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Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv))

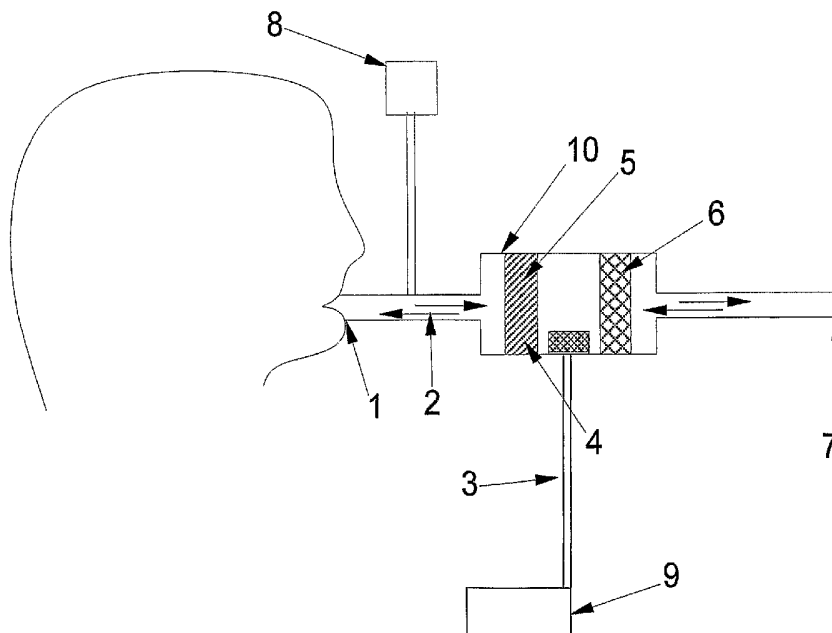
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: IMPROVEMENT OF A DEVCIE FOR RECOVERING ANAESTHETIC AND A METHOD FOR RECOVERING ANAESTHETIC



(57) Abstract: The present invention relates to a device comprising a first unit which is an anaesthetic reflector used for absorbing anaesthetic medium from the gas exhaled by the patient and desorbs anaesthetic medium to the gas inhaled by the patient. According to the invention a second unit is arranged in the system, which distributes the anaesthetic in an even way in the gas inhaled by the patient. The supply of the anaesthetic is placed in between the first and the second unit. The device and the method according to the invention enable the gas inhaled to be correctly monitored by a gas monitor.



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Field of invention:

The present invention relates a device and method for recovering anaesthetic during the use of inhaled anesthetics.

Description of the background art:

Such devices and methods are disclosed through US patents 5044361, 6206002 and 6488028 for instance. The purpose of such devices are to reduce the consumption of anaesthetic preparations when treating a patient.

The US patent 5044361 describes an apparatus and a method where a so-called reflection filter is used in a housing. This reflection filter can be made of zeolite particles in between two filter materials, to avoid that particles are transported to the patient. The anesthetic gas is led into the housing containing the reflection filter in between the patient and the reflection filter with no special means to distribute the gas evenly in the gas stream. The concentration of the anaesthetic given to the patient is very important and in most cases it is necessary to monitor this concentration with a specially designed gas monitor. This is a drawback of the device and method described, as the gas (due to its high density) is not evenly distributed in the gas stream going to the patient and thus the gas sample monitored by the gas monitor will not be the average concentration of anaesthetic given to the patient but will vary from sample to sample due to uneven distribution of the gas in the gas stream.

The US patent 6206002 describes a device containing anaesthetic reflector and a second unit which has the ability to absorb and desorb water. This second unit is placed in between the patient and the reflector. It also describes an anaesthetic supply apparatus connected in between the second unit and the patient. This arrangement gives the same problem to the device as in US 5044028 and the concentration of gas given to the patient is not evenly distributed in the gas stream and thus difficult to monitor correctly. The anaesthetic is mostly described as a gas, but if supplied in liquid form to the device, the problem would be even worse as no gas mixing or distributing arrangement is described.

The US patent 6488028 describes a device where a vaporizing device, called an evaporator, is placed in between the patient and a unit, called absorption-desorption filter, and where the gas passes across the vaporizing device. This evaporator is substantially impervious to the gases flowing to and from the patient and thus takes up a small portion of the cross-section of the housing surrounding it and the gases to and from the patient pass across it. It also describes a first unit described as an absorption filter and which can be laminated to a second unit described as a bacteria filter. The air stream going to the patient is passing through the first unit then the second unit and then across the evaporator before it goes to the patient.

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However, these devices have no means of distributing the anaesthetic in an even way in the gas stream and thus the gas monitor will monitor a varying concentration instead of a stable concentration.

Against this background, the object of the present invention is to alleviate this deficiency in the known devices and methods, and to increase the gas monitoring reliability and performance.

DISCUSSION OF THE PREFERRED EMBODIMENTS

In a particularly preferred embodiment of the invention the supply tube ends close to the surface of either the first unit or the second unit.

This has been found to have the surprising effect of greatly increasing the distribution of the anaesthetic into the gas going to and from the patient. The optimal efficiency obtained with this preferred embodiment is probably a result of capillary transport of the anaesthetic in either unit one or two thus giving an even distribution of the anaesthetic.

In another preferred embodiment, preferably a variation of that described above, both the units, i.e. the anaesthetic reflector and the second unit, are located in a common housing. This simplifies the construction, making it more compact and easily managed. It also ensures that the two units are compatible from the point of view of size.

The supply means for the anaesthetic preparation is preferably arranged in the tube between the first unit and the second unit.

The above and other advantageous embodiments of the device according to the invention are defined in the sub-claims to the main method claim.

Equivalent advantageous embodiments of the method according to the invention are defined in the sub-claims to the main method claim.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following description of preferred embodiments with reference to the accompanying drawings, in which

FIG. 1 illustrates schematically a reflector according to known technology,

FIG. 2 illustrates schematically a preferred embodiment of the present invention, and

FIG. 3-6 illustrates schematically other embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, which illustrates the principle for recovering anaesthetic according to known technology, 1 denotes a patient being treated. The patient 1 is connected via the patient tube 2 to an anaesthetic first unit 6 arranged in a housing 10. This first unit 6 has the ability to absorb and desorb anaesthetic. In the same housing is a second unit 5 is arranged which can be either a filter or a heat and moisture exchanger or both. A supply tube 3 for anaesthetic, connected to a supply of anaesthetic 9, opens into the patient tube at 4. This opening can be

with or without a porous unit which is substantially impervious to the gases, described as arrows, going to and from the patient. This porous unit, if used, can only take up a smaller part of the cross-section of the housing as otherwise the flow of gas to and from the patient will be hindered. The side of the first unit 6 is facing an outlet tube connected to a breathing system 7. This breathing system can be either a connection to the open air, an anesthesia apparatus, a ventilator or any other gas handling system to supply gas and take away gas to and from the patient. 8 is a gas monitor which monitors the gas concentration in the gas supply tube 2. This gas monitor can either work as a mainstream monitor, sensing the gas concentration, going to and from the patient, directly in the patient tube or a side-stream monitor sensing the gas concentration in a sample pumped from the patient tube. The function of this kind of gas monitors are well-known to those skilled in anesthesia or intensive care. The first unit 6 can be made of different materials like e.g. woven active carbon.

The device according to the invention illustrated in an embodiment shown in FIG. 2 is constructed in an equivalent manner to that shown in FIG. 1. Accordingly, the device shown in FIG. 2 illustrates a patient 1 connected via the patient tube 2 to first unit 6 arranged in a housing 10. This first unit 6 has the ability to absorb and desorb anaesthetic. In the same housing is a second unit 5, which can be either a filter or a heat and moisture exchanger or both, is arranged. The second unit 5 is highly porous and have a low gas flow resistance. A supply tube 3 for anaesthetic, connected to a supply of anaesthetic 9, opens into the patient tube at 4. This opening can be with or without a porous unit which is substantially impervious to the gases, described as arrows, going to and from the patient. This porous unit, if used, can only take up a smaller part of the cross-section of the housing as otherwise the flow of gas to and from the patient will be hindered. The side of the first unit 6 is facing an outlet tube connected to a breathing system 7. This breathing system can be either a connection to the open air, an anesthesia apparatus, a ventilator or any other gas handling system to supply gas and take away gas to and from the patient. 8 is a gas monitor which monitors the gas concentration in the gas supply tube 2. The arrangement with the second unit being placed in between the anaesthetic supply opening 4 and the patient results in the good distribution of the anaesthetic in the gas going to the patient and monitored by the gas monitor.

In FIG. 2 both unit one and unit two are shaped as a cylindrical plates with axial through-flow. However, it will be understood that the shape is of minor significance. One or both of these units may be annular in shape, for instance, with radial through-flow direction, in which case the arrangement according to FIG. 2 is also advantageous from an economic manufacturing point of view as it contains few components but still obtains a very good distribution of anaesthetic.

The device according to FIG. 3 incorporates the same components designated by the same reference numerals shown in FIG. 2 but differs from that in FIG. 2 in that the porous unit at the opening 4 is formed as a cross giving an even better anaesthetic distribution in the gas going to the patient and monitored by the gas monitor 8.

The device according to FIG. 4 incorporates the same components designated by the same reference numerals shown in FIG. 3 but differs from that in FIG. 3 in that the porous unit at the opening 4 is formed as a cylindrical piece, close to one of the sides of the housing.

The device according to FIG. 5 incorporates the same components designated by the same reference numerals shown in FIG. 2 but differs from that in FIG. 2 in that the opening 4 is touching the surface of unit two 5. This results in a good spreading of the anaesthetic inside the unit two 5 and thus a good distribution in the gas going to the patient and monitored by the gas monitor 8.

The device according to FIG. 6 incorporates the same components designated by the same reference numerals shown in FIG. 2 but differs from that in FIG. 2 in that the second unit 5 is made of two layers of material 5a and 5b laminated together with the opening 4 is touching the surfaces in between 5a and 5b. This results in a very good spreading of the anaesthetic inside the unit two 5 and thus a good distribution in the gas going to the patient and monitored by the gas monitor 8.

Although only a few embodiments of the device according to the invention have been described above and shown in the drawings it should be understood that the invention is not limited to these embodiments, but only by the limitations defined in the appended claims.

What is claimed is:

1. A device for recovering anaesthetic during the use of inhaled anesthetics, said device comprising a patient tube for connecting to a patient, a first unit capable of absorbing and desorbing anaesthetic preparations, a second unit capable of filtering a gas, both placed in a gas stream that goes to and from a human being or animal, most of this air stream passing through the first and second unit, and a tube which ends in between the first and the second unit and which supplies anaesthetic agent.
2. A device as claimed in claim 1, wherein said first unit and the second unit are arranged in a common housing.
3. A device as claimed in claim 2, wherein the tube is passing through the housing to the second unit.
4. A device as claimed in claim 1, where the first and the second unit are placed to touch each other.
5. A device as claimed in claim 2 where the first and the second unit are placed to touch each other.
6. A device as claimed in claim 3 where the first and the second unit are placed close to each other.
7. A device as claimed in claim 1, where the first and second unit are made of the same material.
8. A device as claimed in claim 1, where the first and second material are made of different materials.
9. A device as claimed in claim 7 where the first and second unit are made of activated carbon fibers.
10. A device as claimed in claim 8 where the first or the second unit is made of activated carbon fibers.
11. A device as claimed in claim 7 where the first and second unit are made of a porous material capable of filtering most of the gases going back and forth to a human being or animal.
12. A device as claimed in claim 8 where the first and second unit are made of porous materials both capable of filtering most of the gases going back and forth to a human being or animal.
13. A device as claimed in claim 1 to 12 where the tube is ending on one of the edges of the second unit.
14. A device as claimed in claim 1 to 12 where the tube is ending inside of the second unit.
15. A device as claimed in claim 1 to 12 where the tube is supplying liquid anesthetic.
16. A device as claimed in claim 1 to 12 where the tube is supplying gaseous anesthetic.

17. A device as in claim 1 where the second unit is comprising of two or more laminated layers to form one unit.
18. A device as in claim 17 where the tube is ending in between the layers.
19. A device as in claim 1 to 18 where the tube is also ending in a porous element through which the anaesthetic is transported and the gas going to and from the patient is flowing across at least one surface of the element.
20. A device as in claim 19 where the porous element is made to distribute the anaesthetic evenly in the air stream going to and from the patient.
21. A method of recovering anaesthetic in an anesthesia circuit during the use of inhaled anesthetics, wherein the gases inhaled and exhaled by a patient are directed through a first unit for absorption of anaesthetic in the gas exhaled and desorption of anaesthetic to the gas inhaled, said method comprising providing a second unit in series with said first unit along said anesthesia circuit through which most of the gases are passing, a tube ending in between the first and the second unit and supplying anaesthetic to the gas to be inhaled in a patient along the anesthesia circuit.

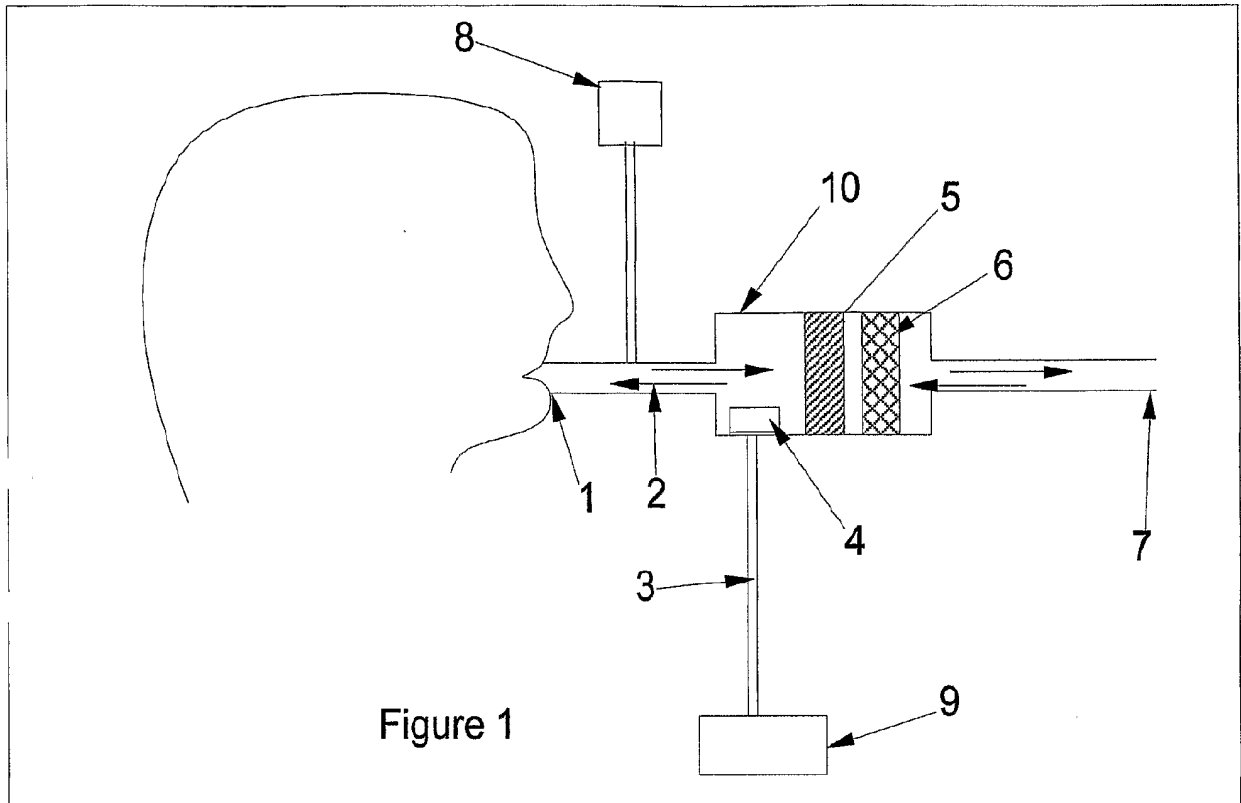


Figure 1

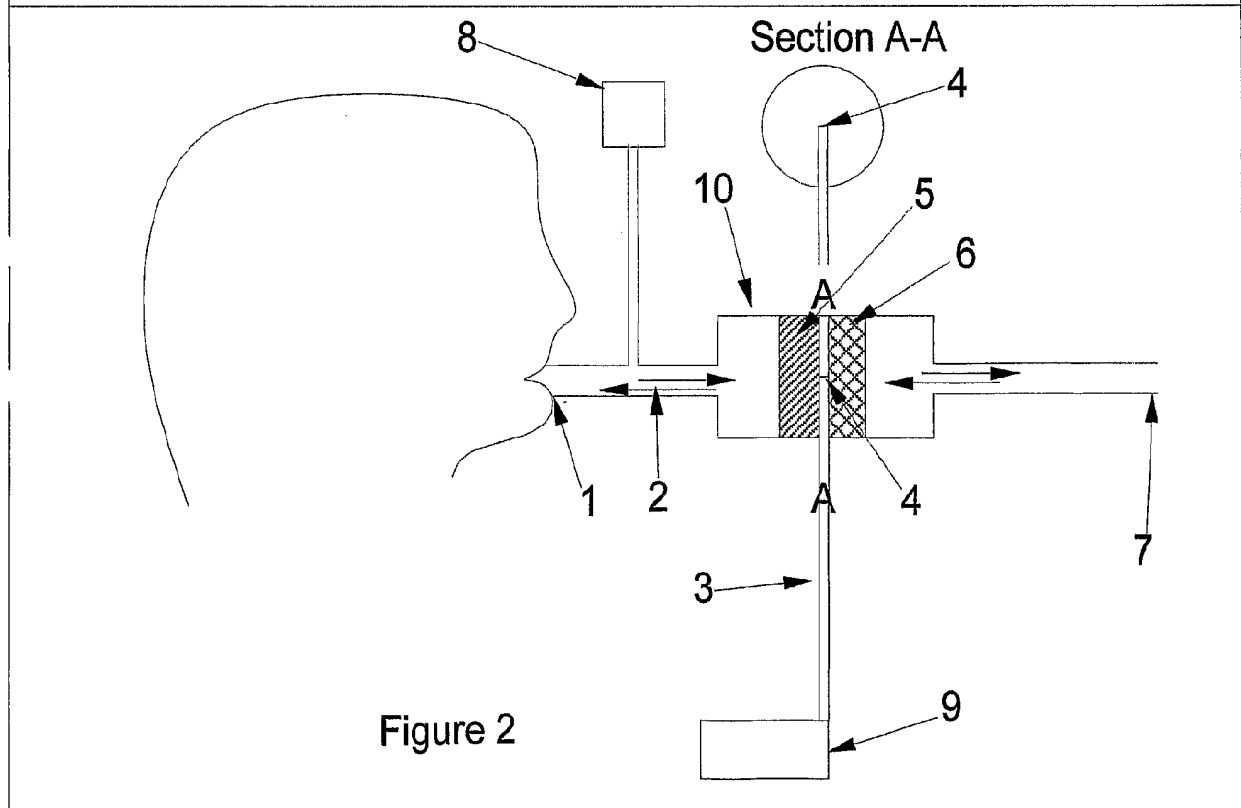


Figure 2

2/3

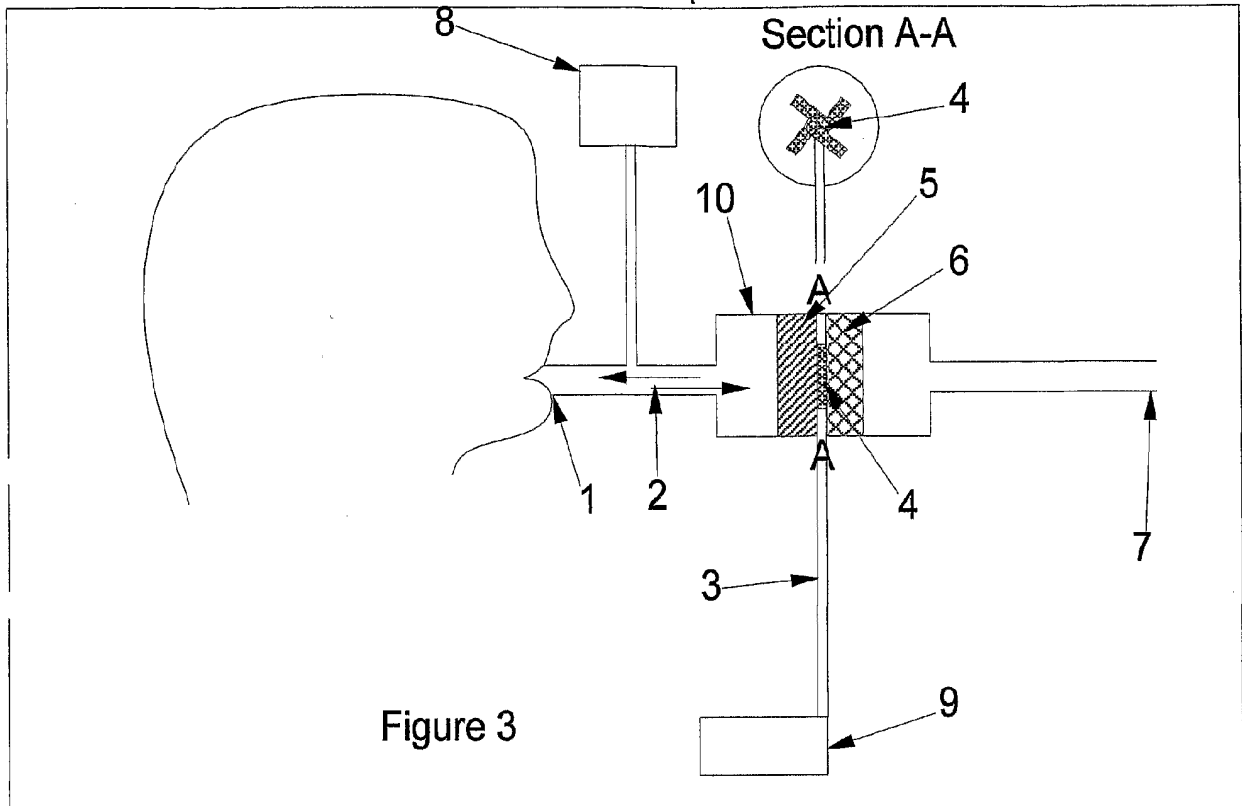


Figure 3

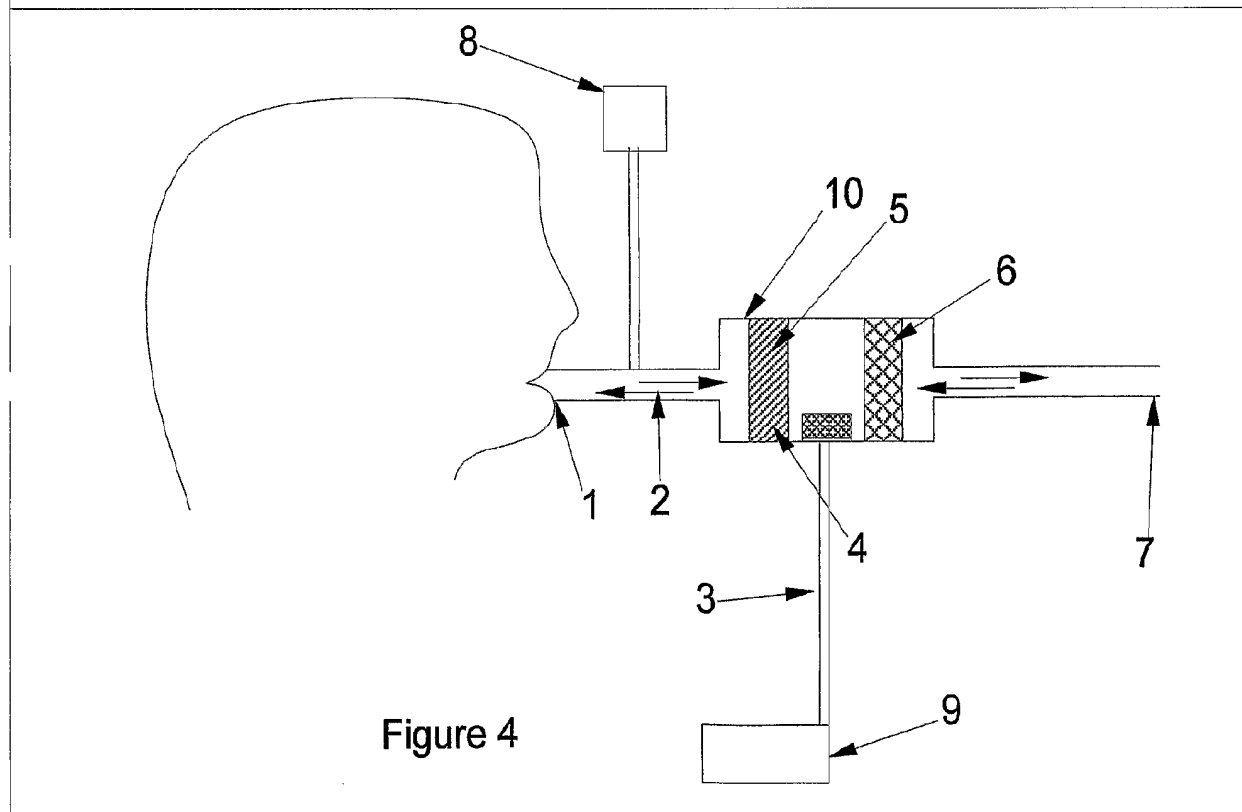
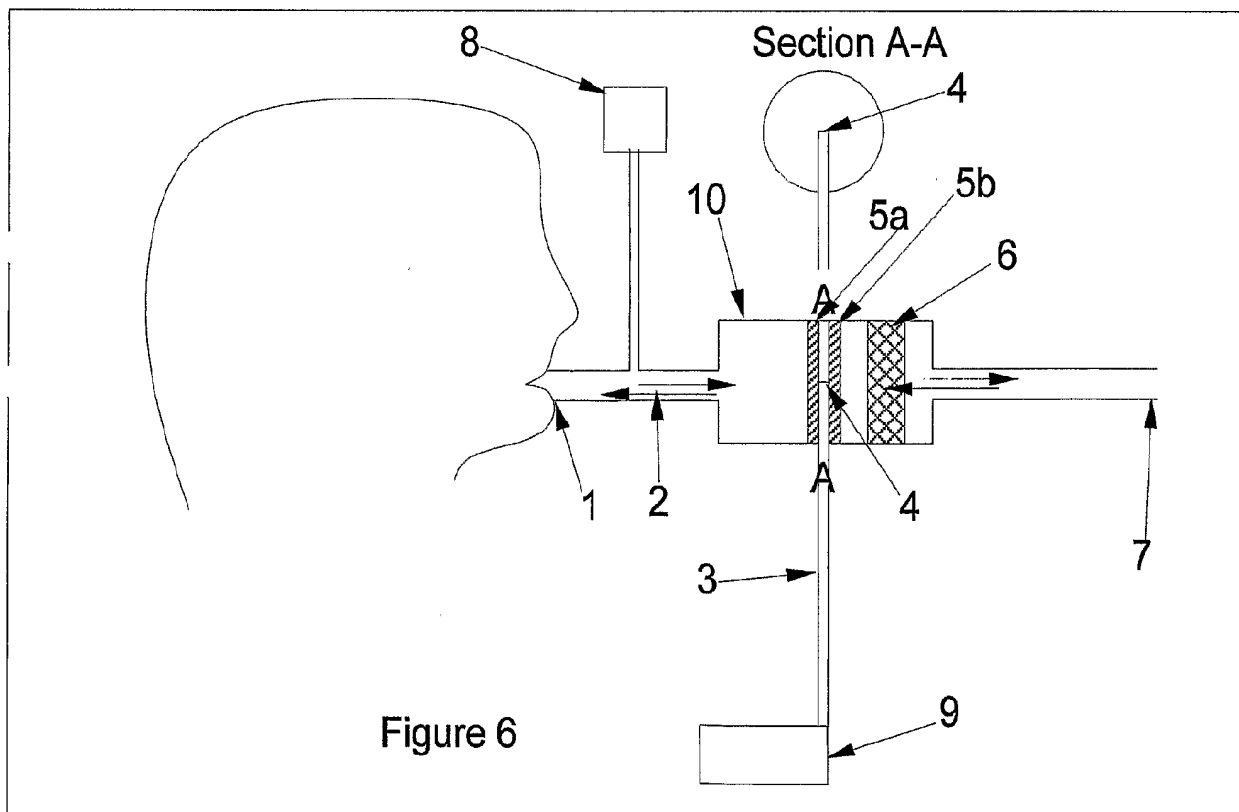
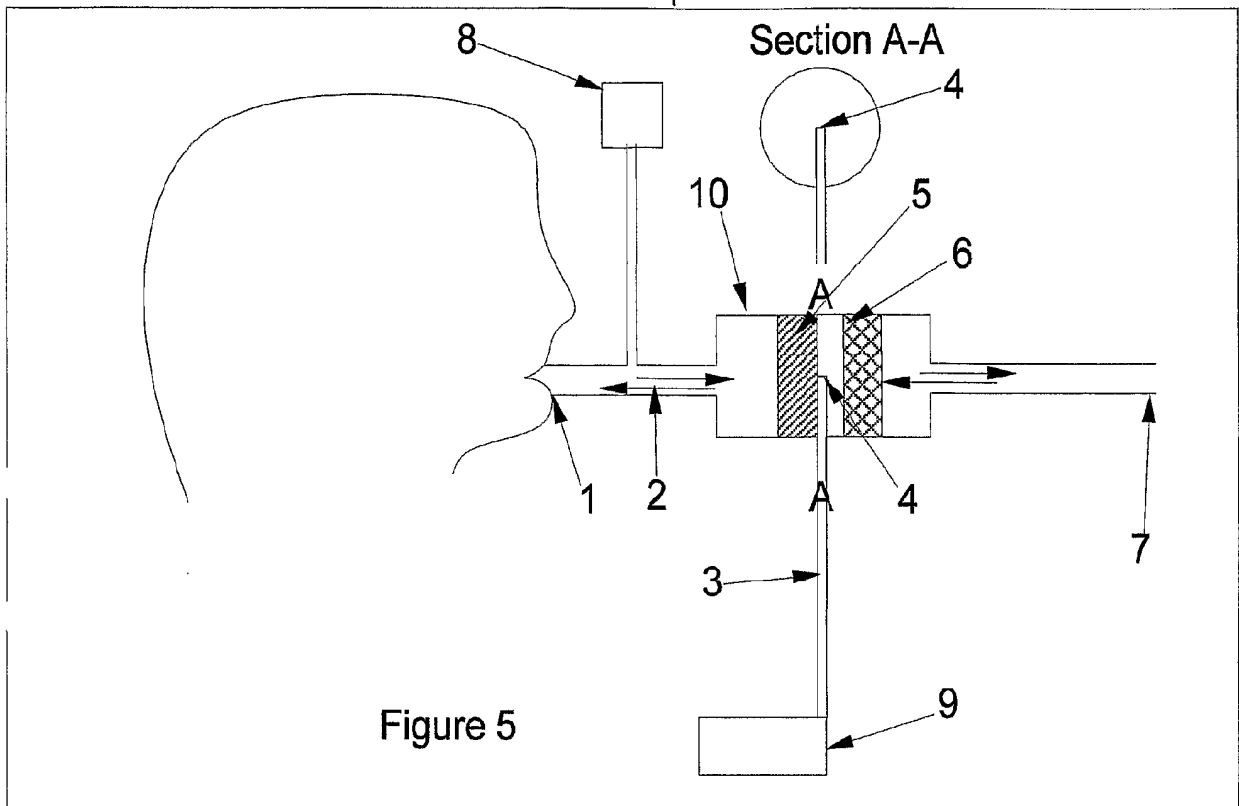


Figure 4

3/3



PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference ACAFILTER	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/SE 2005/001576	International filing date (<i>day/month/year</i>) 21 October 2005	(Earliest) Priority Date (<i>day/month/year</i>) 25 October 2004
Applicant Lambert, Hans		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- the international application in the language in which it was filed
- a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. **Certain claims were found unsearchable** (see Box No. II)

3. **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

**Improvement of a Device for Recovering Anaesthetic and
a Method for Recovering Anaesthetic**

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the drawings to be published with the abstract is Figure No. 4

- as suggested by the applicant.
- as selected by this Authority, because the applicant failed to suggest a figure.
- as selected by this Authority, because this figure better characterizes the invention.

b. none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 2005/001576

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: A61M

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6206002 B1 (LAMBERT), 27 March 2001 (27.03.2001), column 2, line 44 - column 3, line 30 --	1-13,15-17, 19,20
A	US 5044361 A (WERNER ET AL), 3 Sept 1991 (03.09.1991), column 2, line 1 - line 48 --	1-13,15-17, 19,20
A	EP 0455049 A1 (SIEMENS ELEMA AB), 6 November 1991 (06.11.1991), column 3, line 40 - column 5, line 52 --	1-13,15-17, 19,20

 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

16 January 2006

Date of mailing of the international search report

19-01-2006

Name and mailing address of the ISA/

Swedish Patent Office

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INTERNATIONAL SEARCH REPORT

International application No. PCT/SE 2005/001576

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6488028 B1 (LAMBERT), 3 December 2002 (03.12.2002), column 2, line 12 - column 3, line 21 --	1-13,15-17, 19,20
A	EP 0972534 A2 (SIEMENS-ELEMA AB), 19 January 2000 (19.01.2000), column 2, line 19 - column 3, line 46 -- -----	1-13,15-17, 19,20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2005/001576

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.: 14, 18, 21
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:

The description of the invention in claims 14 and 18 contradicts the description of the invention according to

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:

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 fee, this Authority did not invite payment of any additional fee.
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.:

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2005/001576

Box II.2

claim 1. According to claim 1 the tube ends between the first and the second unit. According to claims 14 and 18 the tube ends inside the second unit.

Claim 21 is not clear and concise since the invention is defined by constructional features (Article 6). A method claim should be defined by activities.

Claims 14,18 and 21 are therefor so unclear that no meaningful opinion could be formed.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ SE2005/001576

INTERNATIONAL PATENT CLASSIFICATION (IPC):

A61M 16/01 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

26/11/2005

International application No.
PCT/SE 2005/001576

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				JP	4227270	A	17/08/1992
				SE	9001581	D	00/00/0000
				US	5471979	A	05/12/1995

INTERNATIONAL SEARCH REPORT
Information on patent family members

26/11/2005

International application No.
PCT/SE 2005/001576

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				EP	0855924	A,B	05/08/1998
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