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(54) **LIPOSUCTION CANNULA WITH IMAGING MEANS**

LIPOSUKTIONSKANÜLE MIT BILDGEBUNGSVORRICHTUNG

CANULE DE LIPOSUCCION AYANT UN MOYEN D'IMAGERIE

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Description

[0001] The present invention relates to a liposuction cannula.

[0002] More specifically, the subject of the invention is a liposuction cannula of the type comprising

a tube with a closed front end at which is formed at least one suction opening and with an open back end intended to be connected to a source of vacuum, in the tube there being defined at least one longitudinal flow conduit for the aspirated material, and

detector means arranged at the front end of said tube and capable of providing in use signals containing information useful for the operator using the cannula.

Description of the prior art

[0003] Liposuction is a technique which has been developed by plastic surgeons for the removal, for aesthetic purposes, of excess body fat by means of a cannula, for example made of metal or plastic material, introduced under the epidermis and connected to a source of vacuum.

[0004] The liposuction initially consisted in the dry insertion of a thin cannula under the epidermis through a small incision and in the aspiration of the fatty tissue.

[0005] The more recent techniques provide the ablation of the fatty tissue with the aid of vibrations (PAL - Power Assisted Liposuction), ultrasound (UAL - Ultrasound Assisted Liposuction), or laser (LAL - Laser Assisted Liposuction) which help to remove the fibrotic tissue and to reduce the intervention times.

[0006] The initial technique of dry liposuction, because of the excessive loss of blood, was very early on replaced with the "tumescent" technique, in which adrenaline, lidocaine and a physiological solution are injected into the tissues prior to initiating the intervention, in order to avoid excessive bleeding.

[0007] Although the tumescent technique has allowed the complications associated with the blood losses to be reduced, there however remains the risk associated with the other serious side-effects, the most worrying of which is damage to the adjacent tissues, resulting from an inadequate technique of use of the cannula and the conditions of low visibility.

[0008] In particular, the most recent liposuction techniques (PAL and UAL) make the occurrence of unintentional perforations of the adjacent structures easier. In some cases, the perforation of abdominal organs has occurred as a result of the incorrect positioning of the cannula.

[0009] Equally worrying is the recent development and use of ultrathin cannulae which allow a more superficial use and with which significant tissue necroses are associated, owing to damage caused by the cannula to the superficial vascular network.

[0010] Although liposuction is a medical procedure principally developed for aesthetic ends, in the past few years, it has also been used for the treatment of some pathologies, amongst which are lymphoedema and lipoedema, associated with an increase in the fatty and fibrotic tissue in the affected limbs.

[0011] In lymphoedema, the accumulation of fatty tissue accompanies the progression of the disease and is correlated with a situation of chronic lymphostasis which, aside from the detrimental effects that this causes in the affected parts of the body, can lead to serious complications, including serious and chronic infections. For these reasons, in the past, such excess tissues were surgically removed, even if the results of such interventions for "debulking" were anything but satisfactory and often associated with poor healing of the wounds and with ugly resulting scars.

[0012] Recently, liposuction with assisted aspiration has been introduced as a less invasive procedure for removing the excess fatty tissues. In view of the already low lymphatic drainage in the patients in question, it is becoming increasingly necessary to pay attention to avoiding further damaging the lymphatic vessels during liposuction. In patients with lymphoedema, the lymphatic vessels and channels are often dilated and tortuous, in particular in the advanced stages of the disease, or else when liposuction is prescribed, and thus they can be more difficult to avoid with the cannula and more vulnerable to lesions.

[0013] Furthermore, the application of liposuction to pathologies such as lipoedema and lymphoedema also requires the treatment of the calves and of the lower part of the leg, areas that are not usually treated in the applications with aesthetic goals, which are limited in most cases to the thighs and to the abdomen. The calves have only one layer of subcutaneous fat, being less dense and easier to suck out with the aspiration, which renders the surface layer more vulnerable to accidental damage caused by the cannula, with a higher risk of complications and infections.

[0014] In order to at least partially overcome the aforementioned problems and drawbacks, the use of an external echograph to supply images able to guide the insertion and the movement of the cannula during the liposuction may, at least in theory, be considered. However, with this, a further instrument would be introduced into the sterile surgical area, which would increase the potential risk of contamination. Furthermore, from a practical point of view, the use of an ultrasound echograph at the same time as using a liposuction cannula would be problematic.

[0015] As an alternative, periodically introducing a thin endoscope into the channel created by the liposuction cannula inside the fatty tissue may be considered. This, however, requires both the endoscope and the cannula to be frequently taken out and reinserted, which in itself lengthens the intervention times. Furthermore, even small variations in positioning of these two devices could lead to incorrect information and possibly to damage.

[0016] A liposuction cannula of the type initially defined is described in the Patent US 5 242 386. In this Patent, a liposuction cannula is provided in which, at the front end, a piezoelectric transducer is disposed which emits ultrasounds into the tissues surrounding the cannula. The analysis of the echoes received via the same transducer allows the depth of these tissues to be determined.

[0017] In this regard, it is observed that the piezoelectric transducers operate over a reduced frequency range, a fact which limits the depth of scanning and the resolution obtainable. In particular, the solution known from the said US Patent does not allow blood and lymphatic vessels to be detected, and does not therefore allow any potential damage to be avoided.

[0018] The solution described in the said US Patent furthermore does not allow video images to be obtained, also usable as a tool for training/information in order to enable surgical techniques to be further improved.

[0019] US 2011/257661 A1 discloses a liposuction surgical robot, which includes: a control unit, a robot arm driven by a particular control signal received from the control unit, a cannula mounted on the robot arm and extending in one direction, and a suction unit, which is formed on an end portion of the cannula and which is inserted into a surgical site to suction fat.

[0020] WO 2007/134370 A1 discloses a cannula for conducting surgical procedures at a surgical site of a patient, which cannula comprises a generally elongate tubular body having a distal end locatable at or adjacent tissue at the surgical site within the patient, a proximal end engageable with a vacuum source and/or an infiltration fluid source, a passage providing fluid communication between the distal end and the proximal end, an inlet to the passage at or adjacent the distal end and an outlet from the passage at or adjacent the proximal end. The cannula further comprises an image acquisition means disposed within the passage at or adjacent the distal end, wherein said image acquisition means is adapted to provide an image of tissue at or adjacent the distal end of the cannula when located at the surgical site within the patient.

[0021] US 5 242 386 A discloses an echographic suction cannula having an elongated suction tube with a closed front end and an open back end. Side openings are also provided for admitting therethrough material to be evacuated and discharged. An ultrasonic transducer is encased within the suction tube and partially exposed so as to be able to transmit and receive ultrasonic waves. An electrical cable extending longitudinally within the outer casing of the suction tube connects the transducer to an external circuit for controlling the operation of the transducer, causing pulse signals to be transmitted, receiving reflected signals and calculating the thickness of the layer of fatty tissues into which the front end of the cannula has been inserted.

Summary of the invention

[0022] One aim of the present invention is to provide a liposuction cannula which allows the aforementioned drawbacks of the solutions according to the prior art to be overcome. This and other goals are achieved according to the invention with a liposuction cannula as claimed in independent claim 1, with preferred embodiments disclosed in the dependent claims, wherein the detector means comprise an imaging apparatus designed to supply first signals or data allowing the generation of a visual representation of the environment in close proximity to the front end of the tube of the cannula down to a first depth or distance, and second signals or data allowing the generation of a visual representation of the environment around the front end of the tube of the cannula down to a second depth or distance, greater than said first depth or distance.

[0023] The aforementioned first signals or data allow a "near-field" view to be formed, so as to allow the operator to view the tissues and the organic structures immediately adjacent to the end of the cannula, whereas the second signals or data provide an "in-depth" view that enables vital structures to be identified well in advance avoiding damage to them during the aspiration of the fat, thus improving the safety of the procedure.

[0024] The imaging apparatus comprises first and second imaging devices for the generation of the near-field imaging signals or data and, respectively, of the in-depth imaging signals or data.

[0025] The first imaging device may for example be a scanning fibre endoscope (SFE), which allows coloured images to be generated and acquired that are conveniently displayed on a screen and that can advantageously be recorded.

[0026] SFE endoscopes designed for such a use are described for example in Seibel EJ, Johnston RS, Melville CD, "A full-color scanning fiber endoscope", Biomedical Optics 2006, International Society for Optics and Photonics, 2006, Proc. SPIE 6083, Optical Fibers and Sensors for Medical Diagnostics and Treatment Applications VI, 608303, and also in Lee CM, Engelbrecht CJ, Soper TD, Helmchen F, Seibel EJ, "Scanning fiber endoscopy with highly flexible, 1-mm catheterscopes for wide-field, full-color imaging", J, Biophotonics, 2010; 3:385-407.

[0027] The second imaging device may for example be a device for optical coherence tomography (or OCT), of the type described for example in Kuo WC, Kim J, Shemonski ND, Chaney EJ, Spillman DR Jr, Boppart SA, "Real-time three-dimensional optical coherence tomography image-guided core-needle biopsy system", Biomed Opt Express, 2012; 3:1149-61.

[0028] As an alternative, the second imaging device may be a capacitive micro-machined ultrasound transducer (or CMUT) device, for example of the type described in Stephens D, Truong UT, Nikoozadeh A, Oralkan O, Seo CH, Cannata J, Dentinger A, et al., "First In

Vivo Use of a Capacitive Micromachined Ultrasound Transducer Array-Based Imaging and Ablation Catheter", J Ultrasound Med 2012; 31:247-256, and in Lorenser D, Yang X, Kirk RW, Quirk BC, McLaughlin A, Sampson DD, "Ultrathin side-viewing needle probe for optical coherence tomography", Opt. Lett. 2011; 36:3894-3896.

Brief description of the figures

[0029] Further features and advantages of the invention will become apparent from the detailed description that follows, presented purely by way of non-limiting example, with reference to the appended drawings, in which:

- Figure 1 is a partial side view of a liposuction cannula according to the present invention;
- Figure 2 is a partial side view, in partial cross-section, according to the arrow II in Figure 1;
- Figure 3 shows, on an enlarged scale, the cross-section along the line III-III in Figure 2;
- Figure 4 is a partial side view of another embodiment of a liposuction cannula according to the present invention; and
- Figure 5 shows, on an enlarged scale, the cross-section along the line V-V in Figure 4.

Description of embodiments

[0030] In the figures from 1 to 3, reference 1 is an overall indication of a liposuction cannula constructed in accordance with the present invention.

[0031] Such a cannula comprises a tube 2 made for example from a metal material, such as stainless steel or titanium brushed or coated with zirconium nitride, or else made of plastic material.

[0032] The tube 2 can have standard dimensions and, in particular, a length in the range for example between 7 and 30 cm.

[0033] The outer diameter of the tube 2 of the cannula according to the invention is for example 5-6 mm, in order to be able to define inside it at least one conduit capable of allowing the removal of the aspirated fatty tissue and the accommodation of the imaging means which will be described hereinbelow. The diameter of the tube 2 therefore depends, at least in part, on the dimensions of the imaging devices used and it is predictable that the continual improvements in such devices and in the corresponding technologies is going to allow the implementation of even thinner cannulae.

[0034] A handle 3, for example made of plastic material, is attached to one end of the tube 2. In a manner known per se, at least one passage for the evacuation of the aspirated fatty material is formed in this handle, in addition to at least one other passage for the electrical cables and/or the optical fibres connected to the imaging devices contained in the tube 2.

[0035] At the distal end, opposite to the handle 3, the tube 2 forms a tip with a convex curved profile, composed, at least in part, of a calotte 4 of transparent material for the radiation used by the imaging devices.

[0036] With reference in particular to Figure 3, the cavity defined inside the tube 2 is divided up, by means of two parallel longitudinal partition walls 5 and 6, into a central region or chamber 7 in which imaging devices and the connecting cables/fibres thereof are accommodated, and two lateral regions or chambers 8 and 9, acting as conduits for the flow of the aspirated fatty material.

[0037] The regions or chambers 7, 8 and 9 extend over the entire length of the tube 2. At the back end, or else near the handle 3, the chambers 8 and 9 may be connected, in a manner not shown, to a source of vacuum of the type known per se intended to carry out the aspiration.

[0038] The calotte 4 may be made of transparent Pyrex glass, or of a plastic material potentially coated with a thin metallization layer capable of acting, where necessary, as an electrode.

[0039] In proximity to the tip 4, in the side-wall portions of the tube 2 that cooperate to bound the regions or chambers 8 and 9, respective pluralities of aspiration apertures are formed, indicated by 10.

[0040] The number, the shape and the disposition of the apertures 10 illustrated in the figures are purely exemplary and non-limiting.

[0041] In proximity to the tip 4, in the region or chamber 7 of the tube 2, a first and a second imaging device are disposed, indicated by 11 and 12, respectively.

[0042] The imaging device 11 is capable of supplying signals or data able to allow a view of the environment immediately surrounding the inner end of the tube 2 of the cannula, down to a first depth or distance, for example 5 - 35 mm, so as to make available a display of the "near field" of operation.

[0043] The second imaging device 12 is, on the other hand, capable of supplying signals or data able to allow an in-depth view of the environment surrounding the front end of the tube 2 of the cannula, for example down to a distance equal to 5-6 cm, in order to, in particular, allow the operator to identify sufficiently in advance any potential blood or lymphatic vessels, and hence to be able to avoid damaging them.

[0044] As has already previously been mentioned, the first imaging device 11 is for example a scanning fibre endoscope (SFE), shown schematically in Figures 2 and 3, equipped with a multipolar connecting cable 13 running within the central chamber 7 of the tube 2, and then through a corresponding central passage of the handle 3.

[0045] The second imaging device 12 can comprise a CMUT (Capacitive Micromachined Ultrasound Transducer) device of the types previously mentioned, which is associated with a respective cable 14 running longitudinally within the central chamber 7 of the tube 2, next to the cable 13 associated with the first imaging device 11.

[0046] The longitudinal partition walls 5 and 6 run over the entire length of the tube 2, as far as the calotte of the tip 4, in such a manner as to hermetically separate the central chamber 7 from the aspiration chambers 8 and 9, in order to guarantee sterile conditions within the latter.

[0047] Scanning fibre endoscopes are constructed with diameters of the order of a millimetre or a little more. Such an endoscope comprises a piezoelectric tube and a single-mode optical fibre, and it emits oscillations of light (red, green and blue light), and detects the back-scattered reflected light, containing information useful for forming the display of images.

[0048] In the cannula according to the invention, the transparent calotte or tip 4 allows the free passage of the light towards and from the tissues immediately adjacent to the distal portion of the tube 2, allowing the near field to be viewed, useful for guiding the operator in the use of the liposuction device.

[0049] With respect to other electronic cameras for medical use, the scanning fibre endoscope offers the advantage of an optimum clarity of the images, obtained with the employment of a microscopic camera, whereas the conventional electronic cameras, such as those using bunches of coherent optical fibres and which interpret the diffuse white light illumination, suffer significant loss of sharpness of the images when they are miniaturized. Such conventional electronic cameras do not allow, at the same time, both a high resolution and a wide field of view to be obtained, whereas scanning fibre endoscopes allow high quality images to be produced with an extensive field of view.

[0050] Since the scanning fibre endoscope uses a narrow-band RGB source of illumination, by means of the use of bio-markers, it is possible to perform an imaging of the tissues using fluorescence with a wide field of view.

[0051] As has been said hereinabove, the second imaging device 12 can comprise an OCT device, disposed in the tip of the tube 2 of the cannula, behind the calotte 4.

[0052] OCT devices emit light in the near-infrared, through a transparent window, using a laser.

[0053] OCT probes can implement a forward or side-on scanning (viewing). The devices with forward scanning offer the advantage of being more readily miniaturizable, and they are also produced as needle probes, with dimensions of the order of 0.25 mm.

[0054] OCT side-viewing probes allow images to be produced in 2D and 3D. The need to provide them with a micro-mirror renders their miniaturization more problematic. OCT side-viewing probes with diameters of the order of 0.40 mm have however been produced.

[0055] A catheter for OCT has furthermore been implemented, used for needle-biopsy, having an outer diameter of 0.9 mm. They are designed to produce two-dimensional radial images but, with the use of appropriate software, allow a 3D rendering to be produced.

[0056] OCT probes may also be implemented in such a manner as to enable fluorescent signals to be detected and to allow fluorescent 3D images to be generated that are able to supply more visual information around the structures of the tissues.

[0057] As previously said, the second imaging device 12 may be a CMUT device. Such devices, in contrast to the conventional devices using ultrasounds which employ piezoelectric technology, are not self-heating and are accordingly more suited to high-energy applications. CMUT devices can also be miniaturized without this being detrimental to the clarity of the images, and they operate with a much wider bandwidth compared with the conventional piezoelectric transducers.

[0058] CMUT devices can also be used to produce photoacoustic imaging (PAI) which combines optical imaging with acoustic imaging: short pulses from a laser briefly heat absorbing structures, such as blood vessels, and generate acoustic pressure waves which are detected via ultrasounds. These solutions have allowed the in-depth imaging to be significantly improved, guaranteeing clarity of images down to a depth of around 5 cm.

[0059] A CMUT device may be associated with the capacity to detect bio-markers, for example using indocyanine green fluorescence, in order to enable an optimal in-depth view of structures.

[0060] The recent technological developments allow CMUT devices to be used for an in-depth display of tissues and vulnerable structures, such as veins and lymphatic vessels, thus improving the safety of the liposuction procedure.

[0061] If the second imaging device 12 is of the side-viewing or side-scanning type, then, as is illustrated in the figures from 1 to 3, in the side wall of the tube 2, close to the tip or calotte 4, an aperture or window 15 is conveniently formed that is provided with a closing element 16 made of material transparent to the radiation used.

[0062] In this case, the handle 3 may conveniently comprise a reference, such as a hollow 17 (Figure 1) in which the thumb of the hand of the operator is engaged, so that the latter therefore always has the orientation of the said window present.

[0063] Figures 4 and 5 show one variant embodiment. In these figures, to parts and elements that are equivalent or substantially corresponding to parts and elements already described, are again assigned the same reference numbers used previously.

[0064] In the variant according to Figures 4 and 5, the region internal to the tube 2 is divided up by a single longitudinal partition wall 5 into a first region or chamber 7, within which the imaging devices 11 and 12 and the connecting cables thereof are positioned, and a second region or chamber 8 acting as a conduit for the flow of the aspirated fatty material.

[0065] Also, in this case, the imaging devices 11 and 12 are conveniently of the type described above with reference to the embodiment according to the figures from 1 to 3. The portion of side wall of the tube 2 which is used to bound the chamber or region for aspiration 8 is also, in this case, provided with one or more apertures 10, through which the fatty material can be aspirated into the inside of the said region or chamber.

[0066] The solution according to Figures 4 and 5 may be implemented with a tube 2 having an outer diameter that is slightly smaller with respect to the embodiment according to the figures from 1 to 3.

[0067] A liposuction cannula according to the present invention allows near-field and in-depth video images of the tissues surrounding the distal end of the cannula to be supplied to the operating surgeon. Such images can be recorded, so as to be used as a tool for training/information.

[0068] The possibility for the operator to see the structures surrounding the cannula improves the safety of the procedure, minimizing the risk of damaging the adjacent structures. It is furthermore possible for the operator to perform an optimum removal of the fatty tissue, without compromising vulnerable structures, thus improving the efficacy of the procedure with respect to the equipment currently available. The current equipment, which does not allow viewing of the operating field, leads the operators to be cautious in the removal of the fatty tissue by default, in order to reduce the risks of damaging the adjacent structures, sometimes leaving a quantity of tissue in situ that could/should be removed.

[0069] It does of course go without saying that the principle of the invention, the embodiments and their details of implementation will be able to be widely varied with respect to what has been described and illustrated purely by way of non-limiting example, without however straying from the scope of the invention as defined in the appended claims.

Claims

1. Liposuction cannula (1), comprising
   a tube (2) with a closed front end (4) at which there is provided at least one suction opening (10), and with a back end (3) intended to be connected to a source of vacuum; in the tube (2) there being defined at least one longitudinal flow conduit (8, 9) for the aspirated material; and
   detector means (11, 12) arranged at the front end (4) of said tube (2) and capable of supplying in use signals containing information useful for the operator using the cannula (1); the said detector means comprising an imaging apparatus (11, 12) capable of supplying first signals or data allowing the generation of a visual representation of the environment in close proximity to the front end of the tube (2) of the cannula (1) down to a first depth or distance, and second signals or data allowing the generation of a visual representation of the environment around the front end of the tube (2) of the cannula (1) down to a second depth or distance, greater than the said first depth or distance,
   the cannula (1) being **characterized in that** said imaging apparatus (11, 12) comprises a first imaging device (11) capable of producing video signals or data for displaying the environment in close proximity to the front end (4) of said tube (2), as well as a second imaging device (12) capable of producing signals or data usable for displaying tissues in depth around the front end (4) of the said tube (2).

2. Liposuction cannula according to Claim 1, wherein the first imaging device (11) is a scanning fibre endoscope (SFE).

3. Liposuction cannula according to Claim 1, wherein the second imaging device (12) is an optical coherence tomography device or a capacitive macro-machined ultrasound transducer device.

4. Liposuction cannula according to any of the preceding Claims, wherein the said tube (2) defines a cavity which, by means of at least one longitudinal partition wall (5, 6) extending from the front end (4) to the back end (3) thereof, is divided into at least two regions or chambers (7; 8, 9) hermetically isolated from one another, in one (7) of which there are accommodated first and second imaging devices (11, 12) and connection cables (13, 14) thereof, and at least one other (7, 8) of which forms said longitudinal flow conduit for the aspirated material.

5. Liposuction cannula according to Claim 4, wherein the internal cavity of the said tube (2) is divided by means of two longitudinal partition walls (5, 6) into a central region or chamber (7) in which the said imaging devices (11, 12) are accommodated with their connection cables (13, 14), and two lateral regions or chambers (8, 9) acting as flow conduits for the aspirated material.

6. Liposuction cannula according to Claim 4, wherein the internal cavity of the said tube (2) is divided, by means of a single longitudinal partition wall (5), into a first region or chamber (7) in which said imaging devices (11, 12) and the connection cables (13, 14) thereof are accommodated, and a second chamber (8) acting as a flow conduit for the aspirated material.

7. Liposuction cannula according to any of the preceding Claims, wherein the distal portion of said tube (2) has an end part or tip (4) of a material transparent to the radiation emitted and/or received by the said imaging devices (11, 12).

Patentansprüche

1. Liposuktionskanüle (1), die Folgendes umfasst:

   ein Rohr (2) mit einem geschlossenen vorderen Ende (4), an dem mindestens eine Saugöffnung (10) vorgesehen ist, und mit einem hinteren Ende (3), das mit einer Vakuumquelle verbunden werden soll; wobei in dem Rohr (2) mindestens eine längliche Strömungsleitung (8, 9) für das angesaugte Material definiert ist; und

Erfassungsmittel (11, 12), die an dem vorderen Ende (4) des Rohrs (2) angeordnet sind und in der Lage sind, im Gebrauch Signale zu liefern, die Informationen enthalten, die für den Bediener, der die Kanüle (1) verwendet, nützlich sind; wobei die Erfassungsmittel eine Bildgebungsvorrichtung (11, 12) aufweisen, die in der Lage ist, erste Signale oder Daten zu liefern, welche die Erzeugung einer visuellen Darstellung der Umgebung in unmittelbarer Nähe des vorderen Endes des Rohrs (2) der Kanüle (1) nach unten bis zu einer ersten Tiefe oder Entfernung ermöglichen, und zweite Signale oder Daten zu liefern, welche die Erzeugung einer visuellen Darstellung der Umgebung um das vordere Endes des Rohrs (2) der Kanüle (1) nach unten bis zu einer zweiten Tiefe oder Entfernung, die größer als die erste Tiefe oder Entfernung ist, ermöglichen, wobei die Kanüle (1) **dadurch gekennzeichnet ist, dass** die Bildgebungsvorrichtung (11, 12) eine erste Bildergebungseinrichtung (11) umfasst, die in der Lage ist, Videosignale oder Daten zum Anzeigen der Umgebung in unmittelbarer Nähe des vorderen Endes (4) des Rohrs (2) zu erzeugen, sowie eine zweite Bildergebungseinrichtung (12), die in der Lage ist, Signale oder Daten zu erzeugen, die zum Anzeigen von Geweben in der Tiefe um das vordere Ende (4) des Rohrs (2) verwendet werden können.

2. Liposuktionskanüle nach Anspruch 1, wobei es sich bei der ersten Bildgebungseinrichtung (11) um ein Abtastfaserendoskop (SFE, Scanning Fibre Endoscope) handelt.

3. Liposuktionskanüle nach Anspruch 1, wobei es sich bei der zweiten Bildgebungseinrichtung (12) um eine Vorrichtung für optische Kohärenztomografie oder eine kapazitive makrobearbeitete Ultraschallwandlervorrichtung handelt.

4. Liposuktionskanüle nach einem der vorhergehenden Ansprüche, wobei das Rohr (2) einen Hohlraum definiert, der mittels mindestens einer länglichen Trennwand (5, 6), die sich von dem vorderen Ende (4) zu dem hinteren Ende (3) davon erstreckt, das Rohr in mindestens zwei hermetisch voneinander getrennte Bereiche oder Kammern (7; 8, 9) unterteilt, wobei in einer (7) davon erste und zweite Bildgebungseinrichtungen (11, 12) und ihre Verbindungskabel (13, 14) untergebracht sind, und wobei wenigstens ein anderes (7, 8) davon die längliche Strömungsleitung für das angesaugte Material bildet.

5. Liposuktionskanüle nach Anspruch 4, wobei der innere Hohlraum des Rohrs (2) mittels zweier länglicher Trennwände (5, 6) unterteilt ist in einen zentralen Bereich oder eine zentrale Kammer (7), in dem bzw. der die Bildgebungseinrichtungen (11, 12) mit ihren Verbindungskabeln (13, 14) untergebracht sind, und zwei seitliche Bereiche oder Kammern (8, 9), die als Strömungskanäle für das angesaugte Material dienen.

6. Liposuktionskanüle nach Anspruch 4, wobei der innere Hohlraum des Rohrs (2) mittels einer einzelnen länglichen Trennwand (5) unterteilt ist in einen ersten Bereich oder eine erste Kammer (7), in der die Bildgebungseinrichtungen (11, 12) mit ihren Verbindungskabeln (13, 14) untergebracht sind, und eine zweite Kammer (8), die als Strömungskanal für das angesaugte Material dient.

7. Liposuktionskanüle nach einem der vorhergehenden Ansprüche, wobei der distale Abschnitt des Rohrs (2) einen Endteil oder eine Spitze (4) aus einem Material aufweist, das für die von den Bildgebungseinrichtungen (11, 12) ausgestrahlte und/oder empfangene Strahlung transparent ist.

Revendications

1. Canule de liposuccion (1), comprenant

un tube (2) avec une extrémité avant fermée (4) au niveau de laquelle est ménagée au moins une ouverture de succion (10), et avec une extrémité arrière (3) prévue pour être raccordée à une source de vide ; au moins un conduit d'écoulement longitudinal (8, 9) pour le matériau aspiré étant défini dans le tube (2) ; et

des moyens détecteurs (11, 12) agencés au niveau de l'extrémité avant (4) dudit tube (2) et capables de fournir en utilisation des signaux contenant des informations utiles pour l'opérateur utilisant la canule (1) ; lesdits moyens détecteurs comprenant un appareil d'imagerie (11, 12) capable de fournir des premiers signaux ou données permettant la génération d'une représentation visuelle de l'environnement à proximité étroite de l'extrémité avant du tube (2) de la canule (1) vers le bas jusqu'à une première profondeur ou distance, et des seconds signaux ou données permettant la génération d'une représentation visuelle de l'environnement autour de l'extrémité avant du tube (2) de la canule (1) vers le bas jusqu'à une seconde profondeur ou distance, supérieure à ladite première profondeur ou distance,

la canule (1) étant **caractérisée en ce que** ledit appareil d'imagerie (11, 12) comprend un premier dispositif d'imagerie (11) capable de produire des signaux ou données vidéo pour afficher l'environnement à proximité étroite de l'extrémité avant (4) dudit tube (2), ainsi qu'un second dispositif d'imagerie (12) capable de produire des signaux ou données utilisables pour afficher des tissus en profondeur autour de l'extrémité avant (4) dudit tube (2).

2. Canule de liposuccion selon la revendication 1, dans laquelle le premier dispositif d'imagerie (11) est un fibroscope à balayage (SFE).

3. Canule de liposuccion selon la revendication 1, dans laquelle le second dispositif d'imagerie (12) est un dispositif de tomographie par cohérence optique ou un dispositif de transducteur capacitif ultrasonore macro-usiné.

4. Canule de liposuccion selon l'une quelconque des revendications précédentes, dans laquelle ledit tube (2) définit une cavité qui, au moyen d'au moins une paroi de séparation longitudinale (5, 6) s'étendant à partir de l'extrémité avant (4) vers l'extrémité arrière (3) de celle-ci, est divisée en au moins deux régions ou chambres (7 ; 8, 9) isolées hermétiquement les unes des autres, des premier et second dispositifs d'imagerie (11, 12) et câbles de connexion (13, 14) de ceux-ci étant logés dans l'une (7) d'elles, et au moins une autre (7, 8) d'elles formant ledit conduit d'écoulement longitudinal pour le matériau aspiré.

5. Canule de liposuccion selon la revendication 4, dans laquelle la cavité interne dudit tube (2) est divisée au moyen de deux parois de séparation longitudinales (5, 6) en une région ou chambre centrale (7) dans laquelle lesdits dispositifs d'imagerie (11, 12) sont logés avec leurs câbles de connexion (13, 14), et deux régions ou chambres latérales (8, 9) agissant en tant que conduits d'écoulement pour le matériau aspiré.

6. Canule de liposuccion selon la revendication 4, dans laquelle la cavité interne dudit tube (2) est divisée, au moyen d'une seule paroi de séparation longitudinale (5), en une première région ou chambre (7) dans laquelle lesdits dispositifs d'imagerie (11, 12) et les câbles de connexion (13, 14) de ceux-ci sont logés, et une seconde chambre (8) agissant en tant que conduit d'écoulement pour le matériau aspiré.

7. Canule de liposuccion selon l'une quelconque des revendications précédentes, dans laquelle la portion distale dudit tube (2) a une partie ou un embout d'extrémité (4) d'un matériau transparent au rayonnement émis et/ou reçu par lesdits dispositifs d'imagerie (11, 12).

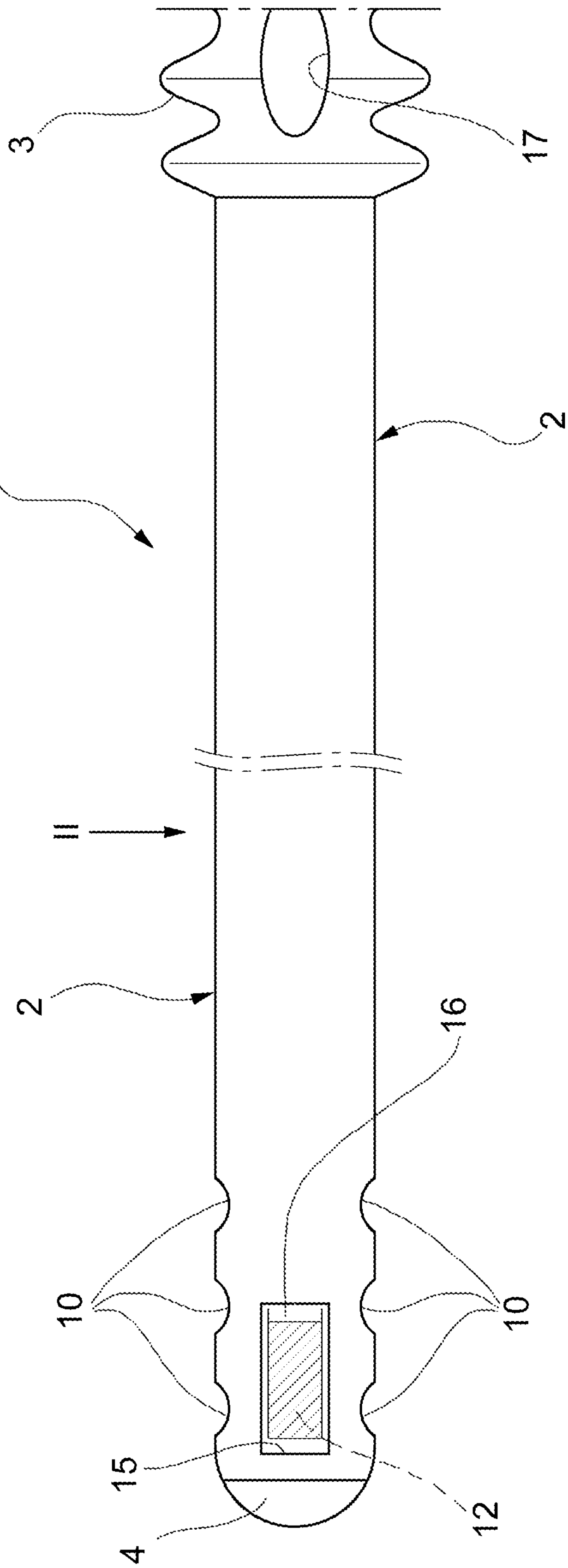

FIG.1

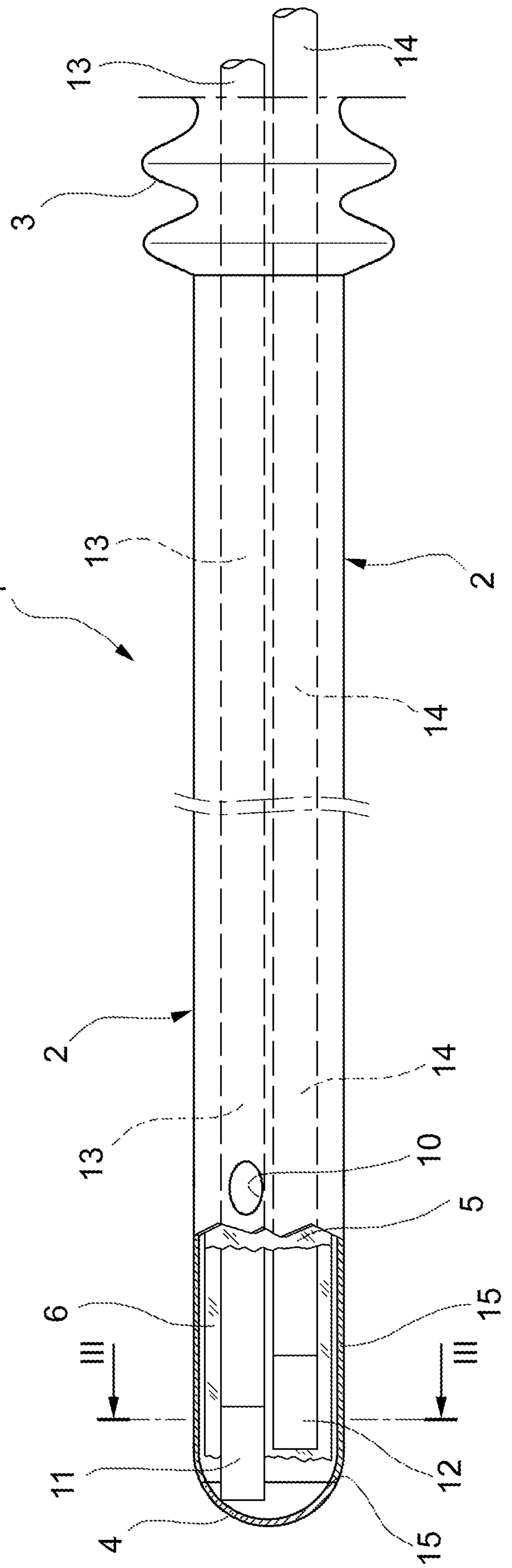

FIG.2

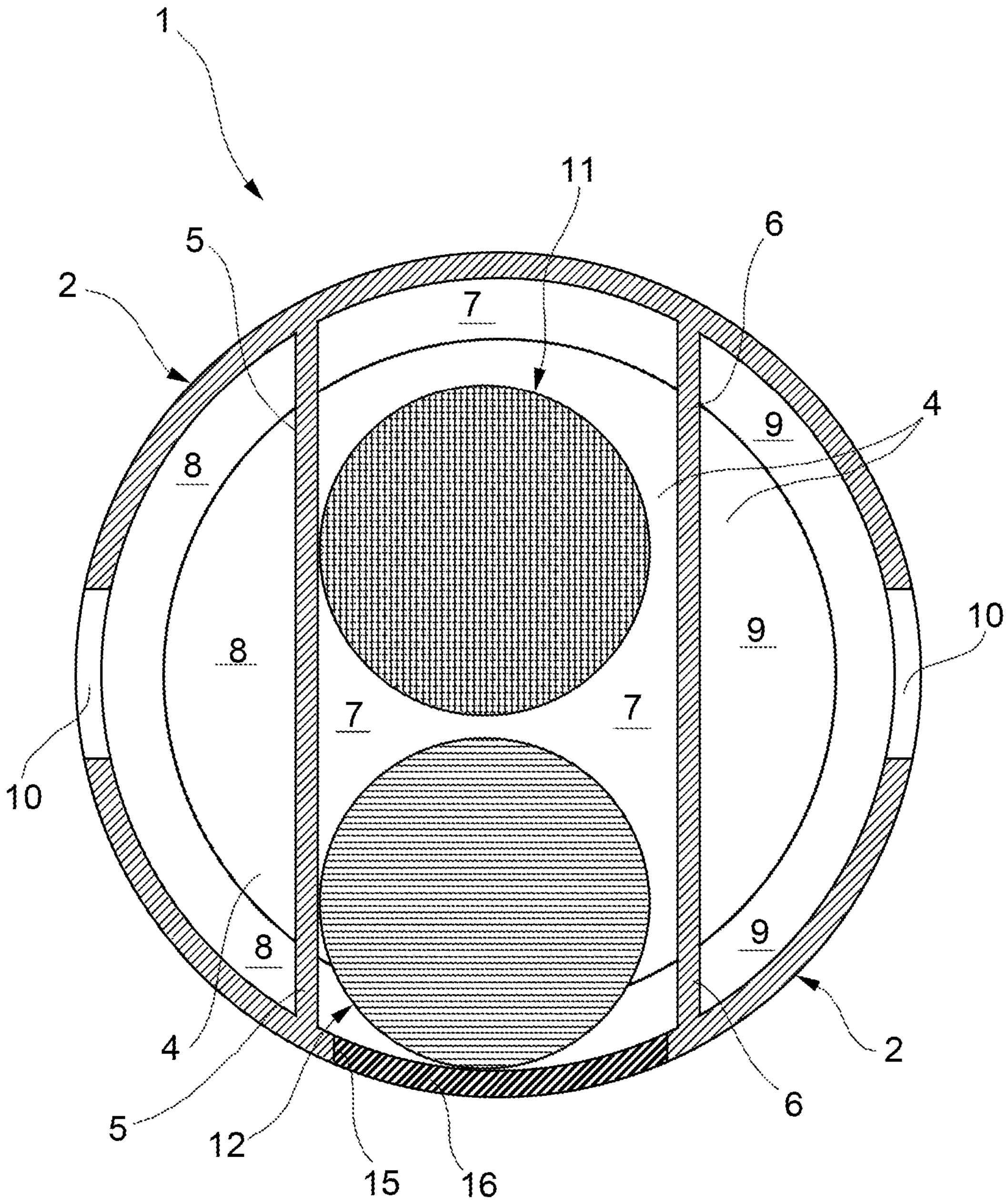

FIG.3

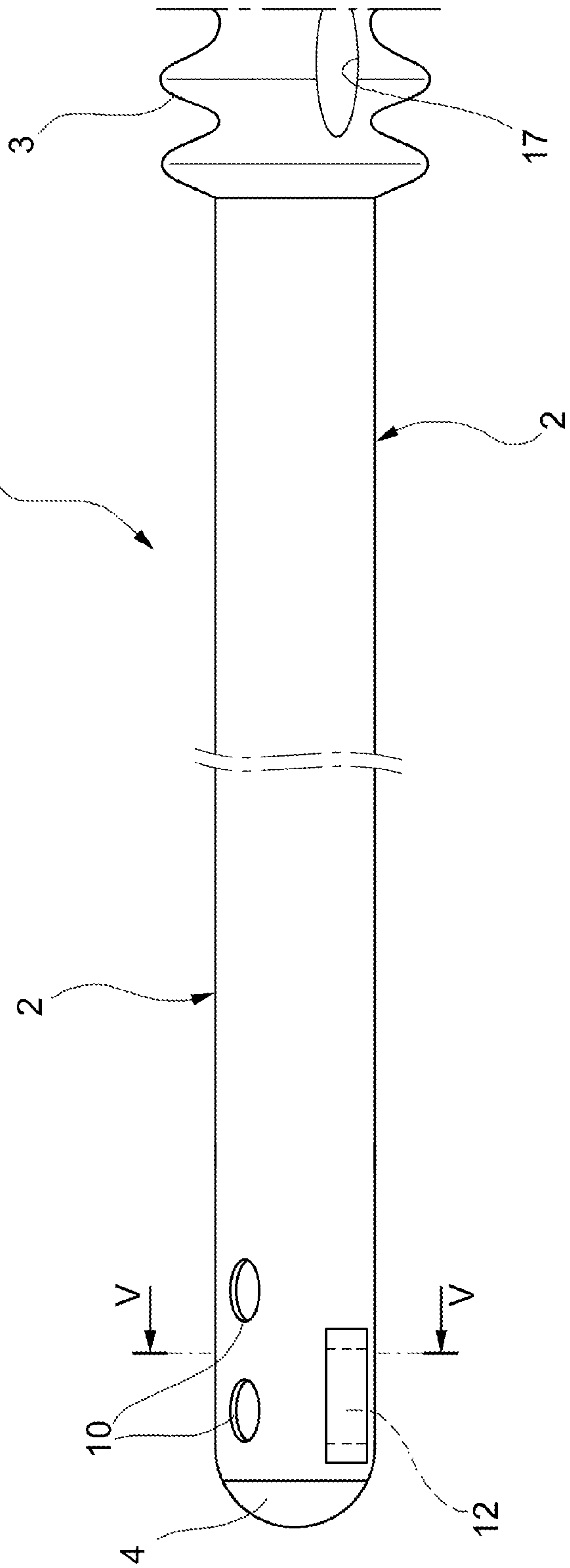

FIG.4

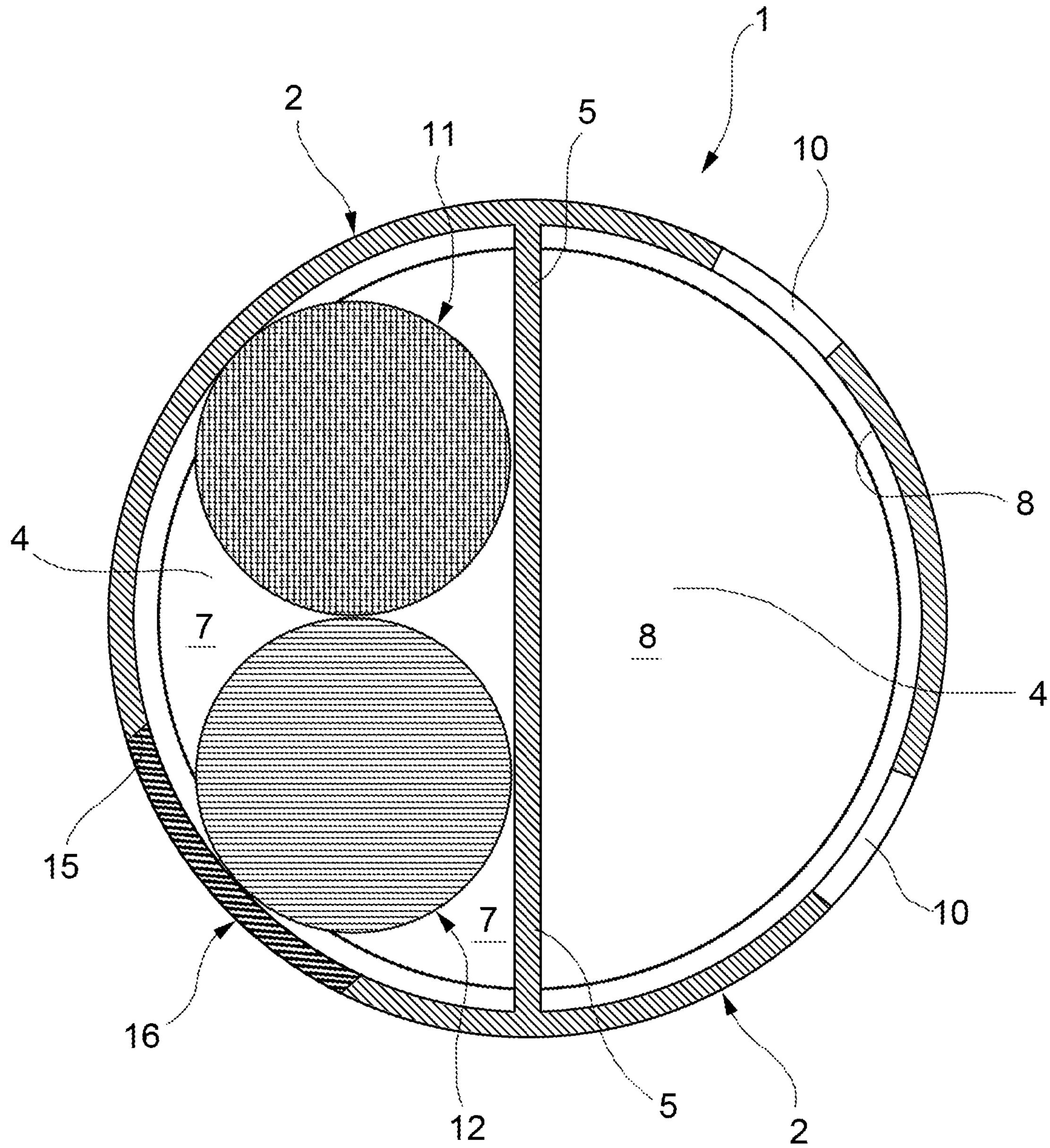

FIG.5

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	带成像装置吸脂插管

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优先权	102014902319551 2014-12-29 IT
其他公开文献	EP3240490A1
外部链接	[Espacenet]

摘要(译)

本文公开了一种抽脂套管，该抽脂套管包括具有前端的管，在前端具有至少一个抽吸口，并且该后端旨在连接至真空源。 在该管中，限定了至少一个用于抽吸材料的纵向流动导管。 以及能够提供第一信号或数据的成像设备，所述第一信号或数据允许产生接近于插管的管的前端向下至第一深度或距离的环境的视觉表示，以及第二信号或数据，其允许产生围绕套管的前端向下至第二深度或距离的环境的视觉表示的角度大于第二深度或距离。

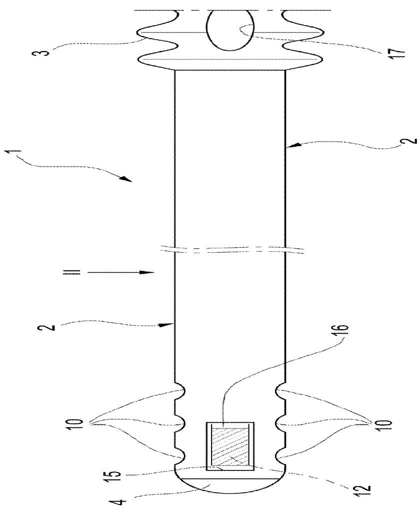

FIG.1