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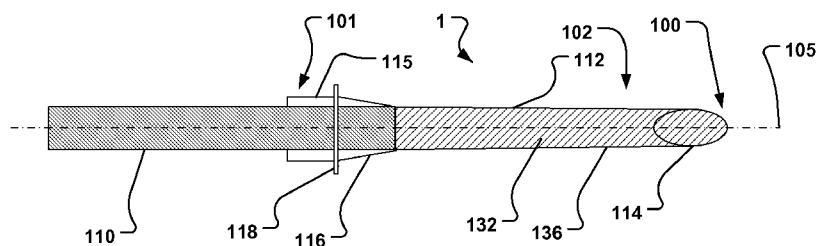


Fig. 1

(57) Abstract: An endoluminal medical access device (1) is disclosed that is devised for endoluminal delivery to an extravascular target site (5) at a vasculature site of a human or animal body vasculature, such as the microvasculature. The device (1) comprises a body (112) that ends in a distal end (100) and comprises a distal penetration portion (102) that is devised to extend across a tissue wall of said microvasculature said microvasculature site (4) at an extravascular target site in said body and devised for at least partly apposition to said tissue wall, and a proximal connection section (101), which proximally adjoins said penetration portion (102), and optionally comprises an intrusion depth limit unit (116, 118) and/or a separation section (115) devised to provide a controllable separation of the penetration portion (102) from a connected proximal portion (110) of the body. The distal portion comprises an outer surface (136) adapted to be in transceiving communication with the target site when arranged at the latter.



NOVEL ENDOLUMINAL MEDICAL ACCESS DEVICE

Field of the Invention

This invention pertains to the field of catheter based medical devices. More particularly, the invention relates to solid or semi-solid probes having a piercing tip. Even more particularly, the invention relates to an endoluminal vascular medical access device for endoluminal delivery of substances to and/or from a vasculature site of a human or animal body and access to an extra-vascular target site located outside of the lumen of the vasculature at said site. The vascular site may be a microvasculature site.

Background of the Invention

There is today a trend towards minimally invasive techniques for administration or sampling of substances or cells to or from various organ systems. Most organs and tissues in the body can be reached by needles with or without ultrasonic or computerized tomography guidance and if this is not possible, open surgery is an option. Stereotactic delivery, assisted by modern imaging techniques, are also existing alternatives.

However, these techniques are not applicable for all organ systems, e.g. due to the limited resolution of the imaging modalities and sub-sequential planning of safe route at justifiable patient risk and radiation doses.

Moreover, there are some target areas in the body that are not accessible by known minimally invasive techniques and devices via safe routes. For such organs with less accessible anatomical location, parenchymal access can be associated with significant surgical risks.

The development of endovascular microcatheter techniques during the last years has opened a possibility to reach parts of the body that have been difficult to reach previously by conventional means by using arteries and veins as via the "internal routes" that they constitute. The potential of these techniques was recognized due to the possibility to do minimally invasive transplantations, such as disclosed in Bliss, T., R. Guzman, et al. (2007). "Cell transplantation therapy for stroke." Stroke 38(2 Suppl): 817-26.

US6602241 of Transvascular Inc. discloses methods and apparatus for delivery of substances or apparatus to target sites located outside blood vessels. A vessel wall penetrating catheter is disclosed that is inserted into the vasculature, positioned and oriented within a blood vessel near a target extravascular site and a penetrator is advanced from the catheter so as to perform an

outward penetration through the wall of the blood vessel in the direction of the target site. Thereafter, a delivery catheter is passed through a lumen of the penetrator to the target site. A desired substance or apparatus is then delivered to or obtained from the target site. In some applications, the penetrator may be retracted into the vessel wall penetrating catheter and the vessel wall penetrating catheter may be removed, leaving the delivery catheter in place for chronic or continuous
5 delivery of substance(s) to and/or obtaining of information or samples from the target site. Alternatively, a delivery catheter having an occlusion member or balloon may be advanced into a vein or venule and the occlusion member or balloon may be used to occlude the lumen of the vein or venule during and after injection of a substance through the catheter, such that the substance will not
10 be carried away by normal venous blood flow and will remain in the vein or venule for a sufficient period of time to have its intended effect, e.g. to enter adjacent tissues through capillary beds drained by that vein or venule.

However, the disclosure of US6602241 describes a system providing penetration of a vein, i.e. the low pressure side of the vasculature, leaving a catheter in position at the penetration
15 site of the vein. The catheter is connected all the way through the vasculature to the entry point into the body or vasculature.

In addition, it appears that the system disclosed in US6602241 does not provide a satisfactory solution to avoid bleeding at the penetration side inside the body after completed treatment when the catheter is retracted. It is mentioned that a backflow of injected fluid may be prevented by
20 injecting a suitable adhesive or embolizing material such as a cyanoacrylate, polyethylene glycol, hydrogel or fibrin glue through the catheter lumen as the catheter is being pulled back through the tissue tract, through which it was initially inserted.

However, this solution to avoid bleeding at the penetration site is not satisfactory from a clinical point of view as it is difficult to perform and to monitor the success thereof. In addition, the
25 injection of adhesive or embolization material may induce thrombotic embolies or unintentionally occlude the delivery vessel completely. Furthermore, the use of adhesives is not feasible in arterial vessels due to the existing higher blood pressure pushing the adhesive material out of the penetration site into the surrounding tissue before the penetration site is closed.

Moreover, the vessel wall penetrating catheter disclosed in US6602241 is of such large
30 size that it cannot navigate into the microvasculature, e.g. into the central nervous system (CNS). Furthermore, the vessel wall penetrating catheter body includes a rigid proximal section and an elongated flexible distal section joined to the proximal section, wherein the distal section is sized to

be received within the coronary sinus (venous system). The catheter body also has a penetrator lumen accommodating a vessel wall penetrator, such as a hollow Nitinol (NiTi - an alloy of Nickel and Titanium) needle, advanceable out of a side exit port. The catheter body also has a guidewire lumen which extends to the distal end of the catheter body. In summary, the catheter comprises
5 many components and is therefore of the aforementioned large size.

Hence, the vessel penetrating catheter disclosed in US6602241 is not suited for vascular navigation into the CNS or other similar small vessels in the body. The vessel wall penetrator body is, amongst other things due to the multi lumen design, so large that it would occlude such small vessels, which is highly undesired, and may be fatal to the CNS parenchyma supported by such an
10 artery.

Other known techniques using stent connections between vessels comprise transjugular intrahepatic portosystemic shunts (TIPS), which is a technique to provide a permanent stent connection between large veins of the liver, e.g. the v. porta and the v. hepatic. This is an endovascular technique, using a radiologic procedure to place a stent in the middle of the liver to reroute the
15 blood flow. The TIPS procedure is done using intravenous sedation or general anesthesia. During the procedure, an interventional radiologist makes a tunnel through the liver with a needle, connecting the portal vein, i.e. the vein that carries blood from the digestive organs to the liver, to one of the hepatic veins, i.e. the three veins that carry blood from the liver. A metal stent is placed in this tunnel to keep the track open. However, this endovascular technique is not suited for the arterial part of the body vascular system. Furthermore, it is not suited for use in microvessels, but in
20 large vessels. In addition, a stent is left in place for keeping a permanent communication between vessels. Moreover, in practice the radiologist usually pushes and retracts the needle several times until the second vein is hit, which implies a risk for bleedings. The amount of bleeding that can occur can sometimes be life threatening needing costly patient monitoring in intensive care.

Similar unwanted multi penetration of a vessel wall with potential patient bleeding is potential while using an apparatus as disclosed in US6302870. The apparatus comprises a plurality of laterally flexible needles for reaching body cavities. The configuration of the apparatus is such that the wall of the blood vessel juxtaposed to the site of delivery is potentially circumferential penetrated by the several needle points. As the blood vessel wall becomes perforated a rupture in the wall
30 may occur, in particular at the arterial side of the vascular system.

A further issue is when vascular walls are penetrated, e.g. by a needle, upon retraction of the needle, a compression of the exit site is needed in order to avoid bleeding. However, often it is

not possible to provide a compression of such an exit site at conventionally difficult accessible target sites in a human or animal body.

Various needle tips may be found for example as disclosed in WO00/1 3728 or US5092848. Commonly these have in common the ability to penetrate into soft tissue and are disclosed to be permanently secured to the distal end of a delivery catheter. As the catheter is retracted the tip follows back with the catheter, leaving a transmural hole which hopefully will collapse sealing the channel in the vessel wall to the extravascular space. However, the ability to seal properly depends on e.g. the compliance of the tissue and the blood pressure in the vessel. A self sealing ability is not sufficient on the arterial side of the vascular system especially in areas where no bleeding is tolerated, e.g. in connection with CNS interventions.

Conventionally difficult accessible target sites in the body may not be reached with the aforementioned devices.

Hence, it is difficult to deliver substances to and/or from conventionally difficult accessible target sites in a human or animal body.

Microcatheters are for instance disclosed in WO030801 67A2. However, a penetration of vessel walls is not anticipated or implementable with this type of microcatheter as the distal tip of the disclosed microcatheter is blunt, and the distal end portion is in addition flexible and has spiral cuts. This provides for a vascular navigation to target sites which are located far more remote in the vascular system than accessible with catheter based techniques aimed for transvascular access such as the technique disclosed in US6602241. Thus, extravascular target sites are not accessible for this kind of microcatheters.

Another microcatheter device disclosed in WO2007121 143 has a tissue penetrating tip member. This device appears to be not suited for use in the microvasculature. The tip is constructed with electrodes to heat the tip facilitating advancement in the tissue. Potentially necrosis may occur. Moreover, a transluminal channel is created, which when the microcatheter is retracted, leaves a hole through the vessel wall to the extravascular space. An undesired effect as e.g. hemorrhage, at least on the arterial side of the vascular system is likely to occur.

An issue needing a novel and inventive solution is thus delivery of substances to conventionally difficult accessible target sites in a human or animal body, such as the microvasculature, e.g. in the CNS, heart, lung or pancreas.

In addition, or alternatively, there is a need to provide a solution that prevents or avoids bleeding from a penetration site of a vessel wall at the target site upon completed delivery of the substances.

In addition, or alternatively, there is a need to provide a solution to navigate to the target
5 site and to characterize the tissue at the target site.

In addition, or alternatively, there is a need to provide a solution to treat the tissue at the target site and to register characteristics of the tissue at the target site.

Furthermore, a device suitable to be used on both the venous and arterial side of the vascular system would be beneficial in the operating theater as less equipment systems would be
10 necessary.

Summary of the Invention

Accordingly, embodiments of the present invention preferably seek to mitigate, alleviate or eliminate one or more deficiencies, disadvantages or issues in the art, such as the above-
15 identified, singly or in any combination by providing an endoluminal medical access device, a kit, and methods according to the appended patent claims.

The invention relates to an endoluminal medical access device for endoluminal delivery of substances to and/or from a vasculature site of a human or animal body and access to an extra-vascular target site located outside of the lumen of the vasculature at said site.

20 The vasculature site may be a microvasculature site, wherein microvasculature is defined as the portion of the circulatory system that is composed of the smallest vessels, such as the capillaries, arterioles, and venules.

According to a first aspect of the invention, a device is provided. The device is an endoluminal medical access device, devised for endoluminal delivery to a microvasculature site, or a
25 vasculature site, of a human or animal body vasculature, and access to an extravascular target site at said site located outside of the lumen of the vasculature at said site. The device comprises a body that ends at a distal end of the device. The body comprises a distal portion that is devised to extend across a tissue wall of the microvasculature, or vasculature, at an extravascular target site in the body and devised for at least partly apposition to the tissue wall, and a proximal section,
30 which proximally adjoins the distal portion. The distal portion is detachable or separable from the proximal portion to be left in place at the vasculature site. The distal portion comprises an outer

surface adapted to be in transceiving communication with said target site when arranged at the latter.

According to a second aspect of the invention, a kit is provided. The kit comprises an endoluminal medical access device according to the first aspect of the invention, and an elongated
5 tubular delivery device.

According to a third aspect of the invention, a method is provided. The method is a method of endoluminal access to a target site in a human or animal body, and comprises of using a device according to the first aspect of the invention. The method comprises perforating a vessel wall of the microvasculature, or vasculature, with the distal portion at an extravascular target site in
10 the body, and positioning the distal portion for extending across the vessel wall at least partly in apposition to the tissue wall. The distal portion comprises an outer surface. The method further comprises providing a transceiving communication between the outer surface and an extravascular space at the target site, and detaching said distal portion from a proximal portion when a procedure is finished.

15 The aspects of the invention provide for sending or registering, i.e. transceiving, of substances, cells, electrical current, heat, irradiation from the outer surface of a distal portion in a targeted manner to a target site.

Further embodiments of the invention are defined in the dependent claims, wherein features for the second and subsequent aspects of the invention are as for the first aspect mutatis
20 mutandis.

The medical access device is an endoluminal medical access device, herein named "extroducer" or extroducer device. The term "extroducer" is, in contrast to an "introducer", a device that is advanced from the inside of a vessel, i.e. from the inner lumen formed by the vessel, to the outside thereof. The extroducer device is advanced into the tissue of the vessel wall. The extroducer
25 device is devised to penetrate the tissue, or alternatively or in addition, penetration may be assisted. Further, the extroducer device is distally extending into the extravascular space with a distal end thereof arranged at a target site in the extravascular space. This type of endoluminal outward delivery is described by the term "extroduced", which is an "inverted introduction" from the inside to the outside of the vessel, all inside the body. The term "extroducer" is based on this understanding.
30 In particular embodiments, the extroducer device is devised for exiting the microvasculature from the inner lumen thereof to an extravascular target site by perforation of the lumen. The vessel for endoluminally inserting the extroducer may be any vessel throughout the body in both the arterial

and the venous side. The term "extroducer" or "extroducer device" used throughout this description is contemplated being such a vascular extroducer or an 'endoluminal medical access device'.

The extroducer device provides for safely penetrating arterial or venous blood vessels with a luminal diameter, in current practical implementations down to a size of approximately 0.5 mm, to be able to characterize and/or manipulate the extravascular space at such vessels. This provides for combining minimal invasiveness of an endoluminal approach with accurate characterization or manipulation at a desired anatomical target location.

For transplantation purposes, the ratio between engrafted and transplanted cells may be increased. Previously, in works with intravascular transplantation of cells, a control over cellular engraftment location, or a favorable ratio between transplanted and engrafted cells has not been thoroughly considered. Embodiments of the extroducer device provide for delivery of an increased ratio between engrafted and transplanted cells in a minimally invasive way.

The endovascular technique provides, at least in certain instances, such as for the CNS, the pancreas, the lung, and the heart, the merit of less invasiveness than open surgical procedures of percutaneous transplantation.

Certain embodiments of the extroducer are believed to combine favorable properties of minimal invasiveness with accurate and efficient engraftment of stem cells.

The extroducer provides for local administration of any substances, such as pharmaceutical agents, including cytostatics; growth factors, contrast agent or cells. Alternatively, or in addition, the extroducer provides for registration or induction of electric activity, induction of temperature changes, and local irradiation in difficult accessible anatomical locations in order to characterize or manipulate a target site at such anatomical locations.

The extroducer device according to some embodiments provides for a high degree of flexibility. The system is devised for delivery inside micro catheters. In embodiments the system is adapted for navigation into vessels down to 0.5 mm and possibly smaller. Other embodiments are not restricted to such small vasculature dimensions. This provides for a vascular navigation to target sites which are located far more remote in the vascular system than accessible with catheter based techniques aimed for transvascular access such as the technique disclosed in US6602241. The access provided by embodiments, provides for instance for delivering of substances, cells or taking cytological preparations according to previously mentioned techniques.

The extroducer device according to some embodiments provides for arterial navigation. Some embodiments provide for venous navigation.

The extroducer device according to some embodiments, when manufactured in its solid or semi-solid form comprises a substance or cells devised for slow-release integrally formed with a perforation device devised for perforation of a vessel wall. This, amongst others, makes the miniaturization of the extroducer possible. Further, when manufactured in its solid or semi-solid form, the
5 extroducer may constitute an electrode, a temperature probe or an irradiation source.

The extroducer device according to some embodiments provides for a perforation of a vessel wall, wherein the perforation site in the vessel wall does not need to be plugged up upon withdrawal of the extroducer device.

Some embodiments of the extroducer device provide for devices which may be left in
10 place in a punctured vessel wall and extravascular target site over a period of time for delivery or dissipation of a substance to a target site, for registration/induction of electric activity, or for local irradiation to a target site.

Some embodiments of the extroducer device provide for devices which may be left in place in a punctured vessel wall over a period of time, wherein no or substantially no leakage or
15 bleeding to or from the vessel occurs, and wherein the device degrades over time at the site of puncture.

A detachable distal elongate portion of the device of some embodiments may be left in place in the vessel wall at the perforation site and inherently thanks to its advantageous design prevents leakage from the vessel wall at physiological pressures. There is no need for using an
20 adhesive or embolization agent to close the puncture channel.

Some embodiments of the extroducer device comprise an element for limiting the entry depth of the perforation device in tissue, e.g. a vessel wall. The limitation element may be a rigid or foldable stop element, or a recess in the outer wall of the hollow body.

Some embodiments of the extroducer device provide for a separation from the perforation device from the microcatheter. A distal portion of the body is detachable and may be left in
25 place at the target site after treatment. Thus the proximal part of the solid or semisolid body, and the microcatheter, may be retracted from the target site through the vasculature. In vivo experiments have shown that the device does not return into the vessel due to positive driving pressure from the inside of the vessel vis-a-vis the extra vascular space and does not substantially travel
30 further into tissue, ensuring patient safety.

Some embodiments of the extroducer device provide for a bioresorption or biodegradation of the device in the body when manufactured in a biodegradable material.

Some embodiments of the extroducer device provide for a delivery of a substance to a target site upon bioresorption or biodegradation of the device in the body.

Some embodiments of the extroducer device provide for a clinically well acceptable and useful system.

5 Some embodiments of the extroducer device provide for a safe way of reaching a target site at or adjacent to a small vessel, wherein a retraction of at least a part of the device is achievable without causing bleedings or thrombotic embolies in the small vessel and without leaving behind a catheter system in the patient.

10 Some embodiments of the extroducer device also provide for advantageous endovascular intervention that may provide both transplantation of cells, delivering drugs, radioactive substances and other substances, registration/induction of electric activity, induction of temperature changes and sampling body fluids, cytological preparations and optical spectra.

15 Some embodiments of the extroducer device also provide for a system that in its entirety fits into current standard microcatheter systems that provide navigation capabilities and integration with currently used equipment. Embodiments of the extroducer device thus provide for quick treatment in emergency cases.

Some embodiments of the extroducer device also provide navigation to a target site and tissue characterization at the target site by means of spectroscopic techniques.

20 It should be emphasized that the term "comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Brief Description of the Drawings

25 These and other aspects, features and advantages of which embodiments of the invention are capable of will be apparent and elucidated from the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1 is a schematic illustration of a device according to an embodiment in a side view from above;

30 Fig. 2 is a schematic illustration of the device of Fig. 1 in a lateral view;

Fig. 3 is a schematic illustration of a device according to an embodiment in a side view from above;

Fig. 4 is a schematic illustration of the device of Fig. 3 in a lateral view;

Fig. 5 is a schematic illustration of a device according to an embodiment in a side view from above;

Fig. 6 is a schematic illustration of the device of Fig. 5 in a lateral view;

5 Fig. 7 is a schematic illustration of a device according to an embodiment in a side view from above;

Fig. 8 is a schematic illustration of a device according to an embodiment in a side view from above;

10 Fig. 9 is a schematic illustration of a device according to an embodiment in a side view from above;

Fig. 10 is a schematic illustration of a device according to an embodiment;

Fig. 11 is a schematic illustration of a device according to an embodiment;

Fig. 12 is a schematic illustration of a device according to an embodiment;

Fig. 13 is a schematic illustration of a device according to an embodiment;

15 Fig. 14A is a schematic illustration of delivery of the device according to an embodiment through the microvasculature to a target site;

Fig. 14B is a schematic illustration of the device of Fig. 1 in penetration of a vascular wall;

Fig. 15 is a schematic illustration of the device of Fig. 5 in penetration of a vascular wall;

20 **Description of embodiments**

Specific embodiments of the invention will now be described with reference to the accompanying drawings. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope
25 of the invention to those skilled in the art. The terminology used in the detailed description of the embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention. In the drawings, like numbers refer to like elements.

Advancements in stem cell techniques have created a potential for regenerative treatments to a vast spectrum of diseases, e.g. diabetes mellitus, morbus Parkinson, ischemic heart
30 disease, traumatic brain injury, and stroke.

Therefore there is a need for efficient and minimally invasive techniques for delivering the cells or substances to a desired target organ and/or pathological system. Such delivery is provided

by the extroducer device. The substances or cells can be integrated into the solid or semisolid distal part of the Extroducer system.

A comparison of different techniques for administration to the central nervous system (CNS) following stroke with emphasis on the sheer number of cells engrafted shows that the most efficient way of administration is intracerebral (ic) followed by intracerebroventricular (icv) and then intravenous (iv) delivery.

To make a successful transplantation of stem cells, a few considerations must be made, e.g. accessibility to a target organ, number of cells and volume of cell suspension and the engraftment success-rate. It has been argued that some cells possess an internal homing feature mediated through receptor-ligand interactions. For cells with such properties an iv route would probably be favorable giving better distribution throughout the transplantation target volume.

In situations where the cellular engraftment rate after endovascular administration is low and when a high anatomical specificity for the engraftment is required, direct puncture of the parenchyma is preferable. This was hitherto done with a percutaneous guided needle puncture or in a combination with open surgery.

The Extroducer can also be constructed to function as an electrode, a thermal probe or as a container of radioactive material for various applications including, but not limited to, electrical registration or induction of electrical activity, induction of temperature changes and emission of local irradiation to the extravascular target site.

However, as mentioned above, with percutaneous guided needle puncture or in a combination with open surgery, some target regions of the body, such as the CNS, the heart, the lung or the pancreas, are difficult or not at all accessible without jeopardizing patient safety, including an increased risk of e.g. morbidity, expense, trauma, patient mortality, and other complications. Hence, a system with improved patient safety would be desirable and is provided in form of the extroducer device.

The design and concept of the device of embodiments is adapted to be clinically applied according to the clinically well proven Seldinger technique, as disclosed in Seldingers original work describing the introducer, Seldinger, S. I. (1953) "Catheter replacement of the needle in percutaneous arteriography; a new technique." Acta radiol 39(5): 368-76, which is incorporated herein in its entirety for all purposes. However, there are differences between the Seldinger introducer and devices according to embodiments.

The design of the extroducer device facilitates to provide the small dimensions necessitated by the required microvasculature access to specific target sites. However, the design is also compatible and adaptable for larger dimension catheter systems, when required in specific embodiments or applications.

5 The extroducer devices comprise a distal perforating unit that may comprise, but is not limited to, a substance or cells to be gradually dissipated from the distal unit over time, an electrode, a thermal probe or an irradiation source.

 Navigation through the vascular system into microvessels, for instance of a diameter of 0.5 mm or smaller, is facilitated by the devices, in particular with an optical fiber within the body of
10 the device. Some embodiments are not limited to aforementioned scale and are scaled up to use in larger vessel systems.

 Some embodiments have a stop element for the perforation unit. The stop element limits intrusion depth. Intrusion depth is thus advantageously controllable without the need of high resolution (and dosage) imaging modalities. The stop element may be a protruding flange. The flange
15 may be foldable or fixed. The stop element may also be a recess in the outer wall of the hollow body at a defined distance from the distal tip of the perforation unit. The stop element provides a defined maximum penetration depth and position in tissue upon insertion. The stop element may be integrated with an anchoring element.

 Some embodiments of the devices are devised to provide an absence of fluid communication across the vessel wall under physical blood pressure levels thanks to its physical dimensions. The arterial system is anatomically substantially more homogenous than the venous system and therefore it is easier to reach target sites via arteries. Conventionally, however, the arterial access path is regarded as more problematic due to the existing higher blood pressure, potentially more difficult stopped bleeding, etc.

25 Some embodiments comprise a separation or detachment section that provides a controllable separation of the distal portion including the perforation unit from the proximal part of the device and/or the microcatheter. Thus, the proximal part and the microcatheter may be retracted from the target site through the vasculature, leaving a distal part perforated in the vessel wall and effectively thereby providing a plug that prevents bleedings..

30 Applicable separation mechanisms are disclosed in WO2006/024040 which is incorporated herein by reference in its entirety for all purposes. However, the present invention differs from the disclosure of WO2006/024040 in many aspects. WO2006/024040 applies to delivery of im-

plants, such as occlusion devices or stents in the vasculature. Applicants refer to the detachment mechanisms, which may be applied to embodiments of the extroducer device. Detachment of the proximal part of the device from the distal, penetration part may thus be implemented according to the detachment principles described in WO2006/024040. These and further embodiments of detachment units are described in more detail below.

The extroducer device may be used according to at least two alternative procedures.

In the first alternative procedure, a vessel wall, such as a microvessel wall, is perforated with a sharp tip of distal end of the extroducer device, namely the penetration portion. Then the penetration portion is further inserted, through the vessel wall, such that access to the extravascular space is provided through the extroducer device. An intrusion depth limiting unit may provide controlled intrusion depth of the penetration portion into the vessel tissue and extravascular space. Hence, the penetration portion or distal portion is in communication with the extravascular space. The distal portion may comprise, but is not limited to, a substance, or cells, that dissipates to the extravascular space over time, an electrode, a thermal probe or an irradiation source. The distal penetration device is then separated or detached from the proximal hollow body of the system and left in place in the tissue at the penetration site or left in place for continued dissipation of the substance to the target site and/or for future use. The distal portion provide sealing as it may be comprised of a monolithic solid part of the substance, or sealing may be provided automatically at physiological pressures due to the dimensions of the device. An optic fiber may be used to direct and collect light through the device for spectroscopy of the tissue. In this case the device comprises a channel devised for the optic fiber.

After the procedure is completed, e.g. delivery of material, registration/induction of electrical activity, induction of temperature changes to the extravascular space of the target site at the puncture site, the penetration device is sealed, automatically or by plugging. Then the distal portion of the extroducer device is separated from the proximal portion thereof or the microcatheter. The distal portion is left in place in the tissue at the penetration site.

The extroducer device may be made of a bioresorbable or biodegradable material, such that the extroducer device is resorbed or degraded and thus eliminated from the target site over time.

Now turning to the Figures, an embodiment of the extroducer device is illustrated in Figs. 1 and 2.

The extroducer device is an endoluminal medical access device 1, devised for endoluminal delivery to a target site, e.g. to a microvasculature 4 of a human or animal body vasculature. The device 1 comprises a body 112 having a distal end 100. The body 112 comprises a distal elongate portion or penetration portion 102 that is devised to extend across a tissue wall 200 (see Figs. 14A-B, and Fig. 15), e.g. of said microvasculature 4, at an extravascular target site 5 in said body. The distal elongate portion 102 (herein in short "distal portion") may have a sharp tip 114. The distal portion 102 may be conically tapering, as shown in the Figs., to allow for improved seating and sealing in the tissue wall 200. The conical tapering is present either along a substantial portion or the entire length of the distal portion 102, as illustrated in some of the Figs., in addition to the pointed tip portion (when present in embodiments not using an external penetrator unit) at the very distal end of the device.

The body 112 has a longitudinal axis 105, and devised for at least partly apposition to said tissue wall 200. A proximal connection section 101 proximally adjoins said penetration portion 102. The distal portion 102 comprises an outer surface 136 adapted to be in transceiving communication with the target site when arranged at the latter. The outer surface 136 being in transceiving communication is to be construed as emission and/or reception occurs at the outer surface 136 towards the target site. The emission and/or reception occur from the outer surface 136. The distal portion has a total outer surface towards the surrounding tissue. The emission may occur from the entire total outer surface or from a fraction thereof. A larger fraction may increase the amount of emission directed towards the target site. The emission may be generated from the material of the distal portion 102. As the distal portion 102 can be disconnected from the proximal portion 110 the emission towards the target site may continue over time without the presence of the proximal portion 110, or delivery device 2 (Fig. 14A), hence minimizing the intrusive time for the benefit of the patient.

Reception may be construed as detection of emission for characterization of the target site. The emission may be in the form of a substance, cells, heat, electromagnetic radiation, ionic radiation, or electrical current as described further below. The emission may thus be purposeful for treatment of the target site.

In the embodiments in Figs. 1-9 the distal portion 102 comprises a substance 132 to be gradually dissipated from the distal portion 132 over time. This may ease delivery of a substance to a target site as the distal portion 102 itself comprises the substance 132, circumventing the need to add a substance through the delivery system, and simplifies the construction of the delivery sys-

tern, comprising a delivery device, catheter etc, as it does not need to carry the substance 132.

This will further facilitate miniaturization of the invasive devices, which in turn improve safety for the patient and facilitates access to varying anatomical target sites. Further, as elucidated above, the distal portion 102 can be disconnected from the proximal portion 110 the substance 132 may continue to dissipate from the distal portion 102 to the target site over time without the presence of the proximal portion 110, or delivery device 2 (Fig. 14A).

The device 1 may comprise an intrusion depth limitation unit 116, as shown in the embodiment. In addition, the intrusion depth limitation unit 116 may be integrated with an anchoring unit, such as a barb, prong, spike, hook, etc. The latter may advantageously support later detachment, as the distal portion 102 is kept safely inserted in the vessel wall, preventing a withdrawal of the distal portion at e.g. partial detachment.

The proximal portion 110, extending from the proximal end of the endoluminal medical access device, may have a larger cross-sectional dimension (diameter in circular cross sections) than the distal portion. A transition from the larger diameter to the smaller diameter may be stepwise or continuously tapering. In this manner the distal end may navigate more flexibly to the target site, such as the microvascular site 4. For instance when navigating towards a target site in the CNS, it is sufficient that a distal portion of approximately 30 cm has a very small cross-sectional dimension, while the remaining proximal part can have a larger cross-sectional dimension / diameter. A stepwise or continuously narrowing or tapering endoluminal medical access device has an advantageous stability and torsional rigidity providing for good maneuverability of the endoluminal medical access device intravascularly.

The endoluminal medical access device 1 comprises a transition section from said distal penetration portion 102 to said proximal connection section 101, which comprises a separation section 115 that is devised to provide a controllable separation of said distal (penetration) portion 102 from a connected proximal portion 110 of said body.

The body 112 may be made as a single, integral part including the proximal portion 110 and the distal portion 102. The separation section 115 may be positioned close to a stop flange 118, or at the flange 118, such that the flange 118 bears against the vessel wall 200 upon insertion, as illustrated in Fig. 14B. In this manner no portion, or only a minor portion, of the endoluminal medical access device 1 protrudes into the microvasculature 4 upon separation, detachment or release of said distal penetration portion 102 from the proximal portion 110 of the body. Flange 118 may also be detached from the proximal portion 110, as in the present embodiment. In other em-

bodiments, the flange portion may be detached from the distal penetration portion 102. The proximal portion 110 may thus be withdrawn from the punctured delivery site upon finished communication with the extravascular space of the target site at the puncture site.

5 The separation, detachment or release is made in a controlled manner and may be done in several ways. Releasing the distal penetration portion 102 from the proximal portion 110, at the separation section 115 may be done in several ways. Separation is for instance achieved by means of electrolytic, magnetic, induction or thermal detachment. Some detachment mechanisms may for instance be thermal, as disclosed in WO2006/024040, which is fully incorporated by reference herein. The disclosure of WO2006/024040 has to be suitably modified to adapt to the present
10 invention for tube distal portion detachment.

The change in mechanical material properties of the structure of the tube at the separation section 115 results in detaching the distal penetration portion 102 from the proximal portion 110.

15 Thermal activation, may e.g. initiated by an electrical current heating a portion of the separation section 115 until separation is achieved and the proximal portion 110 can be withdrawn. An electrical current may be provided via suitable conduction along the hollow body. Conduction of electricity may be made along the body, either by integrated wires or the body itself. When the body is made of a conductive material, it may be provided with an isolating layer along the length of the body which ends at the non-isolated separation section 115. One conductor along the body
20 from the proximal end may be sufficient, in case a counter electrode is provided e.g. outside the body. Alternatively, two conductors may be provided, e.g. in the same layer of separate isolated layers that extend along the hollow body from the proximal end to the separation section 115. Applying the electrical current for a pre-determined time activates the separation. Monitoring the current allows for a feedback when separation has occurred when the current drops. Alternatively, or
25 in addition, an external power source may be used, e.g. outside the body or inside the body but remote from the penetration site. Such external power source may transmit energy by magnetic induction. Alternatively, or in addition, catheter based or endoscopic delivery of external power sources may be provided within the body to the separation section 115. Separation or detachment is provided upon delivery of energy from the external power source.

30 An electrolytic detachment mechanism may for some embodiments utilize reconfiguration of chemical properties in the separation section 115. By causing e.g. a locally elevated temperature, or initiating a chemical reaction which locally changes the chemical properties of the separation

tion section 115, detaching the distal penetration portion 102 may be achieved. Disintegration of a portion of the separation section 115 may be initiated by removing disintegration or removing of a cover layer and exposing the separation section 115 to body fluids.

Alternatively, or in addition, spring force release may be used to provide the separation.

5 A spring unit is thus provided at the separation section 115. The spring force, when initiated, acts upon the separation section 115 to achieve the separation. The spring force may for instance act upon a pre-determined breaking point or weakening in the body. The weakening may be an indentation or notch in the body that is chosen to be sufficient strong for normal handling during insertion and use of the channel 113. Release of the spring force may be done in several ways, e.g. by a tether

10 when drawn from the proximal end, removing a restriction unit that keeps a spring in tension until removed, dissolving a restriction unit after a predetermined time in the body, etc. The spring action may be provided axially pushing the distal penetration portion 102 away from the proximal portion 110 with a sufficient force, e.g. to disrupt the two portions from each other at the separation section 115.

15 Alternatively, or in addition a predetermined breaking point may be provided at the separation section 115. The predetermined breaking point may be activated by a sufficient high pressure exerted on the separation section 115.

Alternatively, or in addition, a threaded detachment may be used to provide the separation. The distal penetration portion 102 may be threaded to the proximal portion 110. Upon suitable

20 rotation of the proximal portion 110 the two may be unscrewed from each other for separation.

Alternatively, or in addition, a cutting rotational movement of a cutter element at the separation section 115 may provide for the separation, similar like a pipe cutter.

A sheath around the separation section 115 may avoid damage to surrounding tissue during separation.

25 In summary, the separation section 115 allows to withdraw the proximal portion, leaving behind the distal portion inserted in the tissue through the vascular wall.

In the embodiment in Fig. 1 the distal portion 102 is comprised of a monolithic solid part comprising the substance 132. Thus the distal portion 102 may not comprised of any additional material besides the substance 132 to be dissipated to the target site. When all of the substance

30 132 has dissipated or been removed, e.g. adsorbed or diffused to the target site, the distal portion 102 has correspondingly been adsorbed by the patient's body. The separation section 115 and the proximal connection section 101 may also be comprised of the substance 132, which may be suit-

able if the separation section 115 is left in place in the patient's body. Likewise, the distal portion 132, separation section 115, and the proximal connection section 101 may be comprised of a carrier material for the substance 132. In this case, the carrier material may be biocompatible, and may be absorbed by the patient's body over time as the substance 132 has dissipated or been delivered
5 to the target site.

Thus, the entire body 112 of the device, including the proximal portion 110, may be comprised of a bio-compatible material, and/or a bioresorbable material and/or biodegradable material.

The distal portion 102 may comprise a semisolid part, that may contain a substance or cells. The semisolid part may be construed as a biopolymer support structure or skeleton that may
10 be bioresorbable and/or biodegradable. The cells may be protected by the biopolymer skeleton, which may be degraded over time and release the cells to the target site.

Fig. 3 shows an embodiment of the device 1 where the distal portion 102 comprises a wall 131 enclosing the substance 132. The wall 131 may enclose the substance 132 completely, or alternatively be discontinuous, e.g. such that the distal end 100 is not covered by the wall 131 as
15 illustrated in Fig. 3 and Fig. 4. In the latter case, the substance 132 may only dissipate or be released from the distal end 100 and not over the entire length or surface 136 of the distal portion 102. In similar manner the wall 131 may have openings for exposing the substance 132 to the tissue only at selected portions of the surface 136 of the distal portion 102. Thereby the delivery of the substance may be controlled.

20 Additionally, the wall 131 may be comprised of a bioresorbable material and/or a biodegradable material to be gradually removed from the distal portion 102 over time. The substance 132 may then dissipate from the distal portion 102 as the wall 131 is adsorbed in the body and removed. The rate of delivery or dissipation of the substance 132 may thus be controlled.

The amount of substance 132 in the distal portion 102 may be varied, and the distal portion 102 may comprise a biocompatible carrier material or filler material at a varying ratio to the substance.
25

The substance is devised for delivery to an extravascular target site, which may occur through diffusion processes in surrounding tissues and vessels. The substance 132 may dissipate to the target site gradually over time which may correspond to long-term release or rapid release of
30 the substance 132.

In the embodiment shown in Fig. 5 and Fig. 6, and also embodiments in Fig. 7-9, the device 1 comprises an optic fiber 130 within the body 112. The optic fiber 130 may transmit light to

and from the device 1, and subsequently to and from the surrounding tissue for spectroscopic tissue characterization, and/or navigation of the device 1 in the body to the target site before the distal portion 102 is detached from the proximal portion 110. A plurality of optical fibers 130 may be contained in the body 112.

5 In Fig. 5 and Fig. 6, the distal portion 102 comprises a channel 133 for the optic fiber 130, where the optic fiber 130 extends through the channel 133. The optic fiber 130 may thus be advanced to the distal end 100. This may facilitate navigation to the target site. In the embodiment in Fig. 5 and Fig. 6 the substance 132 surrounds the optic fiber 130. Hence, the substance 132 may have sufficient structural rigidity to accommodate a channel 133 extending in the centre of the distal portion 102. Alternatively, the distal portion comprises a carrier material for the substance 132 that has the corresponding sufficient structural rigidity, to allow navigation of the device 1 through the body and subsequent piercing with the distal end 100, before the substance 132 is dissipated to the target site. The device 1 and the distal portion 102 thereby fulfils the roles of containing the optic fiber 130 for navigation and characterization and comprising the substance 132 to be dissipated to the target site subsequent to the penetration of the vessel wall and the disconnection from the proximal portion 110.

The channel 133 for the optic fiber has sufficiently small diameter to provide automatic sealing at physiological pressures.

20 After piercing the vessel wall and navigation and/or tissue characterization with the optic fiber 130, the optic fiber 130 may be withdrawn from the distal portion 102. Hence, the optic fiber 130 may be movable within the body 112. Alternatively the optic fiber 130 may be fixed to the proximal portion 110 of the device, or the distal portion 102. The latter case may be preferred for situations where the distal portion 102 is not released from the proximal portion and for a procedure where the substance 132 is to be dissipated for a shorter time to the target site.

25 Characterization of the vessel wall and adjacent extravascular tissue may be performed before penetrating the vessel wall intraluminally towards the extravascular target site.

The entire body 112 of the device 1 may be comprised of a translucent material for transmission of light from the optic fiber 130. The substance 132 and/or a carrier material of the substance 132 may also be translucent. Alternatively, or additionally the body 112 of the device 1, e.g. the proximal portion 110 or distal portion 102, may comprise openings for direction of light to and from the exterior of the device 1 to the optic fiber 130.

In Fig. 7 the optic fiber 130 remains in the proximal portion 110. The end of the optic fiber 130 may be angled to extend in a radial direction of the proximal portion 110 to direct light to the surrounding tissue. The proximal portion may be hollow and thereby comprise a thin-walled enclosure for the optic fiber 130.

5 The body 112 may comprise a light deflection unit 134, 135, for transmission of light from the optic fiber through the body 112. In this case the optic fiber 130 may not be angled, increasing the tolerances in case the optic fiber 130 is moved.

As illustrated in Fig. 8 the light deflection unit 134, 135, may comprise an angled reflective surface 134, 135, positioned in the proximal portion 110 and in the distal portion 102. Alternatively, the device 1 may only comprise a reflective surface 135 in the proximal portion 110, or a reflective surface 134 only in the distal portion 102, as shown in Fig. 9. The substance 132 or a carrier material 132 of the substance may be reflective to light and thereby comprise the angled reflective surface 134. Alternatively the reflective surfaces 134, 135, may be comprised of another material suited for light reflection.

15 In Fig. 10 the distal portion is an electrode 137, and the outer surface 136 is arranged for transmitting electrical current, denoted by reference number 141 for clarity, to the target site in the patient's body. Stimulation or destruction of cells at the target site, in for example the CNS or the heart, may thereby be performed, e.g. for removal of abnormal electrical activity in the CNS or heart. The electrode 137 may be arranged for receiving electrical current from the target site, e.g. for registration of electrical activity before treatment. The body 112 may be comprised of the electrode 137. The catheter 3 may comprise an insulating layer, e.g. the sheath of the catheter may be an insulating layer, which can be withdrawn from the body 112 for exposure of the electrode 137. In this case, the body 112 may have an electrical connection 140 between the proximal 110 and distal portion 102, as illustrated in Fig. 12. The distal portion 102 may still be separated from the proximal portion 110.

25 In Fig. 11 the distal portion is a thermal probe 139 for emission of heat. The outer surface 136 is arranged for conducting heat 142 to the target site. The temperature at the target site may be changed, and the temperature may be such that cells are destroyed, e.g. for treatment of tumors and/or destroying nerve tissue. The thermal probe 139 may be arranged for registering heat from the target site for characterization of tissue and diagnosis.

30

In Fig. 13 the distal portion is an irradiation source 138 and the outer surface 136 is arranged for transmitting radiation 143, such as ionic irradiation, to the target site. Emission of radiation may provide treatment of the tissue at the target site.

In embodiments, the endoluminal medical access device 1 comprises an intrusion depth
5 limitation unit 116.

The intrusion depth limitation unit 116 may be an abutment unit. The abutment unit is for instance comprising the flange 118 devised to limit an intrusion depth of said endoluminal medical access device into said tissue wall upon insertion thereof.

In an embodiment the flange 118 may be foldable towards said body 112.

10 The body 112 may be tapered towards said distal end 100. This ensures that the device 1 securely is held in position in the vessel wall tissue.

Alternatively, or in addition, the intrusion depth limitation unit 116 may be a recess in the outer wall of the body (not shown). The recess is received in the surrounding tissue, which resiliently enters the recess and provides for an increased intrusion force holding the distal portion 102 in
15 place when inserted into the tissue of the vessel wall.

Attachment of the depth limitation unit 116 may be accomplished in various ways, such as adhesive attachment, friction engagement, clamping, crimping, welding, soldering, etc. When the procedure is completed, the distal portion 102 may be detached from the proximal portion of the extroducer device as described above, and the proximal portion of the extroducer device is
20 retracted from the vessel and the body together with the delivery device, such as a polymer tube encapsulating the extroducer during advancement to the target site.

The material of said body 112 may be metal, such as NiTiNol. Alternatively, the body 112 may be made of a polymeric material. In addition, the body may comprise fiducial markers, such as of a radiopaque material, such as gold, tantalum, wolfram. Such fiducial markers may for instance
25 be positioned on the oblique tip of the penetration portion 102. In this manner a position and orientation of the device 1 is determinable by imaging units known in the art.

A material of said extroducer device or only the distal penetration portion 102 may also be a bioresorbable or biodegradable material.

Now turning to Fig. 14A, the device 1 according to an embodiment is illustrated in a position delivered through the microvasculature to a target site 5. Fig. 14B gives a more detailed view of the penetration site of the vascular wall 200, and the device 1 illustrated corresponds to the embodiment in Fig.1, but could be the device 1 according to any of the embodiments in Figs. 1-13.
30

Thus, the distal portion 102 may be disconnected from the proximal portion 110 and left in place through the wall 200, and the substance 132 may dissipate to the target site 5 over time. Fig. 15 shows the device 1 according to the embodiment in Fig. 5 and Fig. 6, where the device 1 has a channel 133 for an optical fiber 130. The optical fiber 130 may be used to navigate to the target site 5 and/or to perform tissue characterization at the target site by spectroscopy. For spectroscopy the optical fiber 130 may be connected to a light source, a light detector and a spectrometer (not shown). The optical fiber 130 may also be used for treatment purposes and direct light of different wavelengths to the target site 5, both chromatic and coherent light. In the latter case, the optic fiber 130 may be coupled to a laser source (not shown).

It should be noted that the wall thickness of the vessel wall 200 is not shown to scale for illustrative purposes. The vessel wall 200 has a thickness that is substantially smaller than the length of the body 112.

In a kit an endoluminal medical access device 1 is comprised, as well as an elongated tubular delivery device 2, as shown in Fig. 14A. The elongated tubular delivery device 2 may be provided in form of a tubing of polymeric material arranged coaxially around said endoluminal medical access device 1, thus providing a first assembly. The medical access device 1 is arranged for sliding motion in said elongated tubular delivery device 2.

The first assembly is coaxially and arranged for sliding motion in a microcatheter 3, providing a second assembly. The microcatheter 3 may for instance be a microcatheter as disclosed in WO030801 67A2. The microcatheter may be of standard types with or without a distal balloon mounted on the outside of the working channel.

The second assembly may be coaxially and arranged for sliding motion in a conventional catheter, for delivery in vessels of a diameter down to approximately 1mm. When the conventional catheter is at the target site, the microcatheter is advanced towards the microvasculature or the vessel wall, and the extroducer device 1 is advanced in the tube of the first assembly towards the target site 5. The microcatheter 3 (and/or the conventional catheter) may comprise an inflatable balloon 31 mounted on the outside of the working channel for fixation of the microcatheter or conventional catheter to the surrounding vessel, as shown in Fig. 14A. The distal tip of the microcatheter 3 may be angled to point radially outwards, towards the interior of vessel wall 200. At the target site, the extroducer device 1 is pushed out of the elongated tubular delivery device 2 and thus penetrates the vessel wall 200. Alternatively, a separate penetrator device may be used, as mentioned above.

Thus endoluminal access is provided to an extravascular target site 5 in a human or animal body by using an extroducer device 1 from inside the vasculature through the vessel wall. In more detail, the extroducer device 1 perforates and/or bridges the vessel wall 200 of said microvasculature 4 with said penetration portion 102 at the extravascular target site 5 in said body. The penetration portion 102 is positioned such that it is extending across said vessel wall 200 at least partly in apposition to said tissue wall 200.

Communication with the target site 5 may thus be provided by performing the above described endoluminal access method. Delivery of a substance 132 to said target site 5 may thus be provided as the substance dissipates from the distal region 102. The substance 132 may comprise cells, such as stem cells, thus providing endovascularly transplanting said cells into said target site 5.

The delivery of said substance may comprise local administration of said substances, such as cytostatics, contrast or growth factors. The substances may also include radioactive agents, such as radioactive isotope particles.

The substances may be delivered to a target site by means of the present device upon puncture. The puncture may comprise, except puncturing a vessel wall, a puncturing of a cyst for delivery of substances to the interior of said cyst for treatment thereof.

The method may further comprise subintimally passing an occlusion or stenosis of a vessel. The intima is the inner layer of the wall of an artery or vein. The body 112 may be at least partly passed within the intima along the vessel wall 200, at an oblique angle, in contrast to the illustration of Fig. 14B, where the vessel wall 200 is penetrated perpendicularly.

The target site 5 may be located and accessed in difficult accessible organs or areas of the body, such as for instance the Central Nervous System (CNS), the pancreas, the heart, or the like, but is not restricted to these organs.

One possible application of the endoluminal medical access device is in connection with cardiac indications, such as myocardial infarction or cardiomyopathy, or the like. The endoluminal medical access device may be delivered via the coronary arteries or veins, which supply a diseased portion of the heart, to a vascular site at the diseased portion of the heart. The endoluminal medical access device is then used to penetrate the vessel wall at the vascular site in order to gain access to the treatment site of the diseased portion of the heart. In this manner substances like cells, growth factors, or other agents may be delivered in order to ameliorate cardiac function.

In an embodiment, the microcatheter 3 may act as the proximal portion 110, wherein the distal portion is attached to the microcatheter 3 by suitable means at the proximal connection section 101, such as by adhesive attachment, friction engagement, clamping, crimping, welding, soldering, etc. Preferably the attachment is made at the hollow separation unit 115, allowing for suitable detachment and separation of the distal portion 102 to be left in situ.

If dimension units are shown in the drawings of exemplary extroducer devices, the dimensions are given in mm. However, any dimensions given are not to be regarded as limiting entities.

In alternative embodiments (not illustrated), the intrusion depth limitation unit may be provided as partial loops, or substantially straight radially extending protrusions, the distal ends thereof not returning to the attachment point on the extroducer device. Alternatively, or in addition, several of the described intrusion depth limitation units may be advantageously combined.

The present invention has been described above with reference to specific embodiments. However, other embodiments than the above described are equally possible within the scope of the invention. Different method steps than those described above, performing the method by hardware or software, may be provided within the scope of the invention. The different features and steps of the invention may be combined in other combinations than those described. The scope of the invention is only limited by the appended patent claims.

CLAIMS

1. An endoluminal medical access device (1), devised for endoluminal delivery to an extravascular target site (5) at a vasculature site (4), such as a microvasculature site, of a human or animal body vasculature, wherein said device (1) comprises

a body (112) that ends at a distal end (100) of said device; wherein said body (112) comprises

a detachable elongate distal portion (102) that is devised to extend across a tissue wall (200) of said vasculature at said vasculature site (4) in said body and devised for at least partly apposition to said tissue wall (200), and

a proximal portion (110), which proximally adjoins said distal portion (102) at a proximal connection section (101); and

a separation section (115) that is arranged at said body (112) for controlled separation of said distal portion (102) from said proximal portion (110) of said body (112) at said proximal connection section (101), wherein

said distal portion comprises an outer surface (136) adapted to be in transceiving communication with said target site when arranged at the latter.

2. The endoluminal medical access device (1) according to claim 1, wherein said distal portion comprises an electrode (137), and wherein said outer surface is arranged for transmitting electrical current (141) to said target site, and/or is arranged for receiving electrical current from said target site.

3. The endoluminal medical access device (1) according to claim 1, wherein said distal portion comprises an irradiation source (138), and wherein said outer surface is arranged for transmitting radiation (143) to said target site.

4. The endoluminal medical access device (1) according to claim 1, wherein said distal portion comprises a thermal probe (139), and wherein said outer surface is arranged for conducting heat (142) to said target site, and/or arranged for registering heat from said target site.

5. The endoluminal medical access device (1) according to claim 2 or 4, wherein said body has an electrical connection (140) between said proximal and distal portion.

6. The endoluminal medical access device (1) according to claim 1, wherein said distal portion is comprised of a substance (132) to be gradually dissipated from said outer surface over time.

7. The endoluminal medical access device (1) according to claim 6, wherein said distal portion is comprised of a monolithic solid part comprising said substance, and/or wherein said distal portion is comprised of a semisolid part comprising said substance.

8. The endoluminal medical access device (1) according to claim 6 or 7, wherein said substance is devised for delivery to said target site.

9. The endoluminal medical access device (1) according to any of claims 1-8, comprising an optic fiber (130) within said body.

10. The endoluminal medical access device (1) according to claim 9, wherein said distal portion comprises a channel (133) for said optic fiber, and wherein said optic fiber extends through said channel.

11. The endoluminal medical access device (1) according to any of claims 1-10, wherein said body comprises a bio-compatible material, and/or a bioresorbable material and/or biodegradable material.

12. The endoluminal medical access device (1) according to claim 6, wherein said distal portion comprises a wall (131) enclosing said substance.

13. The endoluminal medical access device (1) according to claim 11 and 12, wherein said wall is comprised of a bioresorbable material and/or a biodegradable material to be gradually removed from said distal portion over time, whereby said substance is to be dissipated from said distal portion as said wall is removed.

14. The endoluminal medical access device (1) according to claim 9, wherein said body is comprised of a translucent material for transmission of light from said optic fiber.

5 15. The endoluminal medical access device (1) according to claim 14, wherein said body comprises a light deflection unit (134, 135) for transmission of light from said optic fiber through said body.

10 16. The endoluminal medical access device (1) according to claim 15, wherein said light deflection unit comprises an angled reflective surface (134, 135) positioned in said proximal portion and/or said distal portion.

15 17. The endoluminal medical access device (1) according to any of claims 1-16, wherein said detachable elongate distal portion (102) has a tissue penetration tip at said distal end (100).

18. The endoluminal medical access device (1) according to any of claims 1 to 17, wherein said separation section (115) is devised to provide said controlled separation based on electrolytic, magnetic, induction or thermal detachment, spring force release, at least one predetermined breaking point, threaded detachment, or cutting rotational movement, for separation of
20 said distal penetration portion (102) from said proximal connection section (101).

19. The endoluminal medical access device (1) according to any of claims 1 to 18, comprising an intrusion depth limitation unit (116) for preventing introduction of said distal penetration portion (102) beyond a desired insertion depth in said vascular wall,

25 wherein said separation section (115) is arranged proximally said intrusion depth limitation unit (116) and thus arranged to separate together with said distal penetration portion (102) from said proximal connection section (101).

30 20. The endoluminal medical access device (1) according to claim 19, wherein said intrusion depth limit unit (116) is a retention unit comprising a flange (118) devised to limit an intrusion depth of said endoluminal medical access device into said tissue wall, or wherein said intrusion depth limit unit (116) is a retention unit comprising a flange (118) devised to limit an intrusion depth

of said endoluminal medical access device into said tissue wall and wherein said flange (118) is foldable towards said body (112); or wherein said intrusion depth limit unit (116) is a recess in an outer wall of said body (112).

5 21. The endoluminal medical access device (1) according to any of claims 1-20, wherein said elongate distal penetration portion (102) is tapered towards said distal end (100).

 22. The endoluminal medical access device (1) according to any of claims 1-21, wherein said endoluminal medical access device (1) is adapted to fit into a standard larger catheter for de-
10 livery to a site remote of said target site (5) and further a microcatheter (3) coaxially inside said catheter for delivery to neighbouring said microvasculature site .

 23. A kit comprising an endoluminal medical access device (1) according to any of the preceding claims 1-22, and a first elongated delivery device (2).
15

 24. The kit according to claim 23, wherein said first elongated delivery device is tubular and comprises a tubing (2) of polymeric material arranged coaxially around said endoluminal medical access device (1), providing a first assembly, wherein the latter is arranged for sliding motion in said tubing (2).
20

 25. The kit according to claim 24, wherein said first assembly is coaxially arranged for sliding motion in a microcatheter (3).

 26. A method of endoluminal access to an extravascular target site (5) at a vasculature
25 site (4) in a human or animal body, comprising using a device according to any of claims 1-25, said method comprising

 performing a vessel wall (200) of said vasculature (4) at an extravascular target site (5) in said body, and

 positioning a distal portion (102) of said device extending across said vessel wall (200) at
30 least partly in apposition to said tissue wall (200), and wherein said distal portion comprises an outer surface (136),

providing a tranceiving communication between said outer surface and an extravascular space at said target site (5), and

detaching said distal portion (102) from a proximal portion (110) and leaving said distal portion (102) in said vessel wall (200) after a procedure, and removing a proximal connection section (101) of said device from said body.

27. The method according to claim 26, wherein said distal portion comprises an electrode (137), and wherein said outer surface is arranged for transmitting electrical current to said target site, and/or is arranged for receiving electrical current from said target site, and/or wherein said distal portion comprises an irradiation source (138), and wherein said outer surface is arranged for transmitting radiation to said target site, and/or wherein said distal portion comprises a thermal probe (139), and wherein said outer surface is arranged for conducting heat to said target site, and/or arranged for registering heat from said target site, and/or wherein said distal portion is comprised of a substance (132) to be gradually dissipated from said outer surface to said extravascular space over time.

28. The method according to claim 26 or 27, wherein said perforating is made with a sharp tip at a distal end of said distal portion (102).

29. The method according to any of claims 26-28, wherein said distal portion (102) after said detaching is auto sealing for blood flow at physiological pressures in said vessel.

30. The method according to any of claims 26-29, comprising characterizing tissue at said extravascular target site (5) by spectroscopy through an optic fiber (130) positioned within said device.

31. The method according to claim 27, wherein said substance comprises cells, such as stem cells, wherein said method comprises endovascularly transplanting said cells into said target site (5).

32. The method according to claim 27, wherein said substance comprises cytostatics, growth factors, contrast agents, or radioactive material.

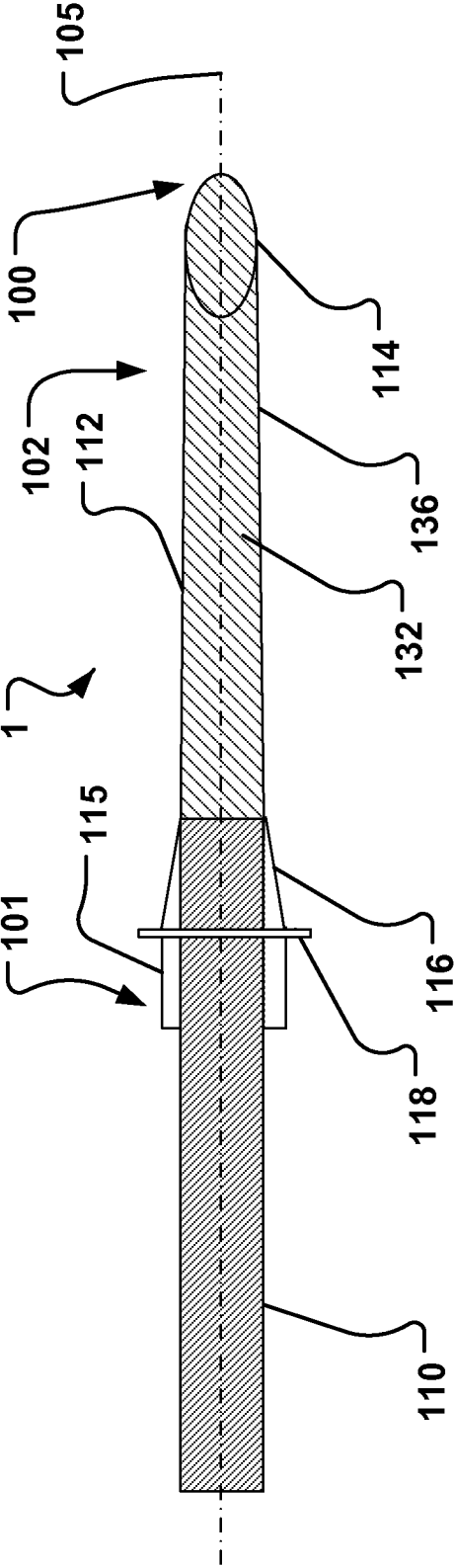


Fig. 1

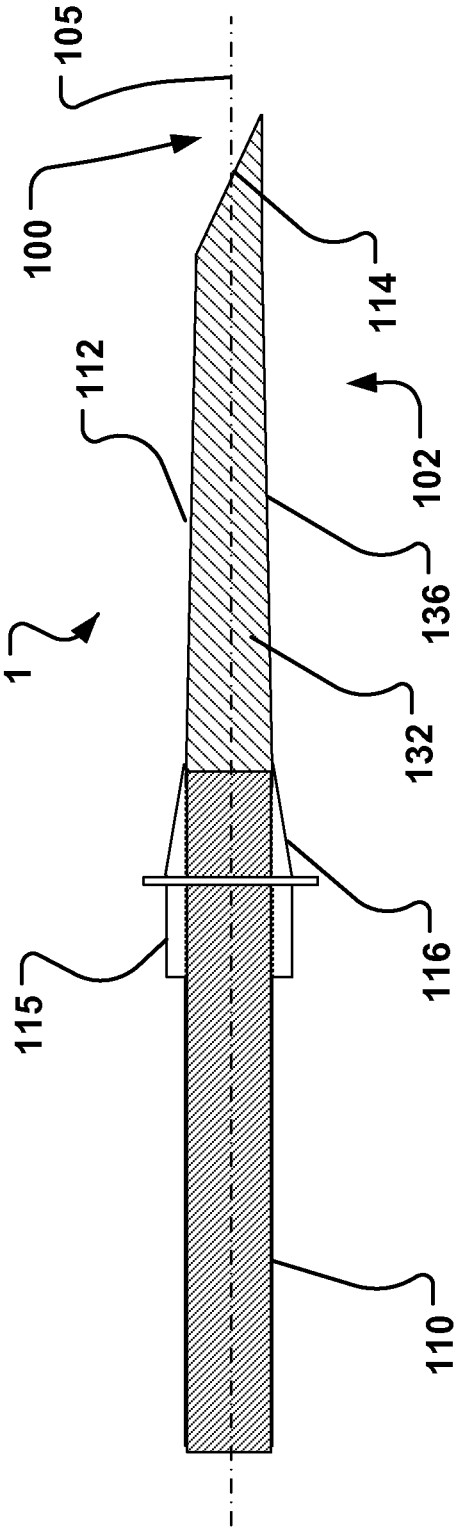


Fig. 2

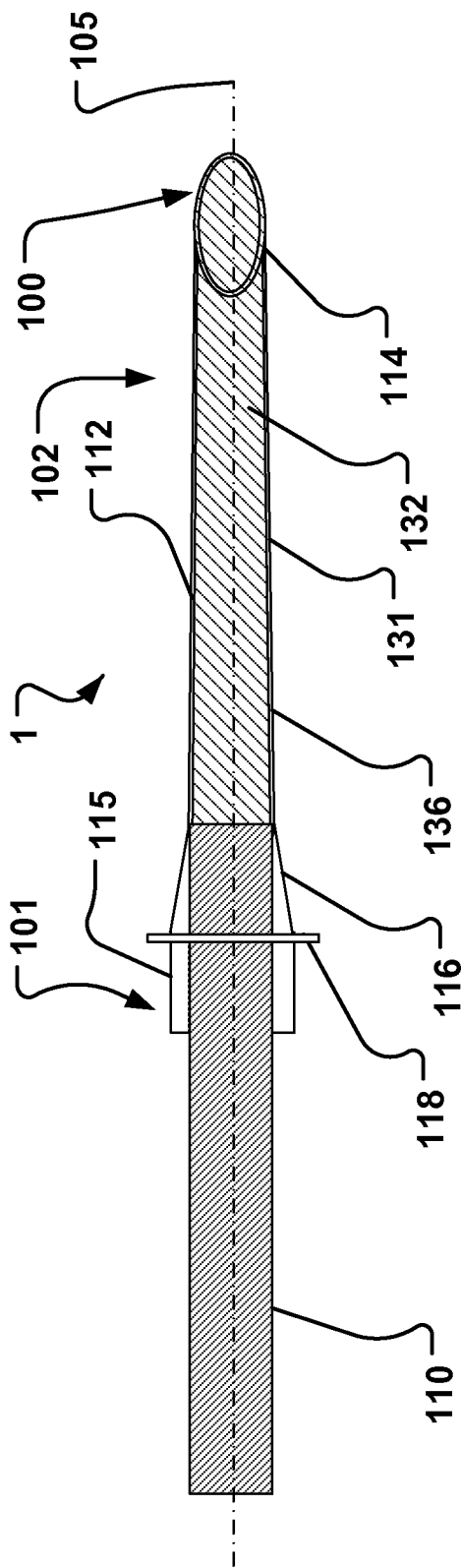


Fig. 3

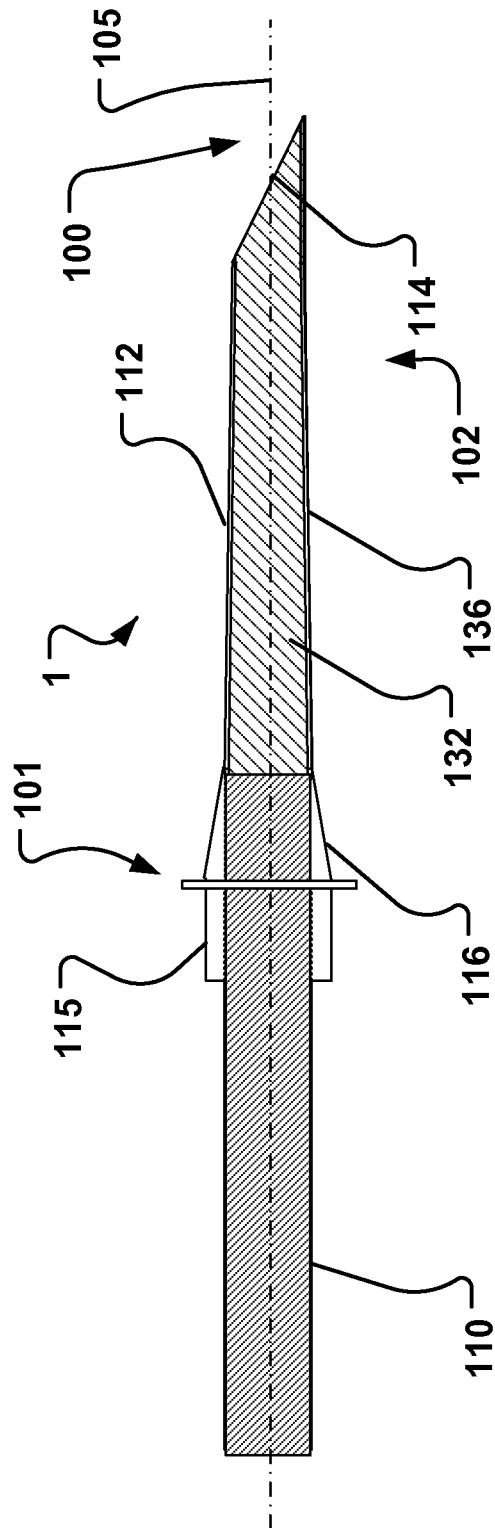


Fig. 4

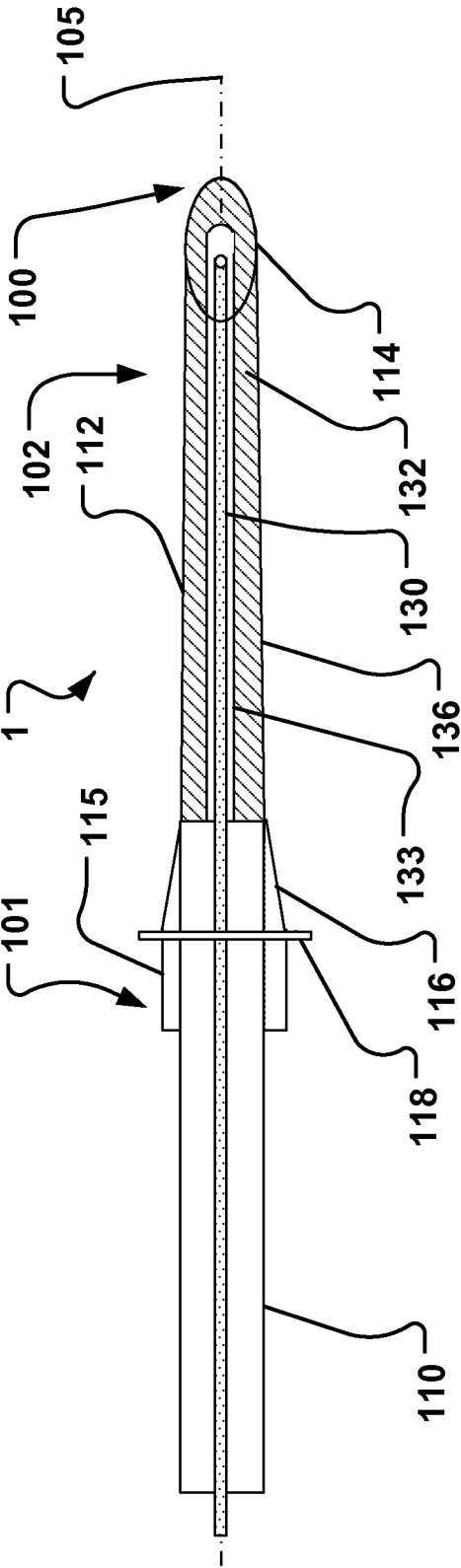


Fig. 5

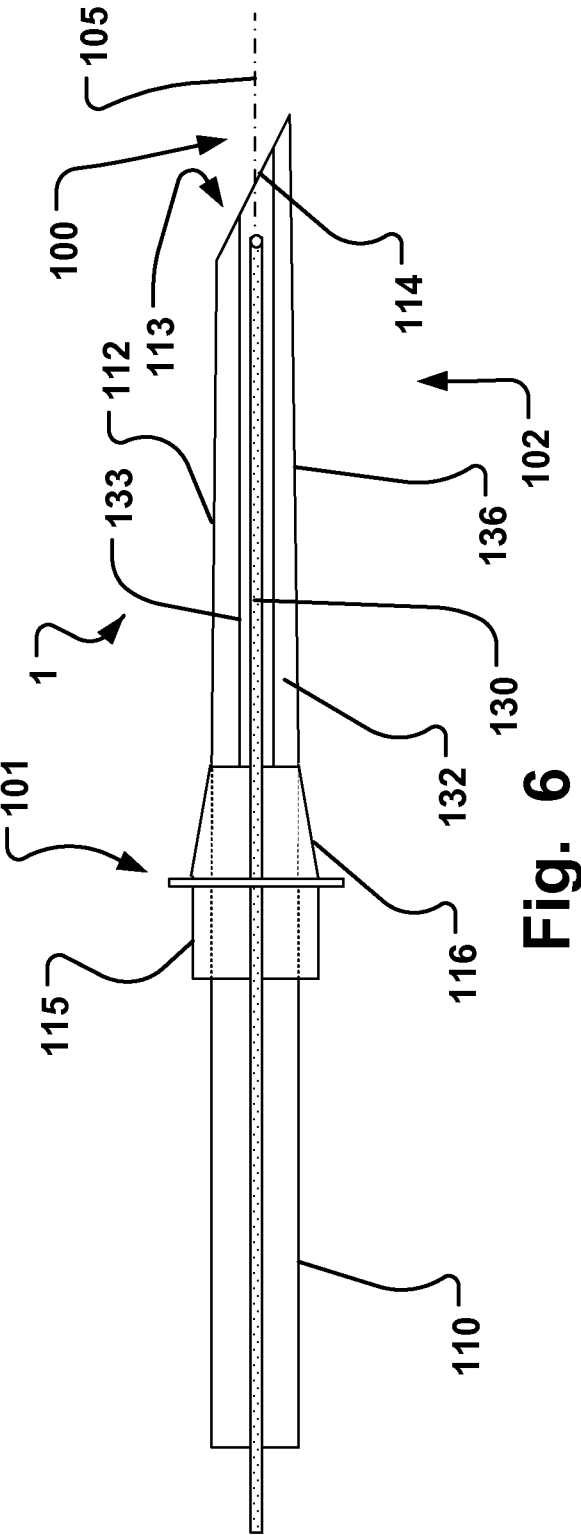


Fig. 6

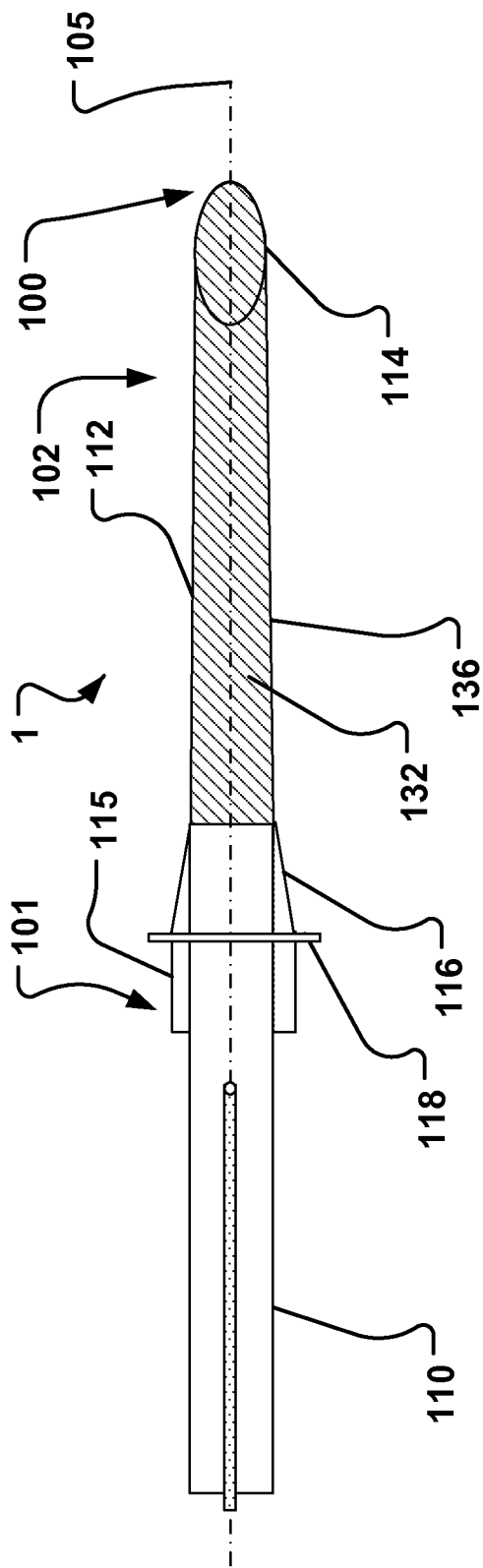


Fig. 7

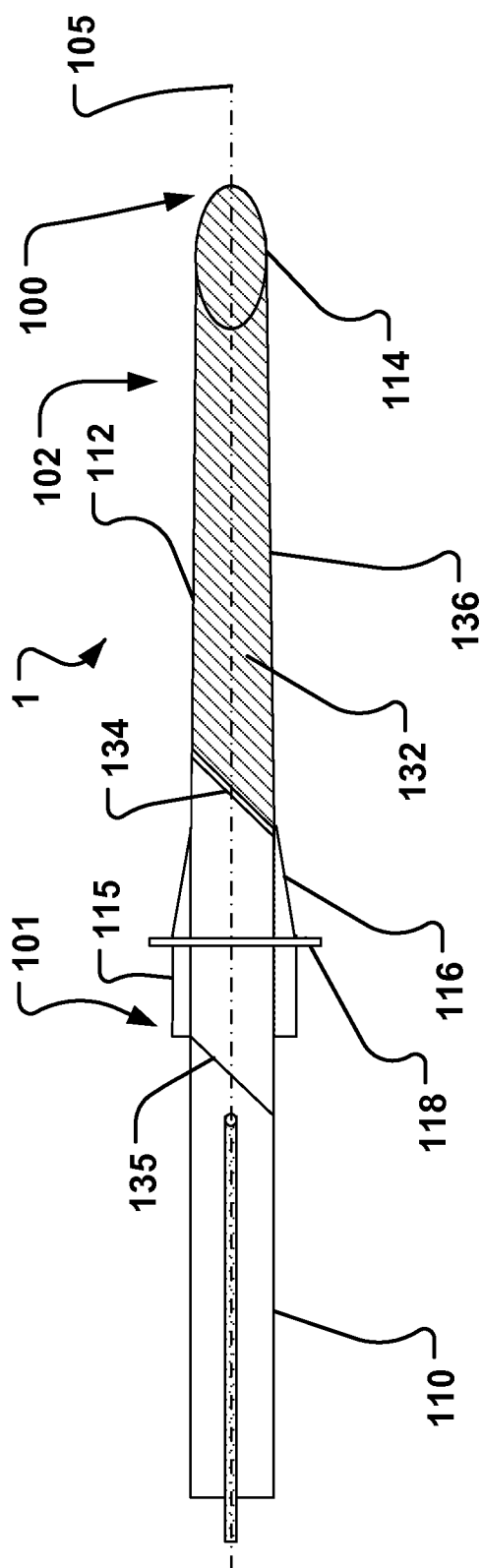


Fig. 8

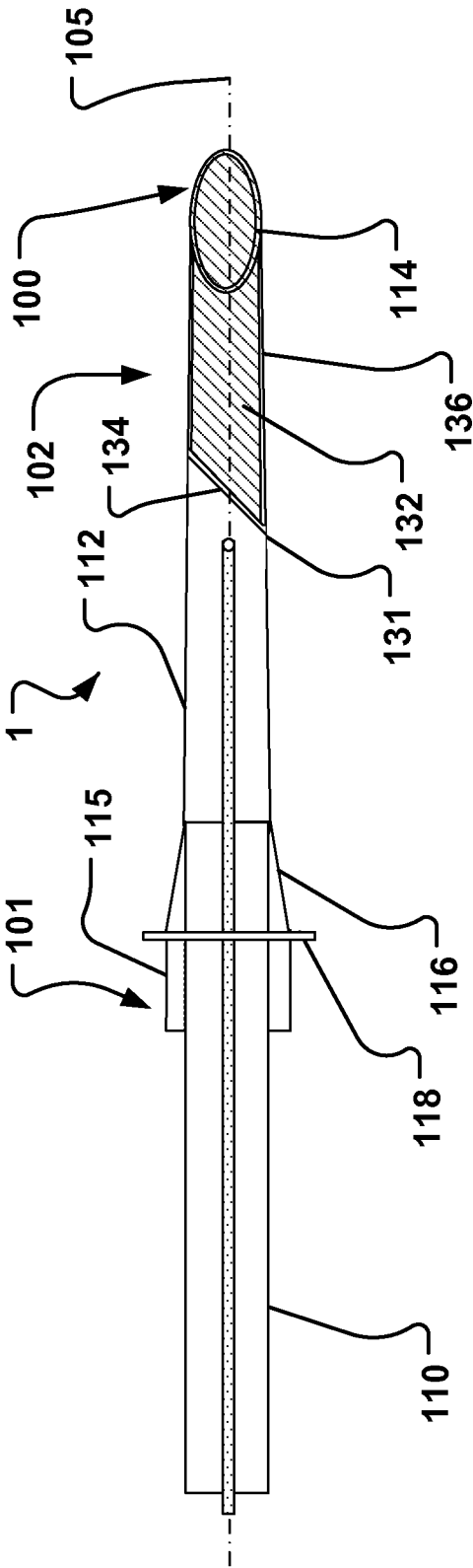


Fig. 9

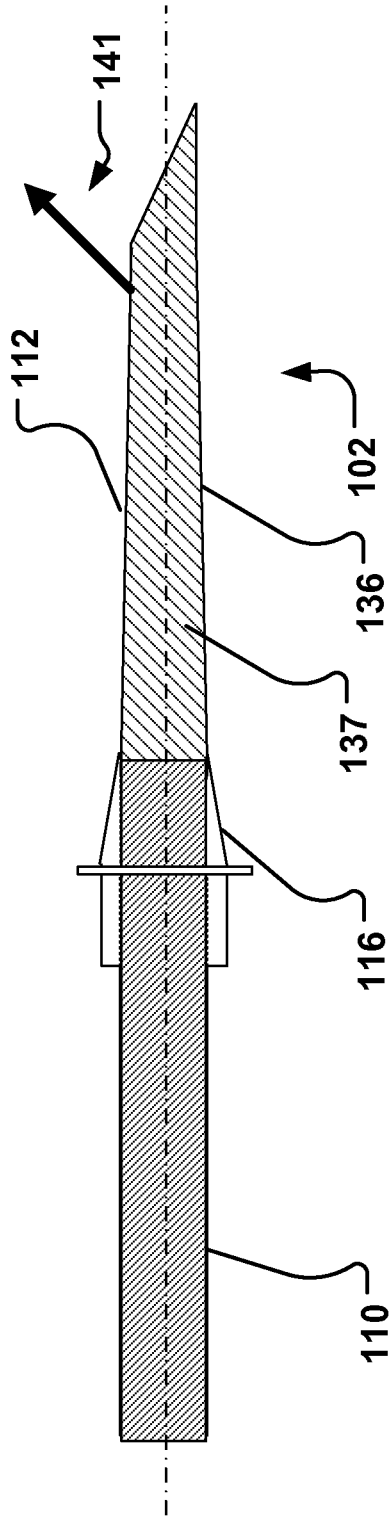


Fig. 10

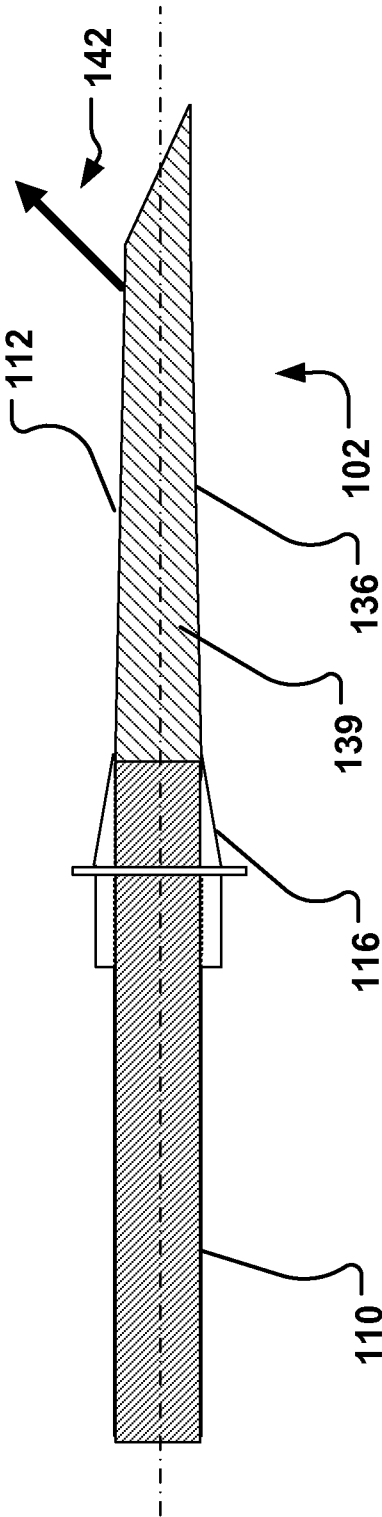


Fig. 11

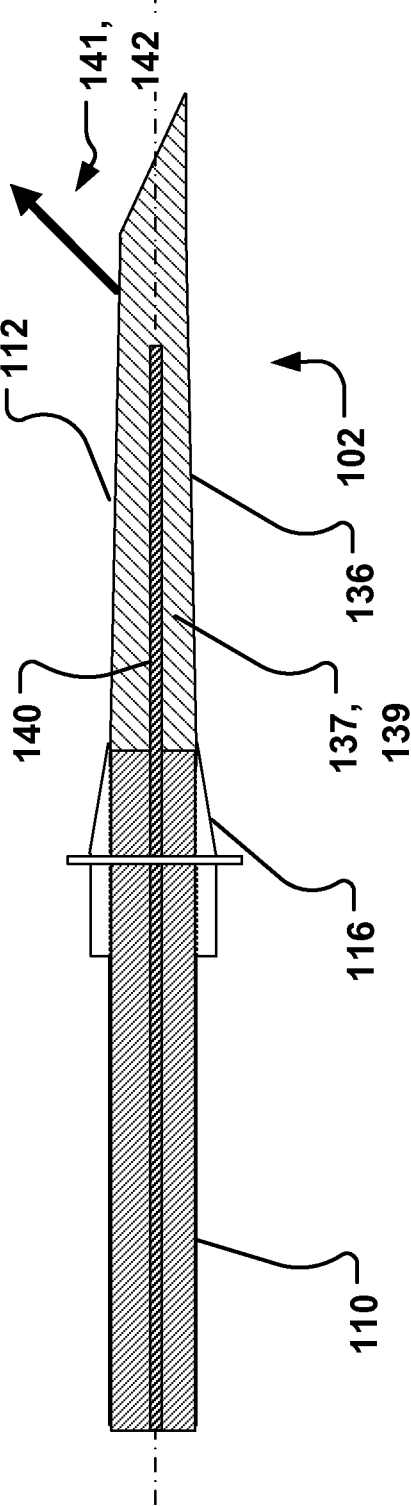


Fig. 12

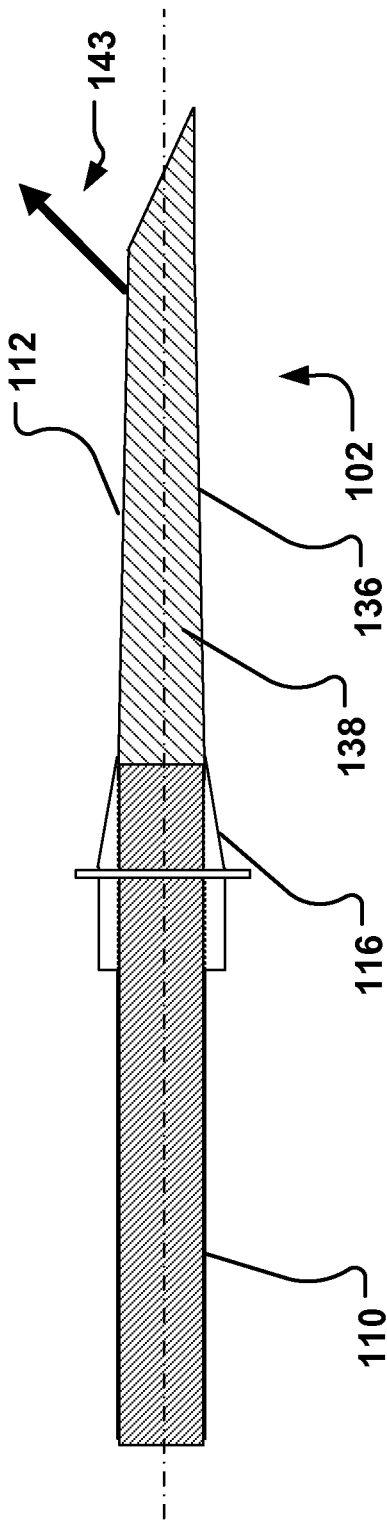


Fig. 13

8 / 9

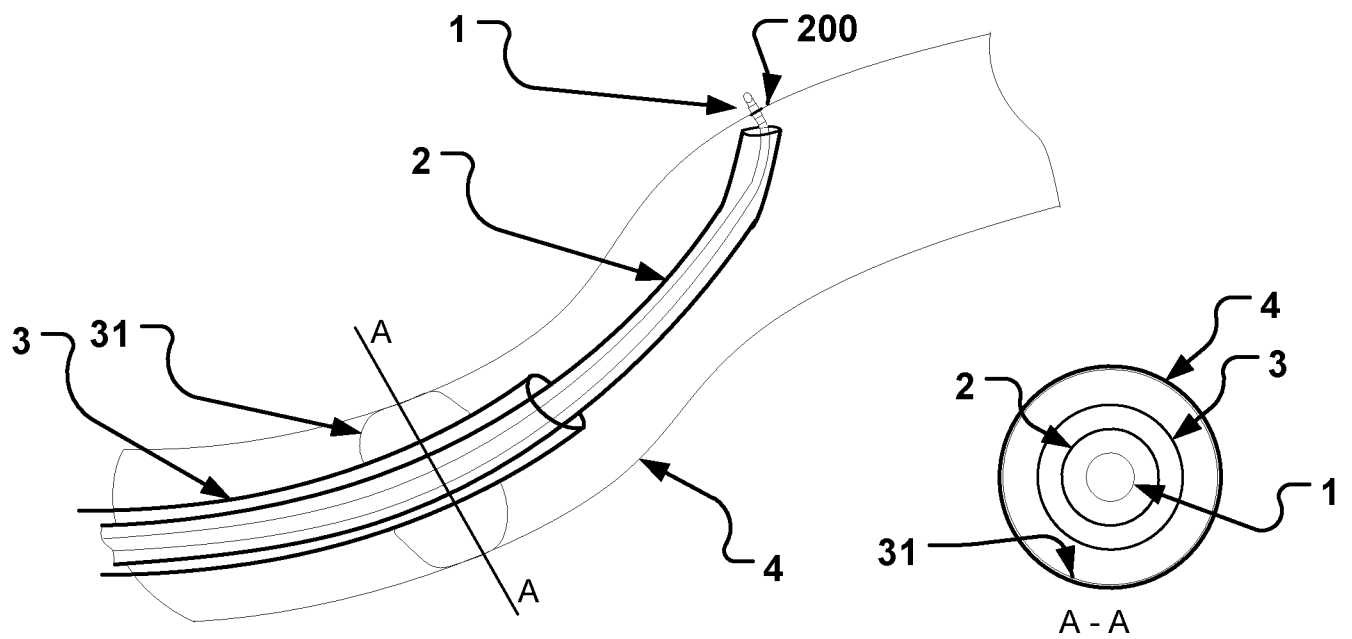


Fig. 14A

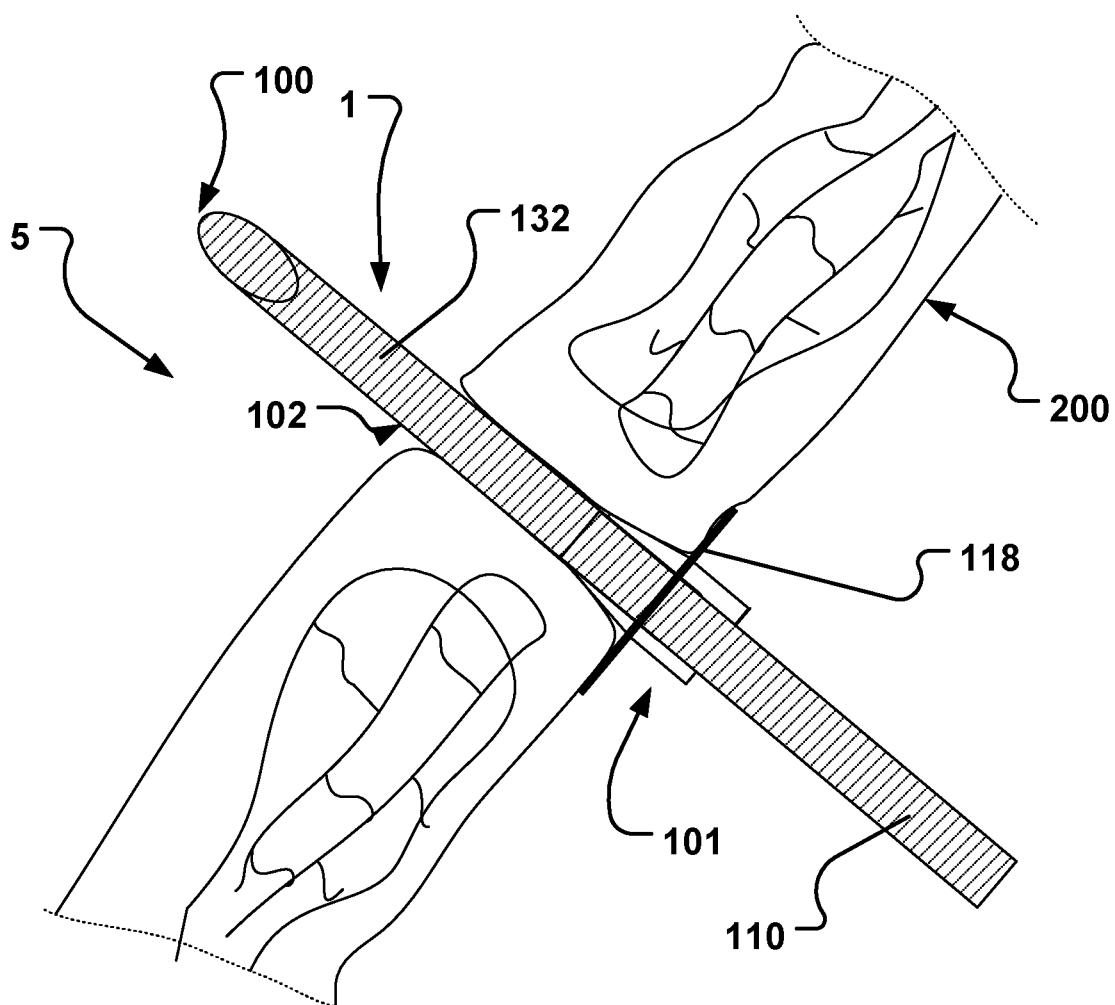
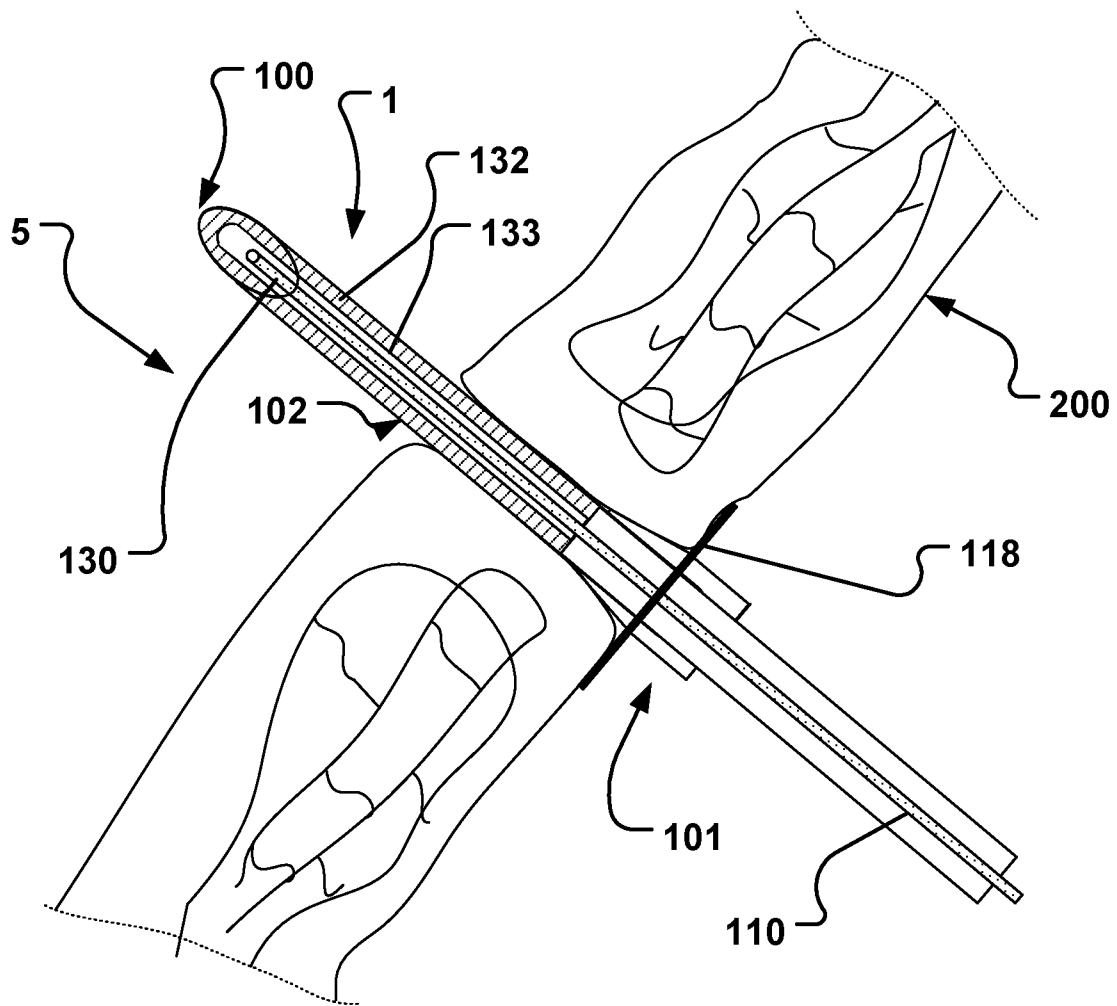


Fig. 14B

**Fig. 15**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/06Q854

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61M25/00 A61M25/06 A61B17/00 A61B18/14 A61N1/05
A61N5/Q0 A61N5/10 A61N5/06

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)

A61M A61B A61N

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 , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with Indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	wo 2009/124990 AI (KAROLINSKA INST INNOVATIONS AB [SE] ; HOLMIN STAFFAN [SE] ; JONSSON STEF) 15 October 2009 (2009-10-15) the whole document -----	1-5, 17-25
Y	wo 2007/078997 A2 (ARDIAN INC [US] ; DEMARAIS DENISE [US] ; CLARK BENJAMIN J [US] ; ZADNO NI) 12 July 2007 (2007-07-12) the whole document -----	1,2,5 , 17-25
Y	US 2006/085039 AI (HASTINGS ROGER N [US] ET AL) 20 April 2006 (2006-04-20) paragraphs [0079] - [0096] ; figures 6-10 -----	1,2,5 , 17-25
Y	EP 1 380 319 AI (NUCLETRON BV [NL]) 14 January 2004 (2004-01-14) the whole document ----- -/--	1,3, 17-25



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 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.

"&" document member of the same patent family

Date of the actual completion of the international search

9 September 2011

Date of mailing of the international search report

08/11/2011

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Fax: (+31-70) 340-3016

Authorized officer

Rodrigues, Elodie

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/06Q854

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 2003/130575 AI (DESAI ASHVIN [US]) 10 July 2003 (2003-07-10) paragraphs [0003] - [0007] , [0069] ; figure 8 -----	1,3,4, , 17-25
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Y	wo 98/19614 AI (FOGARTY THOMAS J [US]) 14 May 1998 (1998-05-14) the whole document -----	1,3-5 , 17-25

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2011/06Q854

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. ☒ Claims Nos.: 26-32
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. ☒ 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.:
see annex

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.I

Claims Nos.: 26-32

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery. The methods of endoluminal access to an extravascular target site at a vasculature site in a human or animal body described in claims 26-32 comprise the step of perforating a vessel wall of the vasculature. These methods are thus surgical methods.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-5, 17-25

Endoluminal medical access device with a distal portion suitable for surgical treatment and monitoring.

2. claims: 6-16

Endoluminal medical access device with a distal portion suitable for drug treatment.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/06Q854

Patent document cited in search report			Publication date		Patent family member(s)		Publication date	
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