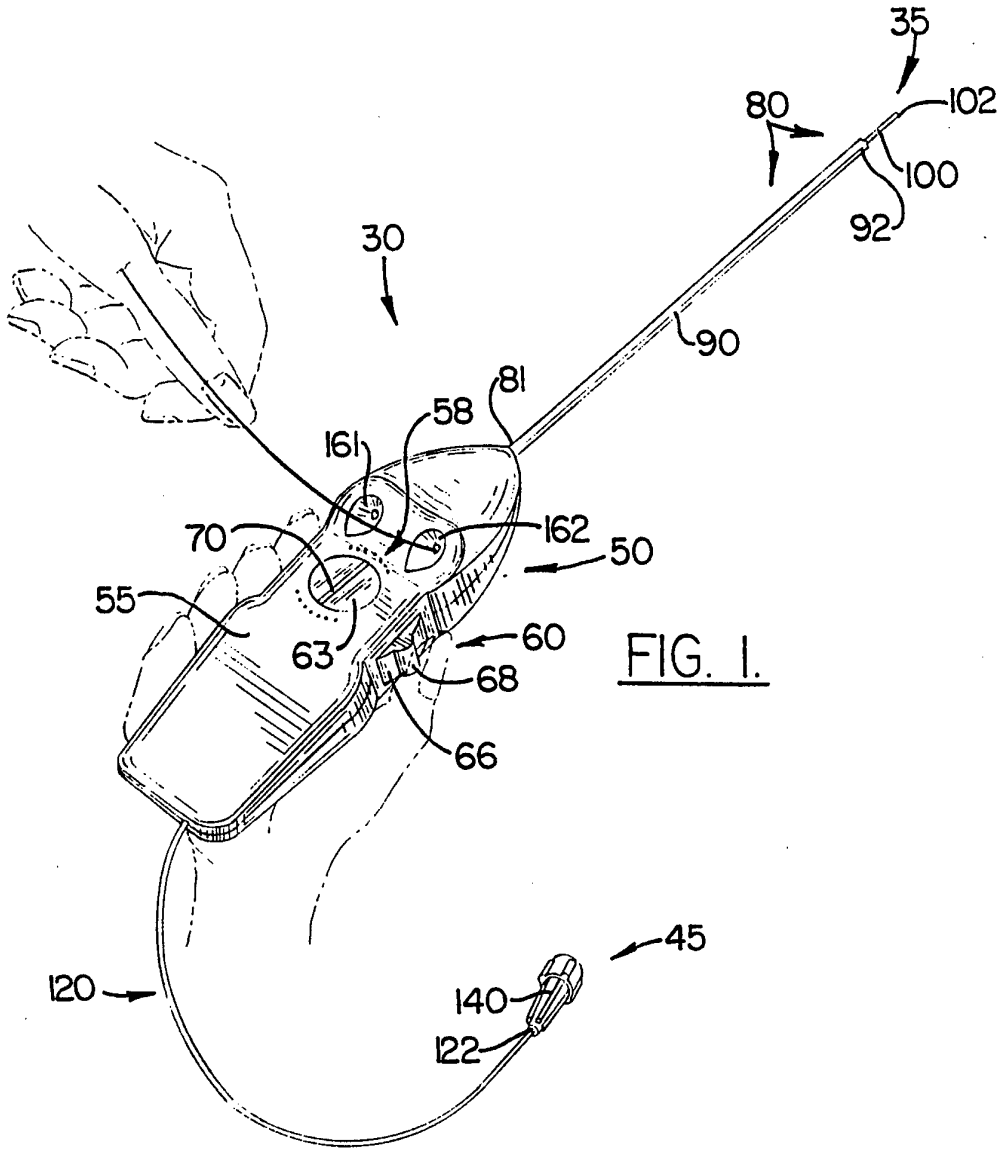
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FIG. 1.

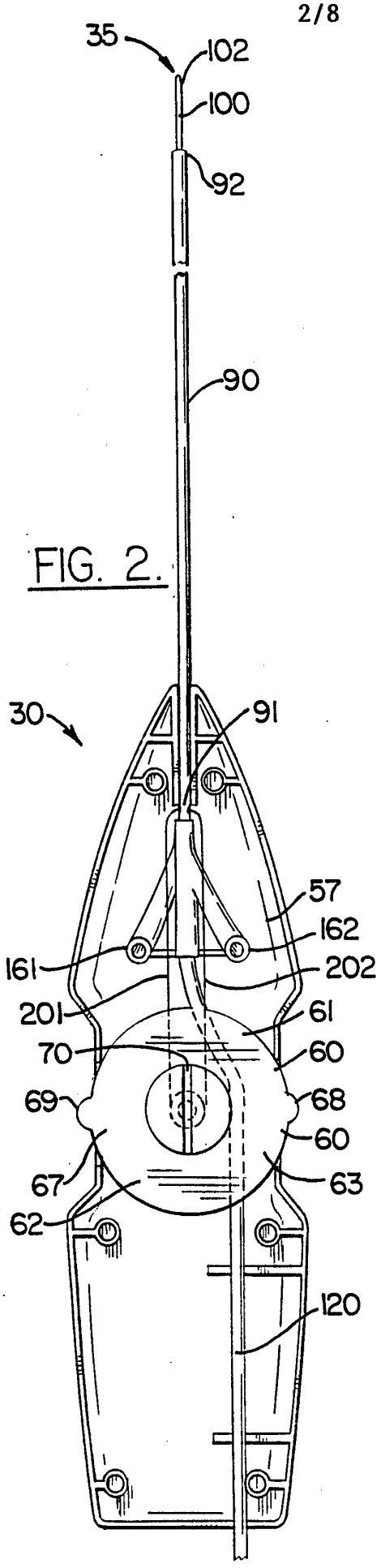
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FIG. 2.

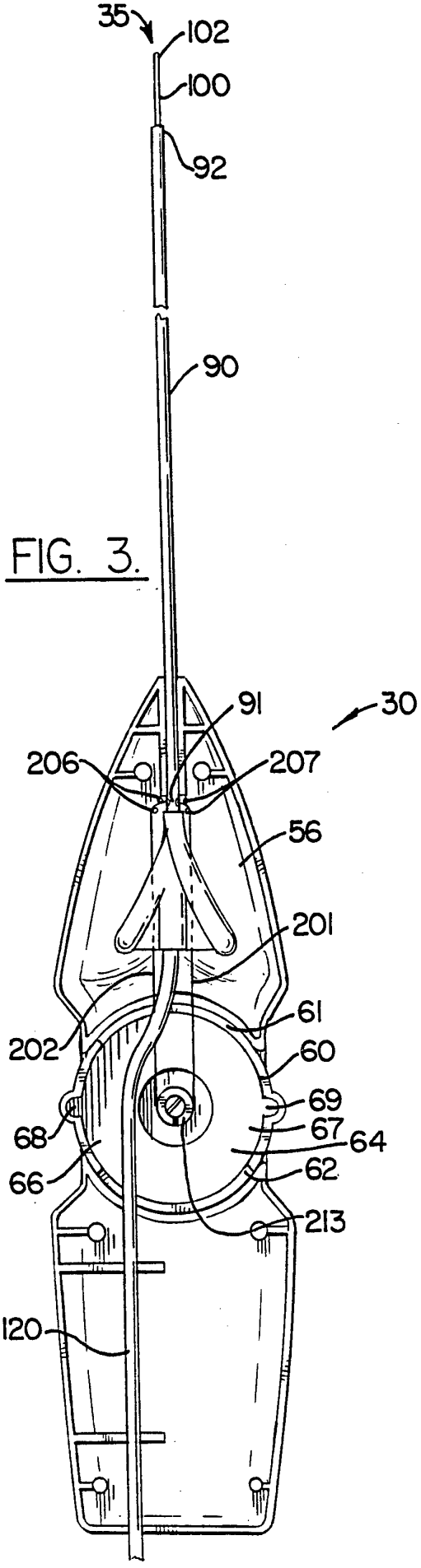
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FIG. 3.

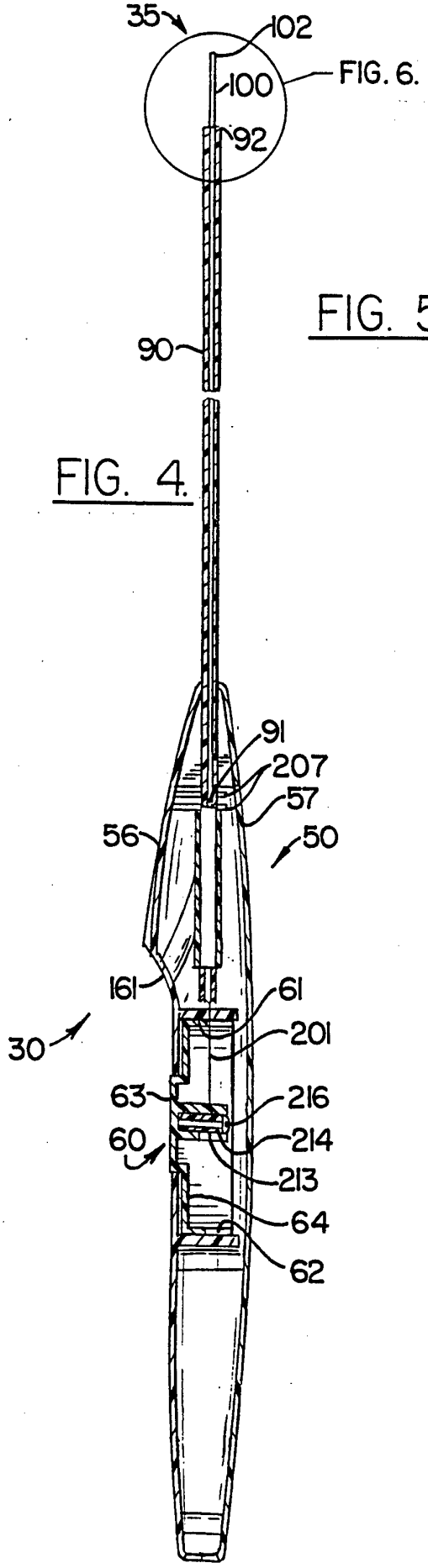
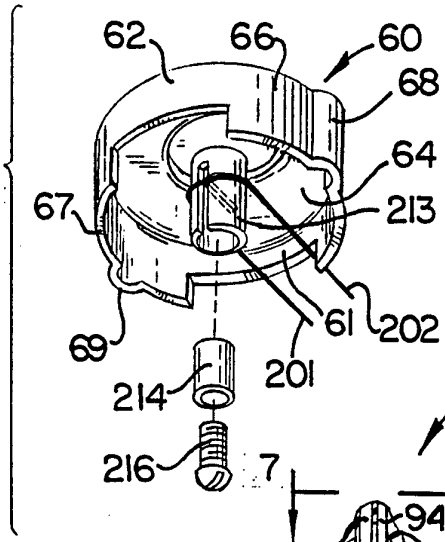


FIG. 4.

FIG. 5.



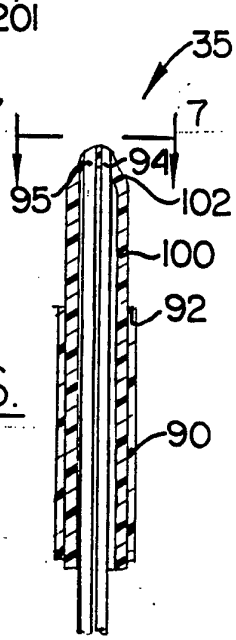
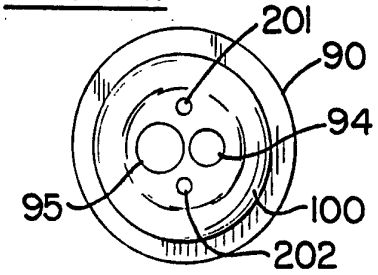


FIG. 6.

FIG. 7.



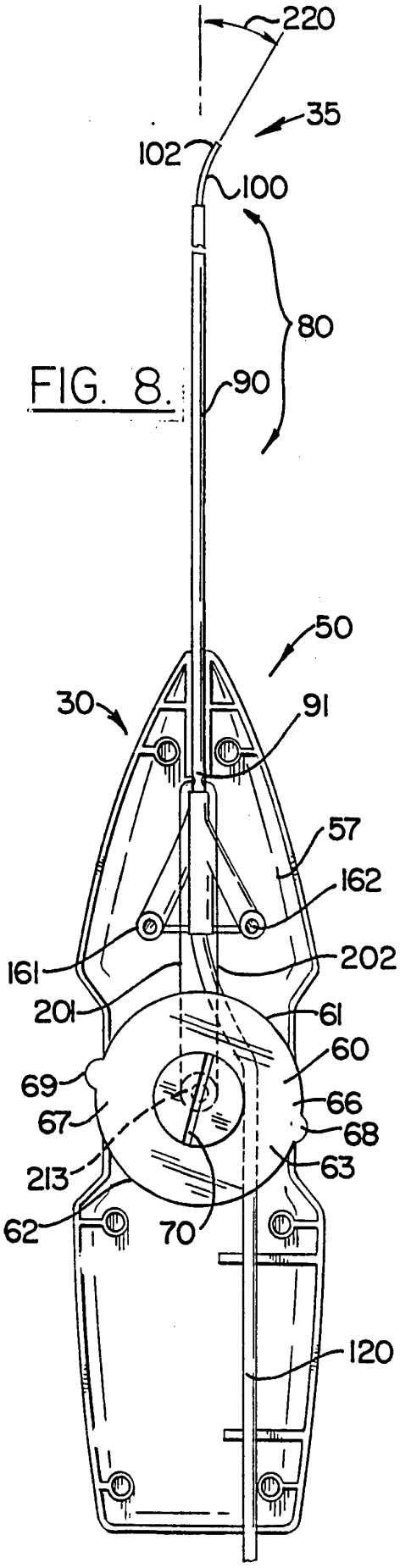

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FIG. 8.

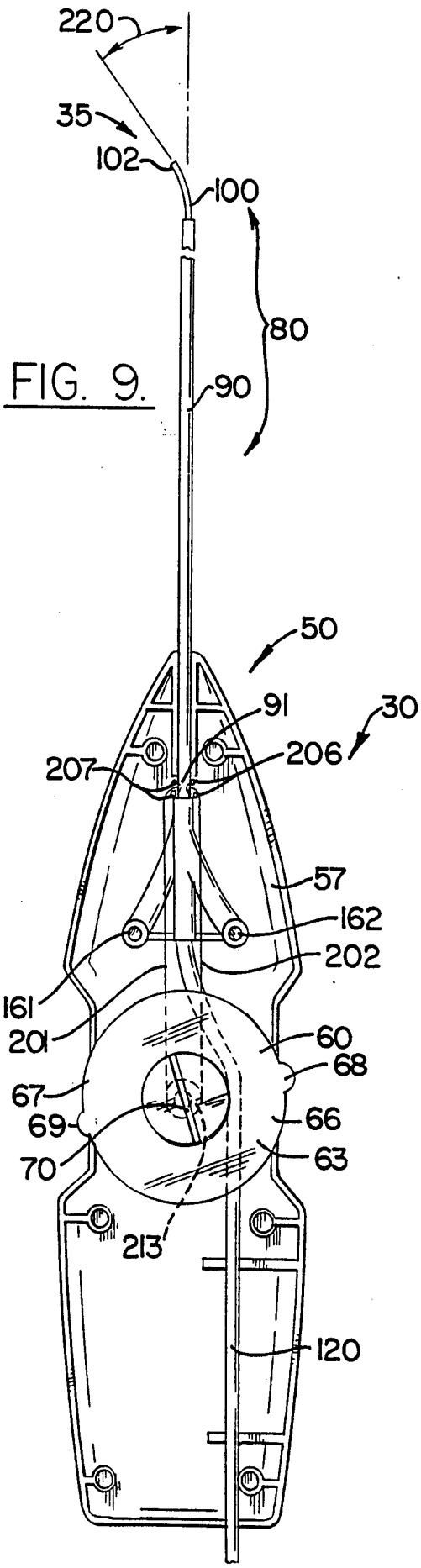
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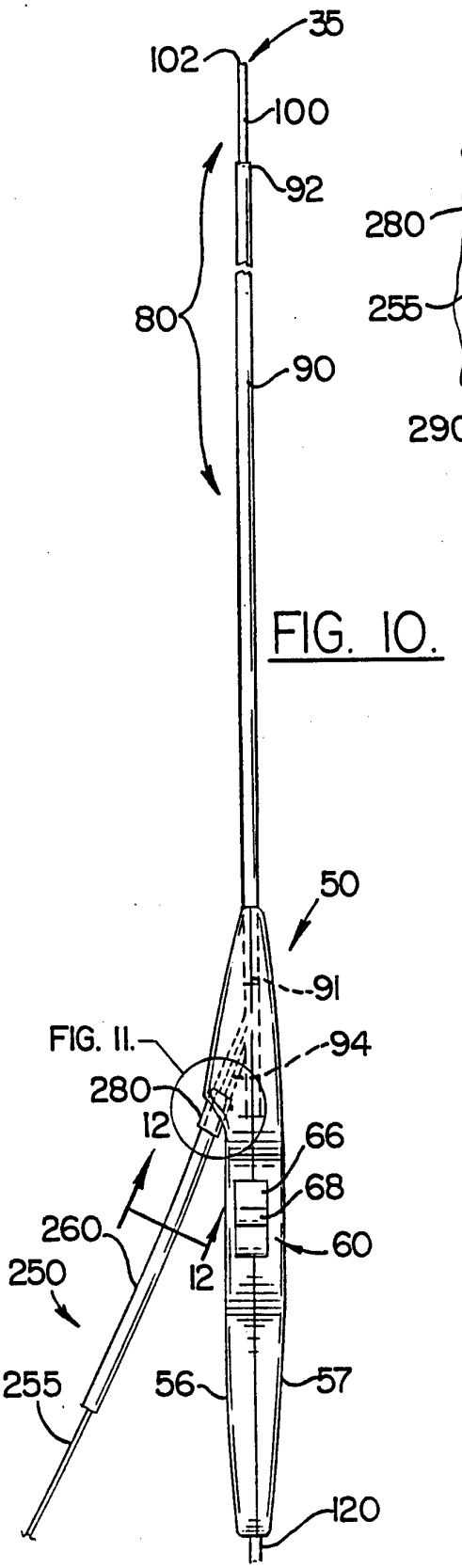
FIG. 9.



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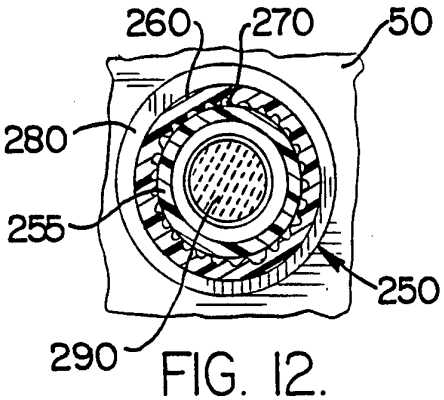

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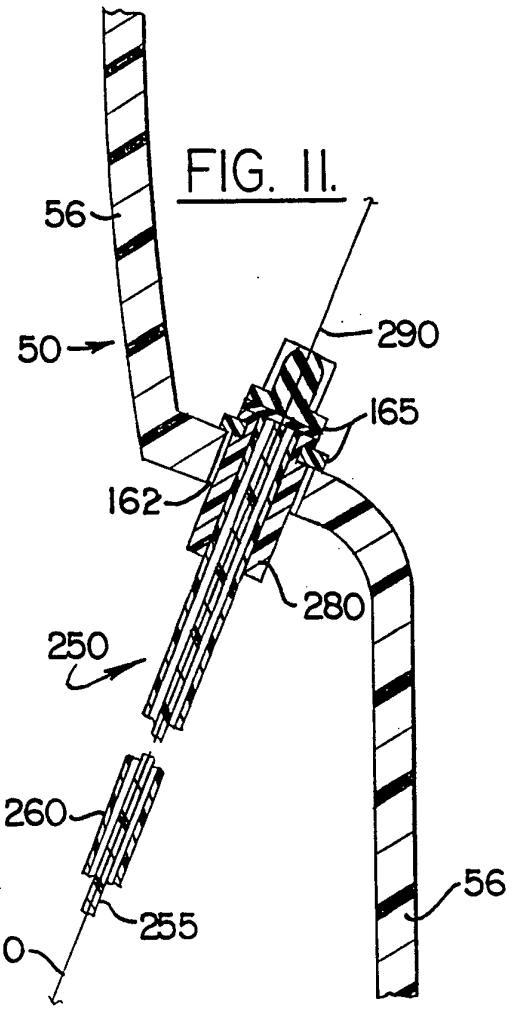

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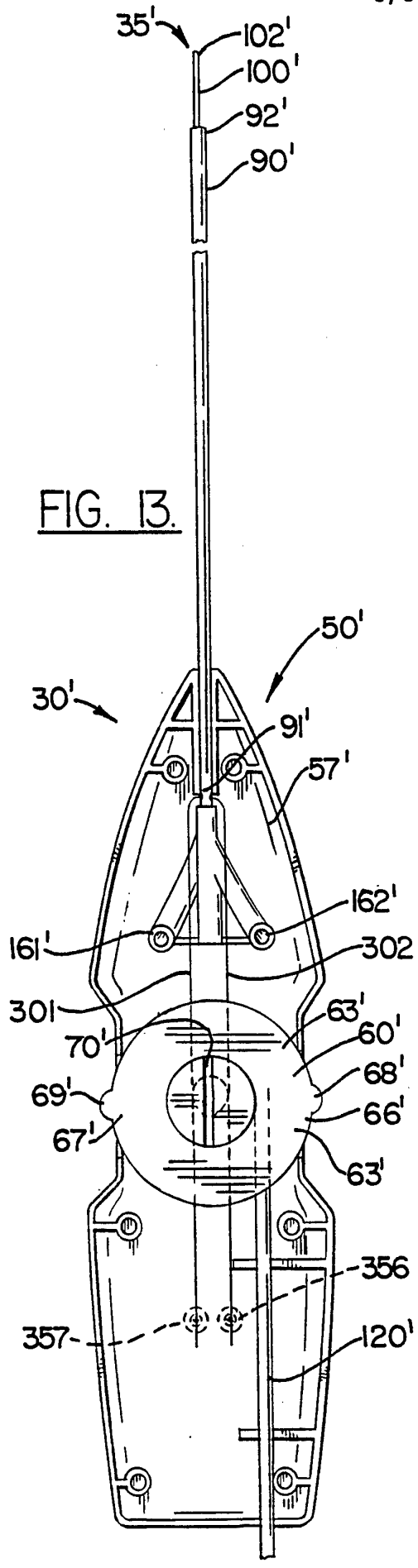
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FIG. 13.

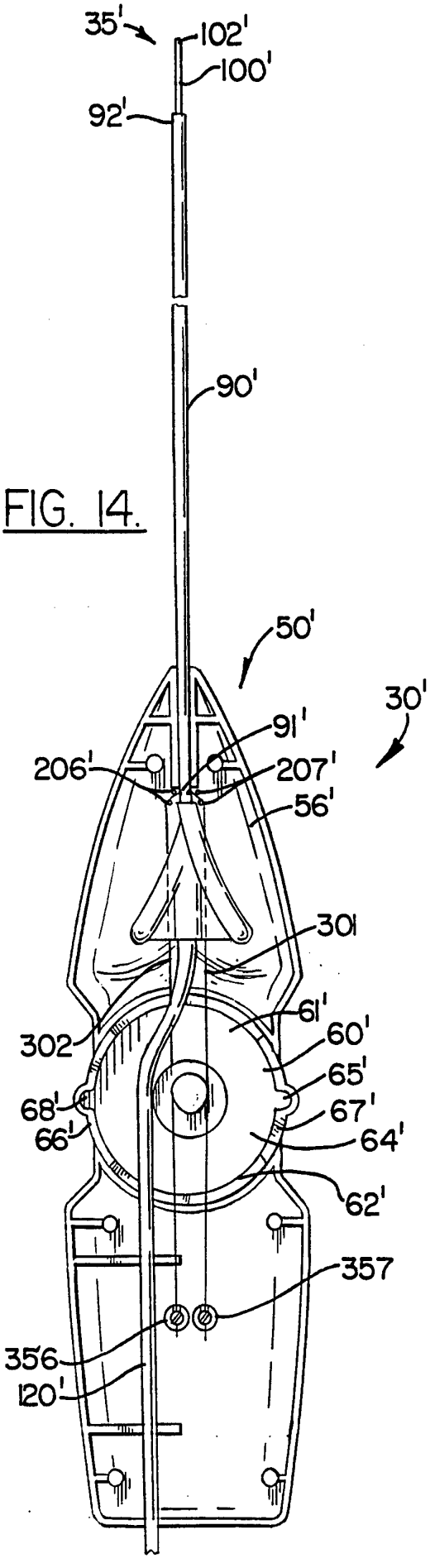
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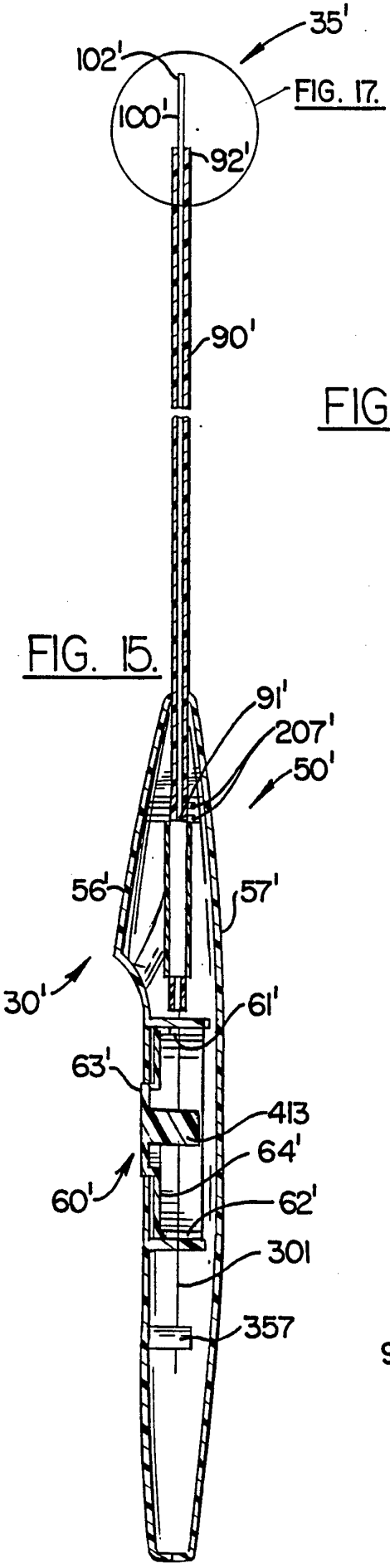
FIG. 14.



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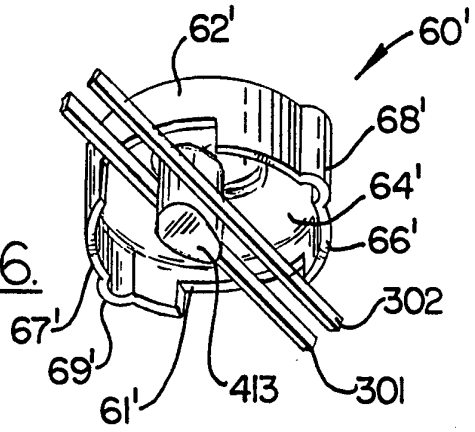

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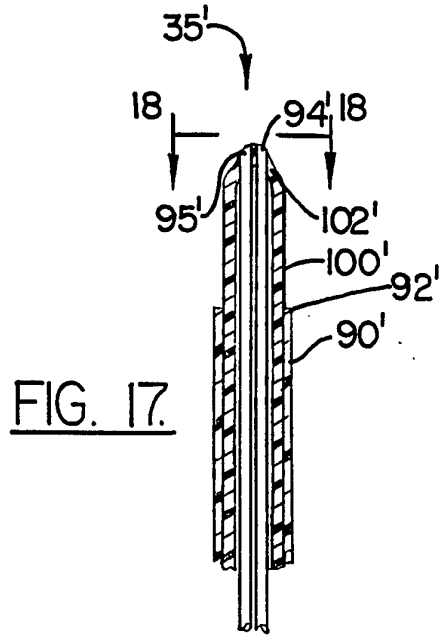

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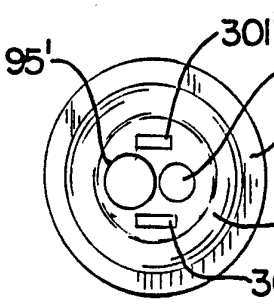

FIG. 18.

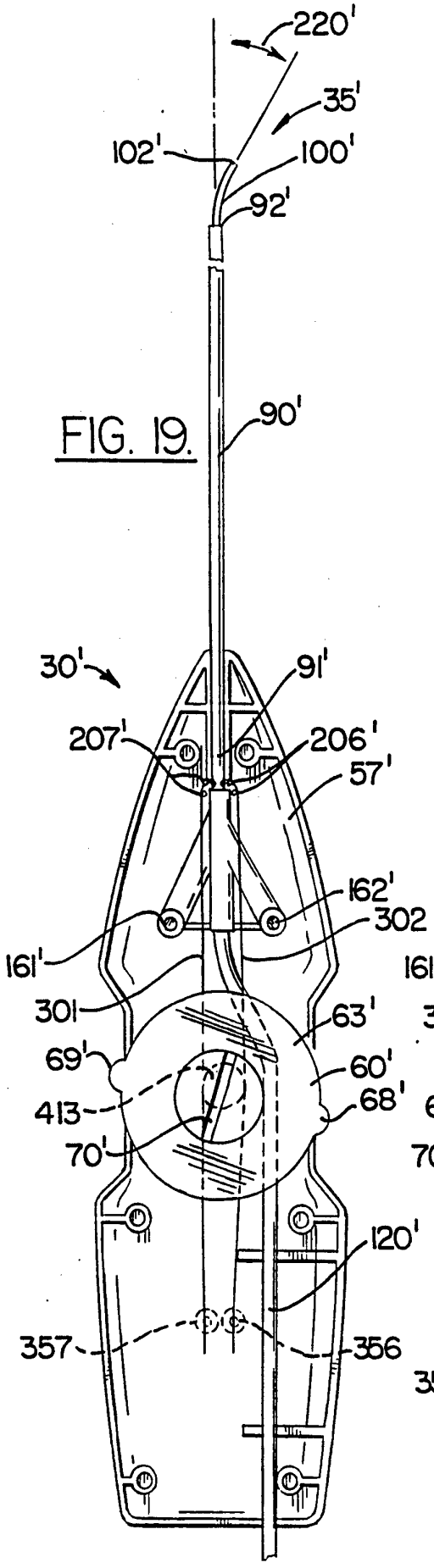
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FIG. 19.

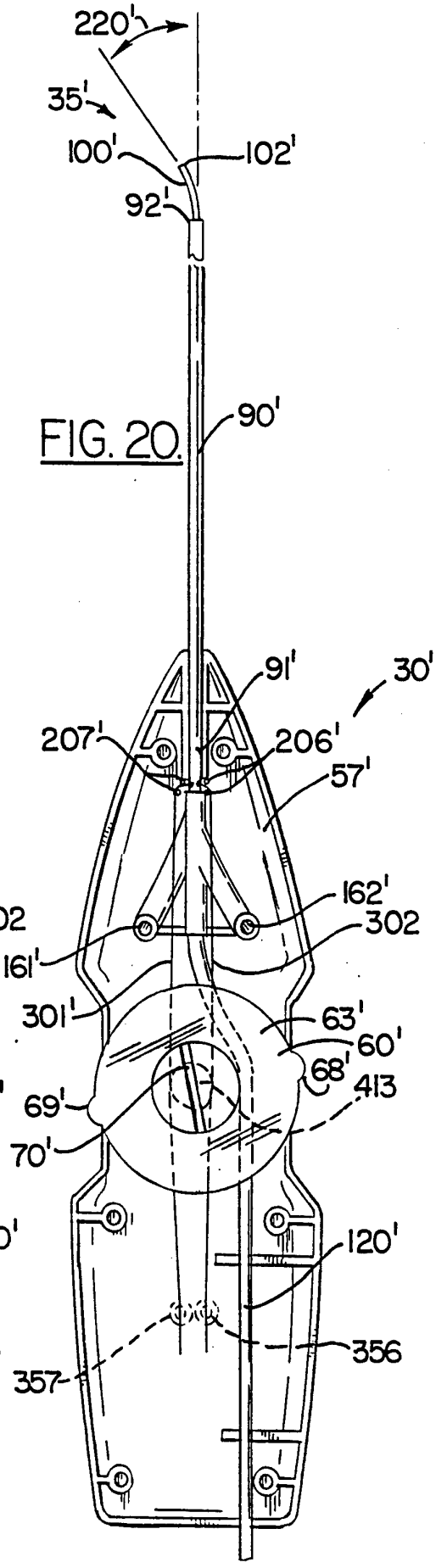
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FIG. 20.