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(71) Applicant: **HOYA CORPORATION** [JP/JP]; 6-10-1
Nishi-Shinjuku, Shinjuku-ku, 160-8347 Tokyo (JP).

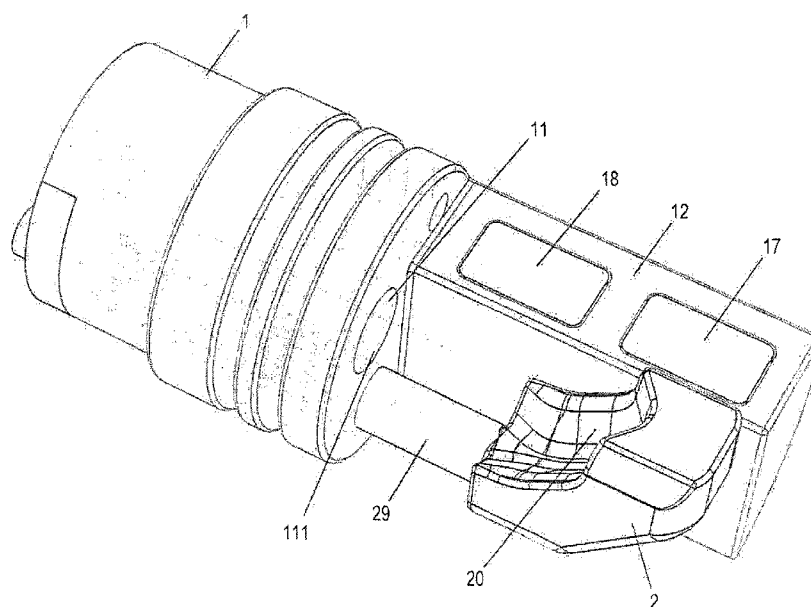
(72) Inventor: **HUBER, Harald**; Lessingstr. 30, 86159 Augsburg (DE).

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(54) Title: ENDOSCOPE, METHOD FOR CLEANING AN ENDOSCOPE, AND CLEANING DEVICE FOR CLEANING AN ENDOSCOPE

FIG. 1



(57) Abstract: The invention refers to an endoscope comprising at least one channel (11) which may be contaminated in use, wherein the channel wall of the at least one channel (11) is formed of a material having properties capable of photocatalysis. The invention further refers to a method for cleaning such an endoscope comprising the steps of: connecting the endoscope to a reprocessing device, performing a photocatalytic treatment at least in the at least one channel (11) for the purpose of the decomposition of organic residues on the surface of the channel, and rinsing the endoscope. The invention further refers to a cleaning device for cleaning such an endoscope.

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Description

Endoscope, Method for Cleaning an Endoscope, and Cleaning Device for Cleaning an Endoscope

The present invention relates to an endoscope comprising at least one channel which may be contaminated in use. Furthermore, the present invention relates to a cleaning method and a cleaning device for cleaning an endoscope.

An endoscope can be used for examining, for example, the esophagus, the duodenum, the bile duct, the gall bladder, the pancreatic duct, the pancreas, etc.

Such an endoscope is inserted into the patient and is advanced to the location where the desired examination is to take place.

After the endoscope has been used, it is subjected to reprocessing. Such reprocessing has to reliably prevent the transmission of all germs or microorganisms, such as bacteria, viruses, fungi, worms and spores. In the course of reprocessing, the endoscope is first cleaned manually in order to remove all traces of organic material or chemical residues. After the cleaning, the endoscope undergoes machine disinfection or sterilization. In this way, it shall be avoided that germs or microorganisms, etc., with which an endoscope has come into contact during its use, are transferred to another patient during the next use.

It is the object of the present invention to provide an endoscope in which it is prevented even more reliably that germs with which an endoscope has come into contact, are transferred to another patient during the next use. Furthermore, an improved cleaning method and an improved cleaning device for cleaning an endoscope shall be provided.

This object is achieved by an endoscope comprising the features of claim 1. An inventive method for cleaning an endoscope is shown in claim 10. An inventive cleaning device for cleaning an endoscope is shown in claim 23.

Advantageous further developments are the subject matter of the dependent claims.

In the invention, an endoscope comprises at least one channel which may be contaminated in use. The channel wall of the at least one channel is formed of a material having properties capable of photocatalysis.

In such an endoscope, a photocatalytic process at the channel wall can be effected by a simple UV treatment, i.e. an exposure to UV light. During this photocatalytic process, radicals are formed from water or air. These radicals, in turn, oxidatively decompose microbiological contaminants.

The channel wall of the at least one channel can be made of plastic to which a photocatalyzable substance is added. In this way, the photocatalyzable substance can be integrated in the material of the channel wall.

The channel wall of the at least one channel can be made of plastic which is compounded with a photocatalyzable substance. During compounding, treatment of plastic takes place by admixing additional substances (fillers, additives, etc.) so as to achieve desired properties. Compounding can take place in an extruder to which the selected additive is added through a feed opening and in which the plastic is uniformly mixed with the additive. In this way, it can be achieved that the photocatalyzable substance is uniformly distributed in the plastic.

Alternatively, the channel inner wall of the at least one channel can be coated with a photocatalyzable substance.

The material having properties capable of photocatalysis may be a material which also has hydrophilic properties. These hydrophilic properties result in that on the surface of the channel inner wall, a water layer is formed by which impuri-

ties can easily be removed. Thus, a self-cleaning, dirt-removing surface is provided which is highly advantageous during endoscopic use.

The photocatalyzable substance can be titanium oxide.

In particular, the photocatalyzable substance can be titanium oxide in anatase modification.

Furthermore, the photocatalyzable substance can be titanium oxide in an anatase-rutile mixture.

A UV stabilizer and/or a thermostabilizer can be added to the photocatalyzable substance.

The channel wall of the working channel can be formed elastically.

The plastic of the at least one channel can be flexible polyether ether ketone or polyamide. Such a channel has the necessary combination of flexibility and rigidity.

The inventive method for cleaning an endoscope comprises the following steps:

- connecting the endoscope to a reprocessing device,
- performing a photocatalytic treatment at least in the at least one channel for the purpose of the decomposition of organic residues on the surface of the channel, and
- rinsing the endoscope.

The photocatalytic treatment can be performed by at least guiding a UV probe through the at least one channel.

The UV probe may be a UV-A probe.

The inventive cleaning device for cleaning an endoscope comprises an integrated UV probe for performing a photocatalytic treatment.

The endoscope can be a duodenoscope. However, the endoscope can also be any other endoscope. Every endoscope has channels which can be designed in accordance with the invention so as to allow microbiological contaminants to be decomposed better.

The above-described aspects of the present invention can be combined appropriately.

Brief description of the drawings

Fig. 1 shows a schematic perspective view of an endoscope head of an embodiment according to the present invention.

Fig. 2 shows a schematic perspective view of a cleaning device according to the present invention.

Fig. 3 schematically shows a detail of the cleaning device.

Fig. 4 schematically shows a detail of an endoscope connected to the cleaning device.

In the following, the present invention is described in detail by means of embodiments while referring to the drawings.

First embodiment

In the following, a first embodiment of the present invention is described while referring to Fig. 1.

First of all, an inventive endoscope head 1 of a duodenoscope is described while referring to Fig. 1.

The endoscope head 1 of the endoscope according to the invention is formed as a cylindrical body and comprises a working channel 11 which extends along the longitudinal direction of the endoscope head 1. Micro-tools for examining, for example, the esophagus, the duodenum, the bile duct, the gall bladder, the pancreatic duct, the pancreas, etc. are guided in the working channel 11.

On the distal side, the endoscope head 1 includes an optical system extension 12 at which an illumination means 17 and a camera 18 are provided in the known manner, with this optical system extension 12 being shown on the right-hand side in Fig. 1. The optical system extension 12 forms a flank portion having a camera and illumination. In other words, the optical system extension 12 is a housing projection with camera and illumination. This housing projection is arranged laterally adjacent to an Albarran lever 2 so that the position and the manipulating movements of the micro-tool are well in the field of vision of the camera 18.

The working channel 11 ends in a portion of the endoscope head 1 which is spaced apart from the distal end where it forms a distal outlet opening 111 of the working channel 11.

Distally of the distal outlet 111 of the working channel 11, the Albarran lever 2 which can be moved relative to the endoscope head 1 is arranged. Thus, the working channel 11 extends in the distal direction towards the Albarran lever 2.

The Albarran lever 2 comprises a tool guiding surface 20 with which a micro-tool guidable through the working channel 11 of the endoscope head 1 can make contact for being deflected in the lateral direction of the endoscope head 1 (in Fig. 1 upwards) so that the micro-tool can, for example, be inserted into a bile duct. The tool guiding surface 20 is arranged opposite to the distal end opening 111 of the working channel 11, see Fig. 1.

The Albarran lever 2 is connected to the endoscope head 1 by a connecting piece 29. The connecting piece 29 can be a pipe section in which a pulling wire an-

chored to the Albarran lever 2 is guided; upon actuation on the proximal side of the endoscope, this pulling wire is pulled and, thus, pivots the Albarran lever 2.

The working channel 11 is formed as a tubular or pipe-shaped element arranged in the endoscope and extending to the distal end of the endoscope head 1. This tubular or pipe-shaped element is elastic so as to allow bendings of the endoscope and follow these bendings. Furthermore, this tubular or pipe-shaped element has a channel wall. The inner circumferential surface of the channel wall faces the micro-tool that is being guided through.

The working channel 11, i.e. the tubular or pipe-shaped element, is made of plastic, such as flexible polyether ether ketone or polyamide. These are merely examples. Other plastics can be used, as well.

A photocatalyzable substance is admixed to the plastic. Thus, a working channel 11 can be formed by producing the tubular or pipe-shaped element by means of extruding the plastic material mixed with the photocatalyzable substance.

As a photocatalyzable substance, titanium dioxide (titanium (IV) oxide) can be used, for example.

Titanium dioxide occurs naturally in the three modifications rutile, anatase and brookite.

Titanium dioxide in rutile modification has conventionally been used e.g. as color additive in plastics technology.

Compared to the rutile modification, titanium dioxide in anatase modification has a higher photoactivity. This property of the anatase modification is, in accordance with the invention, used for photocatalysis (photo-oxidation). Titanium dioxide in anatase modification has so far been used e.g. for wall colors to decompose contaminants, such as nicotine smoke, soot or algae.

During photocatalysis, by exposure to ultraviolet light, cell wall-damaging radicals are formed at the working channel 11, the radicals effectively killing microorganisms. Thus, the working channel 11 designed in accordance with the invention has an anti-microbial effect.

By exposure to energy-rich ultraviolet light, electrons are lifted to a higher energy level and, via oxygen vacancies, can diffuse to the surface of the titanium dioxide where they form, together with molecules, the above-mentioned radicals. In the presence of water or air humidity in the working channel 11, redox reactions occur, during which reactive oxygen species (ROS) can be formed. The resulting radicals are particularly reactive.

Another effect of the titanium dioxide that is used in accordance with the invention is the strong hydrophilic (superhydrophilic) property with extremely small surface contact angles, caused by UV radiation. In this way, no droplets but a thin water layer is formed on the surface in the working channel 11. Thus, the channel inner wall of the working channel 11 becomes a superhydrophilic surface. This hydrophilic property occurs only after activation with UV radiation. In this way, water-wetting properties are imparted to the surface in the working channel 11. This facilitates the removal of dirt particles and harmful microorganisms from the working channel 11.

These photocatalytic effects of the titanium dioxide are now inventively used in the working channel 11. In particular, titanium dioxide in anatase modification is admixed to the plastic for the working channel 11 as an additive; in this way, a so-called compound is formed. During this compounding, a photocatalytic property is imparted to the plastic (e.g. flexible polyether ether ketone or polyamide).

Apart from the admixing of titanium dioxide in anatase modification, a UV stabilizer and/or a thermostabilizer can also be added during compounding of the plastic (e.g. flexible polyether ether ketone or polyamide).

The UV stabilizer protects the plastic from ageing through ultraviolet radiation. The kind of the UV stabilizer is not restricted. Any UV stabilizer can be added to

the plastic as additive, as long as it is suitable for the application in an endoscope.

The thermostabilizer protects the plastic against the harmful effect of high temperatures. The kind of the thermostabilizer is not restricted. Any thermostabilizer can be added to the plastic as additive, as long as it is suitable for the application in an endoscope.

Titanium dioxide in anatase modification is relatively expensive compared to titanium dioxide in rutile modification. For lowering the costs of the added material, titanium dioxide in anatase modification can be diluted by means of titanium dioxide in rutile modification. In this way, the costs can be lowered if titanium dioxide in rutile modification is additionally admixed to the titanium dioxide in anatase modification.

Thus, as an alternative, a mixture of titanium dioxide in anatase modification and titanium dioxide in rutile modification can be admixed to the plastic for the working channel 11. A UV stabilizer and/or a thermostabilizer can be added to this mixture, too.

The channel wall of the working channel 11 therefore has a property capable of photocatalysis. Thus, by the application of ultraviolet radiation, dirt particles and harmful microorganisms can more easily and more efficiently be removed from the working channel 11.

Second embodiment

In the following, a second embodiment of the present invention is described.

In the first embodiment, the working channel 11, i.e. the tubular or pipe-shaped element, is made of plastic (e.g. flexible polyether ether ketone or polyamide) into which titanium oxide is admixed as a photocatalyzable substance.

On the other hand, in the second embodiment, the working channel 11, i.e. the tubular or pipe-shaped element, is made of plastic (e.g. flexible polyether ether ketone or polyamide) without titanium oxide being admixed.

Instead, the channel inner wall of the working channel 11 is coated with the photocatalyzable substance. Any suitable coating method (e.g. immersion) can be applied.

The same titanium oxide compounds as in the first embodiment can be used for the photocatalyzable substance.

The resulting effects and advantages are the same as in the first embodiment.

Third embodiment

In the first embodiment, the working channel 11 is provided with titanium oxide as a photocatalyzable substance. The invention can be applied in each channel of an endoscope.

In the present third embodiment, for example, at least one jet channel 31 is provided with titanium oxide as a photocatalyzable substance.

Furthermore, the third embodiment relates to a specific cleaning device 40 for cleaning an endoscope.

In the following, the cleaning device 40 is described while referring to Figures 2 to 4.

Fig. 2 shows a schematic perspective view of a cleaning device of the present invention.

A cleaning device 40 is formed as a box-like structure and, on its upper side, comprises a known cleaning vessel 41 and a media supply unit 42.

The cleaning vessel 41 is constructed as known from the prior art. An endoscope can be put into the cleaning vessel 41 in the known manner, i.e. in a spiral fashion. In the cleaning vessel 41, the endoscope that has been put therein is, for example, subjected to a photocatalytic treatment, a rinsing process, a disinfection process, etc.

The media supply unit 42 is also provided on the upper side of the cleaning device 40. The media supply unit 42 comprises a plurality of adaptors 421 which can be connected to respective terminals, i.e. at the respective channel openings of an endoscope. In Fig. 2, five adaptors 421 are shown as an example. These adaptors 421 supply air, compressed air, water, rinsing water, disinfectant, etc. to the connected endoscope. Moreover, the media supply unit 42 is constructed such that at each of the adaptors 421, it provides an inlet for a UV probe 80. More precisely, each adaptor 421 has an inlet 4212 for liquid or air media and an inlet 4211 for the UV probe 80. Here, as is shown in Fig. 3, the respective adaptor 421 can have a Y-like structure where the inlet 4212 for liquid or air media and the inlet 4211 for the UV probe 80 open into a common inlet. The common inlet is connected to a supply tube which is connected to the working channel, air/water channel, or jet channel.

The UV probe 80 preferably is a UV-A probe. This UV probe 80 is anchored to an actuating unit (not shown) of the cleaning device 40 via a flexible cable 81. The UV probe 80 may also be integrated otherwise at the cleaning device 40.

Thus, as is shown in Fig. 2, five supply tubes 422 are, for example, provided at the media supply unit 42.

In the present third embodiment, these supply tubes 422 are provided as supply tube 4221 for the jet channel 31, as supply tube 4222 and as supply tube 4223 for the air-water channel 32, as supply tube for a proximal outlet 112 of the working channel 11, and as supply tube for a distal end of the endoscope (e.g. the distal end of the working channel 11 of Fig. 1).

In the following, the application of the cleaning device according to the invention and the cleaning method are described.

After use, an endoscope according to the invention is put into the cleaning vessel 41 of the cleaning device 40, as is shown in Fig. 2. The endoscope plug 3 is connected to the corresponding supply tubes 422. In the present example, the terminal end of the supply tube 4221 is connected to the jet channel 31 of the endoscope plug 3, the terminal end of the supply tube 4222 and the terminal end of the supply tube 4223 are connected to the proximal opening of the air-water channel 32 of the endoscope plug 3, as is shown in Fig. 4. Furthermore, the terminal end of the supply tube for a proximal outlet 112 of the working channel 11 is connected to the proximal end 112 of the working channel 11 at the endoscope control body 35. Moreover, the terminal end of the supply tube for a distal end of the endoscope is connected to the distal end of the working channel 11, as is shown in Fig. 2. The endoscope plug 3 has a cable 30 by which it is connected to the endoscope control body 35.

Now, photocatalytic treatment is carried out. In this regard, the UV probe 80 is advanced in the media supply unit 42 via the respective inlet 4211 of the respective adaptor 421. A propulsion means integrated in the UV probe 80 and actuated via the cable 81 ensures forward movement of the UV probe 80.

In Fig. 4, it is shown how the UV probe 80 is moved forwards in the jet channel 31 of the endoscope plug 3. In accordance with the invention, this jet channel 31 is provided with the photocatalyzable substance, as is described in embodiment 1. As soon as the UV probe 80 has reached the jet channel 31, the UV probe 80 is activated and UV-A radiation is permanently emitted. In the activated state, the UV probe 80 is moved through the entire jet channel 31. At the end of the jet channel 31, the UV probe 80, in the activated state, is again moved back through the entire jet channel 31. Alternatively, the UV probe 80 can only be active during the forward movement.

By emitting the UV-A radiation onto the channel wall of the jet channel 31 provided with the photocatalyzable substance, microbiological contaminants are

oxidatively decomposed by photocatalysis. In this way, organic residues on the channel surface are decomposed. The photocatalytic treatment can be carried out appropriately in all or in selected channels of the endoscope.

Subsequent to the photocatalytic treatment, the endoscope is rinsed.

In the media supply unit 42, a rinsing medium is introduced into the appropriate channel of the endoscope via the respective inlet 4212 of the respective adaptor 421.

Subsequent to the rinsing process, the endoscope is disinfected.

In the media supply unit 42, a disinfectant medium is introduced into the appropriate channel of the endoscope via the respective inlet 4212 of the respective adaptor 421.

Thus, microbiological residues can be removed from the endoscope in a particularly advantageous manner.

Further alternatives

The Albarran lever 2 can be omitted. The invention can also be applied to endoscopes without an Albarran lever.

In the embodiments, the term "titanium oxide" means titanium dioxide (titanium (IV) oxide). The invention is not restricted to titanium dioxide (titanium (IV) oxide). For example, also titanium (II) oxide which is activated by heating can be applied. When heated in air, titanium (II) oxide transforms to other titanium oxides depending on the temperature. Thus, titanium (IV) oxide results when the temperature is 350 °C or higher.

The invention is not restricted to titanium oxides as such, either. Any suitable photocatalyzable substance can be used.

In the embodiments, the working channel 11 or jet channel 31 or air-water channel 32 is provided with titanium oxide as a photocatalyzable substance. The invention is not restricted thereto. For example, the following channels can, in accordance with the invention, be provided with a photocatalyzable substance:

- a water channel which, for example, conducts water for flushing a camera window free;
- a suction channel through which liquids sucked away are conducted into the proximal direction;
- a pulling wire channel through which a pulling wire is guided which actuates an actuatable element (e.g. the Albarran lever);
- an air channel which conducts air into the distal direction;
- a biopsy channel through which biopsy specimens that have been taken are conducted into the proximal direction;
- a combined water-air channel which conducts both water and air;
- a water jet channel as additional rinsing channel.

The above list merely comprises examples and is not to be understood as a limitation. Any channel of the endoscope which may be contaminated in use can be provided with titanium oxide as a photocatalyzable substance.

In the third embodiment, the UV probe 80 is activated when it has reached the corresponding channel, and UV-A radiation is permanently emitted. Alternatively, UV-A radiation can be emitted intermittently. A control can be applied, during which the UV probe 80 is activated when it has reached the corresponding channel so as to emit UV-A radiation for a predetermined period of time. Thereafter, the UV probe 80 is turned off and advanced for a predetermined distance, and is activated again so as to emit UV-A radiation for a predetermined period of time.

The invention can be applied in a duodenoscope. The principle of the invention can also be applied in an ultrasound endoscope and in any other kind of endoscope.

In the embodiments, a UV probe 80 is guided through a channel which comprises a photocatalyzable substance so as to perform a photocatalytic treatment for the

purpose of the decomposition of organic residues on the channel surface. Alternatively, an appropriately strong UV source can be applied from the outside.

The invention can be used in any kind of cleaning device for endoscopes, as long as UV treatment can be applied.

List of reference signs

- 1 endoscope head
- 2 Albarran lever
- 3 endoscope plug
- 11 working channel
- 12 optical system extension
- 17 illumination means
- 18 camera
- 20 tool guiding surface
- 29 connecting piece
- 30 cable of the endoscope plug
- 31 jet channel
- 32 air-water channel
- 35 endoscope control body
- 40 cleaning device
- 41 cleaning vessel
- 42 media supply unit
- 80 UV probe
- 81 cable of the UV probe
- 111 distal outlet of the working channel
- 112 proximal outlet of the working channel
- 421 Y-adaptor of the media supply unit
- 422 supply tubes
- 4211 inlet for UV probe
- 4212 inlet for liquid or air media
- 4221 supply tube for jet channel

4222 supply tube for air for air-water channel

4223 supply tube for water for air-water channel

Claims

1. An endoscope comprising
at least one channel (11, 31, 32) which may be contaminated in use,
wherein the channel wall of the at least one channel (11, 31, 32) is formed
of a material having properties capable of photocatalysis.
2. The endoscope according to claim 1, wherein
the channel wall of the at least one channel (11, 31, 32) is made of plastic
to which a photocatalyzable substance is added.
3. The endoscope according to claim 1, wherein
the channel wall of the at least one channel (11, 31, 32) is made of plastic
which is compounded with a photocatalyzable substance.
4. The endoscope according to claim 1, wherein
the channel inner wall of the at least one channel (11, 31, 32) is coated
with a photocatalyzable substance.
5. The endoscope according to one of claims 1 to 4, wherein
the photocatalyzable substance is titanium oxide.
6. The endoscope according to one of claims 1 to 5, wherein
the photocatalyzable substance is titanium oxide in anatase modification.
7. The endoscope according to one of claims 1 to 5, wherein
the photocatalyzable substance is titanium oxide in an anatase-rutile mix-
ture.
8. The endoscope according to one of claims 1 to 7, wherein
a UV stabilizer and/or a thermostabilizer are added to the photocatalyzable
substance.

9. The endoscope according to one of claims 2 to 8, wherein the plastic is flexible polyether ether ketone or polyamide.
10. A method for cleaning an endoscope comprising at least one channel (11, 31, 32) which may be contaminated in use, wherein the channel wall of the at least one channel (11, 31, 32) is formed of a material having properties capable of photocatalysis, the method comprising the steps of:
 - connecting the endoscope to a reprocessing device (40),
 - performing a photocatalytic treatment at least in the at least one channel (11, 31, 32) for the purpose of the decomposition of organic residues on the surface of the channel, and
 - rinsing the endoscope.
11. The method according to claim 10, wherein the photocatalytic treatment is performed by at least guiding a UV probe (80) through the at least one channel (11, 31, 32) by means of a propulsion means integrated in the UV probe (80).
12. The method according to claim 11, wherein the UV probe (80) is a UV-A probe.
13. The method according to one of claims 10 to 12, wherein the UV probe (80) is moved through the entire channel (11, 31, 32) in the activated state.
14. The method according to one of claims 10 to 12, wherein the UV probe (80) is activated when it has arrived in the corresponding channel so as to emit a UV-A radiation for a predetermined period of time, wherein, thereafter, the UV probe (80) is turned off and is advanced for a predetermined distance and activated again so as to emit a UV-A radiation for a predetermined period of time.
15. The method according to one of claims 10 to 14, wherein

the channel wall of the at least one channel (11, 31, 32) is made of plastic to which a photocatalyzable substance is added.

16. The method according to one of claims 10 to 14, wherein the channel wall of the at least one channel (11, 31, 32) is made of plastic which is compounded with a photocatalyzable substance.
17. The method according to one of claims 10 to 14, wherein the channel inner wall of the at least one channel (11, 31, 32) is coated with a photocatalyzable substance.
18. The method according to one of claims 10 to 17, wherein the photocatalyzable substance is titanium oxide.
19. The method according to one of claims 10 to 18, wherein the photocatalyzable substance is titanium oxide in anatase modification.
20. The method according to one of claims 10 to 18, wherein the photocatalyzable substance is titanium oxide in an anatase-rutile mixture.
21. The method according to one of claims 10 to 20, wherein a UV stabilizer and/or a thermostabilizer is/are added to the photocatalyzable substance.
22. The method according to one of claims 10 to 21, wherein the plastic is flexible polyether ether ketone or polyamide.
23. A cleaning device (40) for cleaning an endoscope comprising at least one channel (11, 31, 32) which may be contaminated in use, wherein the channel wall of the at least one channel (11, 31, 32) is formed of a material having properties capable of photocatalysis, the cleaning device comprising an integrated UV probe (80) for performing a photocatalytic treatment.

24. The cleaning device according to claim 23, wherein the UV probe (80) comprises a propulsion means which is integrated in the UV probe (80) and by which the UV probe (80) can be moved forwards.

FIG. 1

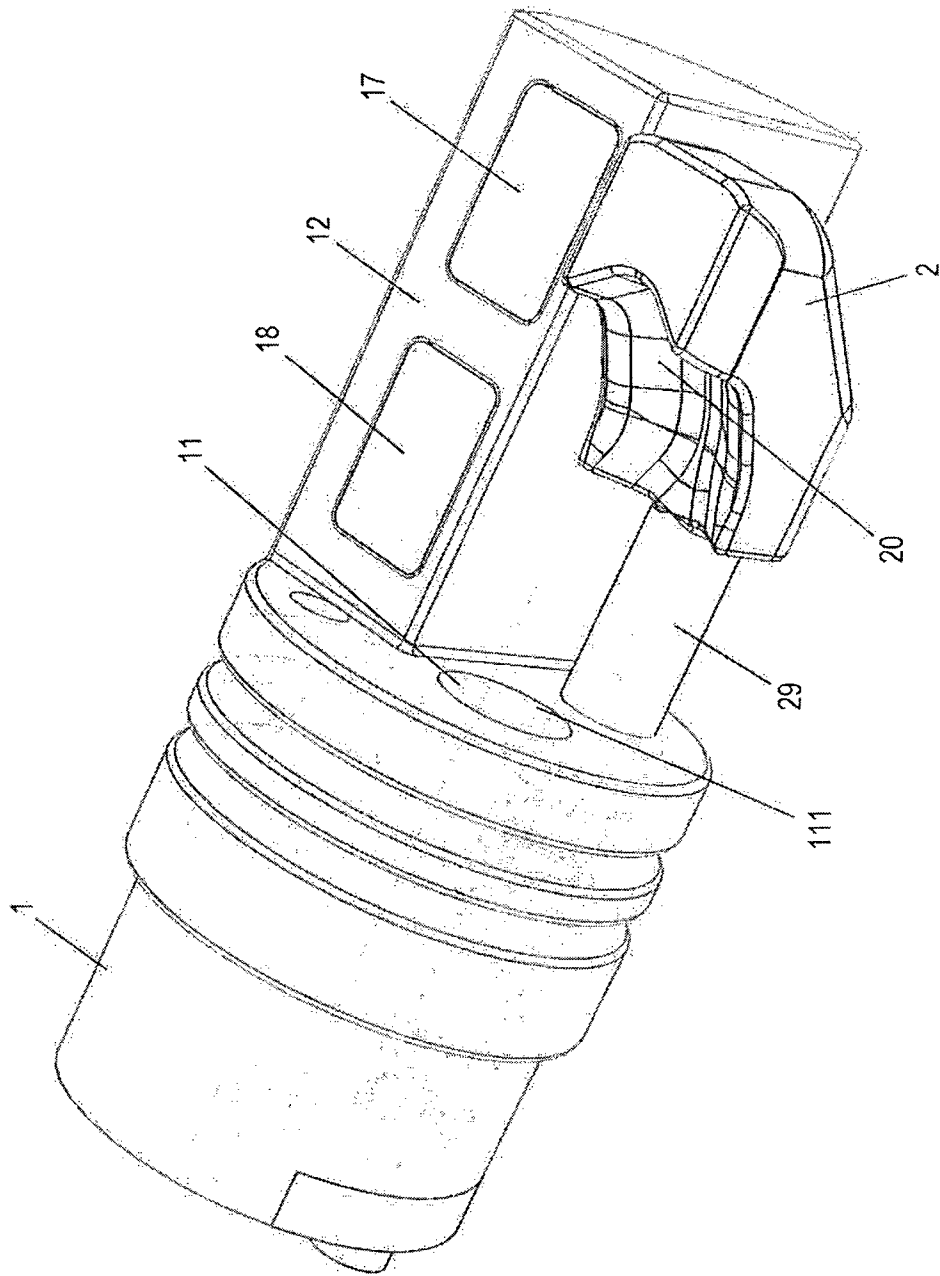


FIG. 2

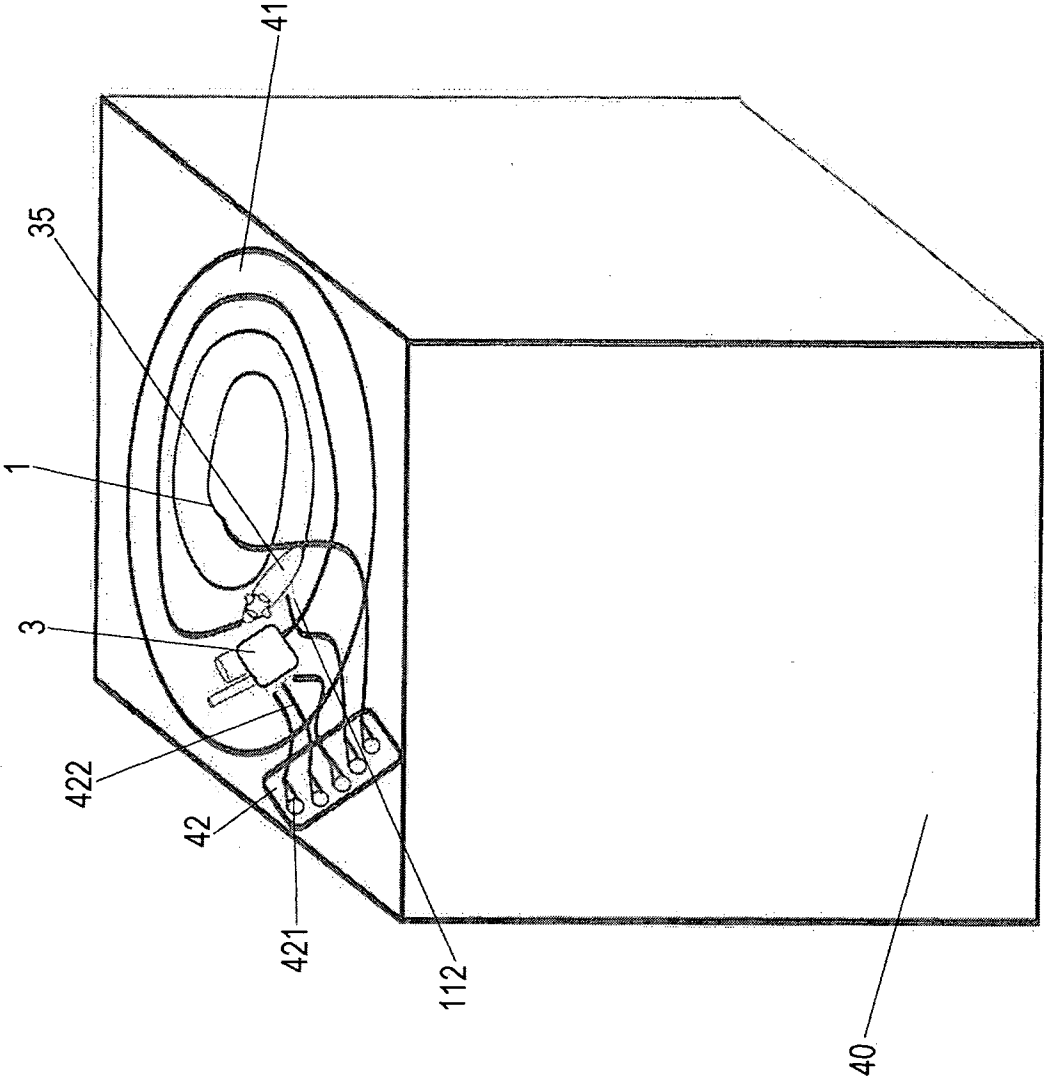


FIG. 3

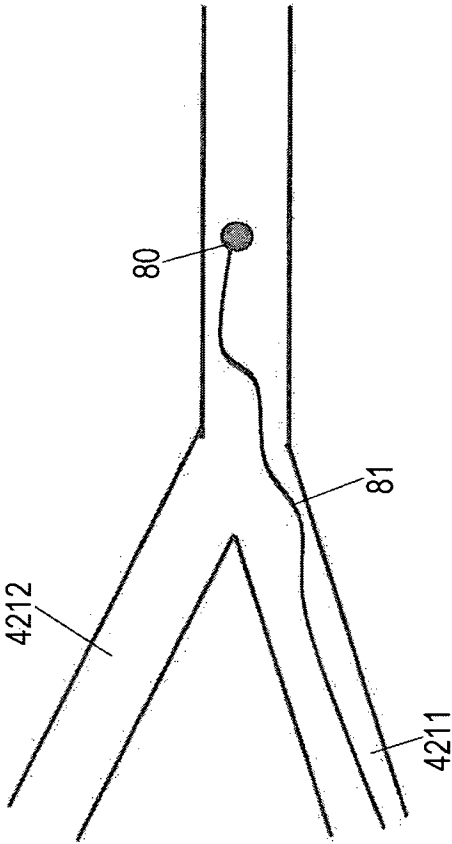
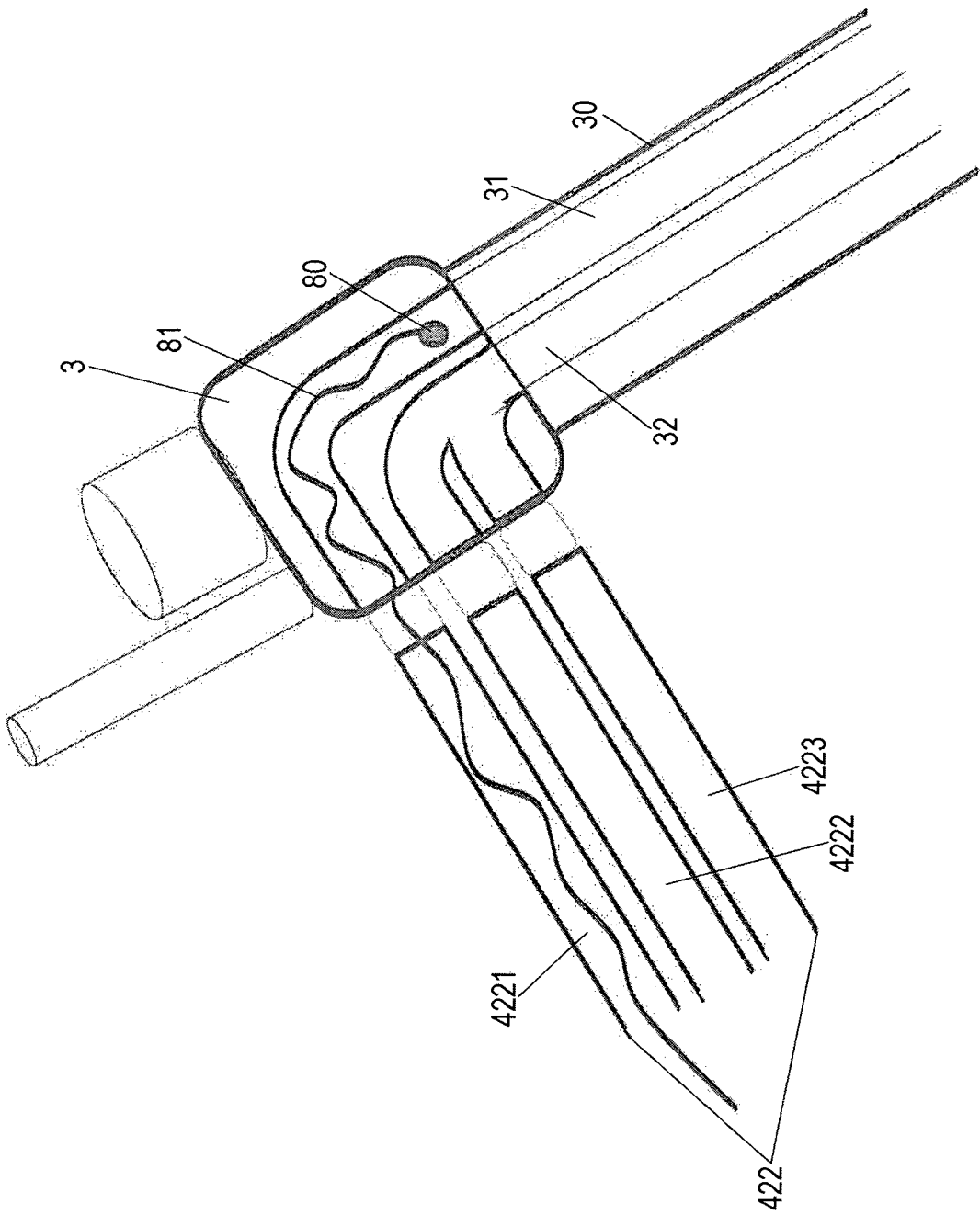


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2018/000095

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61L2/08 A61L29/10 A61L29/12 A61L29/14 A61L2/10
A61L2/232

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)

A61L

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000 139838 A (OLYMPUS OPTICAL CO) 23 May 2000 (2000-05-23)	1,2,4-7, 9,10,15, 17-20, 22,23
Y	paragraph: [0009], [0019], [0028], [0029]; figure: 1	3,16
Y	----- WO 2012/177803 A1 (STANFORD RES INST INT [US]; UNIV LELAND STANFORD JUNIOR [US]; BEDWELL) 27 December 2012 (2012-12-27) page 23: line 26-28; figure: 3 -----	3,16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

"E" earlier application or patent but published on or after the international filing date

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

7 May 2018

Date of mailing of the international search report

10/07/2018

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Nania, Manuela

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/000095

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.:
because they relate to subject matter not required to be searched by this Authority, namely:
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.:

2-7, 9, 15-20, 22(completely); 1, 10, 23(partially)

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

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

1. claims: 2-7, 9, 15-20, 22(completely); 1, 10, 23(partially)

endoscope provided with a channel wall comprising a photocatalytic material, wherein the photocatalytic material comprises titanium dioxide

2. claims: 1, 8, 21(all partially)

endoscope provided with a channel wall comprising a photocatalytic material, and a UV stabiliser

3. claims: 1, 8, 21(all partially)

endoscope provided with a channel wall comprising a photocatalytic material, and a thermostabiliser

4. claims: 11-14, 24(completely); 10, 23(partially)

method for cleaning an endoscope provided with a channel wall comprising a photocatalytic material, by using a UV light which can move through the channel by means of a propulsion device

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2018/000095

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000139838 A	23-05-2000	JP 4294128 B2	08-07-2009
		JP 2000139838 A	23-05-2000

WO 2012177803 A1	27-12-2012	US 2013060188 A1	07-03-2013
		WO 2012177803 A1	27-12-2012
