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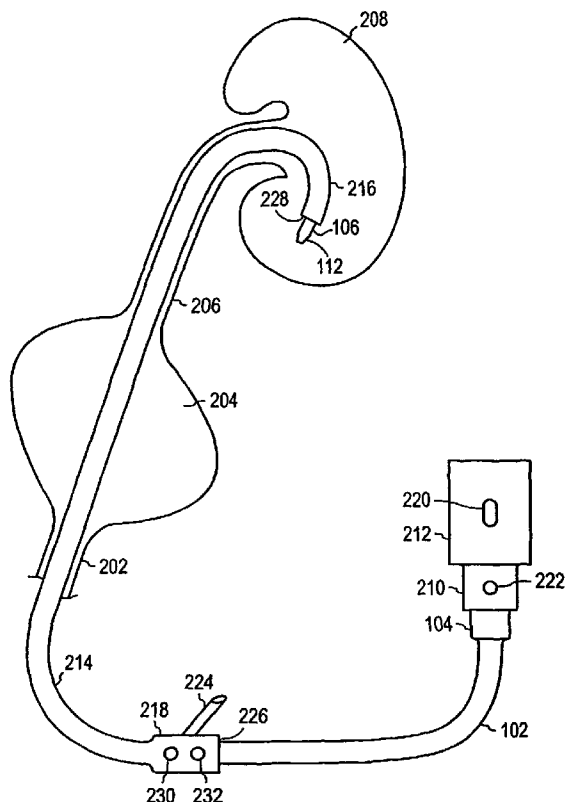
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(54) Title: MEDICAL SUCTION DEVICE, PARTICULARLY ADAPTED FOR REMOVING KIDNEY STONE



(57) Abstract: A stone retrieval suction device (100) facilitates the retention and then relocation and/or removal of objects disposed in a patient's urinary system (208). The device includes an elongated member (102) for placement in a channel of a flexible ureteroscope (214). The elongated member defines a suction passageway which extends longitudinally therethrough. The elongated member (102) is flexible enough to bend with the flexible ureteroscope, and it is strong enough to prevent collapse of the suction passageway when suction is provided through the suction passageway by a vacuum source. The elongated member includes a distal portion (112) for contacting and retaining an object when the suction is provided.

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MEDICAL SUCTION DEVICE, PARTICULARLY ADAPTED FOR REMOVING KIDNEY STONE

Technical Field

5 The invention relates generally to medical devices.

Background Information

Typical stone retrieval devices are used for retrieving objects, such as kidney stones, that are disposed in easily-accessed areas of a patient's urinary tract. Some known stone retrieval devices are configured such that a physician must advance the device past the object, deploy a
10 basket, and then pull the device back toward the object to capture the object in the basket. In situations where the object is embedded in tissue or located in a lower calyx of a patient's kidney, the device cannot be advanced beyond the object and therefore cannot capture the object. Stone retrieval devices configured with graspers can be used to try to retrieve stones embedded in tissue or located in the lower calyx. These devices typically are not very flexible, however,
15 and therefore frequently are not useful in reaching and capturing such objects. Further, grasping stone retrieval devices may not be able to retrieve a certain object due to the size and/or shape of that object.

Summary of the Invention

Objects, such as kidney stones and other natural or foreign materials, can become trapped
20 in a patient's urinary system. These objects can be disposed in areas of the urinary system which are not easily accessed by currently available stone retrieval devices. The present invention relates to medical retrieval devices and related methods for accessing and then retaining, relocating, and/or removing an object disposed in an internal location of a patient's body (such as the urinary system) which is not easily accessed by currently available retrieval devices.

25 In one aspect, the invention involves a medical device. The medical device includes an elongated member that is configured for placement in a channel of a flexible ureteroscope. The elongated member defines a suction passageway which extends longitudinally therethrough. The elongated member bends with the flexible ureteroscope when placed within the channel of the flexible ureteroscope. The suction passageway resists collapsing when suction is provided
30 through the suction passageway by a vacuum source. The elongated member includes a proximal portion for communicating with the vacuum source to provide the suction through the

5 suction passageway and a distal portion for contacting an object and retaining the object in contact with the distal portion when the suction is provided through the suction passageway.

Embodiments according to this aspect of the invention can include various features. For example, the distal portion can include a tapered tip. The distal portion can include a tip which includes a concave portion for contacting the object and retaining the object in contact with the
10 concave portion when the suction is provided through the suction passageway. The distal portion can include a tip which includes a plurality of members extending radially outward from the tip. The plurality of members prevent tissue proximate to the object from being drawn into the suction passageway when suction is provided through the suction passageway. The distal
15 portion can include a tip which includes a concave portion. The concave portion prevents tissue proximate the object from being drawn into the suction passageway when the suction is provided through the suction passageway. The elongated member can include a mesh to reinforce the member and thus resist collapse of the suction passageway when suction is provided. The mesh can extend longitudinally and circumferentially along the elongated member. The mesh can include stainless steel. The elongated member can include a coil which extends longitudinally
20 and circumferentially along the elongated member. The proximal portion can include a luer connector and/or a handle for connecting to the vacuum source. The handle can include a switch for selectively enabling and disabling the suction through the suction passageway. The proximal portion can be in communication with a regulator for regulating the suction through the suction passageway. The elongated member can be made of a material such as a biocompatible plastic, a
25 biocompatible polyurethane, or a biocompatible rubber, for example. The elongated member can have an outside diameter of between two and three french. At least some of the distal portion can be radiopaque.

In another aspect, the invention involves a method of contacting and moving an object disposed in a patient. The method includes providing a vacuum source, providing a flexible
30 ureteroscope and introducing the ureteroscope into a patient, and providing a medical device. The medical device includes an elongated member that is configured for placement in a channel of the flexible ureteroscope. The elongated member defines a suction passageway extending longitudinally therethrough. The elongated member bends with the ureteroscope when the elongated member is placed within the channel of the flexible ureteroscope. The suction
35 passageway resists collapsing when suction is provided through the suction passageway by the vacuum source. The elongated member includes a proximal portion for communicating with the vacuum source to provide the suction through the suction passageway, and a distal portion for

5 contacting an object and retaining the object in contact with the distal portion when the suction is provided through the suction passageway. The method further includes introducing the medical device into the channel of the flexible ureteroscope, providing suction through the suction passageway and retaining the object in contact with the distal portion, and moving the retained object from a first location in the patient to a second location.

10 Embodiments according to this aspect of the invention can include various features. For example, the method can further include moving the retained object to a second location. Moving the retained object to a second location can include moving the retained object outside the patient or to another location inside the patient.

15 The foregoing and other objects, aspects, features, and advantages of the invention will become more apparent from the following description and from the claims.

Brief Description of the Drawings

 In the drawings, like reference characters generally refer to the same parts throughout the different views. Also, the drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention.

20 Fig. 1A is an illustrative diagram of a stone retrieval suction device, according to one embodiment of the invention.

 Fig. 1B is an illustrative cross sectional view of the stone retrieval suction device of Fig. 1A, taken along line B-B in Fig. 1A.

25 Fig. 2 is an illustrative diagram of a flexible ureteroscope disposed in a patient and a stone retrieval suction device in communication with a vacuum source disposed outside of the patient, according to one embodiment of the invention.

 Fig. 3 is an illustrative diagram of the stone retrieval suction device of Fig. 2 partially disposed in a channel of the flexible ureteroscope.

30 Fig. 4A is an illustrative diagram of the stone retrieval suction device of Fig. 2 disposed in the channel of the flexible ureteroscope and extending out of a distal end of the ureteroscope and into the patient's kidney.

 Fig. 4B is an illustrative diagram of a stone retrieval suction device disposed in the channel of the flexible ureteroscope and also in communication with a remote vacuum source through an extension tube, according to another embodiment of the invention.

35 Fig. 5 is an illustrative cross sectional view of a distal portion of a stone retrieval suction device disposed inside the patient and proximate an object disposed in the patient's kidney, according to one embodiment of the invention.

5 Fig. 6 is an illustrative cross sectional view of the distal portion of the stone retrieval suction device of Fig. 5 contacting and retaining the object disposed in the patient's kidney.

 Fig. 7 is an illustrative cross sectional view of the distal portion of the stone retrieval suction device of Fig. 6 after the object disposed in a patient's kidney has been relocated.

10 Fig. 8 is an illustrative cross sectional view of the distal portion of the stone retrieval suction device of Fig. 7 after the object disposed in a patient's kidney has been released.

 Fig. 9 is an illustrative cross sectional view of the distal portion of the stone retrieval suction device of Fig. 7 removing the object from the patient's kidney.

 Fig. 10A is an illustrative diagram of a stone retrieval suction device including a mesh, according to another embodiment of the invention.

15 Fig. 10B is an illustrative cross sectional view of the stone retrieval suction device of Fig. 10A, taken along line B-B in Fig.10A, according to one embodiment of the invention.

 Fig. 10C is an illustrative cross sectional view of the stone retrieval suction device of Fig. 10A, taken along line B-B in Fig.10A, according to another embodiment of the invention.

20 Fig. 10D is an illustrative cross sectional view of the stone retrieval suction device of Fig. 10A, taken along line B-B in Fig.10A, according to still another embodiment of the invention.

 Fig. 11A is an illustrative diagram of a stone retrieval suction device including a coil, according to one embodiment of the invention.

 Fig. 11B is an illustrative cross sectional view of the stone retrieval suction device of Fig. 11A, taken along line B-B in Fig. 11A, according to one embodiment of the invention.

25 Fig. 11C is an illustrative cross sectional view of the stone retrieval suction device of Fig. 11A, taken along line B-B in Fig. 11A, according to another embodiment of the invention.

 Fig. 11D is an illustrative cross sectional view of the stone retrieval suction device of Fig. 11A, taken along line B-B in Fig. 11A, according to still another embodiment of the invention.

30 Fig. 12 is an illustrative cross sectional view of a tapered tip coupled to a distal portion of the stone retrieval suction device, according to one embodiment to the invention.

 Fig. 13A is an illustrative cross sectional view of a tip including a concave portion coupled to a distal portion of the stone retrieval suction device, according to another embodiment to the invention.

35 Fig. 13B is an illustrative cross sectional view of a tip including a concave portion coupled to a distal portion of the stone retrieval suction device, according to yet another embodiment to the invention.

5 Fig. 14 is an illustrative cross sectional view of a tip including a plurality of arms extending radially outward coupled to a distal portion of the stone retrieval suction device, according to still another embodiment to the invention.

 Fig. 15 is an illustrative cross sectional view of a tapered tip coupled to a distal portion of the stone retrieval suction device including a mesh disposed on the inner surface of a wall of the
10 elongated member, according to one embodiment to the invention.

 Fig. 16 is an illustrative cross sectional view of a tip including a concave portion coupled to a distal portion of the stone retrieval suction device including a mesh disposed in a wall of the elongated member, according to another embodiment to the invention.

 Fig. 17 is an illustrative cross sectional view of a tip including a plurality of arms
15 extending radially outward coupled to a distal portion of the stone retrieval suction device including a mesh disposed on the outer surface of a wall of the elongated member, according to still another embodiment to the invention.

 Fig. 18 is an illustrative cross sectional view of a tapered tip coupled to a distal portion of the stone retrieval suction device including a coil disposed on the inner surface of a wall of the
20 elongated member, according to one embodiment to the invention.

 Fig. 19 is an illustrative cross sectional view of a tip including a concave portion coupled to a distal portion of the stone retrieval suction device including a coil disposed in a wall of the elongated member, according to another embodiment to the invention.

 Fig. 20 is an illustrative cross sectional view of a tip including a plurality of arms
25 extending radially outward coupled to a distal portion of the stone retrieval suction device including a coil disposed on the outer surface of a wall of the elongated member, according to still another embodiment to the invention.

 Fig. 21 is an illustrative diagram of the stone retrieval suction device including a handle disposed in the channel of the flexible ureteroscope and extending out of a distal end of the
30 ureteroscope and into the patient's kidney.

 Figs. 22A and 22B are illustrative cross sectional diagrams of a handle of the stone retrieval suction device, according to one embodiment of the invention.

 Figs. 23A and 23B are illustrative cross sectional diagrams of a handle of the stone retrieval suction device, according to another embodiment of the invention.

 Fig. 24A is an illustrative diagram of a handle of the stone retrieval suction device,
35 according to still another embodiment of the invention.

5 Figs. 24B and 24C are illustrative cross sectional diagrams of the handle shown in Fig. 24A.

Description

10 Objects, such as kidney stones (calculi) and other natural or foreign materials, can become trapped in a patient's urinary system. These objects can be disposed in areas of the urinary system that are easily accessed by currently available stone retrieval devices. These objects can also be disposed in areas of the urinary system, such as embedded in tissue or located in a lower calyx of a patient's kidney, for example, which are not easily accessed by currently available stone retrieval devices. The present invention relates to medical devices and related methods for accessing and then retaining, relocating, and/or removing an object disposed in an internal area of a patient's body (such as the urinary system) which is difficult or impossible to access with currently available retrieval devices or methods.

15 Referring to Figs. 1A and 1B, in one embodiment, the stone retrieval suction device 100 includes an elongated member 102 which defines a suction passageway 110 extending longitudinally therethrough. The elongated member 102 is designed to be placed in a channel of a flexible ureteroscope and has an outside diameter of between two and three french. The elongated member 102 bends with the flexible ureteroscope when placed within the channel of the flexible ureteroscope. The suction passageway 110 resists collapsing when suction is provided through the suction passageway 110 by a vacuum source. For example, the elongated member 102 can be reinforced to resist collapse of the suction passageway 110 when suction is provided through the suction passageway 110. Materials that can be used for the elongated member 102 include, but are not limited to, biocompatible plastic, biocompatible rubber, and biocompatible polyurethane. In one embodiment, the bendable elongated member 102 is formed of Pebax, PTFE, or Polyurethane. The elongated member further includes a proximal portion 108. The proximal portion 108 is in communication with the vacuum source to provide suction through the suction passageway 110. In one embodiment, the proximal portion 108 can also include a luer connector 104. The luer connector 104 is used to connect the elongated member 102 to the vacuum source. The elongated member further includes a distal portion 106 for making contact with an object disposed in a patient, such as a kidney stone. The distal portion 106 retains the object in contact with the distal portion 106 when suction is provided through the suction passageway 110. In one embodiment, the distal portion 106 can also include a tapered tip 112 which is used to contact the object. In other embodiments, the distal portion 106 can include other types of tips which are discussed in further detail below. In some embodiments,

5 the distal portion 106 can also include a radiopaque material which facilitates easily locating the elongated member 102 with a fluoroscope when the elongated member 102 is disposed within the patient. The radiopaque material can be painted on, and/or embedded in, the elongated member 102. The radiopaque material can also be a band painted on, embedded in, and/or wrapped around the distal portion 106 of the elongated member 102. In some embodiments, the
10 radiopaque material can be tungsten filled ink, bismuth subcarbonate, or barium sulfate. In other embodiments, the radiopaque material can be a platinum or tantalum metal band.

The elongated member 102 can be extruded from any of the materials previously described using known extrusion techniques. The luer connector 104 can be made of molded plastic or metal, such as stainless steel. The tapered tip 112 can also be made of molded plastic
15 or metal.

Referring to Figs. 2-4A, in operation, a user (e.g. a doctor or other medical personnel) inserts a distal end 216 of a flexible ureteroscope 214 into the patient's urethra 202. The user advances the flexible ureteroscope 214 so that the distal end 216 passes into and through the urinary bladder 204, into and through the ureter 206, and into the kidney 208. The user positions
20 the distal end 216 of the flexible ureteroscope 214 within the patient's kidney 208 by manipulating positioning knobs 230, 232. The knob 230 moves the distal end 216 vertically and the knob 232 moves the distal end 216 horizontally. By manipulating the positioning knobs 230, 232, and viewing the kidney's 208 interior with an eyepiece 224, the user can position a distal channel opening 228 of the flexible ureteroscope 214 proximate an object, such as a kidney
25 stone, that is disposed in the patient's kidney 208.

The user then connects the luer connector 104 to a regulator 210 which, in turn, is connected to a vacuum source 212. The vacuum source 212 provides suction through the suction passageway 110 and the regulator 210 allows the user to vary the suction provided by the vacuum source 212 by adjusting a suction adjustment dial 222. In this embodiment, the vacuum
30 source 212 is located near the patient. In another embodiment, the vacuum source 212 can be located remotely and is discussed in further detail below.

As previously described, the elongated member 102 includes a material that enables the elongated member 102 to bend with the flexible ureteroscope 214. After the user has inserted the flexible ureteroscope 214 into the patient, the user then inserts the distal portion 106 of the
35 elongated member 102 into a proximal channel opening 226 at a proximal end 218 of the flexible ureteroscope 214. The user then advances the distal portion 106 through the channel 502 (shown

5 in Fig. 5) of the flexible ureteroscope 214 until the tapered tip 112 extends out of the distal channel opening 228 at the distal end 216 of the flexible ureteroscope 214.

Referring to Fig. 4B, in another embodiment, the elongated member 102 can be connected to a remotely located vacuum source 212 (such as a vacuum source located on a wall). In this embodiment, the elongated member 102 communicates with the regulator 210 through an
10 extension tube 402. The luer connector 104 of the elongated member 102 is mated to a first luer connector 406 disposed on a proximal end 408 of the extension tube 402. A second luer connector 404 disposed on a distal end 410 of the extension tube is connected to the regulator 210.

Referring to Figs 4A, 5, and 6, after the elongated member 102 is advanced through the
15 channel 502 so that the tapered tip 112 extends out of the channel 502 through the distal channel opening 218 and is proximate to a kidney stone 504, the user switches on the suction (using switch 220). The suction pulls the kidney stone 504 in a direction (indicated by arrow 506) toward the tapered tip 112. Eventually, the kidney stone 504 makes contact with the tapered tip 112 and is held in contact with the tapered tip 112 by the continuous suction through the suction
20 passageway 110 (shown in Fig. 1B). If the kidney stone 504 is embedded in tissue, the user moves the tapered tip 112 toward the embedded kidney stone 504. After the tapered tip 112 makes contact with the embedded kidney stone 504, the suction through the suction passageway 110 retains the kidney stone 504 in contact with the tapered tip 112. The user can then pull the kidney stone 504 free by retracting the distal portion 106 of the elongated member 102 into the
25 channel 502.

This device and method enables the user to capture and retain the kidney stone 504 even when the kidney stone 504 is embedded in tissue or located in a portion of the patient's body that is difficult or impossible to access with typical basket and/or grabber stone retrieval devices.

Referring to Figs. 7-8, after contacting and retaining the kidney stone 504, the user can
30 reposition the distal end 216 of the flexible ureteroscope 214 with the distal portion 106 of the elongated member 102 still extending beyond the distal channel opening 218 and retaining the kidney stone 504 in contact with the tapered tip 112. The purpose of repositioning the distal end 216 of the flexible ureteroscope 214 is to move the kidney stone 504 to an area in the kidney that is easily accessed by typical stone retrieval baskets or grabbers. After the user relocates the
35 kidney stone 504, the user can release the kidney stone 504 by discontinuing the suction and retracting the distal portion 106 of the elongated member 102 through the distal channel opening 218. After the kidney stone 504 is released, the user can use any of a variety of existing stone

5 retrieval devices to capture and remove the kidney stone 504 from the patient's urinary system. If the kidney stone 504 is too large to remove, the user can employ any of a variety stone destruction devices (such as laser or vibration devices, for example) to break the kidney stone 504 into smaller pieces. If the kidney stone 504 has a diameter smaller than the diameter of the channel 502 of the flexible ureteroscope 214, the user can remove the kidney stone 504 from the
10 patient by pulling the kidney stone 504 through the channel 502 of the flexible ureteroscope 214.

Referring to Figs. 10A-D and 15-17, in another embodiment, the stone retrieval suction device 100 includes a mesh 1002 which extends longitudinally and circumferentially along the elongated member 102. The mesh 1002 can be made of stainless steel and/or other material(s). The mesh 1002 can be, for example, formed by two or more cords that are woven together to
15 form the mesh 1002 with each cord having one or more, for example three or more, component strands. Each of the strands could be thin wire or metal or a metal alloy, for example. The mesh 1002 reinforces the elongated member 102 so that the elongated member 102 does not collapse when suction is provided through the suction passageway 110 by the vacuum source 212 (Fig. 4A). The cords of the mesh 1002 can be either spaced closely together to form a dense mesh or
20 spaced far apart to form a sparse or open mesh. The mesh 1002 can be affixed to an inner surface 1006 (Figs. 10C and 15) or an outer surface 1004 (Figs. 10B and 17) of the elongated member 102. The mesh 1002 can also be embedded between the inner surface 1006 and the outer surface 1004 of the elongated member 102 (Figs. 10D and 16).

Referring to Figs. 11A-D and 18-20, in still another embodiment, the stone retrieval
25 suction device 100 includes a coil 1102 which extends circumferentially and longitudinally along the elongated member 102. The coil 1102 can be made of stainless steel and/or other material(s). The coil 1102 can be, for example, formed by a cord with the cord having one or more, for example three or more, component strands. Each of the strands could be thin wire or metal or a metal alloy, for example. The coil 1102 reinforces the elongated member 102 so that the
30 elongated member 102 does not collapse when suction is provided through the suction passageway 110 by a vacuum source. The coil 1102 can be tightly wound so that the individual coils are spaced closely together to form a dense coil or the coil 1102 can be loosely wound so that the individual coils are spaced far apart to form an open coil. As with the mesh 1002, the coil 1102 can be affixed to the inner surface 1006 (Figs. 11C and 18) or the outer surface 1004
35 (Figs. 11B and 20) of the elongated member 102. The coil 1102 can also be embedded between the inner surface 1006 and the outer surface 1004 of the elongated member 102 (Figs. 11D and 19).

5 Referring to Fig. 12, the distal portion 106 of the elongated member 102 can include a tapered tip 112. The tapered tip 112 can be made of molded plastic or metal, for example, although other materials or combinations of materials are possible. In another embodiment shown in Fig. 13A, the distal portion 106 can include a tip 1302 with a concave portion 1304. The concave portion 1304 is used to contact an object disposed in a patient's urinary system and
10 retain the object in contact with the concave portion 1304 when suction is provided through the suction passageway 110. In still another embodiment shown in Fig. 13B, the distal portion 106 can include a concave portion 1306 with a tapered tip 1308 within the concave portion 1306. The concave portion 1306 is used to keep surrounding tissue away from the suction in the tapered tip 1308 when the tapered tip 1308 contacts an object. In yet another embodiment shown
15 in Fig. 14, the distal portion 106 can include a tip 1402 which includes a plurality of members 1404. The plurality of members 1404 extend radially outward from the tip 1402 and prevent tissue (proximate to an object being contacted) from being pulled into the suction passageway 110. The tips 1302, 1402 can also be made of molded plastic or metal.

Referring to Figs. 21, 22A, and 22B, in another embodiment, the suction retrieval device
20 100 can include a handle 2102. The handle 2102 includes a suction button 2104 which is used to enable and disable the suction in the suction passageway 110 by uncrimping and crimping a portion of the elongated member 102 disposed in the handle 2102. When the suction button 2104 is not pressed (default position), the suction button 2104 is positioned such that a rigid member 2108 presses against the suction tube 302 thereby crimping the elongated member 102
25 and disabling the suction in the suction passageway 110.

When the suction button 2104 is pressed (in the direction indicated by arrow 2106), the suction button 2104 is positioned such that the rigid member 2108 no longer crimps the elongated member 102, thereby enabling suction in the suction passageway 110. As long as the suction button 2104 is pressed, the suction in the suction passageway 110 is enabled. As soon as
30 the suction button 2104 is released, the suction in the suction passageway 110 is disabled.

In operation, after inserting the flexible ureteroscope 214 into the patient's urinary system, the user connects the luer connector 104 to the regulator 210 and then guides the elongated member 102 into and through the channel of the flexible ureteroscope 214. The user then turns on the vacuum source 212 with the switch 220 and adjusts the suction with suction
35 adjustment knob 222 on the regulator 210. The user positions the elongated member 102 proximate to an object disposed in the patient's urinary system by the method previously described, and then presses the suction button 2104 on the handle 2102 to engage the suction (by

5 uncrimping the portion of elongated member 102 disposed in the handle 2102). After the object is captured and relocated to a new position or removed from the patient, the user releases the button 2104 to disengage the suction (by crimping the portion of elongated member 102 disposed in the handle 2102) thereby releasing the object.

Referring to Figs 23A and 23B, in still another embodiment, the suction retrieval device
10 100 can include a handle 2302. The handle 2302 includes a suction port 2306 which is used to enable and disable the suction in the distal portion 106 of the suction passageway 110. The suction port 2306 is an opening to the suction passageway 110 and allows outside air to be sucked into the suction passageway 110 by the vacuum source (as indicated by arrows 2304) when left open or uncovered. As a result, the suction in the distal portion 106 of the suction
15 passageway 110 is significantly reduced or disabled entirely. When the suction port 2306 is covered, by a user's finger 2308 for example, the suction port 2306 is sealed and the suction in the distal portion 106 of the suction passageway 110 is restored.

Referring to Figs. 24A-C, in yet another embodiment, the suction retrieval device 100 can include a handle 2402. The handle 2402 includes a rotatable valve 2404 which is used to
20 enable and disable the suction in the distal portion 106 of the suction passageway 110 by redirecting the suction from the vacuum source. The valve 2404 includes a handle 2412 (for rotating the valve) and two perpendicular suction tubes 2416, 2414. When the valve 2404 is rotated to an open position (Fig. 24B), a suction port 2406 is put in communication with the vacuum source via the suction tubes 2414, 2416. Outside air is pulled through the suction port
25 2406, through the suction tubes 2414, 2416, and into the suction passageway 100 by a vacuum source as indicated by arrow 2408. The suction in the distal portion 106 of the suction passageway 110 is thereby disabled. When the valve 2404 is rotated to a closed position (Fig. 24C), the suction port 2406 is sealed and the distal portion 106 of the suction passageway 110 is put in communication with the vacuum source via suction tube 2414. The suction in the suction
30 passageway 110 is thereby enabled as indicated by arrows 2410.

Variations, modifications, and other implementations of what is described herein may occur to those of ordinary skill in the art without departing from the spirit and scope of the invention. Accordingly, the invention is not to be defined only by the preceding illustrative description.

35

What is claimed is:

Claims

1. A medical device, comprising:

an elongated member for placement in a channel of a flexible ureteroscope, the elongated member defining a suction passageway extending longitudinally therethrough, the elongated member bending with the flexible ureteroscope when the elongated member is placed within the channel of the flexible ureteroscope, the suction passageway resists collapsing when suction is provided through the suction passageway by a vacuum source, the elongated member comprising:

a proximal portion for communicating with the vacuum source to provide the suction through the suction passageway; and

a distal portion for contacting an object and retaining the object in contact with the distal portion when the suction is provided through the suction passageway.

2. The medical device of claim 1 wherein the distal portion comprises a tapered tip.

3. The medical device of claim 1 wherein the distal portion comprises a tip comprising a concave portion for contacting the object and retaining the object in contact with the concave portion when the suction is provided through the suction passageway.

4. The medical device of claim 1 wherein the distal portion further comprises a tip comprising a plurality of members extending radially outward from the tip to prevent tissue proximate the object from entering the suction passageway when the suction is provided through the suction passageway.

5. The medical device of claim 1 wherein the distal portion further comprises a tip comprising a concave portion to prevent tissue proximate the object from entering the suction passageway when the suction is provided through the suction passageway.

6. The medical device of claim 1 wherein the elongated member further comprises a mesh to reinforce the elongated member and resist collapse of the suction passageway when the suction is provided through the suction passageway.

7. The medical device of claim 6 wherein the mesh extends longitudinally and circumferentially along the elongated member.

8. The medical device of claim 6 wherein the mesh comprises stainless steel.

9. The medical device of claim 1 wherein the elongated member further comprises a coil extending longitudinally and circumferentially for reinforcing the elongated member and resisting collapse of the suction passageway when the suction is provided through the suction passageway.

10. The medical device of claim 1 wherein the proximal portion further comprises a luer connector.
11. The medical device of claim 1 wherein the proximal portion communicates with a regulator for regulating the suction through the suction passageway.
12. The medical device of claim 1 wherein the elongated member comprises a biocompatible plastic.
13. The medical device of claim 1 wherein the elongated member comprises a biocompatible polyurethane.
14. The medical device of claim 1 wherein the elongated member comprises a biocompatible rubber.
15. The medical device of claim 1 wherein the elongated member has an outside diameter of between two and three french.
16. The medical device of claim 1 wherein the proximal portion further comprises a handle.
17. The medical device of claim 16 wherein the handle comprises a switch for selectively enabling and disabling the suction through the suction passageway when the proximal portion is in communication with the vacuum source.
18. The medical device of claim 1 wherein the distal portion comprises a radiopaque material.
19. A method of contacting and moving an object disposed in a patient, comprising:
 - providing a vacuum source;
 - providing a flexible ureteroscope and introducing the ureteroscope into the patient;
 - providing a medical device comprising:
 - an elongated member for placement in a channel of the flexible ureteroscope, the elongated member defining a suction passageway extending longitudinally therethrough, the elongated member bending with the flexible ureteroscope when the elongated member is placed within the channel of the flexible ureteroscope, the suction passageway resists collapsing when suction is provided through the suction passageway by the vacuum source, the elongated member comprising:
 - a proximal portion for communicating with the vacuum source to provide the suction through the suction passageway; and

a distal portion for contacting an object and retaining the object in contact with the distal portion when the suction is provided through the suction passageway;

introducing the medical device into the channel of the flexible ureteroscope;

positioning the flexible ureteroscope to allow the distal portion to contact the object;

providing suction through the suction passageway and retaining the object in contact with the distal portion; and

moving the retained object from a first location in the patient to a second location.

20. The method of claim 19 wherein moving the retained object to the second location comprises moving the retained object outside of the patient.

21. The method of claim 19 wherein moving the retained object to the second location comprises moving the retained object to another location in the patient.

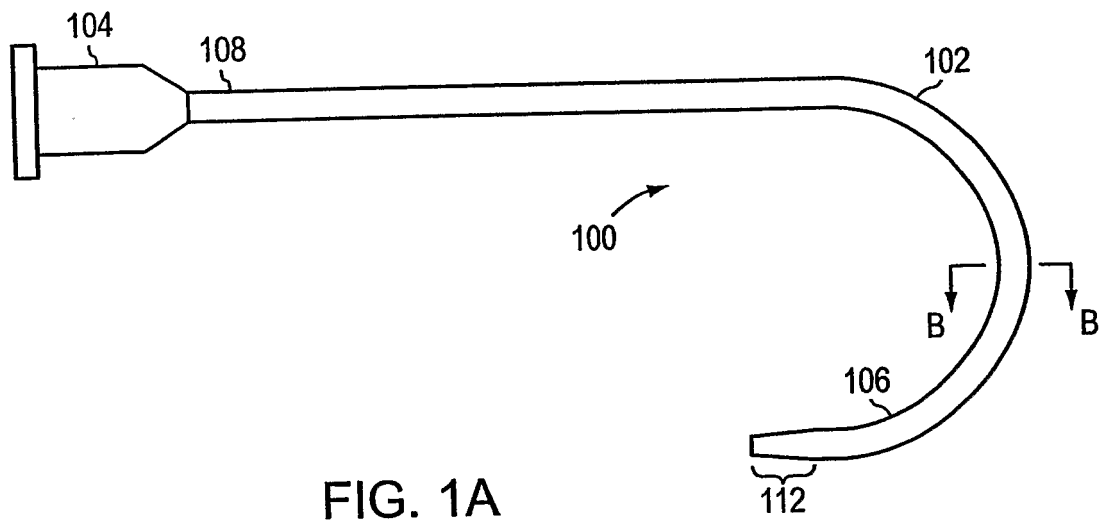


FIG. 1A

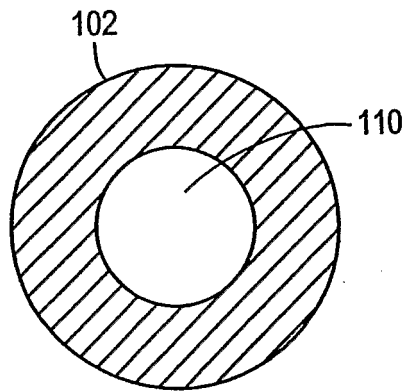


FIG. 1B

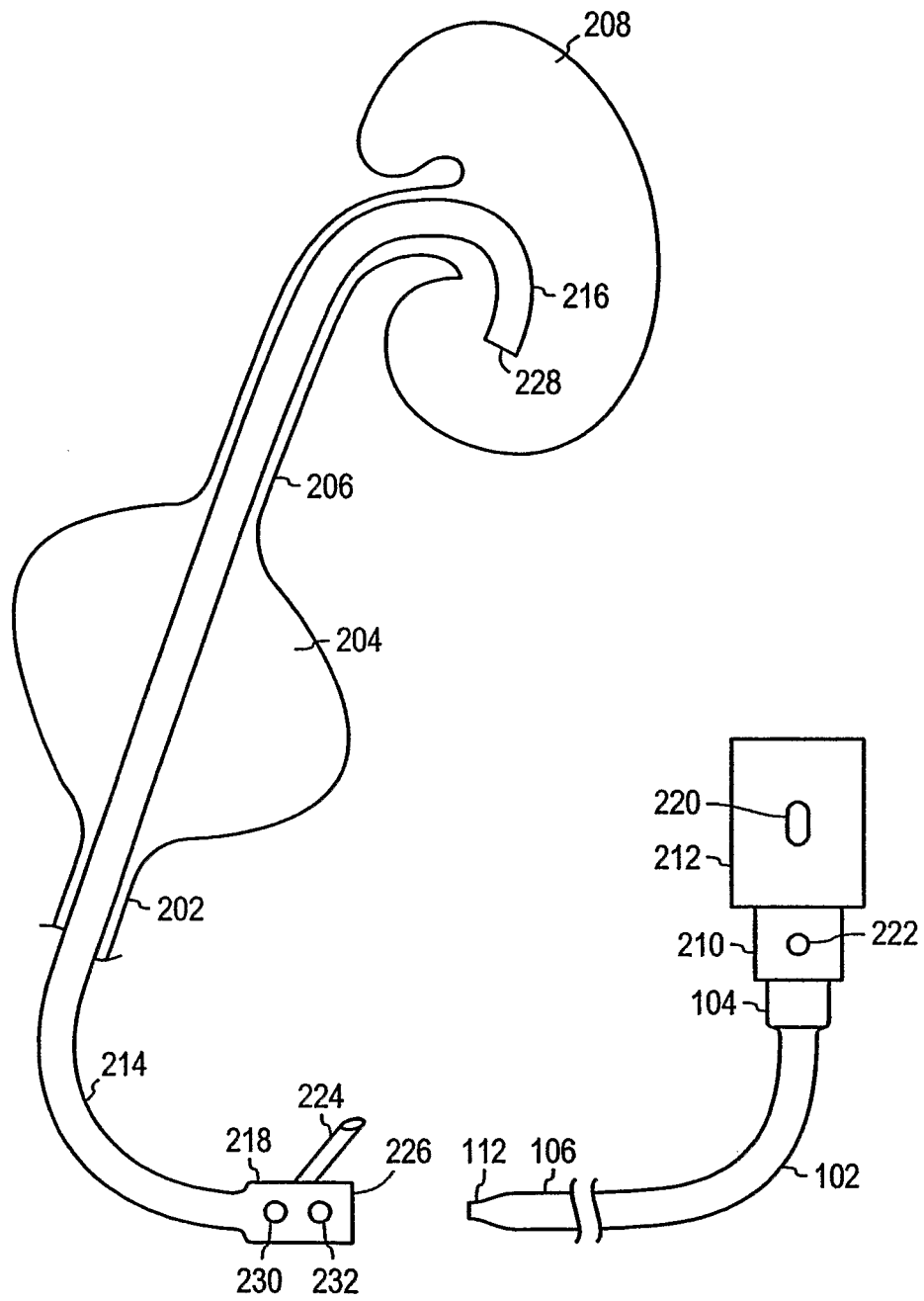


FIG. 2

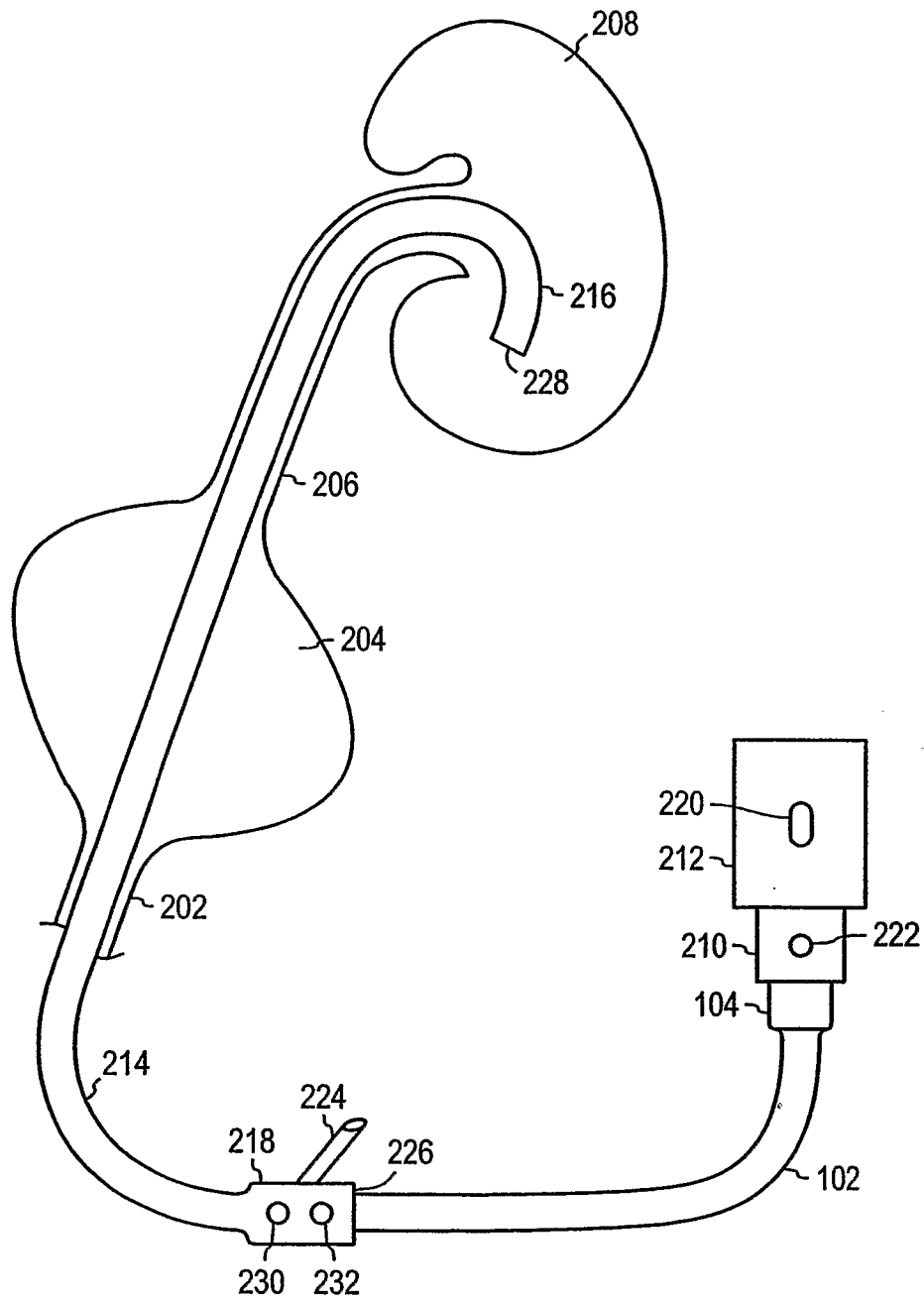


FIG. 3

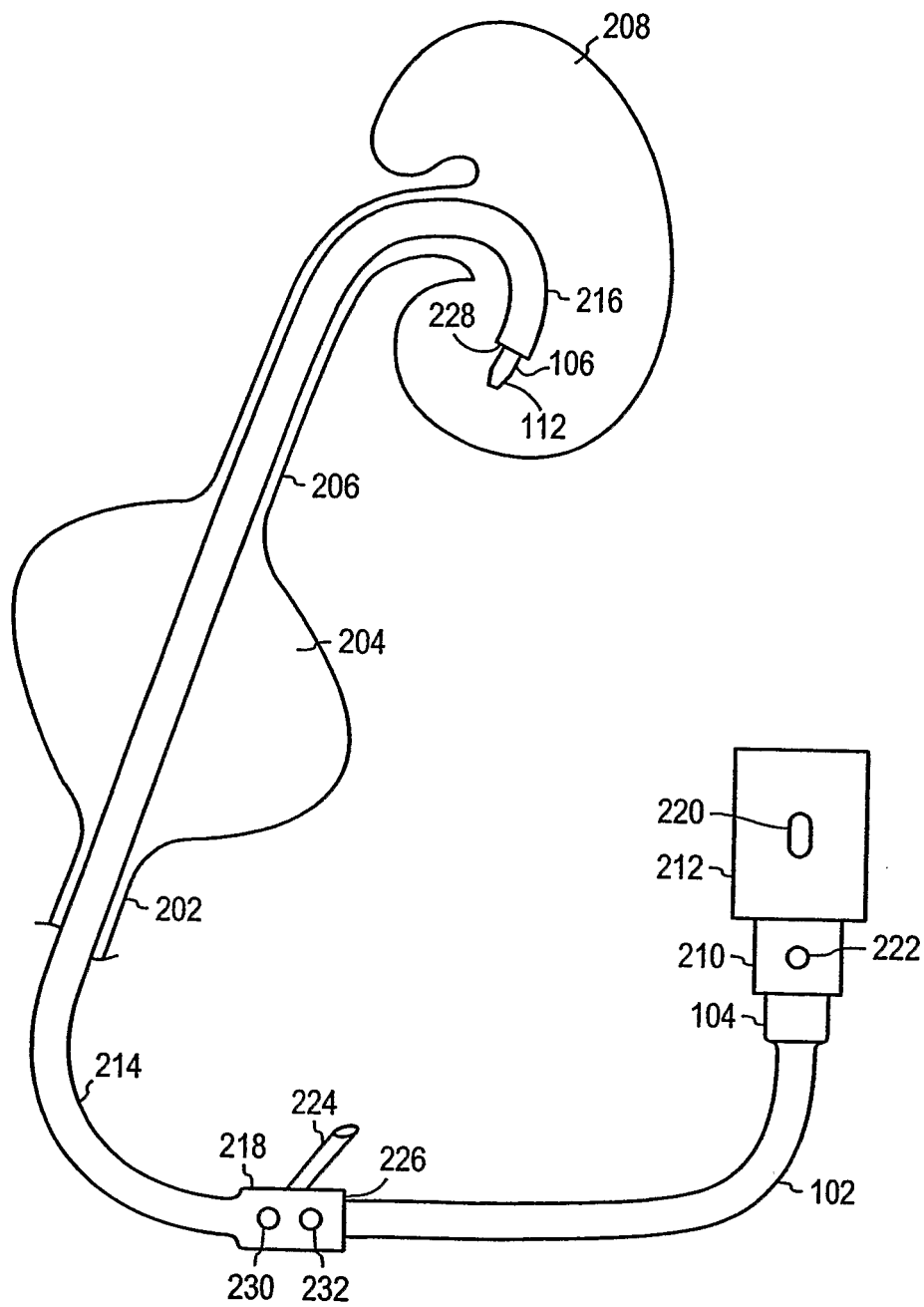


FIG. 4A

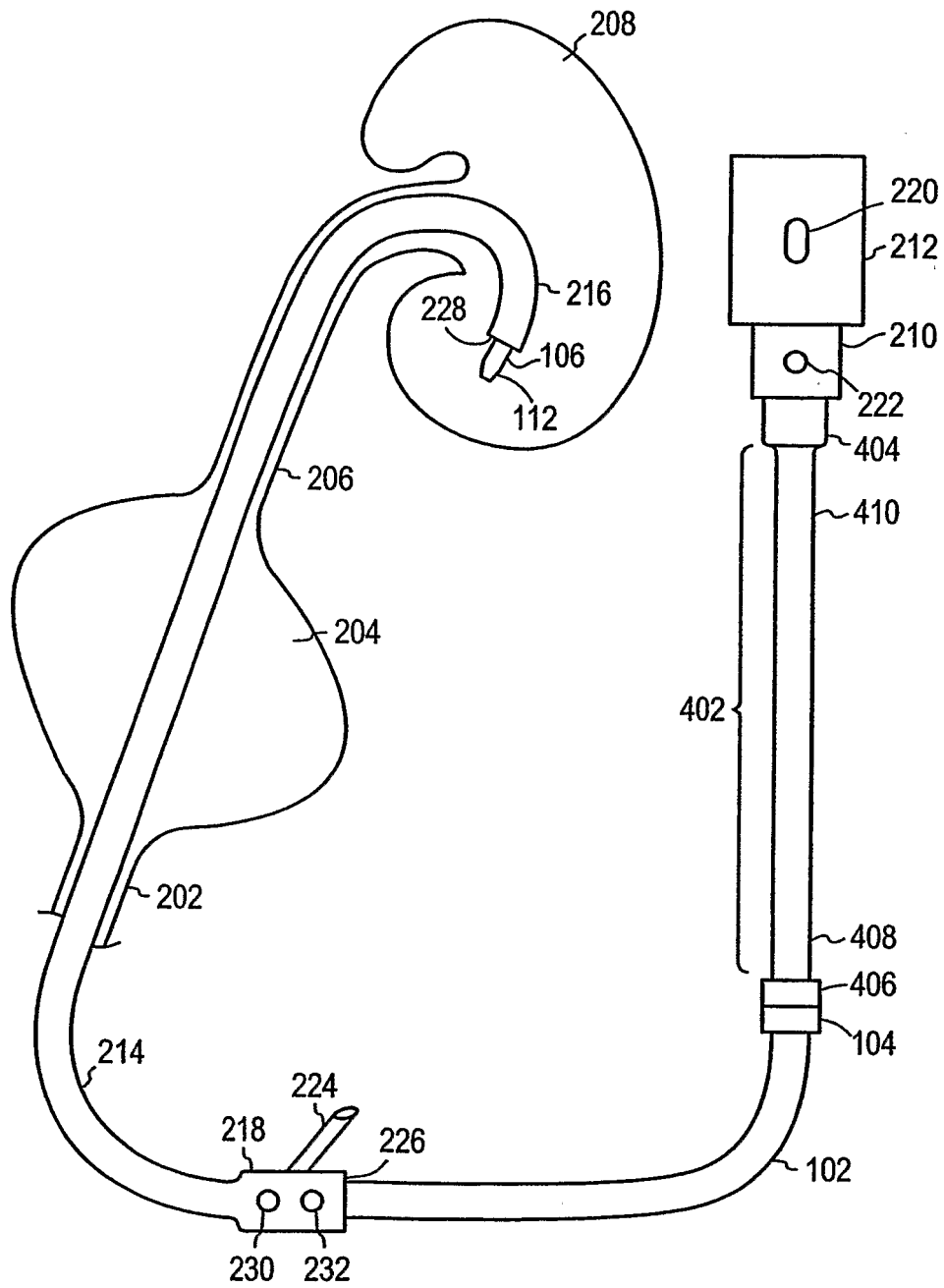


FIG. 4B

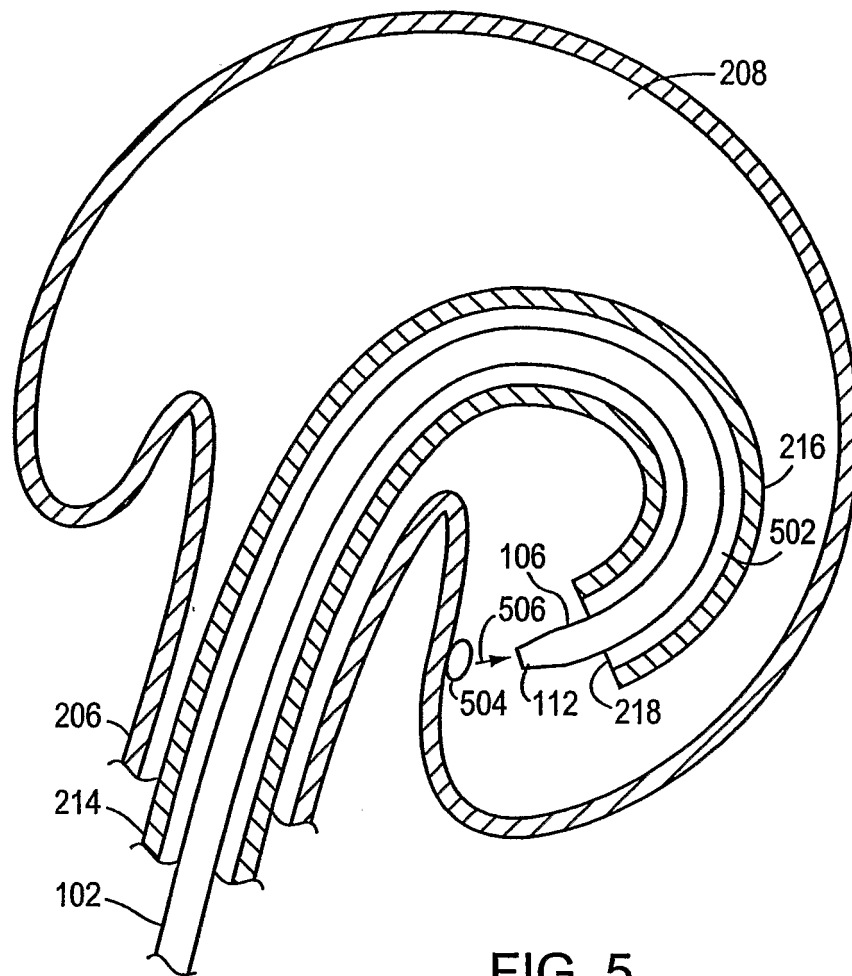


FIG. 5

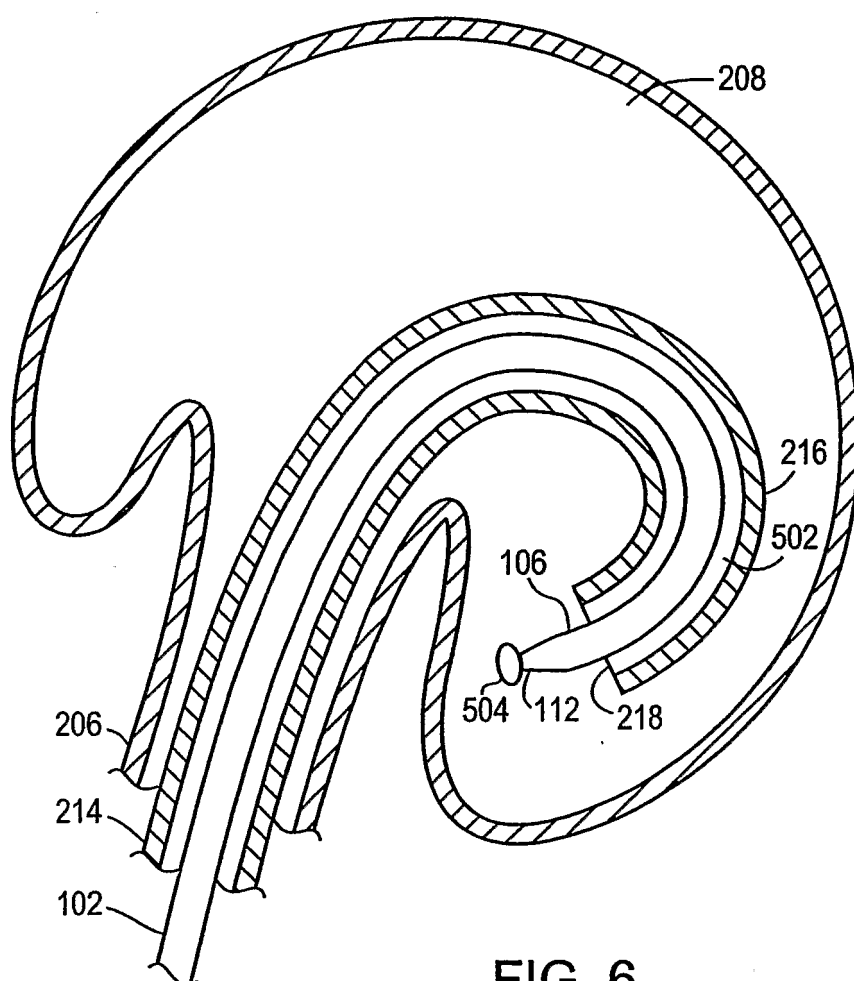


FIG. 6

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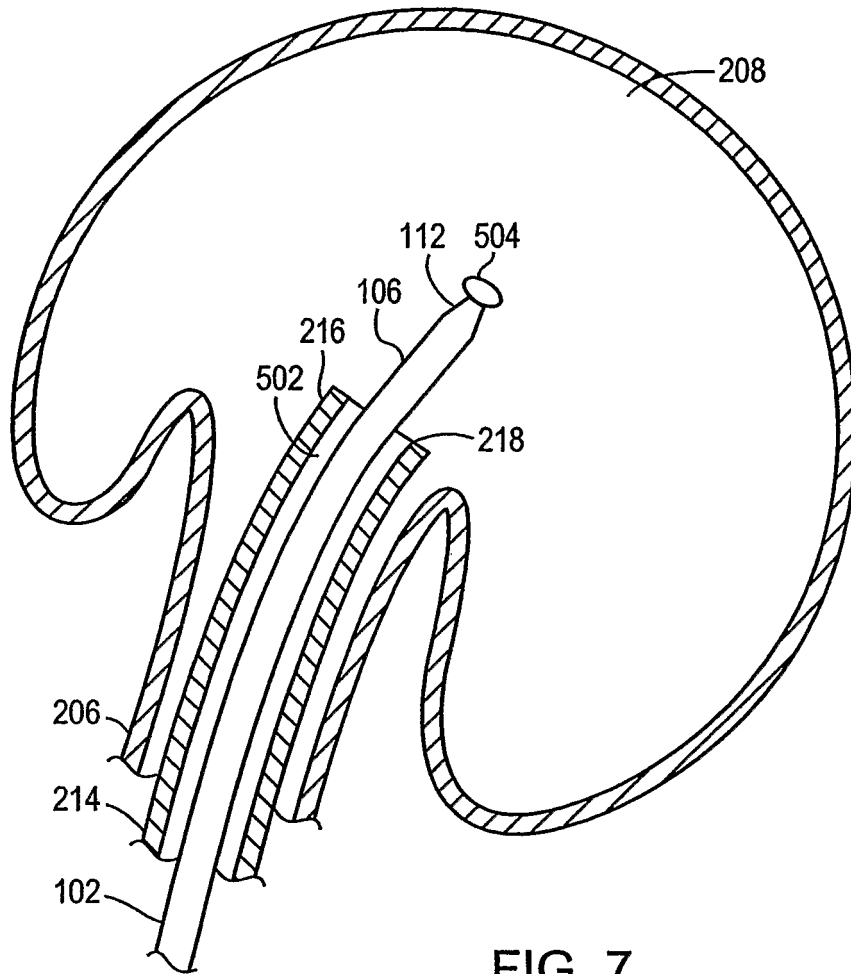


FIG. 7

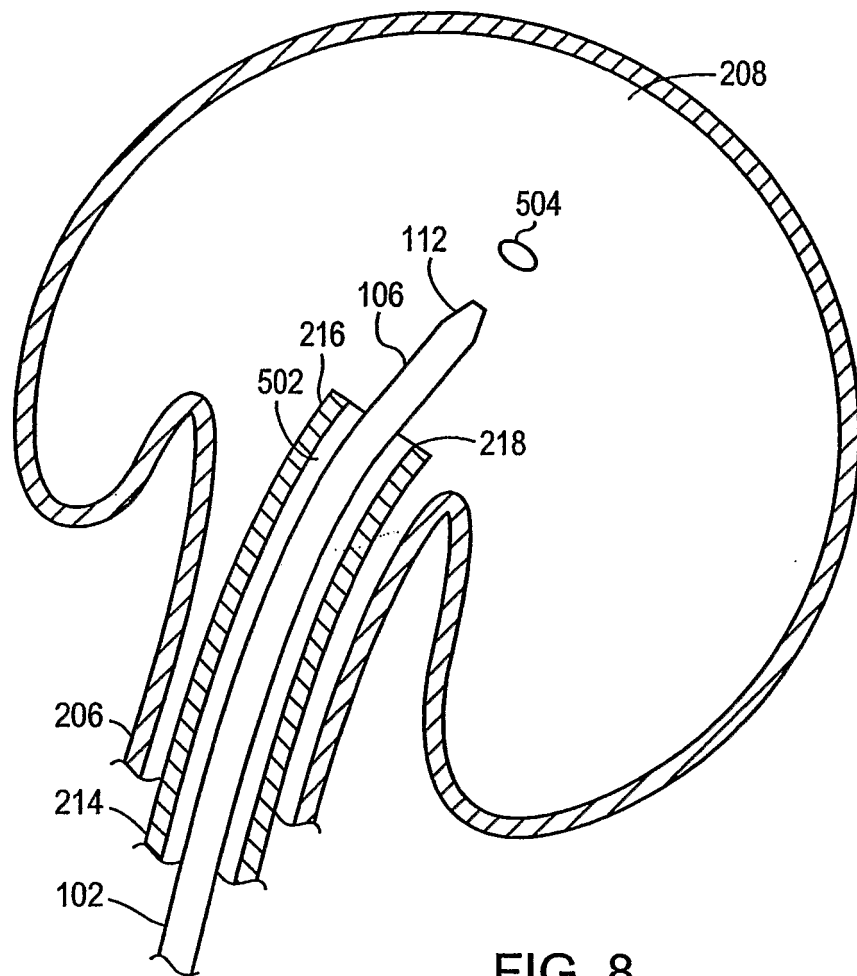


FIG. 8

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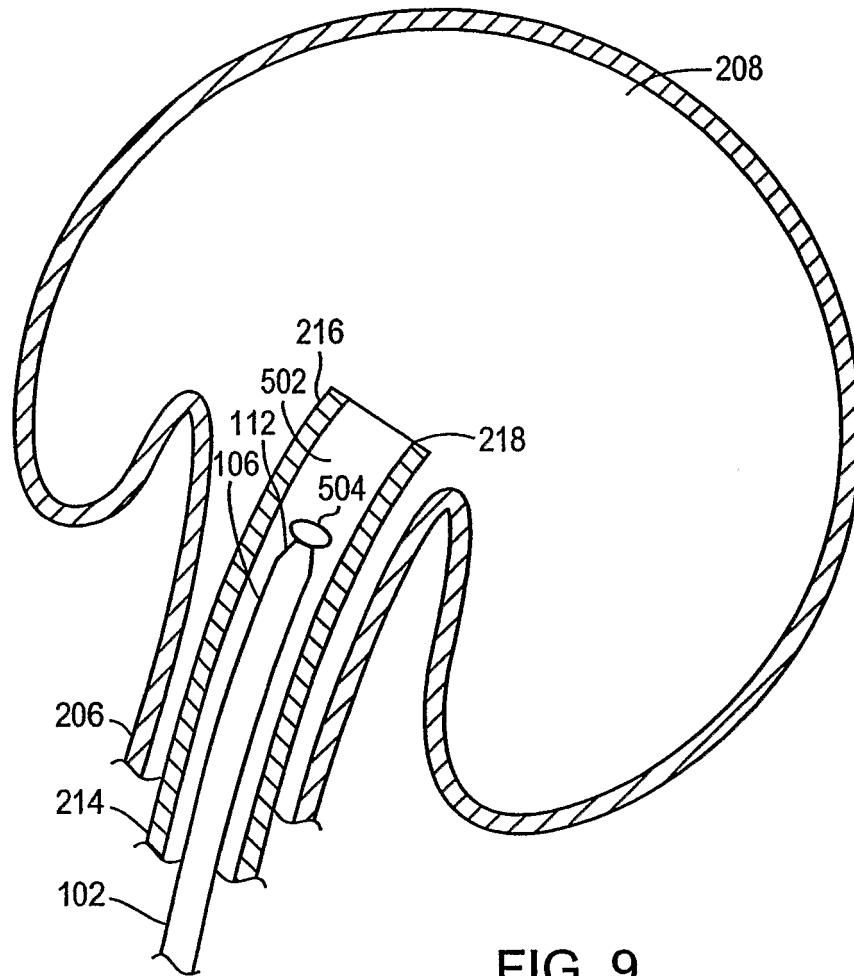


FIG. 9

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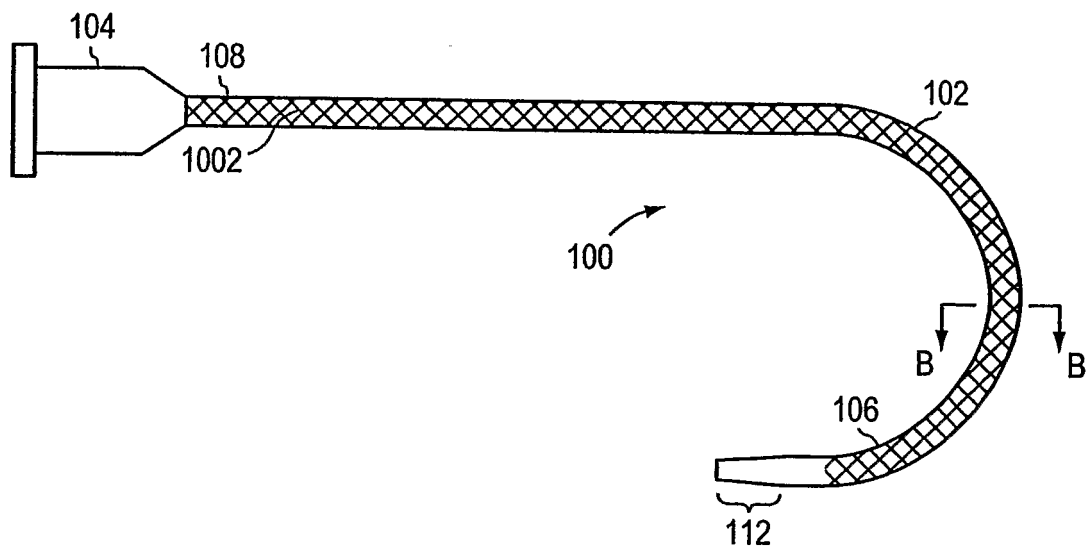


FIG. 10A

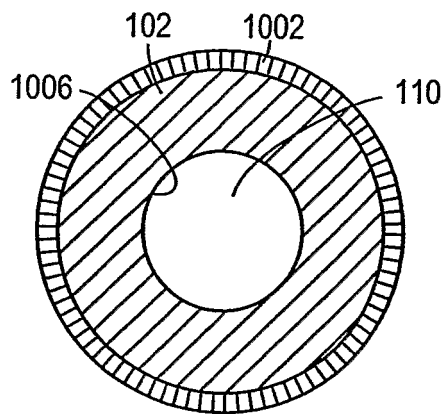


FIG. 10B

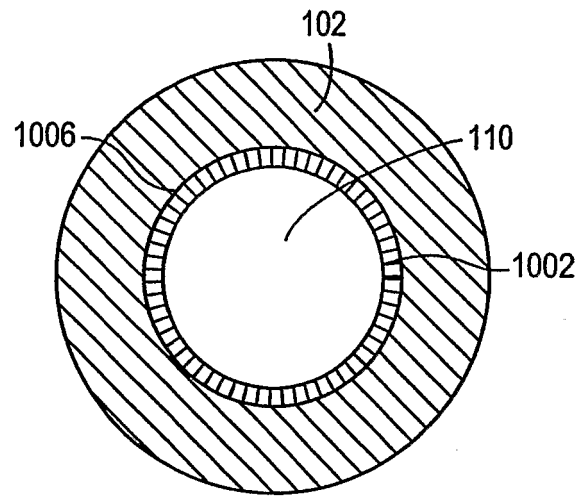


FIG. 10C

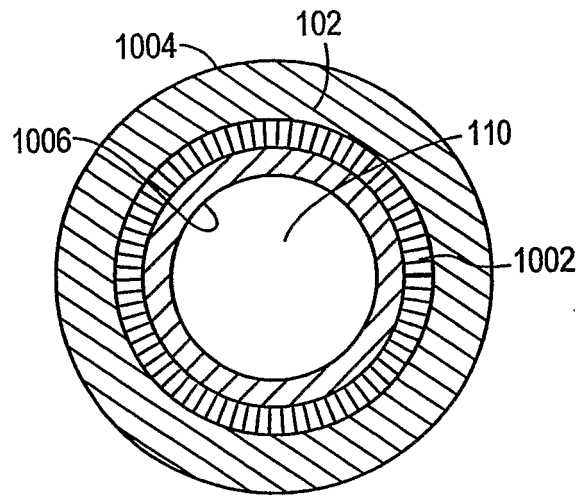


FIG. 10D

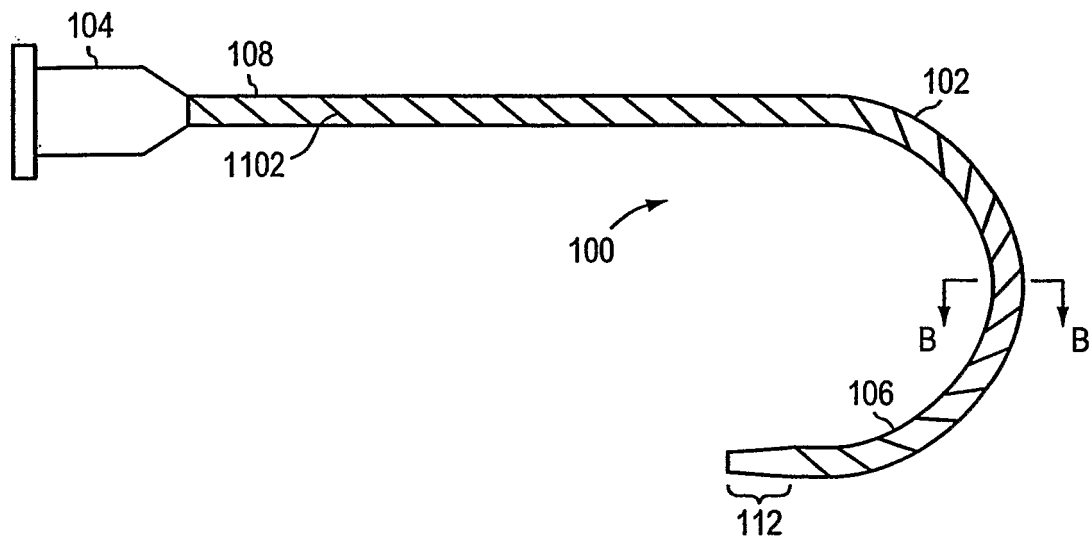


FIG. 11A

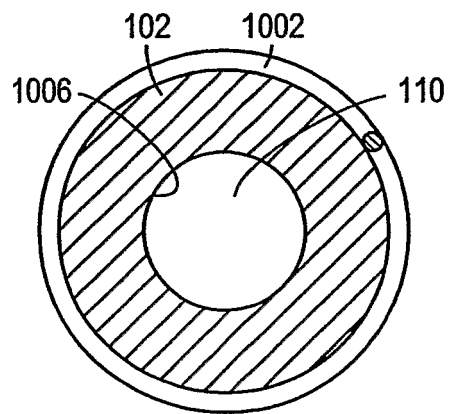


FIG. 11B

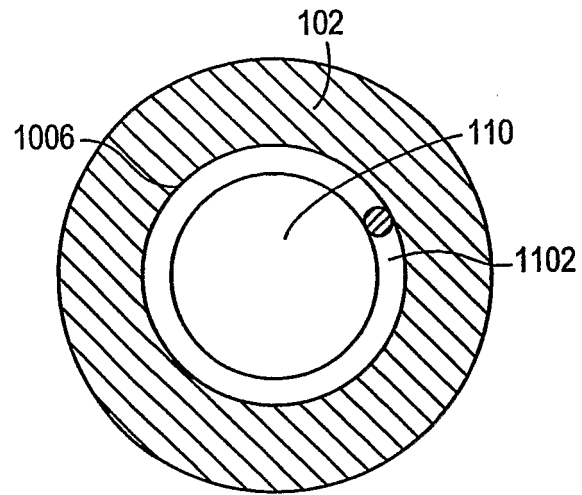


FIG. 11C

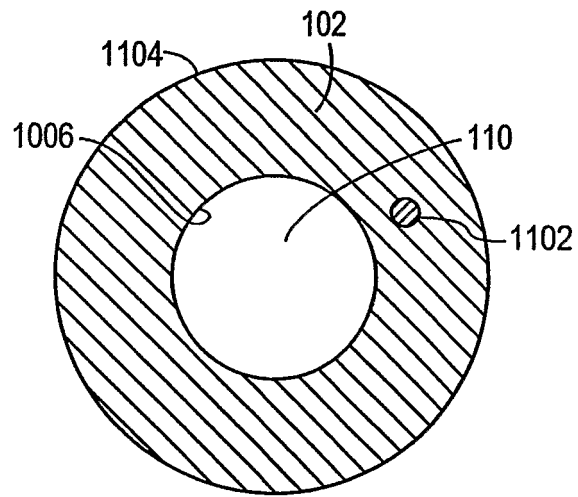


FIG. 11D

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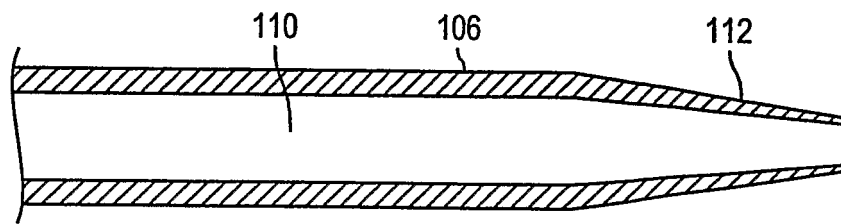


FIG. 12

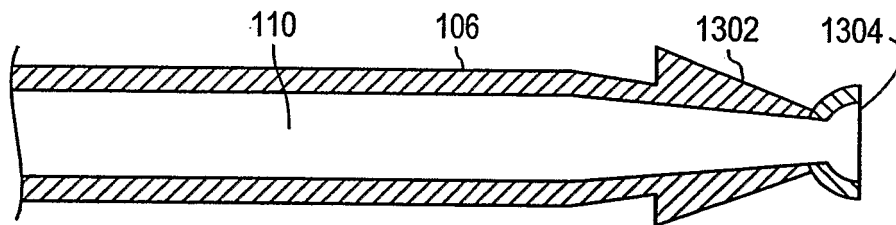


FIG. 13A

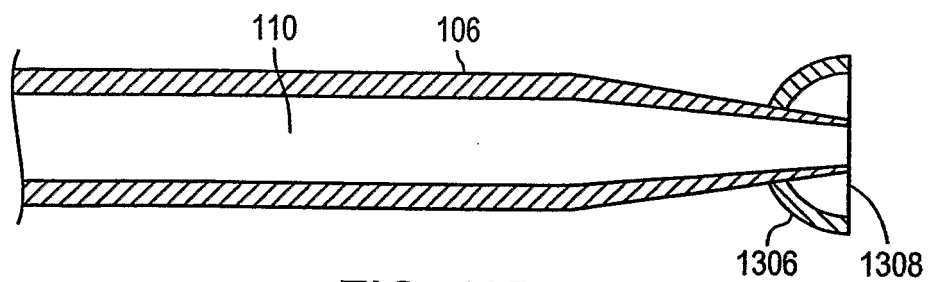


FIG. 13B

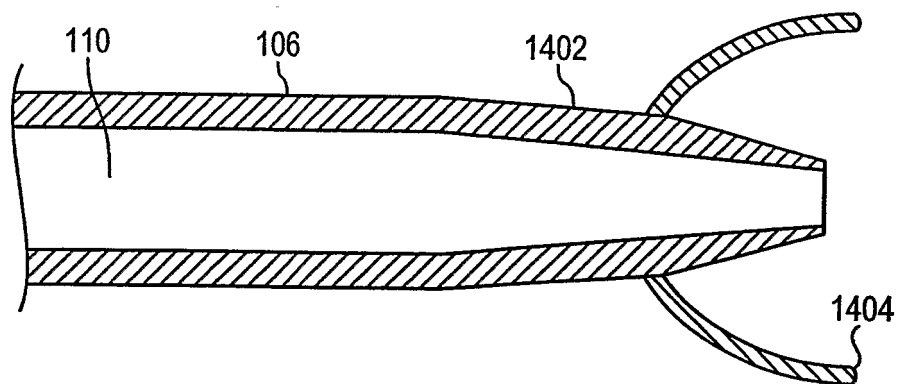


FIG. 14

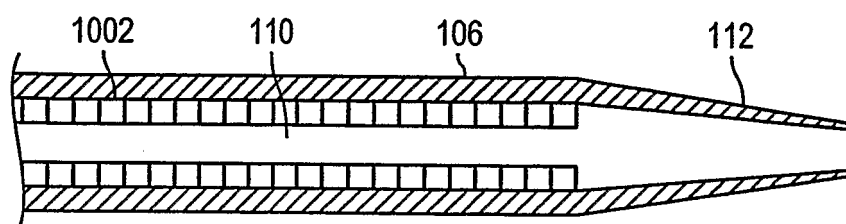


FIG. 15

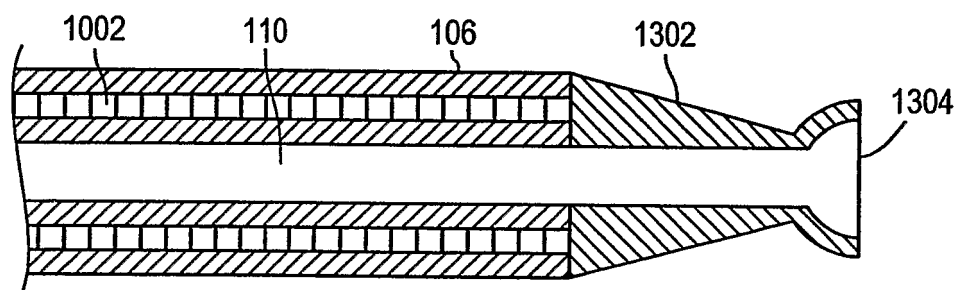


FIG. 16

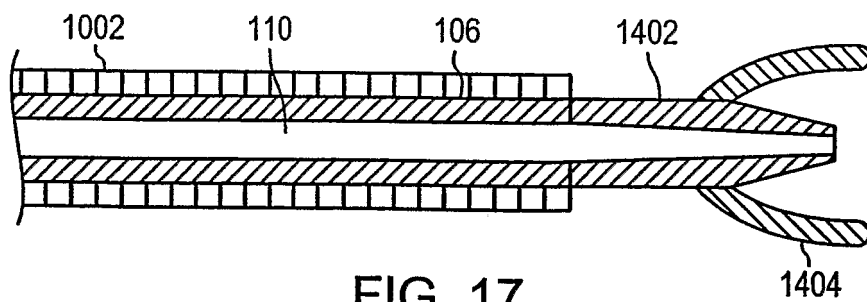


FIG. 17

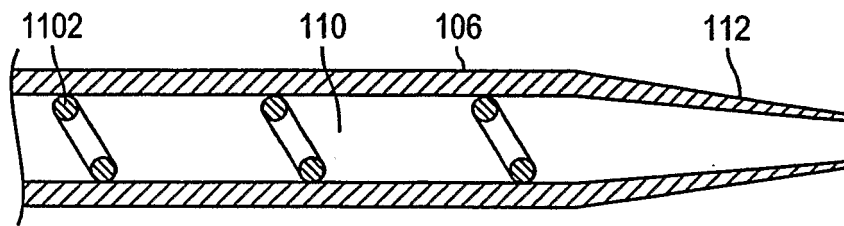


FIG. 18

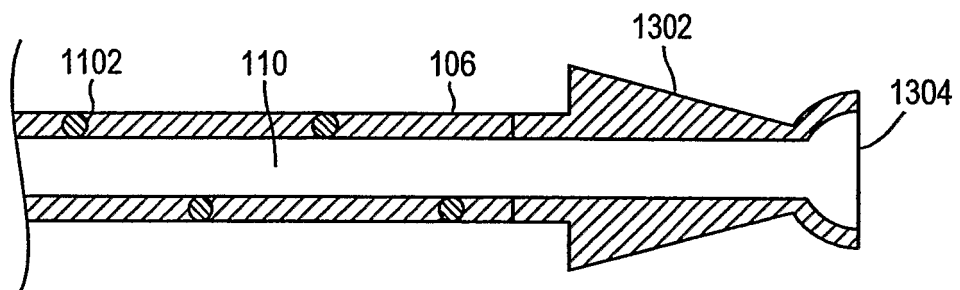


FIG. 19

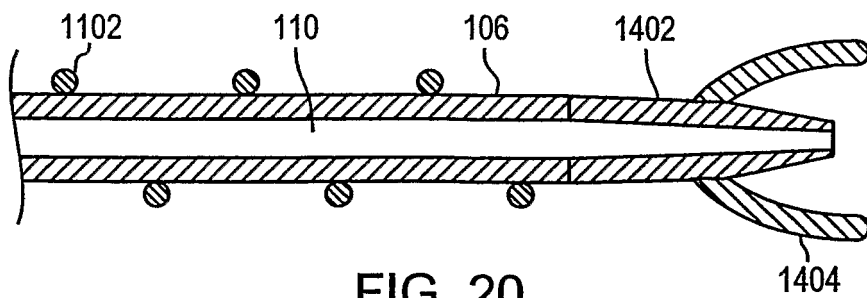


FIG. 20

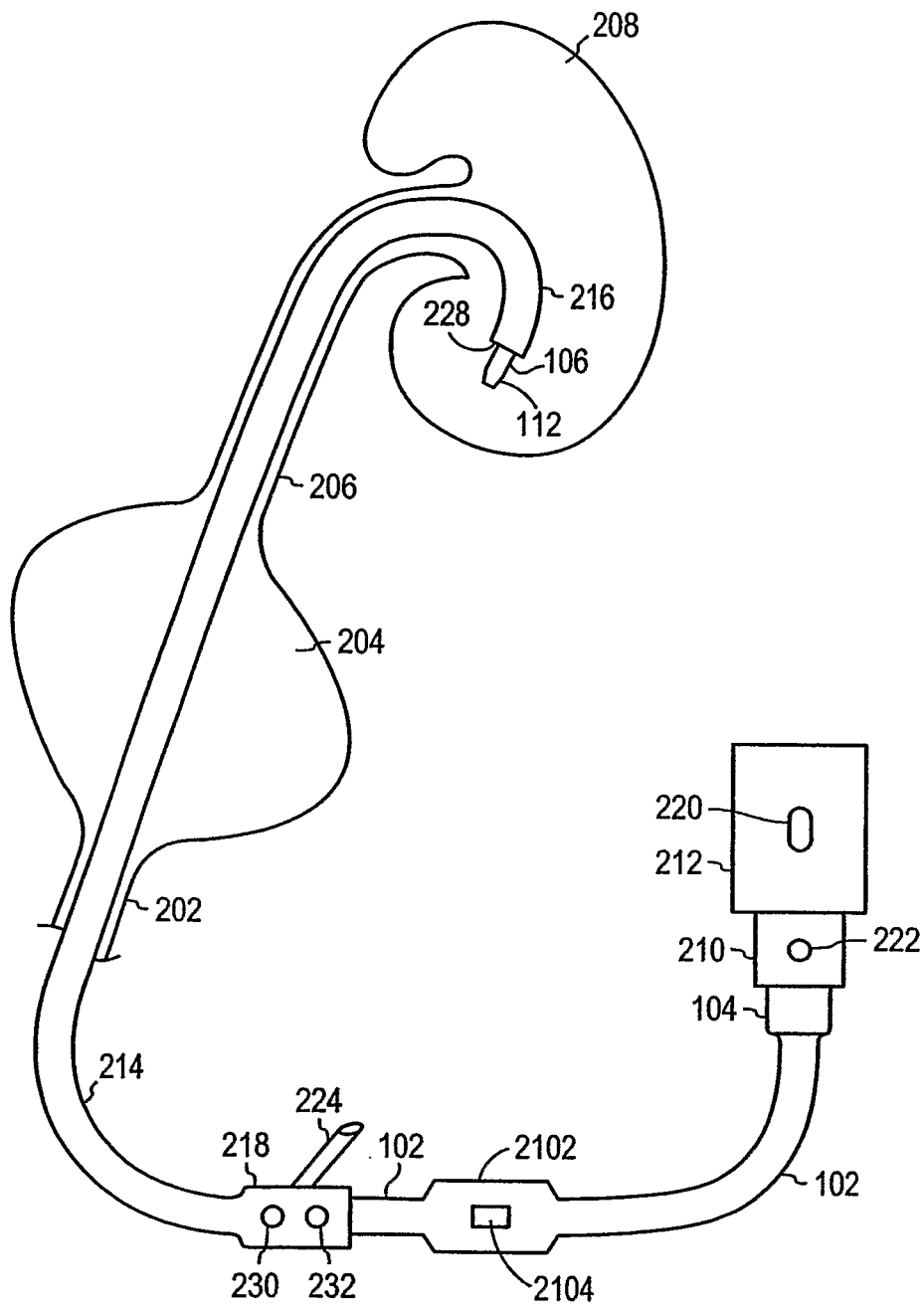


FIG. 21

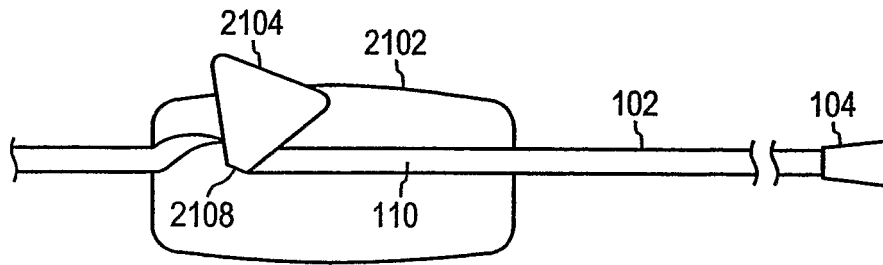


FIG. 22A

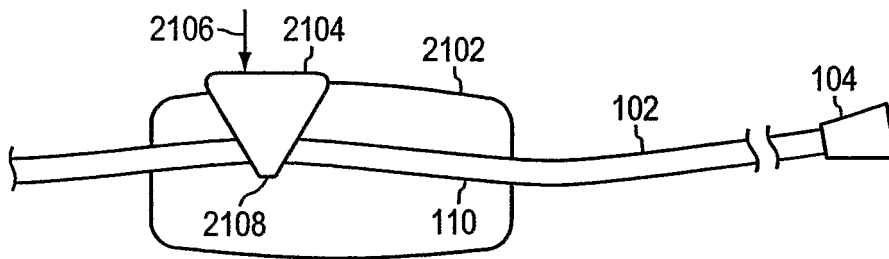


FIG. 22B

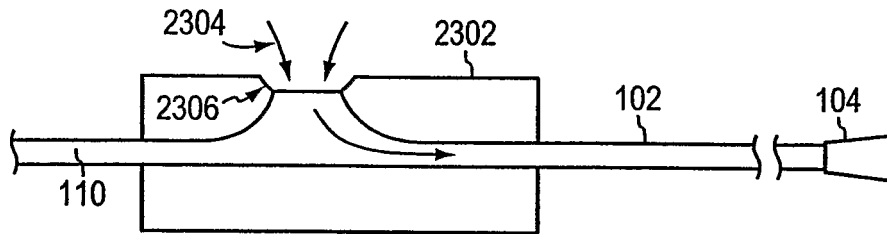


FIG. 23A

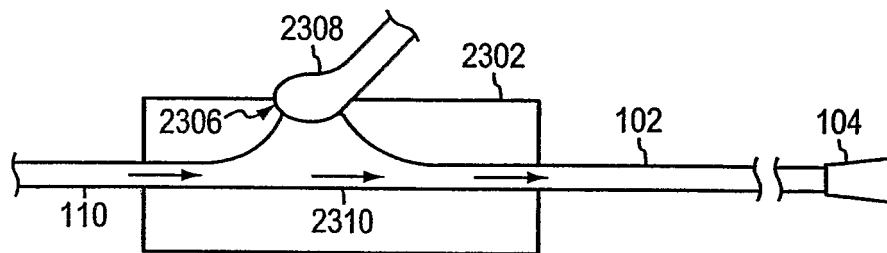


FIG. 23B

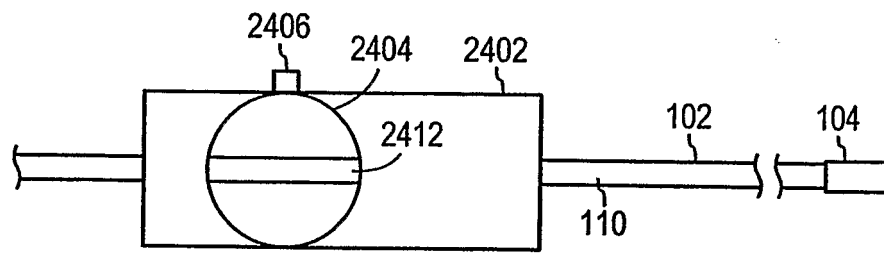


FIG. 24A

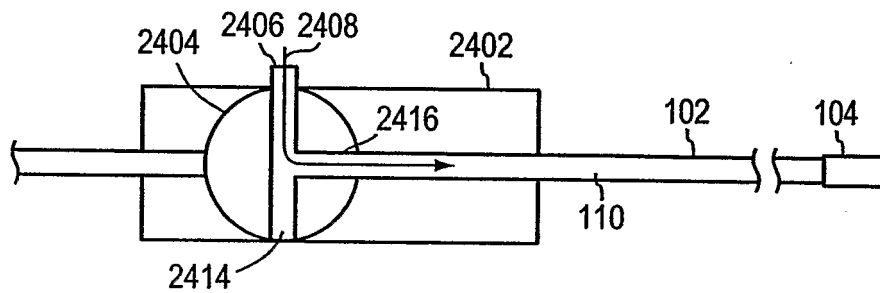


FIG. 24B

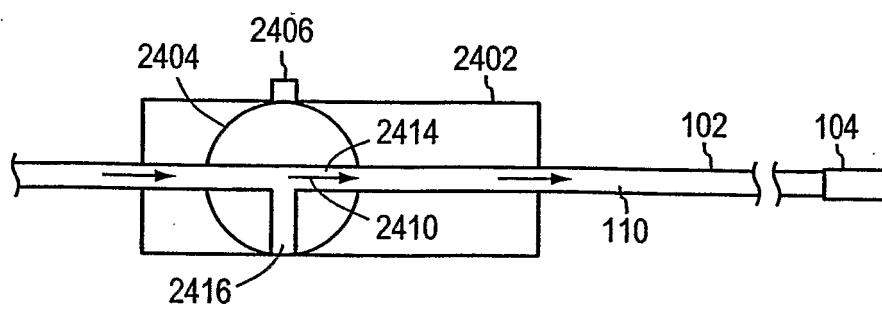


FIG. 24C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/23078

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/22 A61M25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B A61M A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 243 040 A (BEECHER WILLIAM H) 6 January 1981 (1981-01-06)	1-3, 5, 10-16, 18
Y	column 3, line 46-48, 52, 53, 61-63 -column 9, line 25-39; figures 6, 10C, 10E	2-10, 12-14, 17, 18
Y	WO 00 12011 A (HENDLER SHOSHAN ; MAROKO MOSHE (IL)) 9 March 2000 (2000-03-09) page 5, line 14-23 -page 6, line 6-17; figures 1, 4	3-5
Y	US 6 197 014 B1 (DOAN HANH ET AL) 6 March 2001 (2001-03-06) column 7, line 17-22 -column 8, line 1-18; figures 1, 3, 7 column 10, line 29-31	2, 6-10, 12-14, 18
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

6 November 2003

Date of mailing of the international search report

03/12/2003

Name and mailing address of the ISA

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Authorized officer

Assion, J-C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/23078

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 672 953 A (DIVITO ENRICO E) 16 June 1987 (1987-06-16) column 4, line 59 -column 5, line 21; figures 2,5 ---	17
A	EP 0 958 787 A (KIM HAN JOON C O KIM ORTHODONT) 24 November 1999 (1999-11-24) paragraphs '0035!', '0036!'; figures 2,4 -----	16,17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/23078

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 19-21
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/23078

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4243040	A	06-01-1981	NONE	
WO 0012011	A	09-03-2000	AU 5385199 A WO 0012011 A1 US 6506166 B1	21-03-2000 09-03-2000 14-01-2003
US 6197014	B1	06-03-2001	US 5782811 A AT 239520 T AU 692733 B2 AU 2359297 A CA 2206367 A1 DE 69721631 D1 EP 0810003 A2 JP 2965940 B2 JP 10071208 A NO 972452 A	21-07-1998 15-05-2003 11-06-1998 08-01-1998 30-11-1997 12-06-2003 03-12-1997 18-10-1999 17-03-1998 01-12-1997
US 4672953	A	16-06-1987	NONE	
EP 0958787	A	24-11-1999	JP 3249469 B2 JP 11318911 A EP 0958787 A1 US 6159226 A	21-01-2002 24-11-1999 24-11-1999 12-12-2000

专利名称(译)	医用抽吸装置，特别适用于去除肾结石		
公开(公告)号	EP1524944A1	公开(公告)日	2005-04-27
申请号	EP2003771759	申请日	2003-07-24
[标]申请(专利权)人(译)	波士顿科学有限公司		
申请(专利权)人(译)	BOSTON SCIENTIFIC LIMITED		
当前申请(专利权)人(译)	BOSTON SCIENTIFIC LIMITED		
[标]发明人	KEAR JASON W		
发明人	KEAR, JASON, W.		
IPC分类号	A61B17/00 A61B17/22 A61B17/30 A61B19/00 A61M25/00		
CPC分类号	A61B17/22031 A61B90/39 A61B2017/00292 A61B2017/0046 A61B2017/306 A61B2017/308		
优先权	10/202978 2002-07-25 US		
外部链接	Espacenet		

摘要(译)

石块取出抽吸装置 (100) 有助于保持并随后重新定位和/或移除设置在患者泌尿系统 (208) 中的物体。该装置包括细长构件 (102) , 用于放置在柔性输尿管镜 (214) 的通道中。细长构件限定了抽吸通道, 该抽吸通道纵向延伸穿过其中。细长构件 (102) 足够柔韧以与柔性输尿管镜一起弯曲, 并且当用真空源通过抽吸通道提供抽吸时, 细长构件 (102) 足够强以防止抽吸通道的塌陷。细长构件包括远端部分 (112) , 用于在提供抽吸时接触和保持物体。