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(54) Title: MICRO CATHETER CALIPER

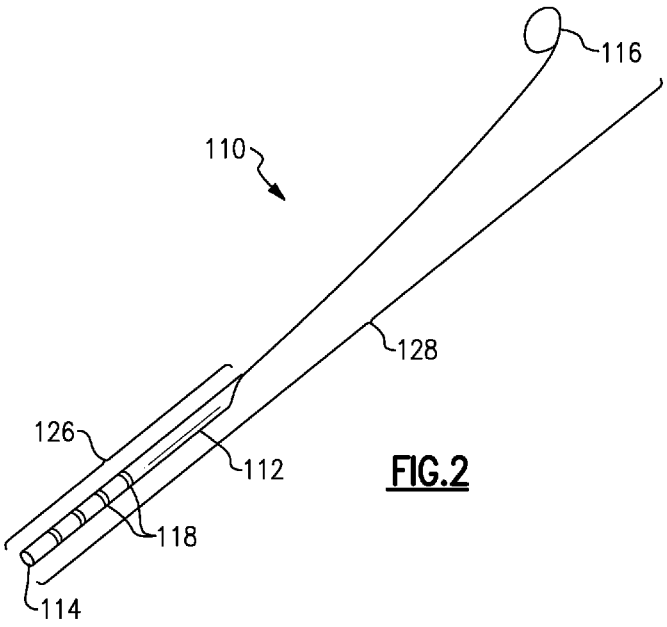


FIG.2

(57) Abstract: An example catheter caliper according to the present disclosure includes a tube having a plurality of markers at predetermined intervals and a wire extending from the tube, wherein the catheter caliper is configured to be received into the vasculature of a patient. Other example catheter calipers and example methods of using the catheter caliper is also disclosed.

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MICRO CATHETER CALIPER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application 63/239,005 filed on August 31, 2021, which is hereby incorporated by reference herein in its entirety.

BACKGROUND

[0002] Certain medical procedures may benefit from the ability to perform intra-vascular length measurements. For instance, catheterization procedures that address or treat artifacts inside blood vessels such as blockages, or perforations/dissections, may benefit from the ability to measure those artifacts. In addition, it is at times beneficial to map the vasculature of a patient such as by determining a distance between adjacent branches in a vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Figure 1 shows an example catheter caliper.

[0004] Figure 2 shows another example catheter caliper.

[0005] Figure 3 shows an example catheter assembly for use with the example catheter caliper of Figure 2.

[0006] Figure 4 shows an example catheter caliper in use.

[0007] Figure 5 shows another example catheter caliper.

[0008] Figure 6A shows the example catheter caliper of Figure 5 in a starting position.

[0009] Figure 6B shows the example catheter caliper of Figure 5 in an extended position.

[0010] Figure 7 shows another example catheter caliper.

[0011] Figure 8A shows the example catheter caliper of Figure 7 in a starting position.

[0012] Figure 8B shows the example catheter caliper of Figure 7 in an extended position.

[0013] Figure 9A shows a portion of the example catheter caliper of Figure 7.

[0014] Figure 9B shows a portion of the example catheter caliper of Figure 7.

SUMMARY

[0015] An example catheter caliper assembly according to the present disclosure includes, among other possible things, a catheter caliper with a tube having a plurality of markers at predetermined intervals and a wire extending from the tube. The catheter caliper is defined between a distal end of the tube and a proximal end of the wire, and is configured to be received into the vasculature of a patient.

[0016] An example catheter caliper assembly according to the present disclosure includes, among other possible things, a first component including an outer tube and a first wire extending from the outer tube. The outer tube has a first marker. The first component is defined between a distal end of the outer tube and a proximal end of the first wire. A second component is configured to be received in the outer tube and is defined between a proximal end and a distal end. The distal end has a second marker. A ruler is arranged at a proximal end of one of the first and second components. The ruler has a plurality of markings each spaced apart by predetermined intervals. A pointer is arranged at a proximal end of the other of the first and second components. The pointer is configured to point to the markings on the ruler.

[0017] An example method of making intravascular measurements according to the present disclosure includes, among other possible things, inserting a catheter caliper into a vasculature of a patient to an artifact or feature to be measured. The catheter caliper includes a tube having a plurality of radiopaque markers each spaced apart by predetermined intervals, and a wire extending from the tube. The catheter caliper is defined between a distal end of the tube and a proximal end of the wire. The method also includes measuring the length of the artifact or feature by comparing the length of the artifact or feature to the markers on the tube.

[0018] An example method of making intravascular measurements according to the present disclosure includes, among other possible things, inserting a catheter caliper into a vasculature of a patient to a location near an artifact or feature to be measured. The catheter caliper includes a first component including an outer tube and a first wire extending from the outer tube. The outer tube has a first marker. The first component is defined between a distal end of the outer tube and a proximal end of the first wire. A second component is configured to be received in the outer tube and is defined between a proximal end and a distal end. The distal end has a second marker. A ruler is arranged at a proximal end of one of the first and second components. The ruler has a plurality of markings each spaced apart by predetermined intervals. A pointer is arranged at a proximal end of the other of the first and second

components. The pointer is configured to point to the markings on the ruler. The method also includes positioning the distal end of the first and second components past the artifact or feature, and moving the pointer with respect to the ruler such that the first marker moves with respect to the second marker and the first marker is positioned at a first end of the artifact or feature and the second marker is positioned at a second end of the artifact or feature.

DETAILED DESCRIPTION

[0019] Figure 1 shows an example catheter caliper 10 according to an embodiment. The example catheter caliper 10 may be used during surgical procedures to estimate intravascular lengths. The catheter caliper 10 is an elongate tubular structure 12 having a distal end 14 and a proximal end 16. The catheter caliper 10 could be made of any known polymeric material, for example. The catheter caliper 10 includes a portion 22 that has a plurality of markers 18 arranged near the distal end 14. In other examples, the portion 22 having markers 18 may extend a longer length of the catheter caliper 10, or even the entire length of the catheter caliper 10. The markers 18 may be marker bands that extend about the circumference of the tubular structure 12, for example.

[0020] The markers 18 are spaced apart by a known interval 20 to form a ruler for measurements. In one example, the markers 18 are spaced by 5 or 10 mm. In the illustrated example, four markers 18 are shown. In other examples, there are between five and ten markers 18 arranged at the distal end 14, but more or fewer markers 18 may be used. The markers 18 are used to determine a length, for example. The markers could be printed, molded, or otherwise included in the catheter caliper 10. The markers 18 may be radio-opaque, so that they are visible using known fluoroscopic imaging. The markers 18 may be made of platinum-based or iridium-based materials, for example, for visibility in imaging.

[0021] The catheter caliper 10 may be sized to have a diameter such that it can be used in the coronary arteries of the heart. The catheter caliper 10 may be any type of catheter, such as a guide catheter, for example. Although the catheter caliper 10 is shown to have a straight proximal end 16, other types of catheter ends could be used.

[0022] The catheter caliper may be used during an angioplasty procedure to determine the length of an artifact such as a blockage, perforation, or dissection in the vasculature of a patient in order to select the appropriate balloon catheter and stent, for example. An angioplasty procedure is used to repair a blockage, perforation, or dissection in a

vessel. An angioplasty procedure typically involves a guide catheter and a balloon catheter (the balloon is used to repair the blockage in various ways, as would be known in the art). During the procedure, a guidewire may be inserted into the vessel via the access point and advanced towards the blockage or perforation/dissection. The catheter caliper 10 is inserted into the vessel via the access point and advanced towards the blockage or perforation/dissection along the guidewire. When the radiopaque markers 18 of the catheter caliper 10 are near the blockage or perforation/dissection, the physician or user can estimate the length of the blockage or perforation/dissection by comparing the length to the markers 18 having known spacing. The number of markers 18 that the blockage spans can then be used to determine a length measurement of the blockage or perforation/dissection. The length measurement can be used to select an appropriately sized stent for the repair.

[0023] Other applications for the catheter caliper are also contemplated. For instance, one may want to measure a feature of a patient's vasculature such as the distance between adjacent branches in the vasculature to select an appropriately sized stent, and place the stent in an appropriate location, without blocking off the branches. Additionally, other anatomical distances or locations could be measured with the catheter caliper, and that would benefit a medical procedure. It should be understood that the example applications described herein are non-limiting.

[0024] Figure 2 shows another example catheter caliper according to an embodiment. To the extent not otherwise described or shown, the catheter caliper 110 corresponds to the catheter caliper 10 of Figure 1, with like parts having reference numerals preappended with a "1." In this example, the catheter caliper 110 has a tubular structure or portion 112 that is shorter in length than a full catheter. This example may be referred to as a "rapid exchange" or "Rx" catheter caliper. The tubular structure 112 is attached to a tether or wire 124. The tubular structure 112 may have a length 126 that is much shorter than the length 128 of the catheter caliper 110. Although four markers 118 are shown, more or fewer may be used. In one example, there may be markers 118 along most or all of the length 126 of the tubular portion 112. This example catheter caliper 110 having a short tubular structure 112 may be easier to insert and remove than a full catheter in some instances and may enable use with a shorter length guidewire.

[0025] Figure 3 shows an example catheter assembly for use with the example catheter caliper of Figure 2. The catheter caliper 110 may be used with a guidewire 130 and

guide catheter 132. The catheter caliper 110 is a "Rapid Exchange" or "Rx" catheter, as the guidewire 130 extends through the tubular portion 112 of the catheter caliper 110. The guidewire 130 and catheter caliper 110 are received inside the lumen 133 of the guide catheter 132. Although a guidewire 130, catheter caliper 110, and guide catheter 132 are shown, the catheter caliper 110 may be used with another combination of components. For example, the catheter caliper 10 of Figure 1 may be configured as a guide catheter, and thus not be used with a separate guide catheter 132. In other embodiments, a plurality of spaced markers 118 may be on other components for making intra-vessel measurements. For example, there may be a plurality of markers on a guidewire 130, a guide catheter 132, a balloon catheter, or other component.

[0026] Figure 4 shows an example catheter caliper in use. In this example, the catheter caliper 110 is used in a heart procedure. A physician or user could access the vascular arteries 152 of a patient 150 through an access point 148. In the illustrated example, the access point 148 is the radial artery at the patient's wrist. In other examples, the access point could be the femoral artery at the patient's groin. A guide catheter 132 is inserted into the patient 150 from the access point 148. A guidewire 130 is then inserted into the lumen 133 of the guide catheter 132 and advanced beyond the distal end of the guide catheter 132 into the coronary artery. The guidewire 130 may be advanced into a distal segment of the artery, such that a tip of the guidewire 130 is beyond the blockage or perforation/dissection 154. The catheter caliper 110 is then inserted over the guidewire 130 and within the lumen 133 of the guide catheter 132. The catheter caliper 110 is advanced along the guidewire 130 until the markers 118 are alongside the blockage or perforation/dissection 154. The physician or user can then make a length measurement of the blockage or perforation/dissection 154 by viewing the markers 118 via fluoroscopic imaging. Although fluoroscopic imaging is discussed, the guidewire and/or catheters may be monitored by any imaging technique known in the art. The physician or user can then choose the appropriate length angioplasty balloon and stent for the angioplasty procedure.

[0027] Figure 5 shows another example catheter caliper. In this example, the catheter caliper 210 is a two-piece device, with the pieces shown unassembled to reveal the components, details and features. To the extent not otherwise described or shown, the catheter 210 corresponds to the catheter calipers 10, 110 of Figures 1-4, with like parts having reference numerals preappended with a "2." The catheter caliper 210 has an outer tube 209 and an inner

tube 211. In this view, the catheter caliper 210 is disassembled. The inner tube 211 is sized to fit within the outer tube 209 such that they are co-axial when assembled. The outer and inner tubes 209, 211 are connected to a proximal end 216 of the catheter caliper 210 via a wires 224A, 224B, respectively. The outer and inner tubes 209, 211 may then both fit within a guide catheter 132 and over a guidewire 130, for example. The outer tube 209 has a marker 218A and the inner tube 211 has a marker 218B. The markers 218A, 218B are near the distal end 214 of the tubes 209, 211. A scale 260 is arranged at the proximal end 216. The scale 260 generally includes a ruler 262 and a pointer 266. The ruler 262 has a plurality of spaced markers 264. The scale 260 may be a millimeter scale, for example, with the spaced markers 264 spaced apart by 1 or 5 millimeters. The pointer 266 may include a finger loop 268 or other handle, in some embodiments. The pointer 266 slides relative to the ruler 262 to indicate length measurements. A physician or other user may slide the pointer 266 along the scale 260 using the finger loop 268. As the pointer 266 is moved relative to the scale 260, the marker 218A moves relative to the marker 218B. In this example, the inner and outer tubes 209, 211 are "rapid exchange" catheters.

[0028] Although the pointer 266 is shown on the outer tube 209 and the ruler 262 is on the inner tube 211, these could be switched, in other examples. Although the tubes 209, 211 are connected to the scale 260 via wires 224A, 224B, in other examples, the scale 260 may be attached directly to the tubes 209, 211. In other words, the tubes 209, 211 could be an over-the-wire catheter with a longer tube.

[0029] The catheter caliper 210 may be a micro sized catheter, which enables it to be used in the coronary arteries of the heart and may be inserted into the diameter of an artery that is reduced smaller by a blockage. The catheter caliper 210 may be designed to interface with a coronary guidewire and coronary catheter. The inner tube 211 has an inner diameter that is big enough to receive a guidewire 130. A typical coronary guidewire 130 may have a diameter of about 0.014 inches and a typical guide catheter may have an inside diameter of about 0.040 inches. In one example, the inside diameter of the inner tube 211 has a diameter of about 0.016 inches and the outer diameter of the outer tube 209 may be about 0.038 inches to accommodate the guidewire and guide catheter. The tubes 209, 211 may have a length 280 that is much smaller than a total length of the catheter caliper 210. In one example, the length 280 may be between about 8 and 12 inches, while the total length of the catheter caliper 210

may be around 55 inches, for example. The catheter caliper 210 may be sized to work with existing guidewires, guide catheters, and balloon catheters.

[0030] Figure 6A shows the example catheter caliper 210 in a starting position. In this view, the inner tube 211 is arranged within the outer tube 209 such that the markers 218A, 218B are aligned with one another. In this position, the pointer 266 is arranged at a first of the markers 264, which indicates a zero position. That is, the distance between the markers 218A, 218B is zero in this position.

[0031] Figure 6B shows the example catheter caliper 210 in an extended or measuring position. After the physician or other user has inserted the catheter caliper 210 and positioned the distal end 214 past the blockage 154 or other artifact in the patient 150 (shown in Figure 4), the physician or user then moves the pointer 266 along the scale 216, which moves the outer tube 209 relative to the inner tube 211 until the marker 218A is at an end of the blockage 154. That is, the marker 218B will be at a one end of the blockage 154 and the marker 218A will be at an opposite end of the blockage 154. The markers 218A, 218B are then spaced apart by a distance 270, which corresponds to the length of the blockage 154. The markers 218A, 218 B are radio-opaque so that a user can see them with medical imaging to line up the markers 218A, 218B with the blockage 154. When the markers 218A, 218B are positioned along the blockage 154, pointer 266 points at a length marker 264 that corresponds to the distance 270. In other words, the physician or user can measure how far apart the markers 218A, 218B are within the patient 150 via the scale 216 that is outside the body of the patient 150 to determine the length of the blockage.

[0032] Figure 7 shows another example catheter caliper. This catheter caliper 310 is also a two-piece device, formed from an outer tube 309 and an inner wire 311. To the extent not otherwise described or shown, the catheter caliper 310 corresponds to the catheter caliper 210 of Figures 5-6B, with like parts having reference numerals preappended with a "3." The catheter caliper 310 operates in the same manner as the catheter caliper 210. The outer tube 309 has a marker 318A and the inner wire 311 has a marker 318B. A distance between the markers 318A, 318B is determinable by a scale 360 at the proximal end 316.

[0033] Figure 8A shows the example catheter caliper 310 in a starting position. In this position, the inner wire is within the outer tube 309 such that the markers 318A, 318B are aligned with one another. The pointer 366 is at the zero position in the starting position.

[0034] Figure 8B shows the example catheter caliper 310 in an extended or measuring position. After the catheter caliper 310 has been positioned adjacent the blockage or perforation/dissection 154 in the patient 150, the physician or user can then move the inner wire 311 relative to the outer tube 309 by moving the pointer 366 until the markers 318A, 318B are at opposite ends of the blockage or perforation/dissection 154. The user can then measure the distance 370 between the markers 318A, 318B by reading the distance 372 on the scale 360.

[0035] Figure 9A shows the distal end of the catheter caliper 310 in a disassembled state. The inner wire 311 is smaller in diameter than the outer tube 309. Although the marker 318B is shown at the end of the inner wire 311, the marker 318B may be spaced from the end of the inner wire 311, in some examples.

[0036] Figure 9B shows a cross-sectional view of the distal end of the catheter caliper 310. The outer tube 309 has an inner lumen 374 that extends a length of the outer tube 309. The inner lumen 374 is sized such that the outer tube 309 fits over the guidewire 130. A space 376 is also formed within the outer tube 309. The space 376 fits the inner wire 311. The space 376 may terminate inward of the distal end 314 of the outer tube 309. The space 376 may terminate at a location such that the marker 318B on the inner wire 311 is aligned with the marker 318A on the outer tube 309 when the inner wire 311 is fully inserted into the space 376.

[0037] Although an angioplasty procedure is described, the example catheter calipers 10, 110, 210, 310 may be used for other medical procedures in which intra-vessel measurements could be made. Although the example catheter calipers 10, 110, 210, 310 are described as measuring blockages, as discussed above, they may also be used to measure other distances, such as the length of an artery or the distance between side branches of an artery.

[0038] Known methods of estimating the size of a blockage or perforation/dissection may include using a guidewire with markers or making a digital measurement using imaging software. The disclosed catheter caliper allows a physician or other user to obtain an accurate length measurement with the guide wire of their choice. The catheter caliper 10, 110, 210, 310 provides a simple, accurate, and intuitive way to make intra-vessel measurements, which may help prevent choosing a balloon or stent that is too short or too long.

[0039] Although the different examples have the specific components shown in the illustrations, embodiments of this disclosure are not limited to those particular combinations.

It is possible to use some of the components or features from one of the examples in combination with features or components from another one of the examples.

[0040] Although an embodiment of this disclosure has been explained, a worker of ordinary skill in this art would recognize that certain modifications would come within the spirit and scope of this invention.

CLAIMS

1. A catheter caliper assembly, comprising:

a catheter caliper, including

a tube having a plurality of radiopaque markers each spaced apart by predetermined intervals; and

a wire extending from the tube, the catheter caliper defined between a distal end of the tube and a proximal end of the wire, wherein the catheter caliper is configured to be received in a vasculature of a patient.

2. The assembly of claim 1, wherein the tube is configured to receive a guidewire.

3. The assembly of claim 1, further comprising a guide catheter, wherein the catheter caliper is configured to be received in a lumen of the guide catheter.

4. A catheter caliper assembly, comprising:

a catheter caliper, including

a first component including an outer tube and a first wire extending from the outer tube, the outer tube having a first marker, the first component defined between a distal end of the outer tube and a proximal end of the first wire;

a second component configured to be received in the outer tube, and defined between a proximal end and a distal end, the distal end having a second marker;

a ruler arranged at a proximal end of one of the first and second components, the ruler having a plurality of markings each spaced apart by predetermined intervals; and

a pointer arranged at a proximal end of the other of the first and second components, the pointer configured to point to the markings on the ruler.

5. The assembly of claim 4, wherein the pointer is arranged on a finger loop or handle.

6. The assembly of claim 4, wherein moving the pointer with respect to the ruler moves one of the first marker and the second marker with respect to the other of the first and second markers.

7. The assembly of claim 4, wherein moving the first marker with respect to the second marker moves the pointer with respect to the ruler.

8. The assembly of claim 4, wherein the second component includes a second wire at the proximal end.

9. The assembly of claim 8, wherein the second component includes an inner tube at the distal end, the inner tube configured to be received in the outer tube, the inner tube including the second marker.

10. The assembly of claim 4, wherein the outer tube includes a lumen therethrough configured to receive a guidewire.

11. The assembly of claim 4, wherein the outer tube includes a space configured to receive the distal end of the second component.

12. The assembly of claim 11, wherein the space is configured such that when the distal end of the second component is received at a terminus of the space, the first and second markers are aligned.

13. A method of making intravascular measurements, the method including:

inserting a catheter caliper into a vasculature of a patient to an artifact or feature to be measured, the catheter caliper including

a tube having a plurality of radiopaque markers each spaced apart by predetermined intervals, and

a wire extending from the tube, the catheter caliper defined between a distal end of the tube and a proximal end of the wire; and

measuring the length of the artifact or feature by comparing the length of the artifact or feature to the markers on the tube.

14. The method of claim 13, wherein the artifact is a blockage, perforation, or dissection.

15. The method of claim 13, wherein the inserting includes inserting the catheter caliper over a guidewire such that the guidewire is received in the tube.

16. The method of claim 13, wherein the inserting includes inserting the catheter caliper through a guide catheter.

17. A method of making intravascular measurements, the method including:

inserting a catheter caliper into a vasculature of a patient to a location near an artifact or feature to be measured, the catheter caliper including

a first component including an outer tube and a first wire extending from the outer tube, the outer tube having a first marker, the first component defined between a distal end of the outer tube and a proximal end of the first wire;

a second component configured to be received in the outer tube, and defined between a proximal end and a distal end, the distal end having a second marker;

a ruler arranged at a proximal end of one of the first and second components, the ruler having a plurality of markings each spaced apart by predetermined intervals, and

a pointer arranged at a proximal end of the other of the first and second components, the pointer configured to point to the markings on the ruler;

positioning the distal end of the first and second components past the artifact or feature; and

moving the pointer with respect to the ruler such that the first marker moves with respect to the second marker and the first marker is positioned at a first end of the artifact or feature and the second marker is positioned at a second end of the artifact or feature.

18. The method of claim 17, wherein the second component includes an inner tube at the distal end, the inner tube configured to be received in the outer tube, the inner tube including the second marker.

19. The method of claim 17, wherein the outer tube includes a lumen therethrough configured to receive a guidewire.

20. The method of claim 17, wherein the outer tube includes a space configured to receive the distal end of the second component.

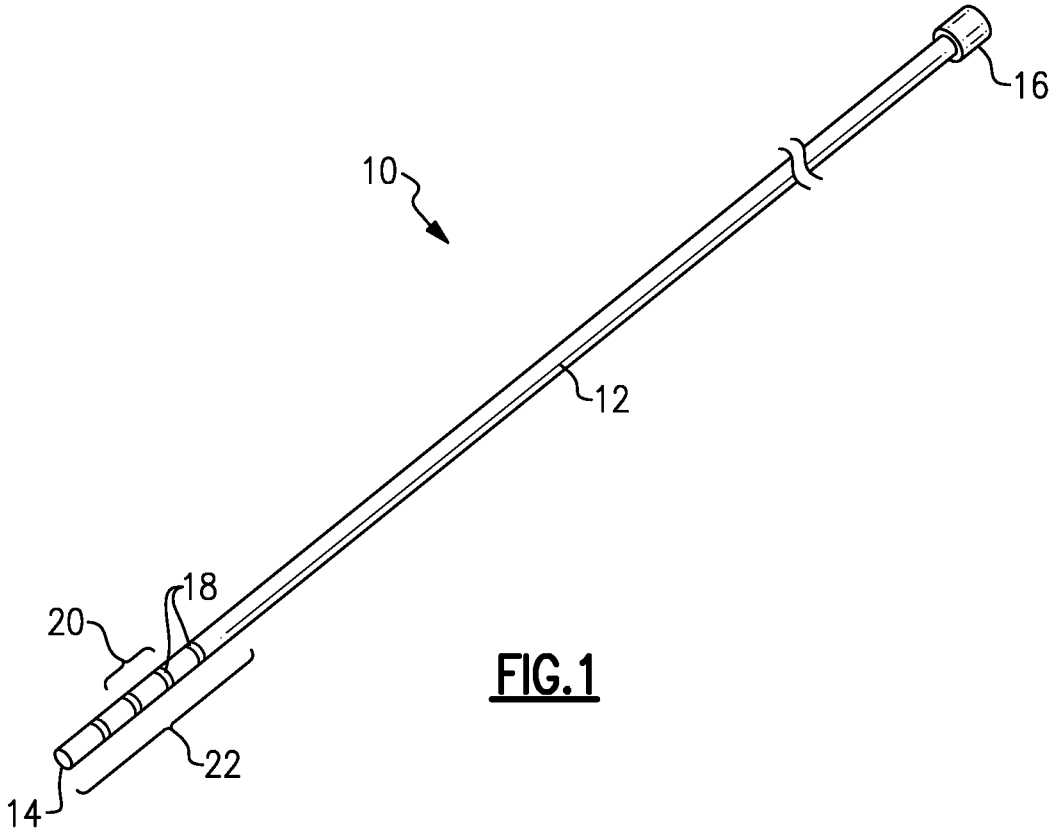


FIG.1

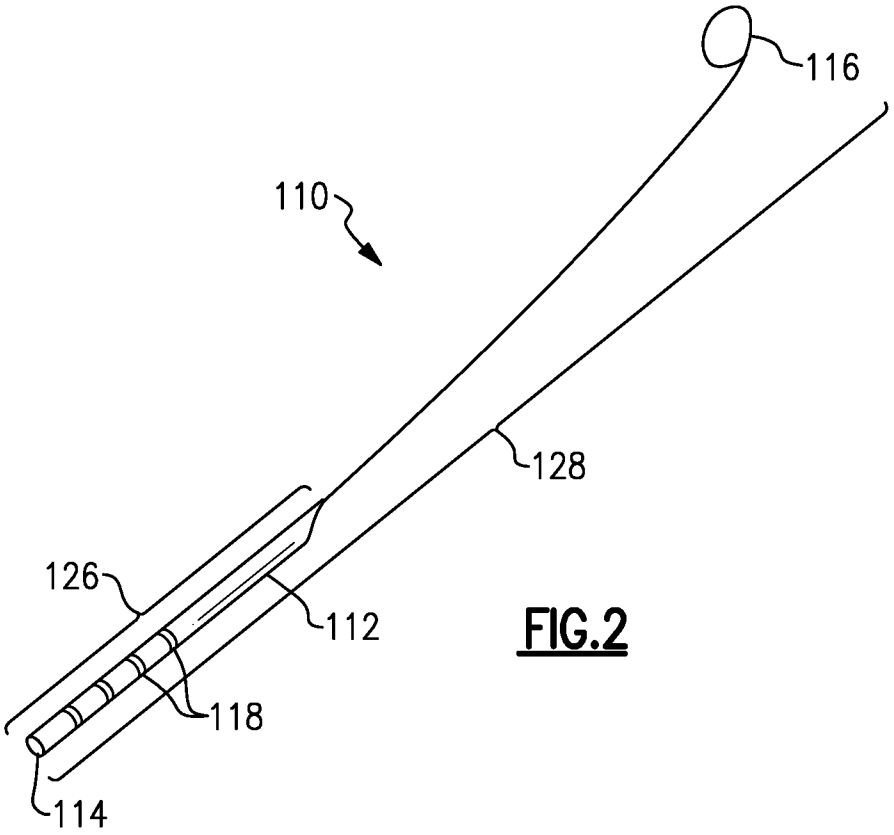


FIG.2

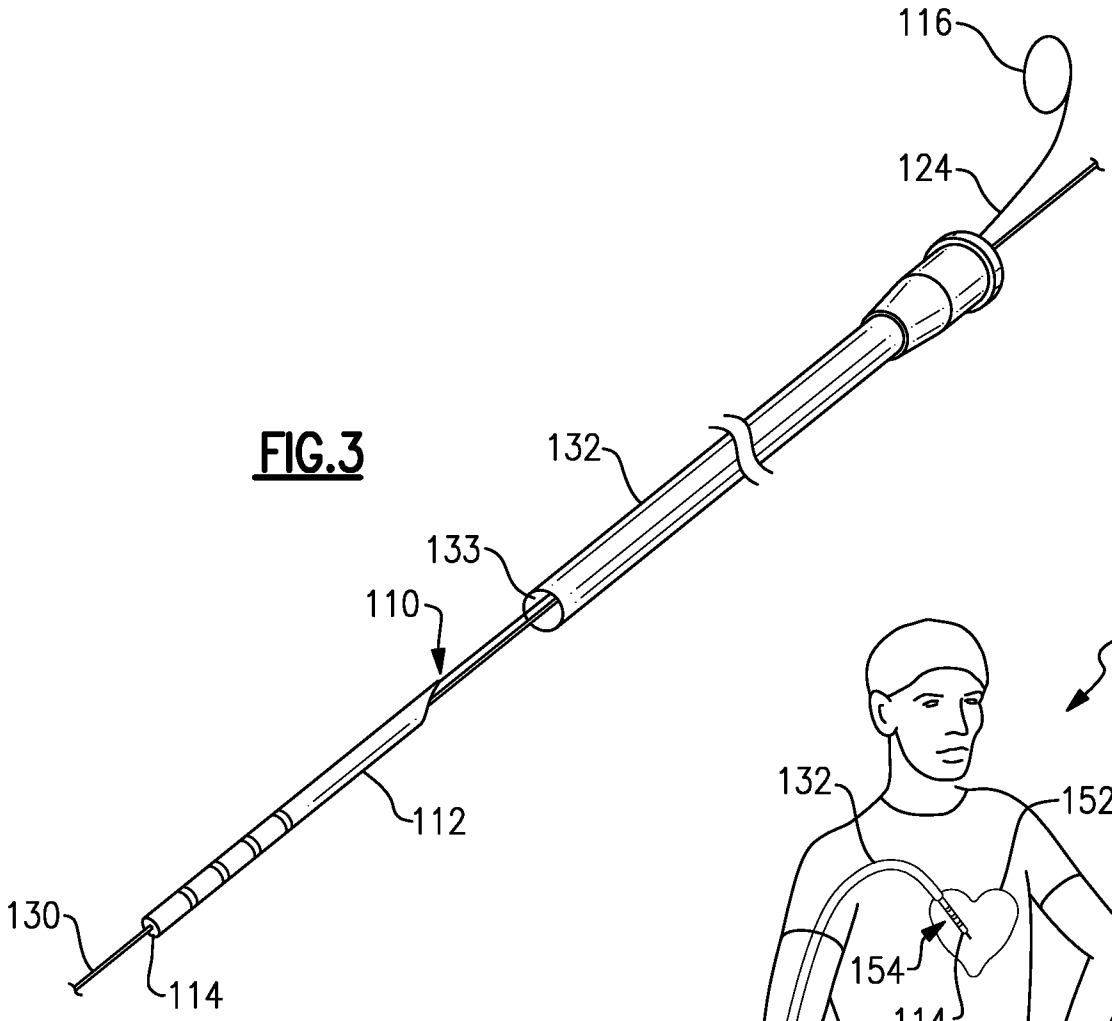


FIG.3

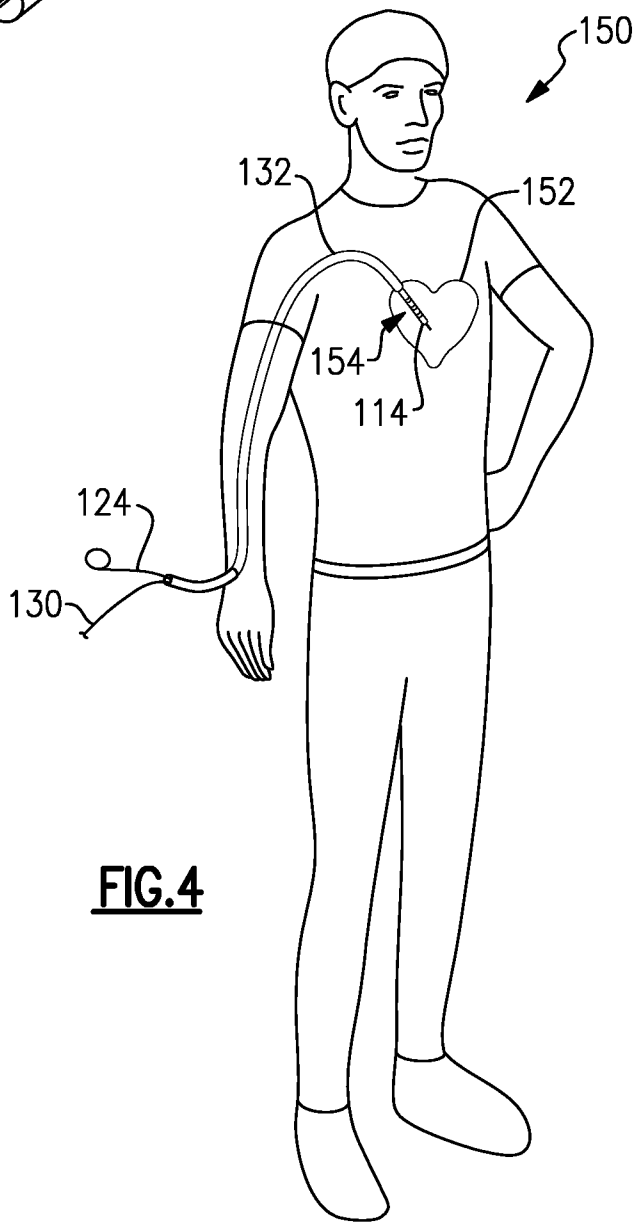


FIG.4

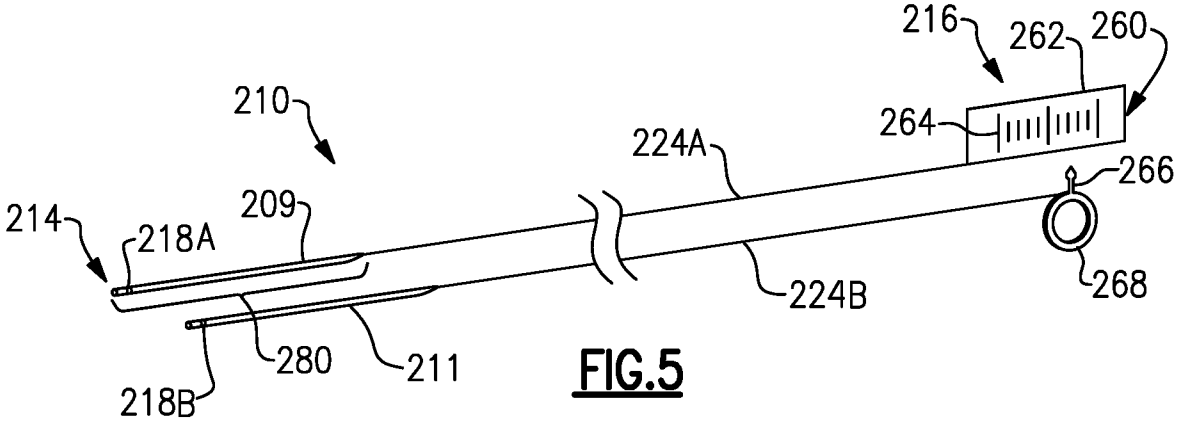


FIG.5

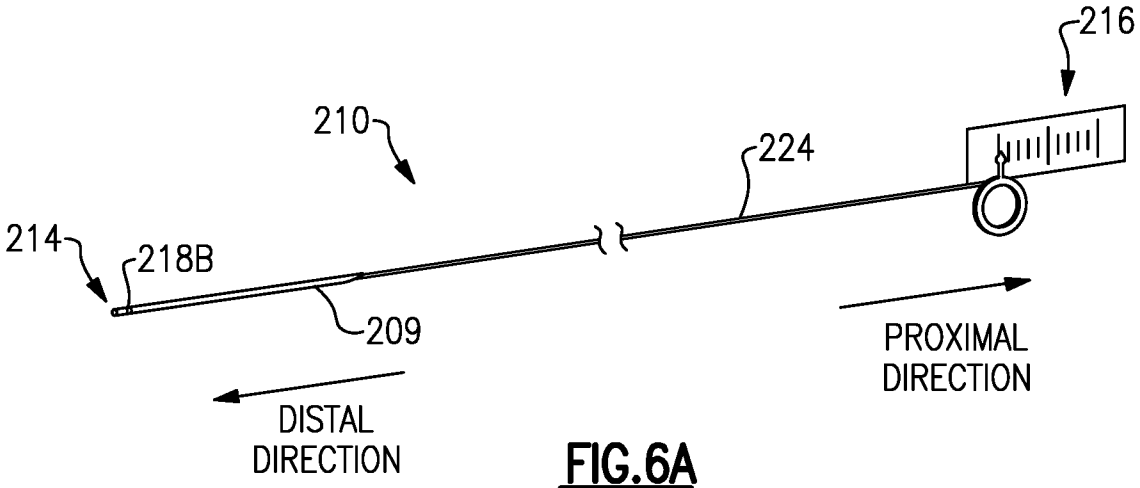


FIG.6A

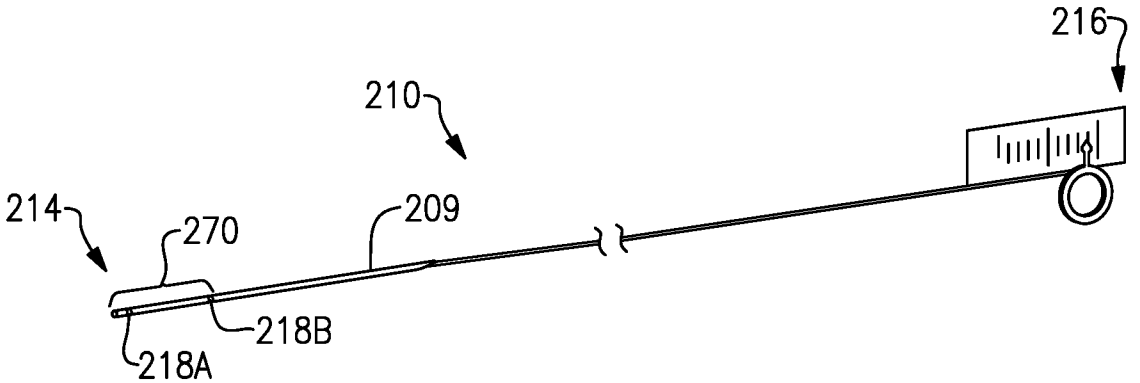


FIG.6B

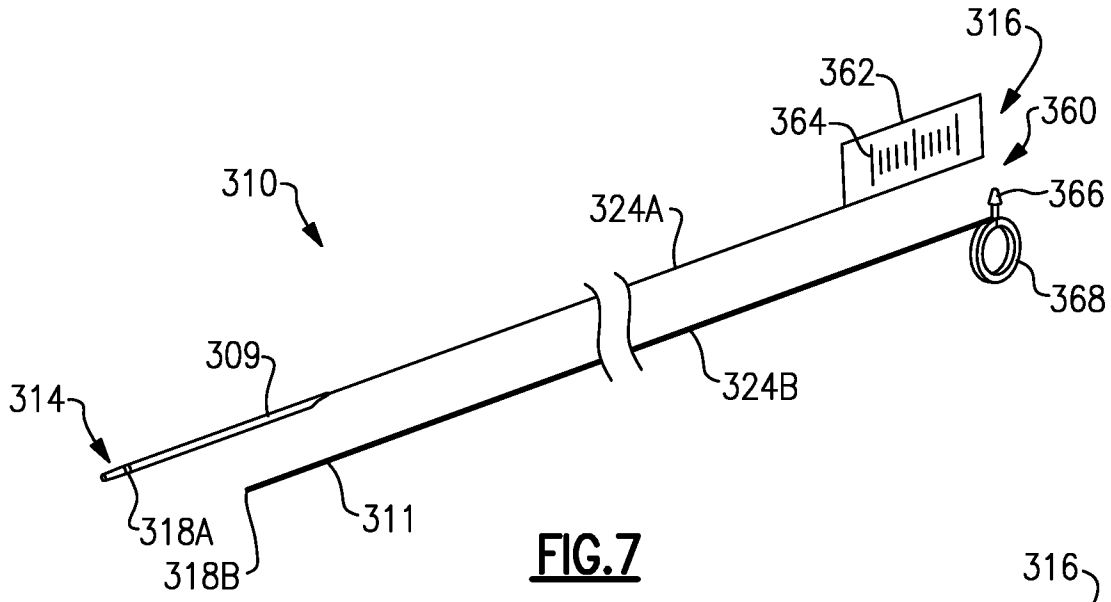


FIG.7

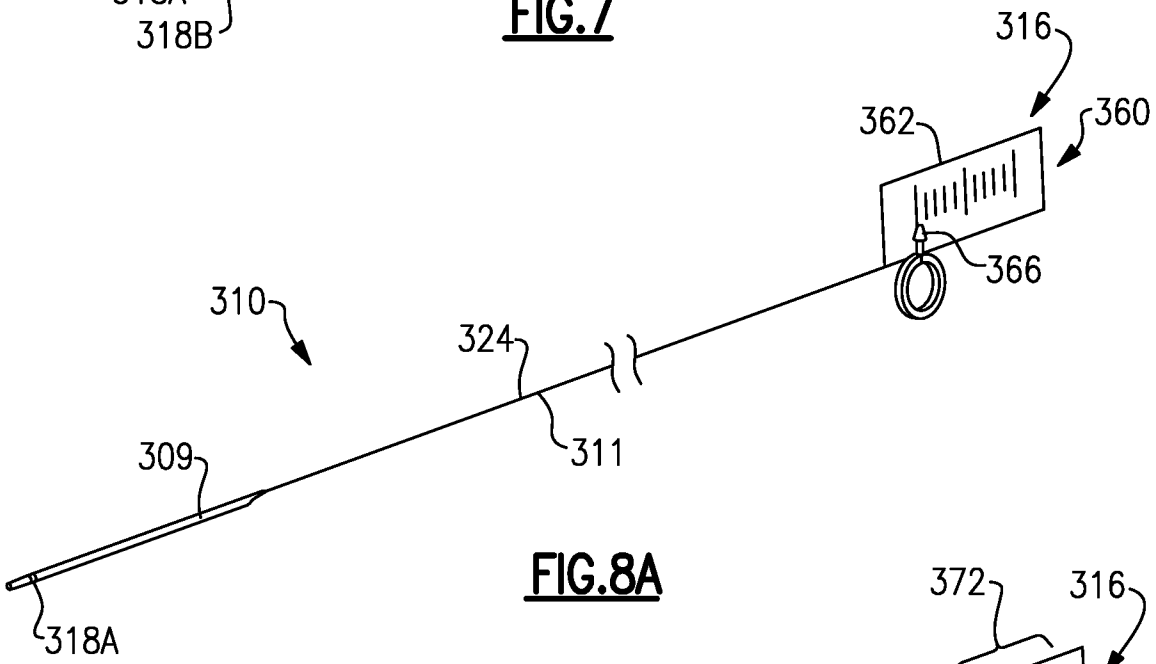


FIG.8A

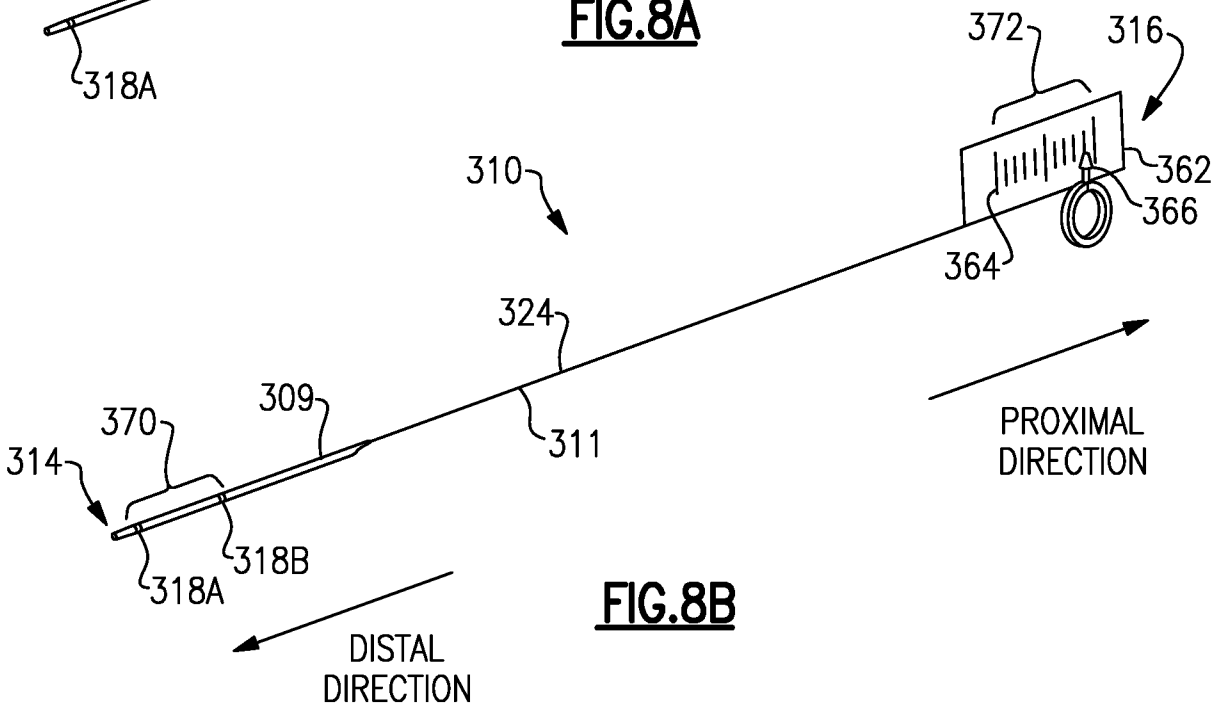


FIG.8B

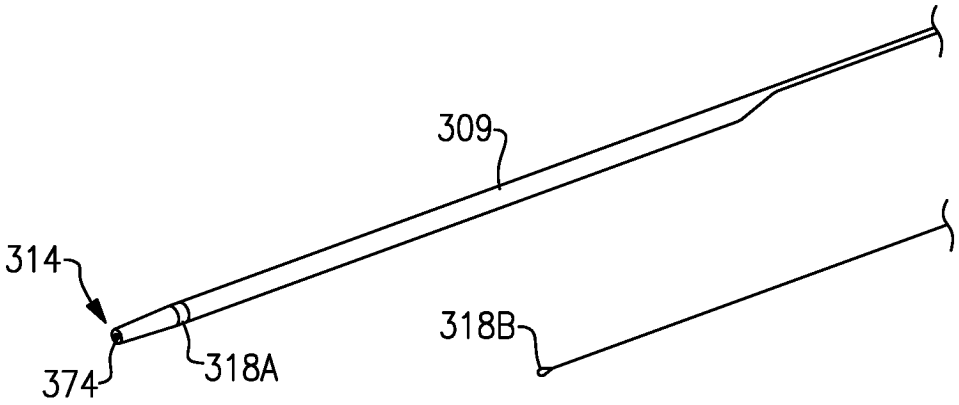


FIG.9A

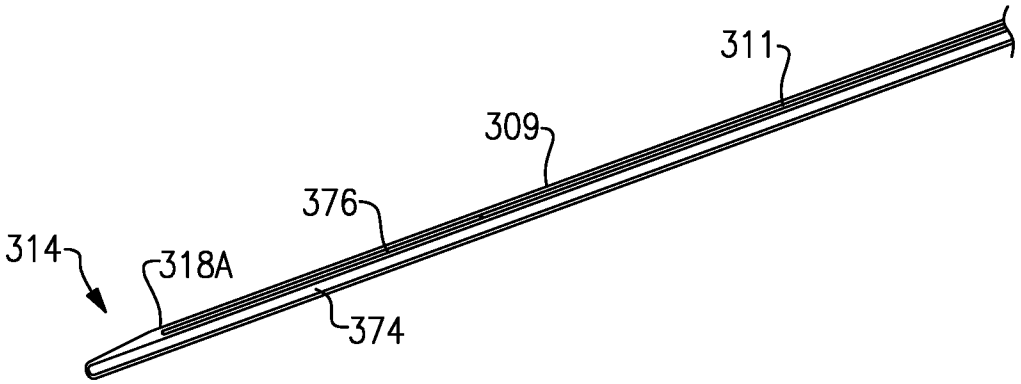


FIG.9B

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2022/042189

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B90/00 A61B5/107 A61B10/00 A61M25/00
ADD.

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)

A61B A61M

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/088195 A1 (VARDI GIL M [US] ET AL) 8 May 2003 (2003-05-08) paragraphs [0044] - [0046]; figures 5a-5c	1-3
A	WO 2018/081008 A1 (ABOUFARES ALI [US]) 3 May 2018 (2018-05-03) figures 6, 7	1-3
A	US 2021/251515 A1 (KOROTKO JOSEPH R [US] ET AL) 19 August 2021 (2021-08-19) the whole document	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family 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 application or patent 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 December 2022	16/02/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schmidt, Matthias

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2022/042189

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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. [X] Claims Nos.: 13-20
because they relate to subject matter not required to be searched by this Authority, namely:
see FURTHER INFORMATION sheet PCT/ISA/210

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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

see additional sheet

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 fees, this Authority did not invite payment of additional fees.

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. [X] 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.:
1-3

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 13-20

Claim 13-20 define the step of "inserting a catheter into a vasculature of a human body", which is a surgical step. These claims therefore include features which define a physical activity that is not allowable. Hence, claim 13-20 define a method of treatment of the human body by surgery in the meaning of Rules 39.1(iv) and Rule 67.1(iv) PCT. Therefore, according to Article 34(4)(a)(i) PCT no written opinion regarding novelty, inventive step or industrial applicability is given for claims 13-20.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-3

intravascular length measurement via fluorscopic imaging

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2. claims: 4-12

intravascular length measurement via a proximal catheter ruler / scale

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2022/042189

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003088195 A1	08-05-2003	US 2003088195 A1	08-05-2003
		US 2004064070 A1	01-04-2004
WO 2018081008 A1	03-05-2018	NONE	
US 2021251515 A1	19-08-2021	CA 3170355 A1	19-08-2021
		EP 4103101 A1	21-12-2022
		US 2021251515 A1	19-08-2021
		US 2022322969 A1	13-10-2022
		WO 2021163028 A1	19-08-2021