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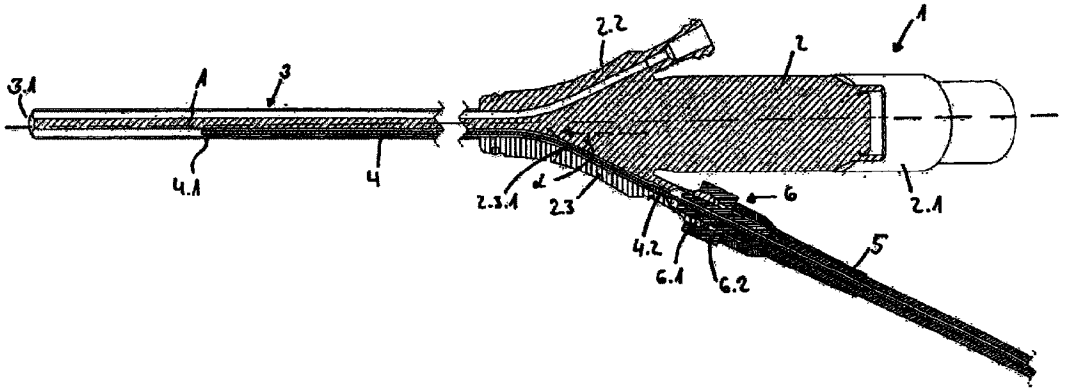

(57) Abrégé/Abstract:
The invention proposes, for determining the precise orientation and positioning of an endoscope in an electromagnetic field, an endoscope device having a proximal insertion head and having a shaft extending distally therefrom having a centre axis, which extends with at least one oblong lumen through the device, which is characterized by a sensor rod having at least two sensor coils arranged with finite spacing in relation to one another in the longitudinal direction, which are oriented in relation to one another at a finite angle.

Abstract

The invention proposes, for determining the precise orientation and positioning of an endoscope in an electromagnetic field, an endoscope device having a proximal insertion head and having a shaft extending distally therefrom having a centre axis, which extends with at least one oblong lumen through the device, which is characterized by a sensor rod having at least two sensor coils arranged with finite spacing in relation to one another in the longitudinal direction, which are oriented in relation to one another at a finite angle.

Endoscope device

The invention relates to an endoscope device having a proximal insertion head and having a shaft extending distally therefrom having a centre axis, which extends with at least one oblong lumen through the device.

Minimally invasive operations are already carried out presently by means of navigation-assisted operating methods. Different navigation systems are used for this purpose. Active and passive systems are used. In active systems, a part introduced into the body of a patient, such as an instrument or surgical tool, is provided with a transmitter, via which the position of the instrument or tool, in particular the distal end located at the engagement location, may be externally determined. In passive systems, a field is generated, which is detected via a sensor, whereby the position and alignment of the instrument or surgical tool, in particular its distal end, can in turn be detected directly or indirectly. Direct detection of the distal end of a surgical part includes the arrangement of the sensor on the distal end of the part itself; indirect detection includes the fixed rigid attachment of the sensor in a defined point, in particular axial position, on the surgical part. Inferences about the position and possibly the orientation of the distal end can be seen on the basis of the measured sensor signal. In passive navigation, in particular electromagnetic navigation has proven itself, in which an electromagnetic field is generated externally around the operation region, for example, by a generator of an electromagnetic field in a cushion on which the patient

lies. Coil-type sensors installed in the surgical part enable the locating of the instruments, whereupon a representation can be performed in CT or MRT images. This method does not include a radiation exposure and thus overall reduces the radiation exposure, also due to a reduced use of x-rays. The image quality is not impaired, nor can sensors be concealed, since they are not optical sensors. The freedom of movement of the operator is not restricted, as is the case with optical systems. The work of the operator is significantly facilitated.

The invention is based on the object of providing a device, in which the location and orientation of an endoscope, in particular of the distal end, can be precisely determined using the above-described system while avoiding the mentioned disadvantages.

The mentioned object is achieved according to the invention by an endoscope device of the type mentioned at the outset, which is characterized by a sensor rod having at least two sensor coils arranged in the longitudinal direction at a finite spacing in relation to one another, which are oriented in relation to one another at a finite angle.

Because the two sensor coils are arranged at a finite angle in relation to one another in the endoscope device, because of the different arrangement, the orientation of the endoscope device in the magnetic field of the detection system and thus also in space can be precisely determined.

In one preferred embodiment, it is provided in this case that the first sensor coil is oriented in parallel in relation to the centre axis and the second sensor coil is oriented at a finite angle in relation to the centre axis, wherein in particular the first sensor coil is arranged in the shaft and the second sensor coil is arranged in an attachment of the insertion head.

In one refinement, it is provided that the rod bearing the two sensor coils extends through a lumen of the device, wherein in particular the rod is connected in an axially fixed manner to a holder which is attachable to the attachment of the insertion head. In this way, the location of the one sensor coil, in particular the first sensor coil, is accurately defined in the endoscope device and therefore on the basis of the determination of the location of the first sensor coil by the detection system in the magnetic field, the exact determination of the precise location of the distal end of the sensor device and thus of the working location is also possible, since the spacing of the (first) sensor coil from the distal end of the endoscope shaft is fixedly predetermined in this manner.

Due to the fixed connection of the rod bearing the sensor coil to a separable holder, furthermore, on the one hand, after positioning, the rod bearing the sensor coil is removed, and the lumen occupied thereby for the positioning can be released for other usage purposes. Furthermore, the sensor device formed by the rod having the sensor coils is thus separable from the actual

endoscope and can be used in another way. This also enables simpler sterilization.

Further advantages and features of the invention result from the claims and from the following description, in which an exemplary embodiment of the invention is explained in detail with reference to the drawing.

In this case, the single figure is a longitudinal section view of an endoscope device according to the invention.

The endoscope device 1 according to the invention comprises in the illustrated exemplary embodiment a proximal insertion head 2 and a shaft 3 extending distally therefrom. In the illustrated exemplary embodiment, the insertion head 2 comprises three branches or attachments 2.1 to 2.3, namely one attachment 2.1 for introducing a light guide from the proximal end of the device 1 up to its distal end and also two attachments 2.2, 2.3, which each also comprise a lumen or a channel which extends from the distal end of the elongated shaft 3 with a centre axis A up to an exit from the respective adapter 2.2, 2.3.

A rod 4, which bears two coils 4.1 and 4.2 with spacing in its longitudinal extension, extends through the lumen 2.3.1 of the attachment 2.3. The rod can be formed as a solid or flexible rod or also as a rod coiled in a helix. A connecting wire (not shown) extends from each of the coils 4.1, 4.2 in the proximal direction up to a respective proximal connecting or contact end of the respective wire, possibly in the

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formation of a plug for connection of the wires to an analysis unit (not shown).

The coil 4.1 is located at the distal end of the rod 4 and thus inside the shaft 3 extending in parallel to its centre axis A and is therefore also oriented in parallel to the centre axis A or axially-parallel. The coil 4.2 arranged with spacing in relation to the coil 4.1 on the rod 4 is located in the attachment 2.3 of the insertion head extending at a finite angle in relation to the centre axis A. In that the lumen section of the lumen 2.3.1 also extends at a finite angle in relation to the centre axis A, the orientation or extension of the coil 4.2 in the attachment 2.3 also encloses a finite angle in relation to the centre axis A. The two coils 4.1, 4.2 are therefore not parallel to one another, but rather are oriented at a finite angle in relation to one another.

In the case of an externally applied inhomogeneous electromagnetic field, in which the coils 4.1, 4.2 are located, these coils therefore perceive the field differently and transmit different signals to the analysis unit. Due to this different orientation of the coils 4.1, 4.2, the orientation of the endoscope device in the electromagnetic field and thus in space can therefore be exactly determined.

The rod 4 is arranged axially fixed in a holder 5. The holder 5 and the attachment 2.3 are connectable to one another by a Luer adapter 6, wherein each of the parts bears a respective part 6.1, 6.2 corresponding to one another of the Luer adapter 6, so that the attachment

2.3 and the holder 5 can be fixedly connected to one another like a bayonet by the Luer adapter 6 in a way known per se. The location of the holder 5 in relation to the attachment 2.3 and also in relation to the head 2 and the shaft 3 of the endoscope device 1 is thus defined in the fastened state. Since the shaft 4, as stated, is arranged axially fixed in the holder 5, the longitudinal position of the coils 4.1, 4.2 and in particular of the distal coil 4.1 in the shaft 3 and thus the endoscope device 1 is therefore also defined and therefore the spacing, in particular the axial spacing of the coil 4.1 from the distal end 3.1 of the shaft 3, is also defined. By way of the sensor signal of the coil 4.1 in the applied electromagnetic field, its location and, because of the fixed spacing in relation to the distal end 3.1 of the shaft 3, the location of the distal end 3.1 of the shaft 3 in the electromagnetic field and thus in space can also thus be determined.

An operator therefore recognizes, on the basis of the analysis of the sensor signals and an image display on a display screen of the analysis unit, the position of the distal end 3.1 of the shaft 3 and thus also of the endoscope device 1 accurately and thus knows where exactly they are working with their instruments, which they possibly introduce into other lumens of the endoscope device and through them.

Patent Claims

1. An endoscope device comprising:

a proximal insertion head with an attachment of the insertion head;

a shaft extending distally from the insertion head, the shaft having a center axis;

at least one elongate lumen extending through the device; and

a sensor rod having at least two sensor coils arranged at a finite spacing in relation to one another in a sensor rod longitudinal direction, the at least two sensor coils being oriented in relation to one another at a finite angle and wherein the at least two sensor coils comprise a first sensor coil oriented in parallel to the center axis and a second sensor coil located in the attachment of the insertion head and oriented at the finite angle in relation to the center axis.

2. An endoscope device according to claim 1, wherein the first sensor coil is arranged in the shaft.

3. An endoscope device according to claim 1, wherein the rod bearing the two sensor coils extends through the lumen.

4. An endoscope device according claim 1, further comprising a holder, wherein the holder is attachable to the attachment of the insertion head and the rod is connected axially fixed to the holder.

5. An endoscope device according to claim 4, wherein the

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attachment of the insertion head and the holder comprise corresponding Luer adapter parts facing toward one another forming a Luer adapter, and the attachment and the holder are fixedly connectable to one another by the Luer adapter.

6. An endoscope device according to claim 1, wherein the sensor rod further comprises a connecting wire that extends from each sensor coil through the rod up to a sensor rod proximal end for connection to an analysis unit.

7. An endoscope device comprising:

a proximal insertion head with an attachment of the insertion head;

a shaft extending distally from the insertion head, the shaft having a center axis, wherein the attachment of the insertion head extends at a finite angle with respect to the center axis;

at least one elongate lumen extending through the device, the lumen having a lumen section that extends in the attachment of the insertion head and at the finite angle in relation to the center axis;

a sensor rod;

a first sensor coil supported by the sensor rod and located at a distal end of the sensor rod, inside the shaft, and extending in parallel to the center axis and oriented in parallel to the center axis; and

a second sensor coil supported by the sensor rod and arranged with a spacing in relation to the first sensor coil at the sensor rod and located in the attachment of the insertion head, the attachment of the insertion head extending at the finite angle in relation to the center axis, wherein an orientation or extension of the second sensor coil in the

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attachment of the insertion head also encloses the finite angle in relation to the center axis and the first sensor coil and the second sensor coil are not parallel to one another and the second sensor coil is oriented at the finite angle in relation to the first sensor coil, wherein the rod bearing the two sensor coils extends through the lumen with the second sensor coil arranged in the lumen section extending at the finite angle in relation to the center axis.

8. An endoscope device according claim 7, further comprising a holder attachable to the attachment of the insertion head, wherein the rod is axially fixed to the holder whereby upon attaching the holder to the attachment, the first sensor coil is located at a first predefined position inside the shaft and the second sensor coil is located at a second predefined position inside the lumen section extending at the finite angle in relation to the center axis.

9. An endoscope device according to claim 8, wherein the attachment of the insertion head and the holder comprise corresponding Luer adapter parts facing toward one another forming a Luer adapter, and the attachment and the holder are fixedly connectable to one another by the Luer adapter to set the defined positions in a fixed state.

10. An endoscope device according to claim 7, wherein the sensor rod further comprises a connecting wire that extends from each sensor coil through the rod up to a sensor rod proximal end for connection to an analysis unit.

11. An endoscope device comprising:

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a proximal insertion head with an attachment of the insertion head;

a shaft extending distally from the insertion head, the shaft having a center axis;

at least one elongate lumen extending through the device, the lumen having a lumen section that extends in the attachment of the insertion head and at a finite angle in relation to the center axis;

a sensor rod;

a first sensor coil supported by and located at the distal end of the sensor rod, inside the shaft, and extending in parallel to the center axis and oriented in parallel to the center axis;

a second sensor coil supported by and arranged with a spacing in relation to the first sensor coil at the sensor rod and located in the attachment of the insertion head, the attachment of the insertion head extending at the finite angle in relation to the center axis, wherein an orientation or extension of the second sensor coil in the attachment of the insertion head also encloses the finite angle in relation to the center axis and the first sensor coil and the second sensor coil are not parallel to one another and the second sensor coil is oriented at the finite angle in relation to the first sensor coil, wherein the rod bearing the two sensor coils extends through the lumen with the second sensor coil arranged in the lumen section extending at the finite angle in relation to the center axis; and

a holder attachable to the attachment of the insertion head, wherein the rod is axially fixed to the holder whereby upon attaching the holder to the attachment, the first sensor coil is located at a first predefined position inside the shaft and the second sensor coil is located at a second predefined

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position inside the lumen section extending at the finite angle in relation to the center axis.

12. An endoscope device according to claim 11, wherein the attachment of the insertion head and the holder comprise corresponding Luer adapter parts facing toward one another forming a Luer adapter, and the attachment and the holder are fixedly connectable to one another by the Luer adapter to set the defined positions in a fixed state.

13. An endoscope device according to claim 12, wherein the sensor rod further comprises a connecting wire that extends from each sensor coil through the rod up to a sensor rod proximal end for connection to an analysis unit.

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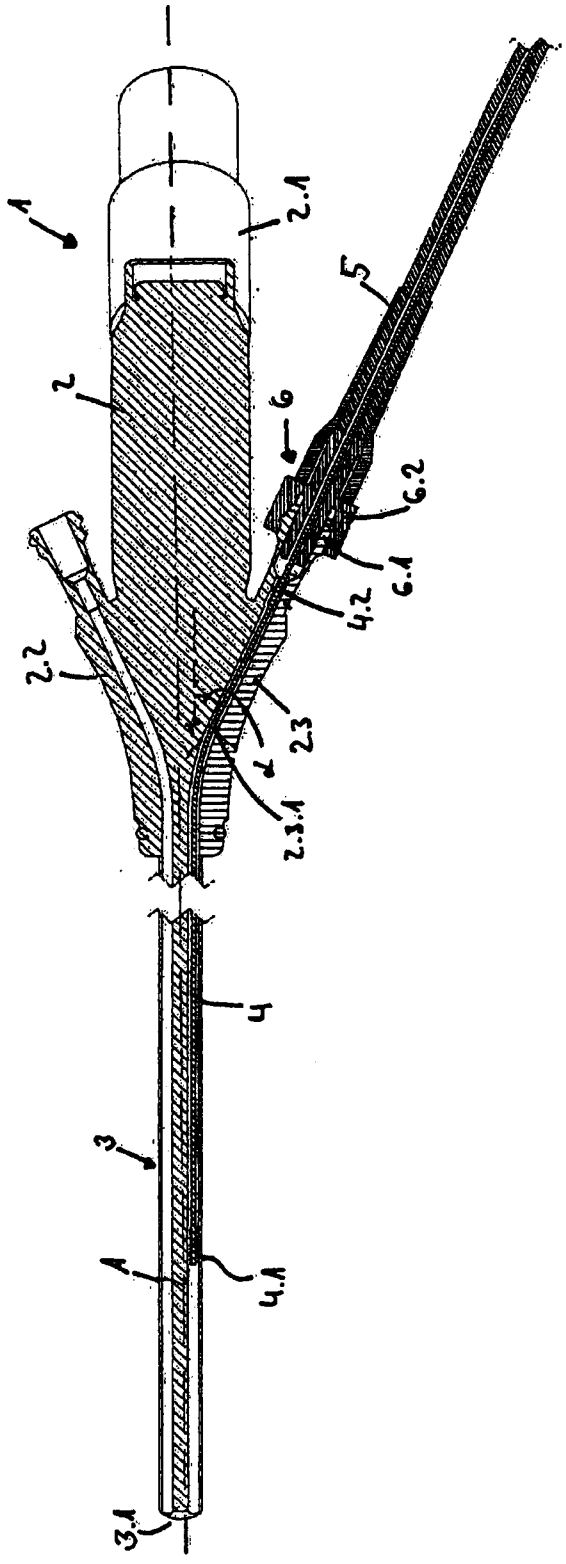
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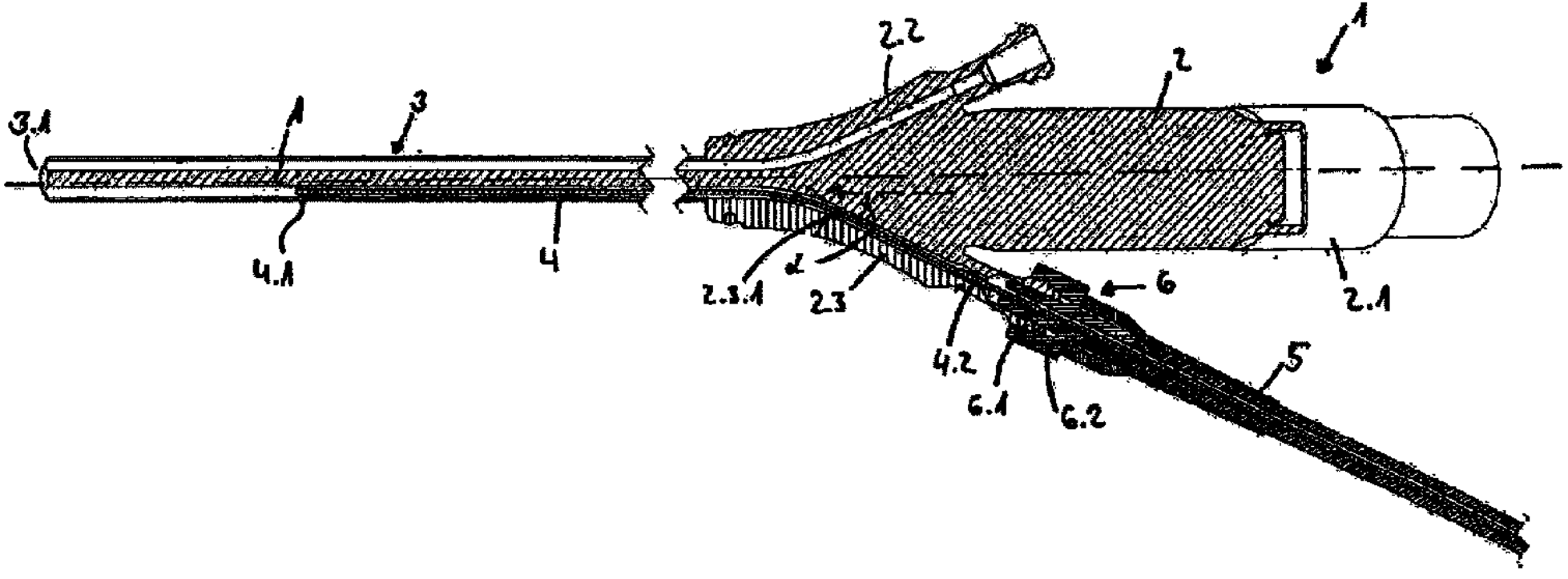
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