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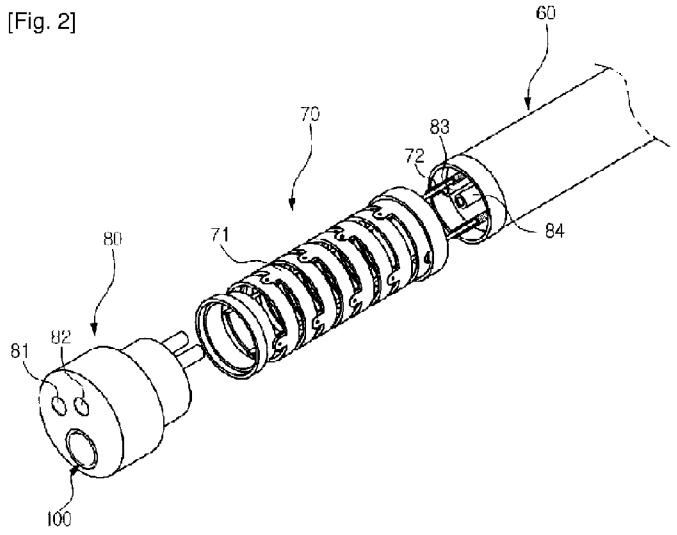
(54) Title: ENDOSCOPE

[Fig. 2]



(57) Abstract: Disclosed is an endoscope having a biopsy unit inserted in a tip member thereof. The endoscope includes a freely bendable flexible member, a bending member provided at the front of the flexible member, the bending member being bendable with at least one degree of freedom, an operating unit provided at the rear of the flexible member and serving to control bending of the bending member, a tip member coupled to a front end of the bending member and inserted into the human body, and a biopsy unit inserted in the tip member to collect and store tissue within the human body.

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Description

Title of Invention: ENDOSCOPE

Technical Field

[1] Embodiments of the present invention relates to an endoscope having a biopsy unit provided in a tip member thereof to collect and store tissue.

Background Art

[2] Generally, a medical endoscope is a medical instrument which is inserted into the body cavity or the internal organs to allow an operator to view the interior of the internal organs without a surgical operation and has made considerable contributions to medicine.

[3] Unlike other medical imaging instruments such as radiography systems, an endoscope is directly inserted into the human body. Thus, endoscopic inspection advantageously allows an operator to directly observe the shape or condition of the internal organs or the cavity of the human body with the naked eye.

[4] Such an endoscope includes a flexible tubular insert unit and an operating unit which an operator grips to adjust a radius of curvature operate of the insert unit.

[5] The endoscope may have a biopsy function to collect internal tissue, in addition to a function of observing the internal organs or the body cavity of the human body. Histological inspection of internal tissue collected from the endoscope enables diagnosis of the presence or absence of diseases or progression of a disease. To this end, the insert unit of the endoscope longitudinally defines a biopsy channel through which a forceps to collect internal tissue is insertable.

[6] Biopsy is performed simultaneously with endoscopic inspection. A forceps is inserted into the human body through the biopsy channel and is operated to collect tissue by manipulation from the outside of the human body. Then, the forceps is pulled from the body through the biopsy channel to allow an operator to collect the tissue. Insertion of the forceps and collection of internal tissue are generally performed by an assistant who participates in endoscopic inspection. In this case, instead of pulling the forceps from the body, a suction device and a suction container may be connected to an entrance of the biopsy channel at the outside of the body such that internal tissue is suctioned and collected into the suction container.

[7] The endoscope designed to be inserted into the human body may apply great physical burden to a person who is subjected to endoscopic inspection when the endoscope has a large outer diameter.

Disclosure of Invention

Technical Problem

[8] It is an aspect of the present invention to provide an endoscope having a biopsy unit provided in a tip member thereof.

Solution to Problem

[9] In accordance with one aspect of the present invention, an endoscope includes a freely bendable flexible member, a bending member provided at the front of the flexible member, the bending member being bendable with at least one degree of freedom, an operating unit provided at the rear of the flexible member and serving to control bending of the bending member, a tip member coupled to a front end of the bending member and inserted into the human body, and a biopsy unit inserted in the tip member to collect and store tissue within the human body.

[10] The biopsy unit may include a collector to collect the tissue in contact therewith, and a reservoir having a storage chamber in which the collected tissue is stored.

[11] The biopsy unit may further include a carrier to carry the tissue from the collector to the reservoir.

[12] The biopsy unit may further include a drive unit to drive the collector and the carrier.

[13] The collector may include a forceps having an interior space such that the tissue is cut and is temporarily stored in the space, and the reservoir may be connected to the collector such that the storage chamber communicates with the interior space of the forceps.

[14] The carrier may include a clamp movably placed between the interior space of the forceps and the storage chamber and serving to pull the tissue from the interior space of the forceps to the storage chamber.

[15] The reservoir may include an anti-movement member to prevent the tissue stored in the storage chamber from moving toward the collector.

[16] The collector may include a cylindrical case provided with an insertion opening for introduction of the tissue, a rotating shaft placed in the case, and a rotating blade coupled to the rotating shaft so as to be rotated close to an inner surface of the case.

[17] The collector may further include a stationary blade placed near the insertion opening and serving to cut the tissue inserted into the insertion opening in cooperation with the rotating blade.

[18] The stationary blade may be integrally formed with the case so as to define at least one edge of the insertion opening.

[19] The reservoir may include a through-hole for penetration of the rotating shaft, and the storage chamber may be provided around the through-hole so as to communicate with the through-hole.

[20] The reservoir may be separably mounted to the case.

[21] The reservoir may extend helically about the through-hole.

[22] The carrier may include a screw fastened to the rotating shaft.

[23] The screw may include a first screw to guide the cut tissue to an entrance of the storage chamber, and a second screw to carry the tissue, having passed through the entrance, into the storage chamber.

[24] The first screw may be rotated close to the inner surface of the case, and a rear surface of the first screw may come into contact with the tissue to move the tissue rearward during rotation of the first screw.

[25] The second screw may be provided at the rear of the first screw, and the second screw may come into contact with the tissue to move the tissue rearward of the storage chamber during rotation of the second screw.

[26] The drive unit may include a transfer drive unit to transfer the collector forward or rearward, and a rotation drive unit to rotate the rotating shaft.

[27] The collector may be movable forward or rearward to collect the tissue.

[28] The storage chamber may take the form of a pipe having one end thereof with an entrance and the other end closed such that a plurality of tissue samples is sequentially stored.

[29] The operating unit may further include a biopsy operation unit connected to the biopsy unit so as to manipulate the biopsy unit.

[30] The tip member may include a mounting bore into which the biopsy unit is inserted.

[31] The tip member may further include a connection member placed in the mounting bore and connected to the biopsy unit, and the biopsy unit may be electrically connected to the biopsy operation unit via the connection member.

[32] The biopsy unit may be separably coupled to the tip member.

[33] An outer diameter of the flexible member may be less than an outer diameter of the tip member.

[34] The flexible member may do not have a biopsy channel.

[35] The biopsy operation unit may include an operating member to allow the operator to manipulate the biopsy unit.

[36] In accordance with another aspect of the present invention, a biopsy unit includes a collector to collect tissue in contact therewith, a reservoir having a storage chamber in which the collected tissue is stored, and a carrier to carry the tissue from the collector to the reservoir.

[37] The biopsy unit may further include a drive unit to drive the collector and the carrier, and the drive unit may include a micro-motor.

[38] The collector may include a forceps having an interior space such that the tissue is cut and is temporarily stored in the space, and the reservoir may be connected to the collector such that the storage chamber communicates with the interior space of the forceps.

[39] The carrier may include a clamp movably placed between the interior space of the forceps and the storage chamber and serving to pull the tissue from the interior space of the forceps to the storage chamber.

[40] The collector may include a cylindrical case provided with an insertion opening for introduction of the tissue, a rotating shaft placed in the case, and a rotating blade coupled to the rotating shaft so as to be rotated close to an inner surface of the case.

[41] The collector may further include a stationary blade placed near the insertion opening and serving to cut the tissue inserted into the insertion opening in cooperation with the rotating blade.

[42] The stationary blade may be integrally formed with the case so as to define one edge of the insertion opening.

[43] The reservoir may include a through-hole for penetration of the rotating shaft, and the storage chamber may be provided around the through-hole so as to communicate with the through-hole.

[44] The reservoir may be separably mounted to the case.

[45] The reservoir may extend helically about the through-hole.

[46] The carrier may include a screw fastened to the rotating shaft.

[47] The screw may include a first screw to guide the cut tissue to an entrance of the storage chamber, and a second screw to carry the tissue, having passed through the entrance, into the storage chamber.

[48] The first screw may be rotated close to the inner surface of the case, and a rear surface of the first screw may come into contact with the tissue to move the tissue rearward during rotation of the first screw.

[49] The second screw may be provided at the rear of the first screw, and the second screw may come into contact with the tissue to move the tissue rearward of the storage chamber during rotation of the second screw.

[50] The drive unit may include a transfer drive unit to transfer the collector forward or rearward, and a rotation drive unit to rotate the rotating shaft.

[51] The collector may further include a suction member to suction the tissue.

[52] The storage chamber may be divided into a plurality of spaces in which a plurality of tissue samples is stored respectively.

[53] In accordance with a further aspect of the present invention, a biopsy method using an endoscope including a flexible insert unit to be inserted into the human body, an operating unit coupled to the insert unit, a tip member provided at a front end of the insert unit, and a biopsy unit to collect tissue, includes mounting the biopsy unit in the tip member, inserting the insert unit into the body and operating the operating unit so as to locate the tip member near the tissue, operating the operating unit to collect the internal tissue using the biopsy unit and store the collected internal tissue in the biopsy

unit, and pulling the insert unit from the body and separating the biopsy unit from the tip member.

Advantageous Effects of Invention

[54] As a result of removing a biopsy channel for entrance/exit of a biopsy unit from an insert unit of an endoscope, one or more embodiments of the present invention include an endoscope, which provides an insert unit with a reduced outer diameter, thereby reducing physical burden applied to a person being diagnosed. Removal of the biopsy channel has the effect of improving flexibility of the insert unit, resulting in enhanced workability of the endoscope. In addition, the endoscope does not require cleaning of a biopsy channel after completion of biopsy and therefore, may have reduced washing and sterilization time for reuse of the endoscope.

[55] Further, an operator using the endoscope can perform biopsy without an assistant, unlike a conventional endoscope in which a forceps is inserted into a biopsy channel in a state in which the endoscope has been inserted into the human body and then is pulled from the biopsy channel after collection of internal tissue to allow an operator to separate the tissue from the forceps.

[56] Furthermore, removal of the biopsy instrument, such as a biopsy channel, suction device, or collecting container, may reduce manufacturing costs of the endoscope and result in enhanced productivity.

Brief Description of Drawings

[57] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[58] FIG. 1 is a view illustrating an endoscope system according to an embodiment of the present invention;

[59] FIG. 2 is a view illustrating an insert unit of an endoscope according to an embodiment of the present invention;

[60] FIG. 3 is an enlarged view illustrating a front end of the endoscope provided with a biopsy unit according to an embodiment of the present invention;

[61] FIG. 4 is a view illustrating a configuration of a biopsy unit according to an embodiment of the present invention;

[62] FIG. 5 is a perspective view illustrating a biopsy unit according to an embodiment of the present invention;

[63] FIG. 6 is an exploded perspective view of the biopsy unit;

[64] FIGS. 7 to 10 are views illustrating operation of the biopsy unit;

[65] FIG. 11 is a perspective view illustrating a biopsy unit according to an embodiment of the present invention;

[66] FIG. 12 is an enlarged perspective view illustrating a part of the biopsy unit; and

[67] FIGS. 13 to 16 are views illustrating operation of the biopsy unit.

Best Mode for Carrying out the Invention

[68] Reference will now be made in detail to the exemplary embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. FIG. 1 is a view illustrating an endoscope system according to an embodiment of the present invention, and FIG. 2 is a view illustrating an insert unit of an endoscope according to an embodiment of the present invention.

[69] As illustrated in FIGS. 1 and 2, an endoscope system 1 for use in endoscopic inspection includes an endoscope 10, a light source device 20, a signal processing device 30, and a display device 35. The endoscope 10 includes an insert unit 40 to be inserted into the internal organs or the body cavity, and an operating unit 50 that an operator grips to perform a variety of functions of the endoscope 10.

[70] The insert unit 40 includes a freely bendable flexible member 60, a bending member 70, and a hard tip member 80 connected to a front end of the bending member 70. The flexible member 60 may consist of a helical steel band, a metallic wire mesh surrounding the helical steel band, and a covering tube. The flexible member is passively bent upon receiving external force.

[71] A plurality of bending wires 72 is inserted through the insert unit 40 such that the bending member 70 is bendable vertically or horizontally. One end of each bending wire 72 is secured to an end of the bending member 70.

[72] The bending member 70 may include a plurality of bending segments 71 connected to one another using, e.g., rivets, so as to be bent with at least one degree of freedom.

[73] The tip member 80 may be provided with an objective lens 81 to focus on an object and a light guide lens 82 to guide light directed from the light source device 20 to the object. A charge coupled device (not shown) may be provided behind the objective lens 81 to convert an image of the object collected by the objective lens 81 into an image signal. The charge coupled device may be connected to the objective lens 81.

[74] A signal cable 83 is connected to the charge coupled device (not shown) and is inserted through the insert unit 40 and the operating unit 50. The signal cable 83 is also connected to the signal processing device 30 by way of the interior of a universal cable 90 that extends rearward from the operating unit 50.

[75] A light guide 84 is inserted through the insert unit 40 and the operating unit 50 to guide light from the light source device 20 to the object. The light guide 84 is connected to the light source device 20 by way of the interior of the universal cable 90. The light source device 20 irradiates light into the human body through the light guide

84.

[76] The signal processing device 30 receives an image photographed by the tip member 80 of the endoscope 10 through the signal cable 83 and processes the image signal. The display device 35 receives the image signal from the signal processing device 30 and displays it to the operator of the endoscopy system.

[77] The operating unit 50 is provided with a bending operation unit 51 to control bending of the bending member 70. The bending operation unit 51 may include at least one knob.

[78] The endoscope 10 may have a biopsy function to collect tissue within the human body, in order to accurately diagnose diseases, in addition to a function of obtaining an image of an object within the human body. To this end, a biopsy channel is inserted through the insert unit 40 and a forceps to collect tissue is inserted into the human body through the biopsy channel. The operator collects tissue within the human body by operating the forceps at the outside of the human body.

[79] However, the above-described biopsy necessitates the biopsy channel inserted through the insert unit 40 and therefore, increases an outer diameter of the insert unit 40 proportionally to an outer diameter of the biopsy channel. In particular, if an outer diameter of the flexible member 60 increases, a person being diagnosed receives an increased physical burden during endoscopic inspection and bending ability of the bending member 70 is deteriorated. In addition, performing the biopsy using the biopsy channel necessitates an assistant who assists in biopsy.

[80] The endoscope 10 includes a biopsy unit 100 provided in the tip member 80 to collect and store body tissue and a biopsy operation unit 52 provided in the operating unit 50 to operate the biopsy unit 100. The biopsy operation unit 52 may be electrically operated and may include an operating member including a button, a lever, or a knob. An electric control circuit may be installed in the operating unit 50 or in the signal processing device 30.

[81] FIG. 3 is an enlarged view illustrating a front end of the endoscope provided with the biopsy unit according to an embodiment of the present invention, and FIG. 4 is a view illustrating a configuration of the biopsy unit according to an embodiment of the present invention.

[82] As illustrated in FIGS. 3 and 4, the biopsy unit 100 includes a collector 110 to collect tissue, a reservoir 120 to store the collected tissue, and a drive unit 140 to drive the collector 110. The biopsy unit 100 may further include a carrier 130 to carry the tissue from the collector 110 to the reservoir 120, and the carrier 130 may be driven by the drive unit 140 similar to the collector 110. The biopsy unit 100 includes a housing 101 defining an external appearance of the biopsy unit 100, and the aforementioned components may be placed within the housing 101.

[83] The tip member 80 contains a mounting bore 86 in which the biopsy unit 100 is mounted. That is, the biopsy unit 100 is inserted into and mounted in the mounting bore 86. The biopsy unit 100 may have a capsule shape and the mounting bore 86 may have a shape corresponding to the biopsy unit 100.

[84] The biopsy unit 100 may be separably coupled into the mounting bore 86. As such, the biopsy unit 100 is mounted into the mounting bore 86 prior to inserting the insert unit 40 illustrated in FIG. 1 into the body of a person being diagnosed. Then, after the insert unit 40 is pulled from the body when biopsy of the interior of the body is completed, the biopsy unit 100 may be separated from the mounting bore 86. The operator can obtain tissue from the separated biopsy unit 100.

[85] A connecting member 87 is provided in the mounting bore 86. the connecting member 87 may be a power connector to supply power to the biopsy unit 100. The biopsy operation unit 52 illustrated in FIG. 1 is electrically connected to the connecting member 87 provided in the mounting bore 86. To this end, a biopsy drive cable 85 is inserted through the insert unit 40 illustrated in FIG. 1 and serves to connect the biopsy operation unit 52 and the connecting member 87 to each other. The biopsy drive cable 85 may include an electric cable to supply power to the biopsy unit 100.

[86] The biopsy unit 100 is coupled to the connecting member 87 once being inserted into the mounting bore 86. The drive unit 140 of the biopsy unit 100 may be directly coupled to the connecting member 87, or the biopsy unit 100 may include a connector 150 coupled to the connecting member 87. The connector 150 may be a power connector to electrically connect the biopsy unit 100 and the connecting member 87 to each other.

[87] The collector 110 cuts tissue in contact therewith. To this end, the connector 100 may include a collecting member to collect tissue, such as a forceps, a blade, or the like. The collector 110 is movable outward from the tip member 80 so as to come into contact with tissue. The operator may first locate the biopsy unit 100 around tissue to be collected and thereafter, may operate the collector 110 by manipulating the biopsy operation unit 52. The collector 110 serves to collect tissue by ripping or cutting tissue while coming into contact with the tissue.

[88] The reservoir 120 stores the tissue collected by the collector 110 until biopsy is completed. The reservoir 120 contains a storage chamber in which tissue is stored, the storage chamber being provided with at least one entrance for introduction of tissue. The reservoir 120 may be connected to or separated from the collector 110. Alternatively, the reservoir 120 may be separated from the tip member 80 rather than being placed in the tip member 80. For example, the reservoir 120 may have a capsule shape and may be inserted into the body of a person being diagnosed.

[89] The storage chamber is configured such that a plurality of tissue samples is se-

quentially stored based on a collecting sequence. If the storage chamber takes the form of a pipe provided at one end thereof with an entrance, a plurality of tissue samples is sequentially stored in the pipe such that firstly collected tissue sample is located at an innermost position of the pipe. Alternatively, the storage chamber may be divided into a plurality of spaces. For example, the reservoir 120 may have a cylindrical shape and the storage chamber may include a plurality of storage spaces radially divided about a rotating shaft thereof.

[90] The carrier 130 carries the tissue collected by the collector 110. If the collector 110 and the reservoir 120 are arranged close to each other and connected to each other, the carrier 130 is movably placed between the collector 110 and the reservoir 120 so as to carry tissue from the collector 110 to the reservoir 120. The carrier 130 may carry tissue to the reservoir 120 in a contact or non-contact manner. In one example of non-contact carry methods, the carrier 130 may be a suction device to suction the tissue collected by the collector 110 and move the tissue to the reservoir 120.

[91] If the reservoir 120 is separated from the collector 110, the carrier 130 may be coupled to the collector 110 and serve to carry tissue by moving the collector 110 to the reservoir 120. For example, the carrier 130 may include a power transmission device, such as a screw, a wire and pulley, or a chain and sprocket.

[92] The drive unit 140 supplies drive force to the collector 110 to operate the collector 110. The drive unit 140 may move the collector 110 toward tissue, or may operate the collecting member provided in the collector 110 to collect tissue. The drive unit 140 may include an electrically-driven power generating device, such as a micro-motor, and a power transmission device, such as a screw, a wire and pulley, or a chain and sprocket. In addition, the drive unit 140 may be coupled to the carrier 130 to supply drive power to the carrier 130.

[93] FIG. 5 is a perspective view illustrating a biopsy unit according to an embodiment of the present invention, and FIG. 5B is an exploded perspective view of the biopsy unit.

[94] As illustrated in FIGS. 5 and 6, a biopsy unit 200 includes a collector 210 provided at a front end thereof so as to come into contact with tissue, a reservoir 220 placed at a rear end of the collector 210, a carrier 230 movably provided between the collector 210 and the reservoir 220, and a drive unit 240 to drive the collector 210 and the carrier 230.

[95] The collector 210 includes a forceps 211, which is pivoted about a hinge shaft 214 and serves to cut tissue. The forceps 211 includes a first forceps part 212 and a second forceps part 213 hingedly coupled to each other. The second forceps part 213 is pivotable relative to the first forceps part 212 and has a cutting opening 216 into which tissue is inserted. The first forceps part 212 is a stationary part and the second forceps part 213 is pivotable relative to the first forceps part 212 to open or close the cutting

opening 216. Alternatively, both the first forceps part 212 and the second forceps part 213 may be pivotable relative to each other.

[96] The first forceps part 212 is provided with a cutting blade 215. The cutting blade 215 comes into contact with the second forceps part 213 or is located close to the second forces part 213 when the second forceps part 213 is pivoted to close the cutting opening 216. The cutting blade 215 may be provided around the cutting opening 216. The cutting blade 215 may be integrally formed with the first forceps part 212. In addition, the cutting blade 215 may be provided at the second forceps part 213 other than the first forceps part 212, or may be provided at either forceps part 212 or 213.

[97] The forceps 211 contains a collecting chamber 217 in which cut tissue is temporarily stored. The collecting chamber 217 is a space defined by inner surfaces of the first forceps part 212 and the second forceps part 213 when the cutting opening 216 is closed. A rear end of the collecting chamber 217 communicates with a storage chamber 222 provided in the reservoir 220 such that tissue is carried from the collecting chamber 217 to the storage chamber 222.

[98] The reservoir 220 is located at the rear end of the collector 210 and is coupled to the collector 210. Alternatively, the reservoir 220 may be integrally formed with the collector 210, rather than being separated from the collector 210.

[99] The storage chamber 222 in which tissue is stored is provided in the reservoir 220. The storage chamber 222 is configured to sequentially store a plurality of tissue samples. To this end, the storage chamber 222 is provided at one end thereof with an entrance 223 and extends in a given direction from the entrance 223, and the other end of the storage chamber 222 is closed. The entrance of the storage chamber 222 communicates with the collecting chamber 217. As such, the tissue temporarily stored in the collecting chamber 217 can be carried into the storage chamber 222 by the carrier 230.

[100] An anti-movement member 224 is provided in the storage chamber 222. The anti-movement member 224 prevents the tissue stored in the storage chamber 222 from moving toward the entrance 223 of the storage chamber 222 and leaking from the storage chamber 222. The anti-movement member 224 may be a boss provided at an inner wall surface of the storage chamber 222. The boss is inclined inward of the storage chamber 222 to prevent the tissue from moving to the entrance 223 of the storage chamber 222. The boss may have a pointed end to prevent movement of the tissue.

[101] The carrier 230 includes a clamp 231 movably placed between the collecting chamber 217 of the collector 210 and the storage chamber 222 of the reservoir 220. The clamp 231 is placed across the collecting chamber 217 and the storage chamber 222 such that a folded end of the L-shaped clamp 231 faces the front end of the biopsy

unit 200. An opposite end of the clamp 231 extends toward the drive unit 240 and is connected to the drive unit 240. As the clamp 231 is moved rearward of the biopsy unit 200, the folded end pulls tissue and carries the tissue from the collecting chamber 217 to the storage chamber 222.

[102] The drive unit 240 is located behind the collector 210. The drive unit 240 may include a collector drive unit 250 to drive the collector 210 and the carrier 230 and a transfer drive unit to transfer the collector 210 forward or rearward.

[103] The collector drive unit 250 is coupled to a rear end of the reservoir 220. The collector drive unit 250 contains at least one micro-motor therein and the micro-motor is connected to the forceps 211 and the clamp 231. Power transmission device may be respectively placed between the micro-motor and the forceps 211 and between the micro-motor and the clamp 231. For example, the power transmission device, such as a wire and a pulley, may be connected to the micro-motor and the hinge shaft 214 of the forceps 211 and serve to transmit rotational power of the micro-motor to the second forceps part 213. In addition, the power transmission device, such as a ball screw, may be placed between the micro-motor and the clamp 231 and serve to move the clamp 231 forward or rearward.

[104] The collector drive unit 250 may be movably coupled to the transfer drive unit 260. The collector drive unit 250 may be provided with a transfer groove 252 in a movement direction thereof, and the transfer drive unit 260 may be provided with a transfer guide 262 coupled into the transfer groove 252. At least one rotating plate 263 is provided in the transfer drive unit 260 and is rotated about a rotating shaft extending in the movement direction of the collector drive unit 250. The collector drive unit 250 is provided at a bottom surface thereof with helical grooves (253, FIGS. 7-10) to which the rotating plate 263 is screwed. Thus, the collector drive unit 250 is movable forward or rearward based on rotation of the rotating plate 263. The transfer drive unit 260 may include a micro-motor 264 to drive the rotating plate 263.

[105] FIGS. 7 to 10 are views illustrating operation of the biopsy unit.

[106] As illustrated in FIGS. 7 and 8, the transfer drive unit 260 transfers the collector drive unit 250 forward until the collector 210 accesses tissue. Then, the collector drive unit 250 pivotally rotates the second forceps part 213 to open the cutting opening 216 such that the tissue is inserted into the forceps 211 through the cutting opening 216. Once the tissue is inserted into the forceps 211 through the cutting opening 216, the collector drive unit 250 pivotally rotates the second forceps part 213 to close the cutting opening 216. The tissue is cut by the cutting blade 217 when the cutting opening 216 is closed and the cut tissue is temporarily stored in the collecting chamber 217 of the forceps 211.

[107] As illustrated in FIGS. 9 and 10, the folded end of the clamp 231 is initially located

close to the first forceps part 212. The collector drive unit 250 moves the clamp 231 rearward to carry the tissue from the collecting chamber 217 to the storage chamber 222. The tissue introduced into the storage chamber 222 is supported by the anti-movement member 224 so as not to be moved toward the forceps 211. Then, the collector drive unit 250 returns the clamp 231 to an original position thereof and the transfer drive unit 260 returns the collector drive unit 250 to an original position thereof. The above-described collection and storage of tissue can be performed at any position within the human body. Collected tissue samples are sequentially stored in the storage chamber 222.

Mode for the Invention

[108] FIG. 11 is a perspective view illustrating a biopsy unit according to an embodiment of the present invention, and FIG. 12 is an enlarged perspective view illustrating a part of the biopsy unit.

[109] As illustrated in FIGS. 11 and 12, a biopsy unit 300 includes a collector 310 provided at a front end thereof, a reservoir 320 placed at a rear end of the collector 310, a carrier 330 provided between the collector 310 and the reservoir 320, and a drive unit 340 to drive the collector 310 and the carrier 330.

[110] The collector 310 includes a cylindrical case 311, a rotating shaft 313 placed in the case 311 in a longitudinal direction of the biopsy unit 300, and a rotating blade 314 coupled to the rotating shaft 313 to perform rotation at a position close to an inner surface of the case 311.

[111] The case 311 has a cutting opening 312 into which tissue is inserted. The cutting opening 312 of the case 311 is formed at a front position of the case 311 such that tissue is inserted into the case 311 when the case 311 comes into contact with the tissue.

[112] The rotating blade 314 is coupled to the rotating shaft 313 such that a blade edge is rotated at a position close to the inner surface of the case 311. When the rotating shaft 313 is rotated, the rotating blade 314 is rotated around the cutting opening 312, thereby cutting the tissue inserted through the cutting opening 312.

[113] The collector 310 includes a stationary blade 315 provided at the periphery of the cutting opening 312, to assure effective cutting of tissue. When the rotating blade 314 is rotated so as to be close to the stationary blade 315, tissue between the rotating blade 314 and the stationary blade 315 can be cut. The stationary blade 315 may be separately provided and be installed to the periphery of the cutting opening 312, or may be integrally formed with the case 311 so as to define one edge of the cutting opening 312.

[114] The reservoir 320 is placed behind the rotating blade 314 and is coupled to the case

311. The reservoir 320 has a cylindrical shape and is centrally provided with a through-hole 324 through which the rotating shaft 313 penetrates.

[115] The reservoir 320 contains a storage chamber 322 therein. The storage chamber 322 communicates with the through-hole 324 such that tissue within the storage chamber 322 comes into contact with the carrier 330 near the through-hole 324. An entrance 323 of the storage chamber 322 is formed at a front position of the reservoir 320 so as to be located close to the cutting opening 312 of the case 311.

[116] The storage chamber 322 may extend helically about the through-hole 324. Thus, the storage chamber 322 may have a greater length than the reservoir 320 to ensure that a plurality of tissue samples can be stored in the storage chamber 322.

[117] The reservoir 320 may be separably coupled to the case 311. As such, the reservoir 320 may be separated from the case 311 at the outside of the body of a person being diagnosed after completion of biopsy, allowing the operator to take the tissue from the storage chamber 322.

[118] The carrier 330 includes a screw 311 fastened to the rotating shaft 313 and a toothed rotating member 334 fastened to the rotating shaft 313 behind the screw 311. The screw 331 comes into contact with tissue to guide the tissue to the entrance 323 of the storage chamber 322, and carries the tissue having passed through the entrance 323 into the storage chamber 322. The toothed rotating member 334 supports a rear end of the screw 331 and carries the tissue into the storage chamber 322 while being rotated along with the screw 331.

[119] The screw 331 includes a first screw 332 fastened to the rotating shaft 313 at a position near the rotating and a second screw 333 coupled to the rotating shaft 313 at a position behind the first screw 332. The first screw 332 is rotated close to the inner surface of the case 311 and a rear surface of the first screw 332 is rotated in contact with tissue to carry tissue into the entrance 323 of the storage chamber 322. The second screw 333 is rotated in contact with tissue through the through-hole 324 to carry tissue into the storage chamber 322. In this case, the first screw 332 and the second screw 333 are provided with helical threads threaded in opposite directions.

[120] The drive unit 340 is placed behind the collector 310. The drive unit 340 may include a rotation drive unit 350 to drive the collector 310 and the carrier 330 and a transfer drive unit 360 to transfer the collector 310 forward or rearward.

[121] The rotation drive unit 350 is coupled to a rear end of the case 311. A micro-motor to rotate the rotating shaft 313 is placed in the rotation drive unit 350. The micro-motor may be directly coupled to the rotating shaft 313, or may be coupled to the rotating shaft 313 with a reduction gear interposed therebetween, the reduction gear serving to reduce the rotational speed of the rotating shaft 313. The rotation drive unit 350 may drive the collector 310 and the carrier 330 simultaneously by rotating the rotating shaft

313. Thus, it is unnecessary to connect the collector 310 and the carrier 330 to the micro-motor and therefore, the biopsy unit 300 may have a reduced size, simplified control and reduced production costs.

[122] The rotation drive unit 350 may be movably coupled to the transfer drive unit 360. The rotation drive unit 350 may be provided with a transfer groove 352 in a movement direction thereof, and the transfer drive unit 360 may be provided with a transfer guide 362 coupled into the transfer groove 352. A rotating plate 363 is provided in the transfer drive unit 360. The rotation drive unit 350 is provided at a bottom surface thereof with helical grooves (not shown) to which the rotating plate 363 is screwed. Thus, the rotation drive unit 350 is movable forward or rearward based on rotation of the rotating plate 363. The transfer drive unit 360 may include a micro-motor 364 to drive the rotating plate 363.

[123] FIGS. 13 to 16 are views illustrating operation of the biopsy unit.

[124] As illustrated in FIGS. 13 and 14, the transfer drive unit 360 transfers the rotation drive unit 350 forward until the collector 310 can access the tissue. The case 311 presses tissue by operation of the transfer drive unit 360, thereby acting to insert tissue into the cutting opening 312. Then, the rotation drive unit 350 rotates the rotating shaft 313, causing the rotating blade 314 to be rotated along with the rotating shaft 313. As the rotating blade 314 becomes close to the stationary blade 315, the tissue is cut and separated, thereby entering the case 311.

[125] As illustrated in FIGS. 15 and 16, the rotation drive unit 350 continuously rotates the rotating shaft 313, causing the first screw 332 and the second screw 333 to be rotated along with the rotating shaft 313. The first screw 332 is rotated while coming into contact at a rear surface thereof with the tissue, thereby acting to carry the tissue to the entrance of the storage chamber 322. The second screw 333 comes into contact with the tissue to carry it from the entrance of the storage chamber 322 into the storage chamber 322. The rotation drive unit 350 stops operation when the tissue is completely stored, and the transfer drive unit 360 returns the rotation drive unit 350 to an original position. The above-described collection and storage of tissue can be performed at any position within the human body. Collected tissue samples are sequentially stored in the storage chamber 322.

Industrial Applicability

[126] The present invention is applicable to a medical endoscope having a biopsy function.

[127] Although the embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

[Claim 1] An endoscope comprising:
a freely bendable flexible member;
a bending member provided at the front of the flexible member, the bending member being bendable with at least one degree of freedom;
an operating unit provided at the rear of the flexible member and serving to control bending of the bending member;
a tip member coupled to a front end of the bending member and inserted into the human body; and
a biopsy unit inserted in the tip member to collect and store tissue within the human body.

[Claim 2] The endoscope according to claim 1, wherein the biopsy unit includes a collector to collect the tissue in contact therewith, and a reservoir having a storage chamber in which the collected tissue is stored.

[Claim 3] The endoscope according to claim 2, wherein the biopsy unit further includes a carrier to carry the tissue from the collector to the reservoir.

[Claim 4] The endoscope according to claim 3, wherein the biopsy unit further includes a drive unit to drive the collector and the carrier.

[Claim 5] The endoscope according to claim 4, wherein the collector includes a forceps having an interior space such that the tissue is cut and is temporarily stored in the space, and
wherein the reservoir is connected to the collector such that the storage chamber communicates with the interior space of the forceps.

[Claim 6] The endoscope according to claim 5, wherein the reservoir is separably mounted.

[Claim 7] The endoscope according to claim 5, wherein the carrier includes a clamp movably placed between the interior space of the forceps and the storage chamber and serving to pull the tissue from the interior space of the forceps to the storage chamber.

[Claim 8] The endoscope according to claim 5, wherein the reservoir includes an anti-movement member to prevent the tissue stored in the storage chamber from moving toward the collector.

[Claim 9] The endoscope according to claim 4, wherein the collector includes a cylindrical case provided with an insertion opening for introduction of the tissue, a rotating shaft placed in the case, and a rotating blade coupled to the rotating shaft so as to be rotated close to an inner surface of the case.

[Claim 10] The endoscope according to claim 9, wherein the collector further includes a stationary blade placed near the insertion opening and serving to cut the tissue inserted into the insertion opening in co-operation with the rotating blade.

[Claim 11] The endoscope according to claim 10, wherein the stationary blade is integrally formed with the case so as to define at least one edge of the insertion opening.

[Claim 12] The endoscope according to claim 9, wherein the reservoir includes a through-hole for penetration of the rotating shaft, and
wherein the storage chamber is provided around the through-hole so as to communicate with the through-hole.

[Claim 13] The endoscope according to claim 9, wherein the reservoir is separably mounted to the case.

[Claim 14] The endoscope according to claim 12, wherein the reservoir extends helically about the through-hole.

[Claim 15] The endoscope according to claim 12, wherein the carrier includes a screw fastened to the rotating shaft.

[Claim 16] The endoscope according to claim 15, wherein the screw includes a first screw to guide the cut tissue to an entrance of the storage chamber, and a second screw to carry the tissue, having passed through the entrance, into the storage chamber.

[Claim 17] The endoscope according to claim 16, wherein the first screw is rotated close to the inner surface of the case, and
wherein a rear surface of the first screw comes into contact with the tissue to move the tissue rearward during rotation of the first screw.

[Claim 18] The endoscope according to claim 16, wherein the second screw is provided at the rear of the first screw, and
wherein the second screw comes into contact with the tissue to move the tissue rearward of the storage chamber during rotation of the second screw.

[Claim 19] The endoscope according to claim 9, wherein the drive unit includes a transfer drive unit to transfer the collector forward or rearward, and a rotation drive unit to rotate the rotating shaft.

[Claim 20] The endoscope according to claim 2, wherein the collector is movable forward or rearward to collect the tissue.

[Claim 21] The endoscope according to claim 2, wherein the storage chamber takes the form of a pipe having one end thereof with an entrance and the other end closed such that a plurality of tissue samples is sequentially

stored.

[Claim 22] The endoscope according to claim 1, wherein the operating unit further includes a biopsy operation unit connected to the biopsy unit so as to manipulate the biopsy unit.

[Claim 23] The endoscope according to claim 1, wherein the tip member includes a mounting bore into which the biopsy unit is inserted.

[Claim 24] The endoscope according to claim 23, wherein the tip member further includes a connection member placed in the mounting bore and connected to the biopsy unit, and
wherein the biopsy unit is electrically connected to the biopsy operation unit via the connection member.

[Claim 25] The endoscope according to claim 1, wherein the biopsy unit is separably coupled to the tip member.

[Claim 26] The endoscope according to claim 1, wherein an outer diameter of the flexible member is less than an outer diameter of the tip member.

[Claim 27] The endoscope according to claim 1, wherein the flexible member does not have a biopsy channel.

[Claim 28] The endoscope according to claim 22, wherein the biopsy operation unit includes an operating member to allow the operator to manipulate the biopsy unit.

[Claim 29] A biopsy unit comprising:
a collector to collect tissue in contact therewith;
a reservoir having a storage chamber in which the collected tissue is stored; and
a carrier to carry the tissue from the collector to the reservoir.

[Claim 30] The biopsy unit according to claim 29, further comprising a drive unit to drive the collector and the carrier,
wherein the drive unit includes a micro-motor.

[Claim 31] The biopsy unit according to claim 30, wherein the collector includes a forceps having an interior space such that the tissue is cut and is temporarily stored in the space, and
wherein the reservoir is connected to the collector such that the storage chamber communicates with the interior space of the forceps.

[Claim 32] The biopsy unit according to claim 31, wherein the reservoir is separably mounted.

[Claim 33] The biopsy unit according to claim 31, wherein the carrier includes a clamp movably placed between the interior space of the forceps and the storage chamber and serving to pull the tissue from the interior space of

the forceps to the storage chamber.

[Claim 34] The biopsy unit according to claim 30, wherein the collector includes a cylindrical case provided with an insertion opening for introduction of the tissue, a rotating shaft placed in the case, and a rotating blade coupled to the rotating shaft so as to be rotated close to an inner surface of the case.

[Claim 35] The biopsy unit according to claim 34, wherein the collector further includes a stationary blade placed near the insertion opening and serving to cut the tissue inserted into the insertion opening in co-operation with the rotating blade.

[Claim 36] The biopsy unit according to claim 35, wherein the stationary blade is integrally formed with the case so as to define one edge of the insertion opening.

[Claim 37] The biopsy unit according to claim 34, wherein the reservoir includes a through-hole for penetration of the rotating shaft, and
wherein the storage chamber is provided around the through-hole so as to communicate with the through-hole.

[Claim 38] The biopsy unit according to claim 34, wherein the reservoir is separably mounted to the case.

[Claim 39] The biopsy unit according to claim 37, wherein the reservoir extends helically about the through-hole.

[Claim 40] The biopsy unit according to claim 37, wherein the carrier includes a screw fastened to the rotating shaft.

[Claim 41] The biopsy unit according to claim 40, wherein the screw includes a first screw to guide the cut tissue to an entrance of the storage chamber, and a second screw to carry the tissue, having passed through the entrance, into the storage chamber.

[Claim 42] The biopsy unit according to claim 41, wherein the first screw is rotated close to the inner surface of the case, and
wherein a rear surface of the first screw comes into contact with the tissue to move the tissue rearward during rotation of the first screw.

[Claim 43] The biopsy unit according to claim 41, wherein the second screw is provided at the rear of the first screw, and
wherein the second screw comes into contact with the tissue to move the tissue rearward of the storage chamber during rotation of the second screw.

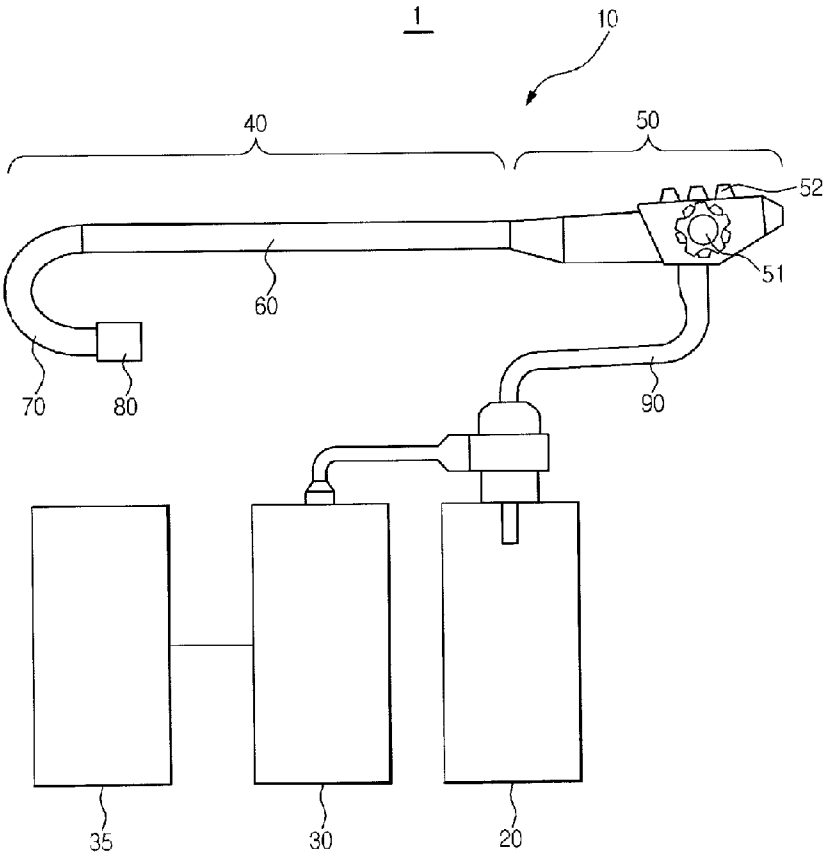
[Claim 44] The biopsy unit according to claim 34, wherein the drive unit includes a transfer drive unit to transfer the collector forward or rearward, and a

rotation drive unit to rotate the rotating shaft.

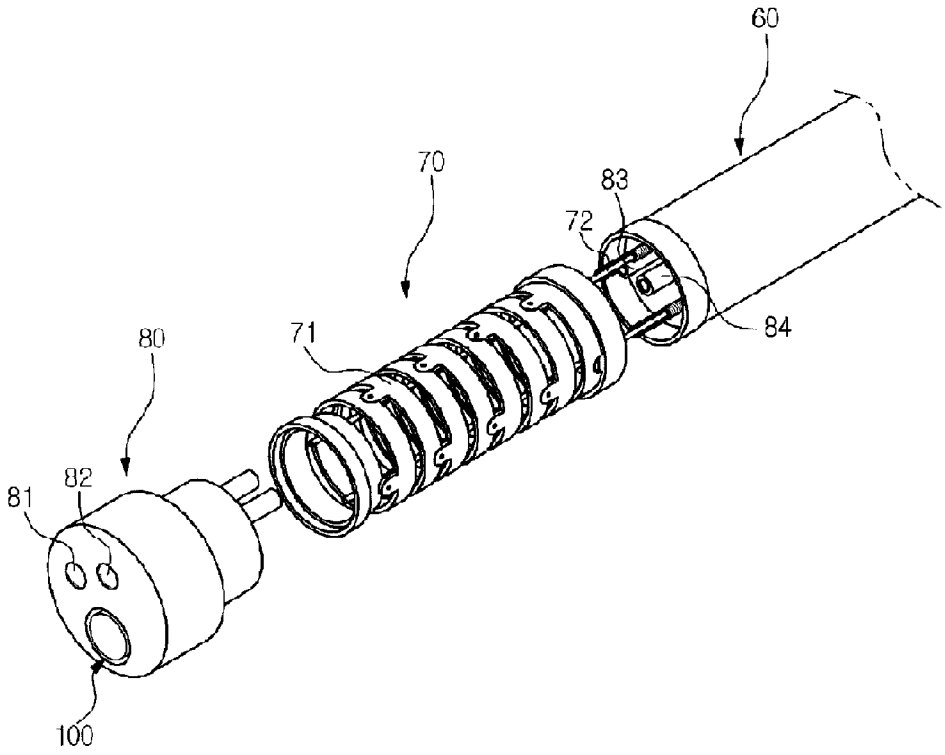
[Claim 45] The biopsy unit according to claim 29, wherein the storage chamber is divided into a plurality of spaces in which a plurality of tissue samples is stored respectively.

[Claim 46] A biopsy method using an endoscope comprising a flexible insert unit to be inserted into the human body, an operating unit coupled to the insert unit, a tip member provided at a front end of the insert unit, and a biopsy unit to collect tissue, comprising:
mounting the biopsy unit in the tip member;
inserting the insert unit into the body and operating the operating unit so as to locate the tip member near the tissue;
operating the operating unit to collect the internal tissue using the biopsy unit and store the collected internal tissue in the biopsy unit; and
pulling the insert unit from the body and separating the biopsy unit from the tip member.

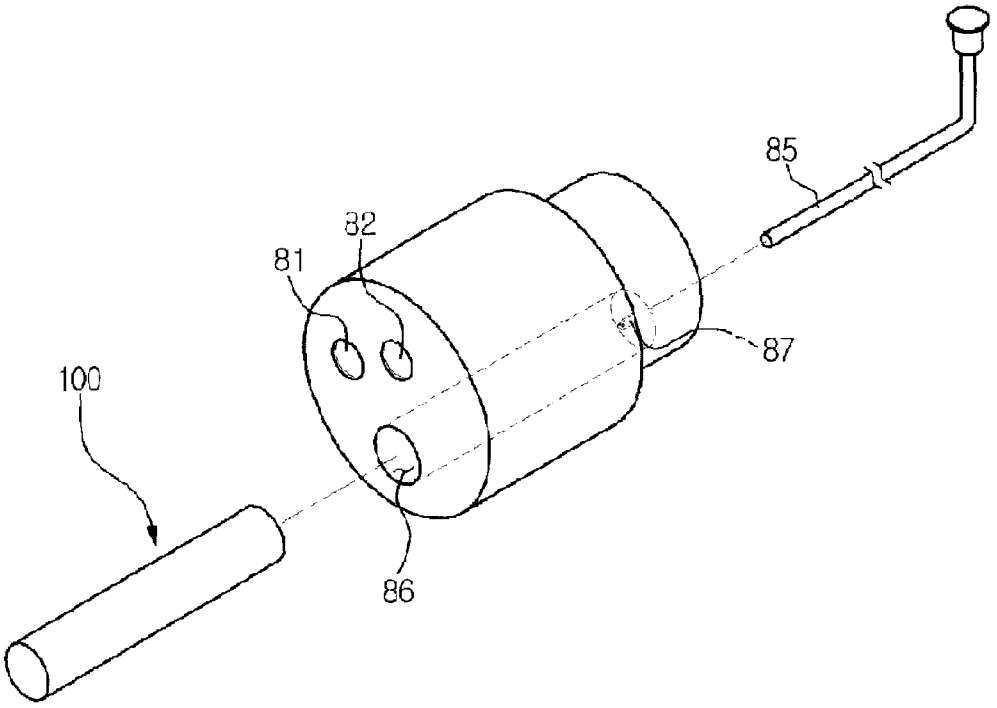
[Fig. 1]



[Fig. 2]



[Fig. 3]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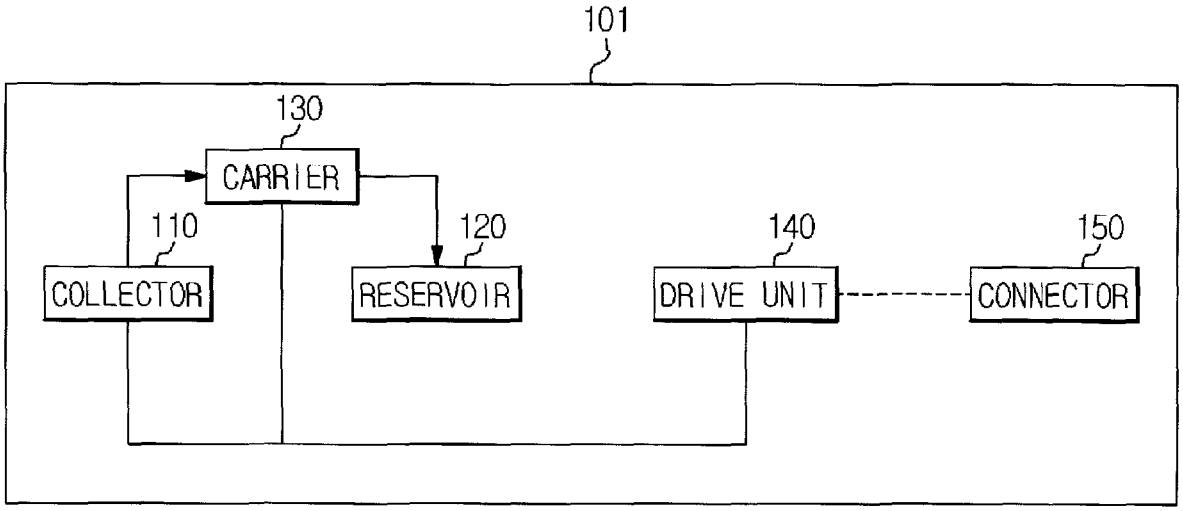
[Fig. 4]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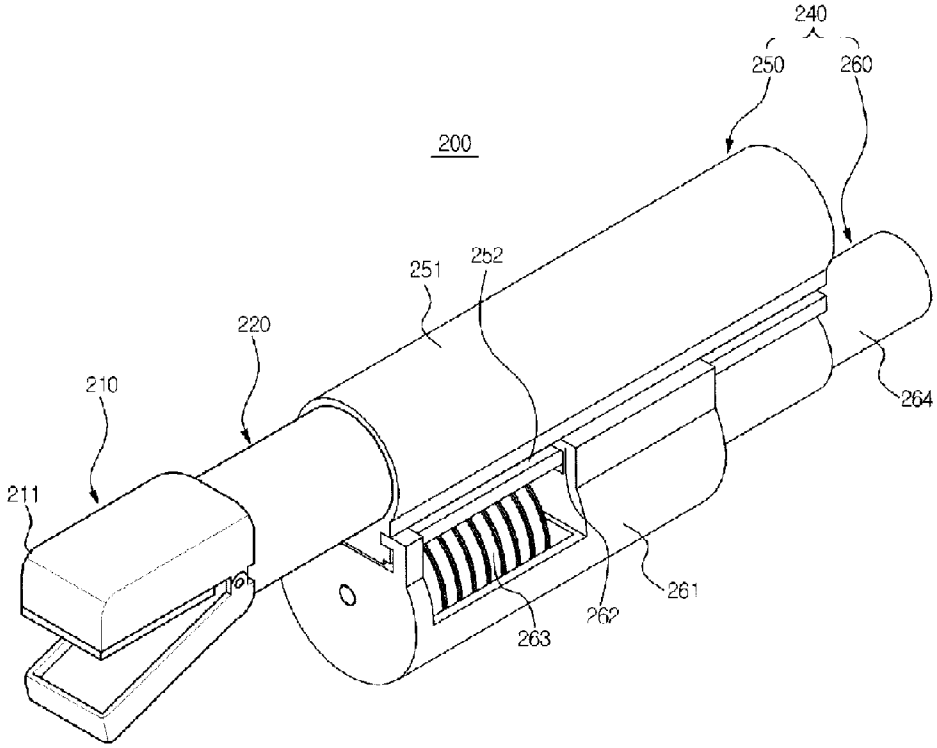
[Fig. 5]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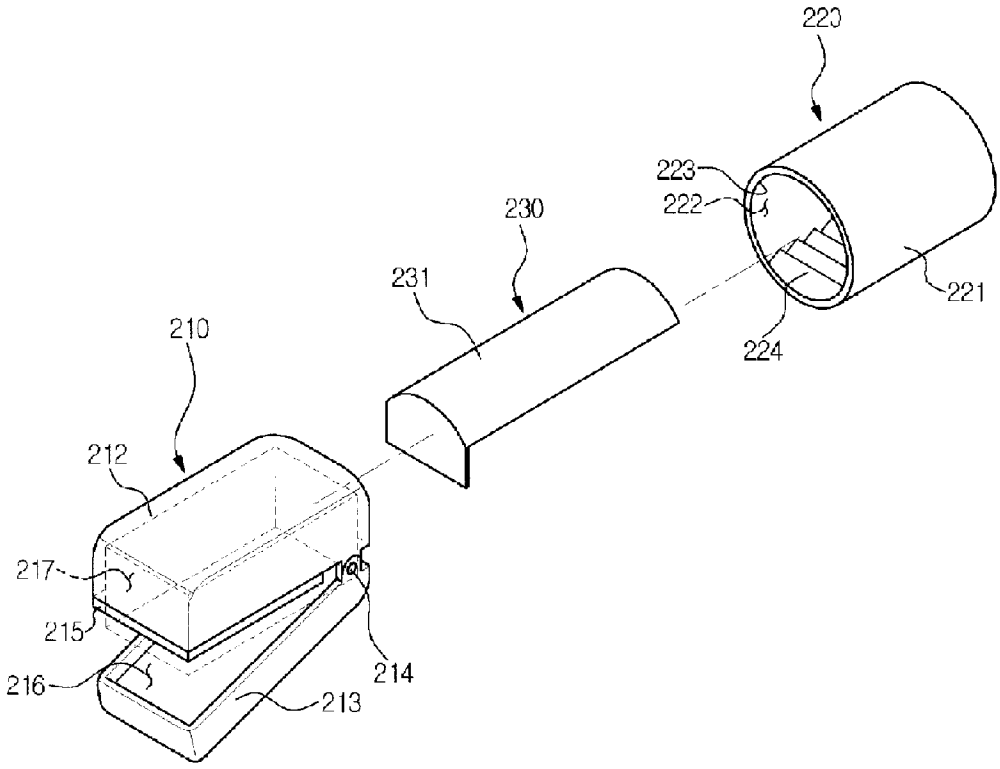
[Fig. 6]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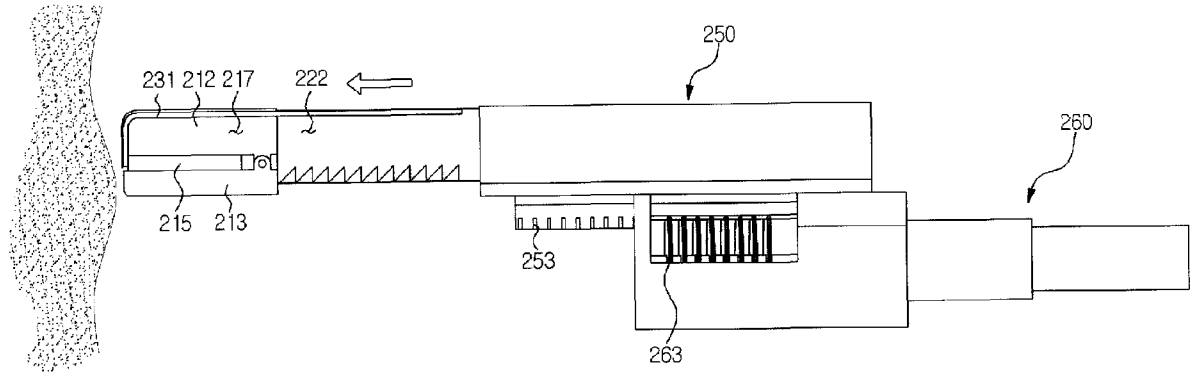
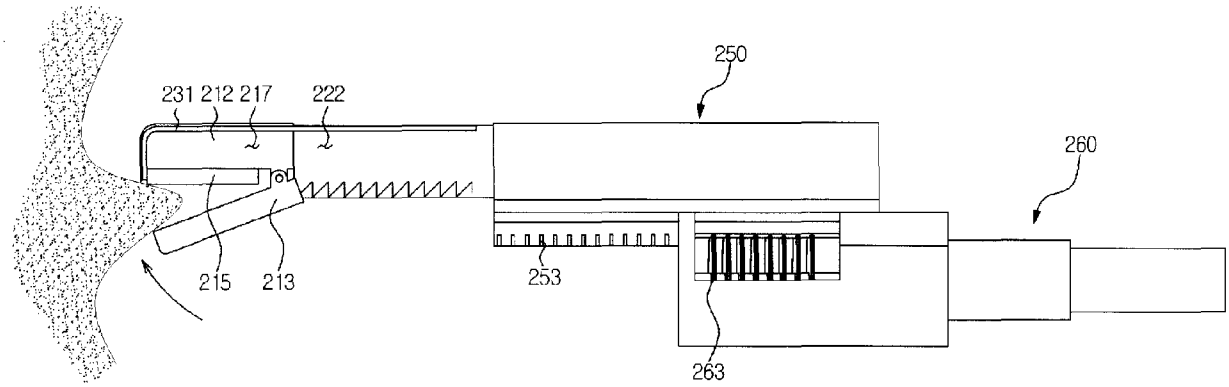
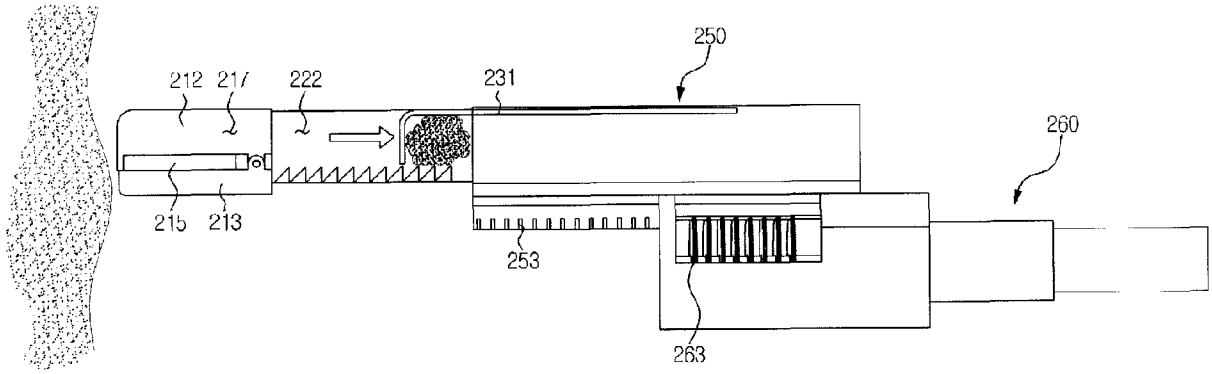
[Fig. 7]



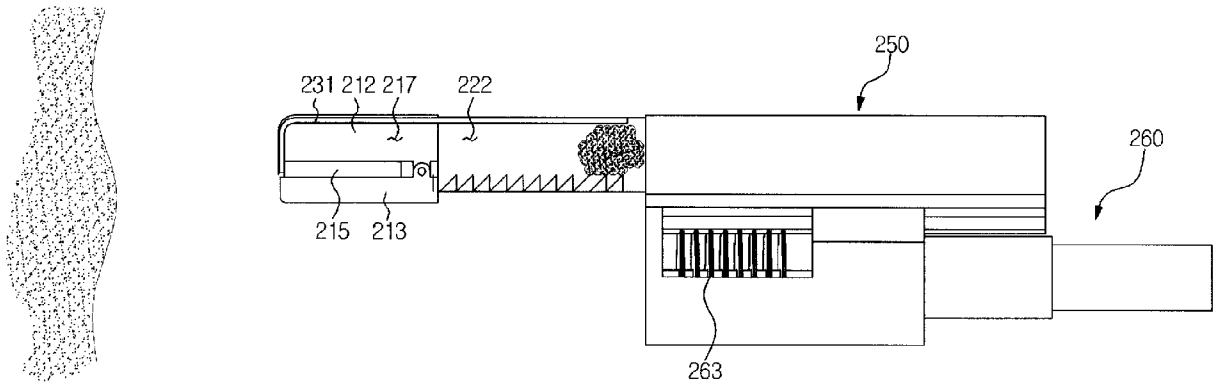
[Fig. 8]



[Fig. 9]



[Fig. 10]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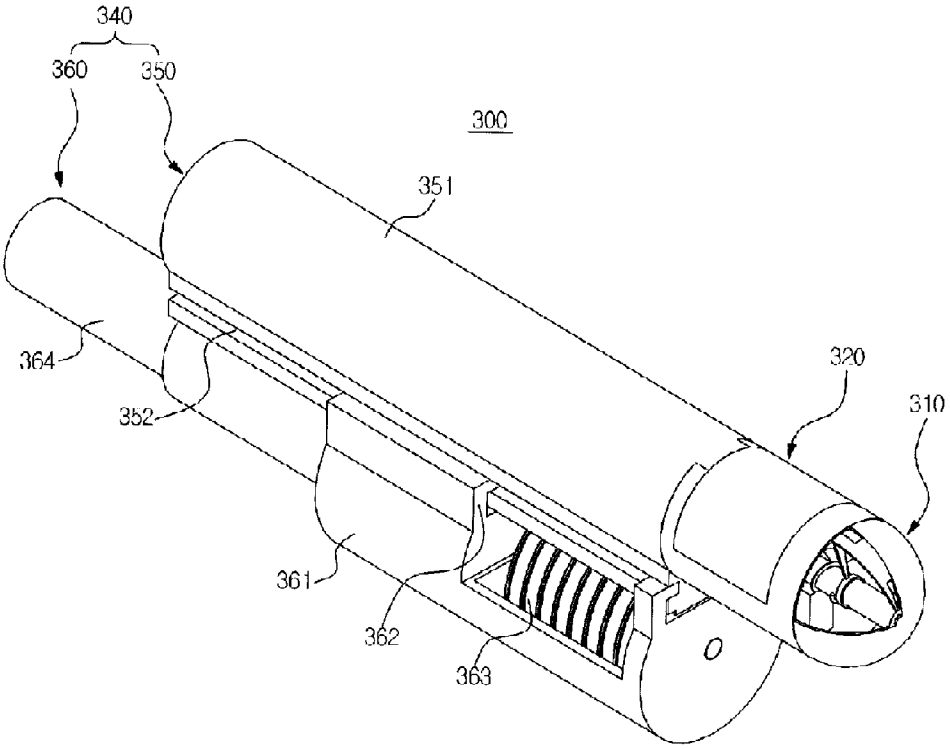
[Fig. 11]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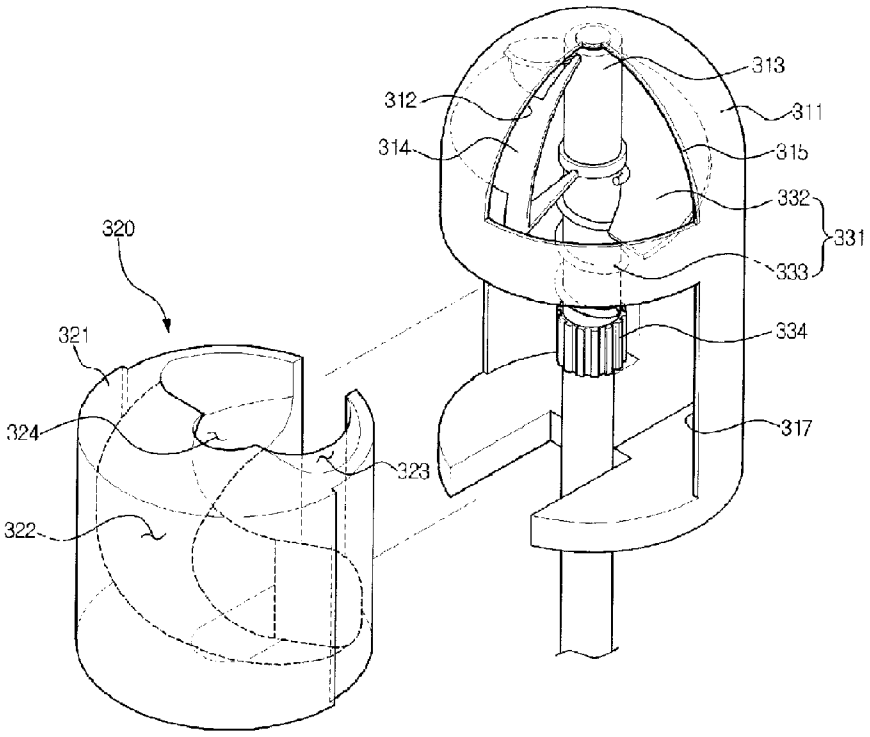
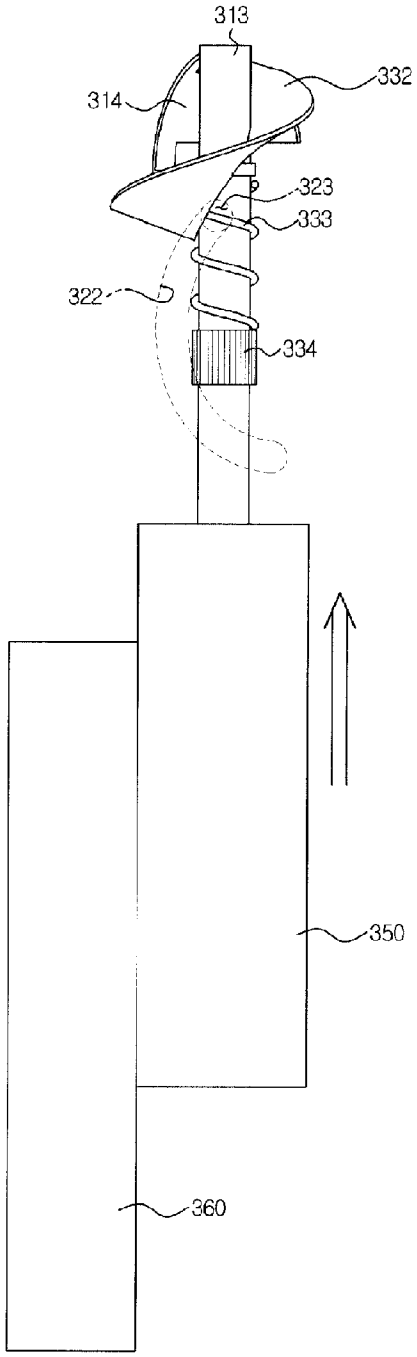
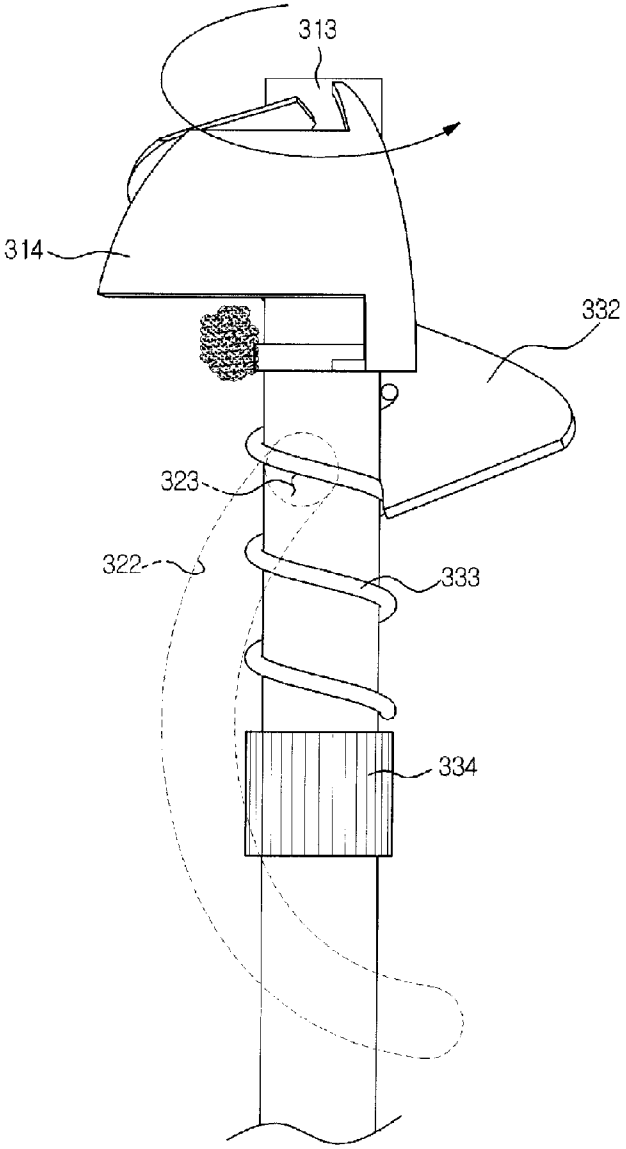
[Fig. 12]



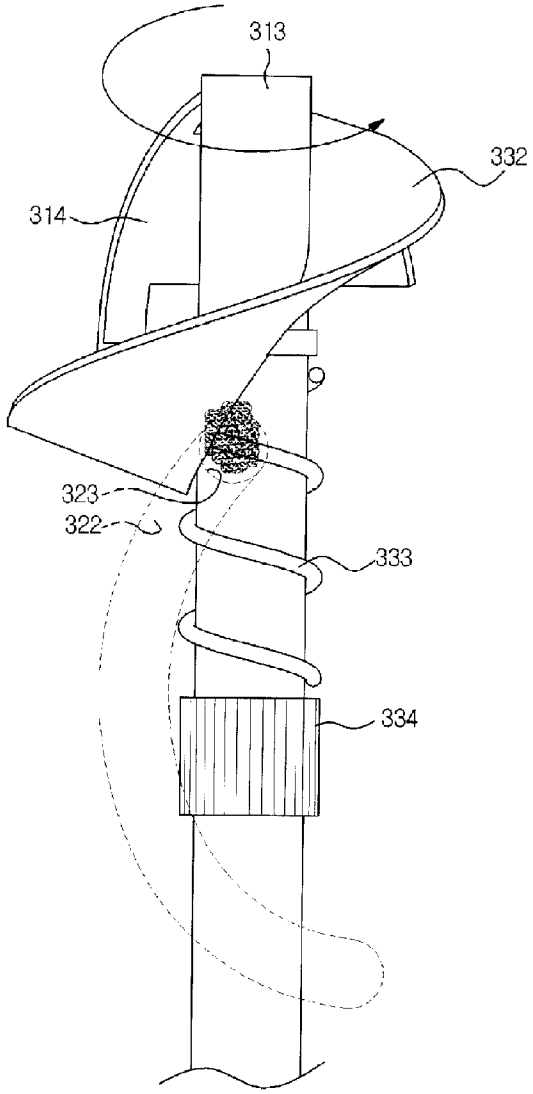
[Fig. 13]



[Fig. 14]



[Fig. 15]



[Fig. 16]