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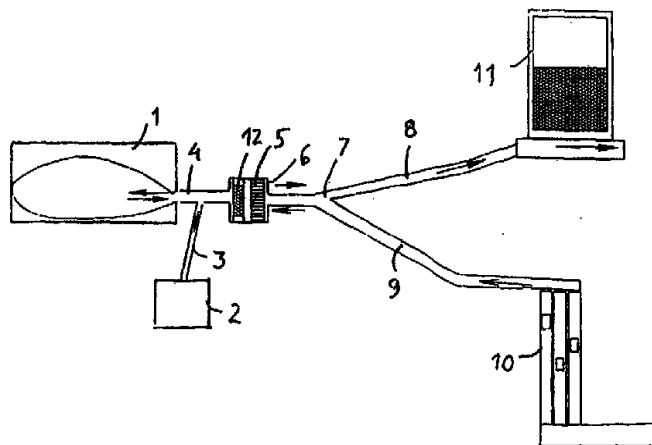


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(54) Title: A DEVICE AND METHOD FOR RECOVERING ANAESTHETIC DURING THE USE OF INHALED ANAESTHETICS



(57) Abstract

The invention relates to a device and a method for recovering anaesthetic during the use of inhaled anaesthetics. An anaesthetic reflector (5) is used which absorbs 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 moisture-heat exchanger (12) is arranged in the system which, in an equivalent manner, recovers water vapour from the gas exhaled to the gas inhaled. The moisture-heat exchanger (12) is preferably located between the anaesthetic reflector (5) and the patient (1). The device and the method according to the invention enable the gas inhaled to be moistened to prevent dehydration, as well as increasing the efficiency of the reflector (5).

A DEVICE AND METHOD FOR RECOVERING ANAESTHETICS DURING THE USE OF INHALED ANAESTHETICS

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

10 Such devices and methods are disclosed through EP-A-0 496 336, SE-B 459 155 and SE-B-515 217, for instance. The purpose of such a device is to reduce the consumption of anaesthetic preparations when treating a patient, since preparations such as Fluothane-(2-bromine-2-chlorine-1,1,1-trifluorethane) are often relatively expensive. According to older, conventional technology the anaesthetic preparation is conducted away to the surroundings together with the air exhaled and is therefore lost, as well as contaminating the surroundings.

15 However, these devices are unable to compensate the loss of moisture upon exhalation. It would also be desirable to be able to improve the reflection efficiency, i.e. the proportion of exhaled anaesthetic which is absorbed and returned to the gas inhaled.

20 The above discussion of documents, acts, materials, devices, articles and the like is included in this specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia before the
25 priority date of each claim of this application.

Against this background, it is an aim of the present invention to alleviate this deficiency in the known devices and methods, and to increase the reflection efficiency.

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According to a first aspect of the present invention there is provided a device for recovering anaesthetic during the use of inhaled anaesthetics, said device being connectable to a patient via a patent tube, and including a first unit capable of absorbing and desorbing anaesthetic preparations, a second unit arranged in



series with the first unit between the first unit and the patient tube and being capable of absorbing and desorbing water vapour, wherein a supply means for anaesthetic preparations is connected to the patient tube between said second unit and the patient, said supply means including an anaesthetic vaporizer arranged in the patient tube.

According to a second aspect of the present invention there is provided a method of recovering anaesthetic during the use of inhaled anaesthetics, wherein the gases inhaled and exhaled by a patient are caused to pass a unit for absorption of anaesthetic in the gas exhaled and desorption of anaesthetic to the gas inhaled, wherein the gases breathed are also caused to pass a unit for absorption of water vapour in the gases exhaled and desorption of water vapour in the gases inhaled, and wherein anaesthetic is supplied in the gas to be inhaled in a patient tube between said units and the patient, which anaesthetic is supplied in liquid form to the patient by a connector tube and is caused to vaporize therein by means of an anaesthetic vaporizer in the tube.

Thanks to the second unit with the ability to absorb and desorb water vapour, i.e. a moisture-heat exchanger, which is arranged in series with the first unit, i.e. the anaesthetic reflector, both anaesthetic and water vapour in the gas exhaled will be recovered since each component is absorbed in



a separate unit. During inhaling, the anaesthetic preparation and water vapour recovered are released and desorbed out in the gases breathed, which will thus re-use a part of the anaesthetic preparation, as well as having part of its moisture content restored. The use of this device and
5 this method thus enables a lower consumption of anaesthetic preparation than has been possible with known technology, as well as eliminating the need for any special supply of water vapour in order to avoid the risk of dehydration.

10 In a particularly preferred embodiment of the invention the second unit is situated between the patient and the first unit.

This has been found to have the surprising effect of greatly increasing the proportion of anaesthetic preparation recovered. It has been ascertained
15 that the reflection efficiency is considerably increased with such an arrangement in comparison with other alternatives and even in comparison with a device without any moisture-heat exchanger at all. The optimal efficiency obtained with this preferred embodiment is probably a result of the reduced moisture content in the gas exhaled before it enters the anaes-
20 thetic reflector, increasing the ability of the latter to absorb and desorb anaesthetic. A greater proportion of this will therefore be returned to the patient in the gas inhaled.

In another preferred embodiment, preferably a variation of that described
25 above, both the units, i.e. the anaesthetic reflector and the moisture-heat exchanger, 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.

30 The supply means for the anaesthetic preparation is preferably arranged in the tube between the patient and the air-heat exchanger, which offers maximum utilization of the anaesthetic preparation as well as more reliable control of dosages. In this case the means suitably comprises a vaporizer arranged in the patient tube. The advantages of such an arrangement
35 are further described in patent application SE-B-459 155 mentioned above.



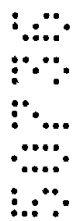
AMENDED SHEET

The above and further features of the present invention will be more fully appreciated from the following detailed description of preferred embodiments of the invention with reference to the accompanying drawings, in which:

5 Figure 1 illustrates schematically a reflector according to known technology,

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

10 Figure 3 illustrates schematically a second embodiment of the present invention.



15 In Figure 1, which illustrates the principle for recovering anaesthetic according to known technology, 101 denotes a patient being treated with anaesthetic or an apparatus simulating the respiratory organs of a patient. The patient 101 is connected via the patient tube 104 to an anaesthetic reflector 105 arranged in a housing 106. A supply tube 103 for anaesthetic, connected to a supply 102 of anaesthetic, opens into the patient tube 104. The side of the reflector 105 facing away from the patient is connected via a Y-connection 107 to an outlet tube 108 for exhaled gas and an inlet tube 109 for inhaled gas, these being connected to a gas pump 111 and a gas supply device 110, respectively.



20 The reflector 105 consists of a material having the ability to absorb or desorb anaesthetic, e.g. woven active carbon. Measurements indicate that such a device is able to return 70% of the anaesthetic exhaled.



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The device according to the invention illustrated in an embodiment shown in Figure 2 is constructed in an equivalent manner to that shown in Figure 1, with the difference that a moisture-heat exchanger 12 which absorbs and desorbs the moisture in the gases breathed is arranged in the housing 5 6 on the side of the anaesthetic reflector facing the patient. Thanks to this arrangement the proportion of anaesthetic recovered is increased to 80%. At the same time about 80% of the water vapour exhaled is also returned to the patient. As is clear from the Figure, the reflector 5 has a larger cross-sectional area than the moisture-heat exchanger, which has proved 10 to be advantageous.

In Figure 2 both the moisture-heat exchanger 12 and the anaesthetic reflector 5 are shaped as a cylindrical plate with axial through-flow. However, it will be understood that the shape is of minor significance. One or 15 both of these units may be annular in shape, for instance, with radial through-flow direction, in which case they may be arranged radially one outside the other.

The device according to Figure 3 differs from that in Figure 2 in that the 20 anaesthetic preparation is supplied in liquid form through the tube 3 to the patient tube 4 and is only then vaporized in the patient tube via an anaesthetic vaporizer 13. This may be of a type described in more detail in the Swedish patent application No. 9601028-5 and offers certain advantages which are described in said patent application.

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AMENDED SHEET

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A device for recovering anaesthetic during the use of inhaled anaesthetics, said device being connectable to a patient via a patient tube, and including a first
5 unit capable of absorbing and desorbing anaesthetic preparations, a second unit arranged in series with the first unit between the first unit and the patient tube and being capable of absorbing and desorbing water vapour, wherein a supply means for anaesthetic preparations is connected to the patient tube between said second unit and the patient, said supply means including an anaesthetic vaporizer
10 arranged in the patient tube.
2. A device as claimed in claim 1, wherein said first unit and said second unit are arranged in a common housing.
- 15 3. A device as claimed in claim 1 or claim 2, wherein said first unit has a larger area transverse to the direction of flow of the gas than said second unit.
4. A method of recovering anaesthetic during the use of inhaled anaesthetics, wherein the gases inhaled and exhaled by a patient are caused to pass a unit for
20 absorption of anaesthetic in the gas exhaled and desorption of anaesthetic to the gas inhaled, wherein the gases breathed are also caused to pass a unit for absorption of water vapour in the gases exhaled and desorption of water vapour in the gases inhaled, and wherein anaesthetic is supplied in the gas to be inhaled in a patient tube between said units and the patient, which anaesthetic is supplied
25 in liquid form to the patient by a connector tube and is caused to vaporize by means of an anaesthetic vaporizer in the patient tube.
5. A method as claimed in claim 4, wherein water vapour in the gases exhaled is absorbed before anaesthetic in the gas exhaled is absorbed, and
30 anaesthetic is desorbed to the gases inhaled before water vapour is desorbed to the gases inhaled.
6. A device as claimed in claim 1 substantially as herein described with reference to the accompanying drawings.



7. A method as claimed in claim 4 substantially as herein described with reference to the accompanying drawings.

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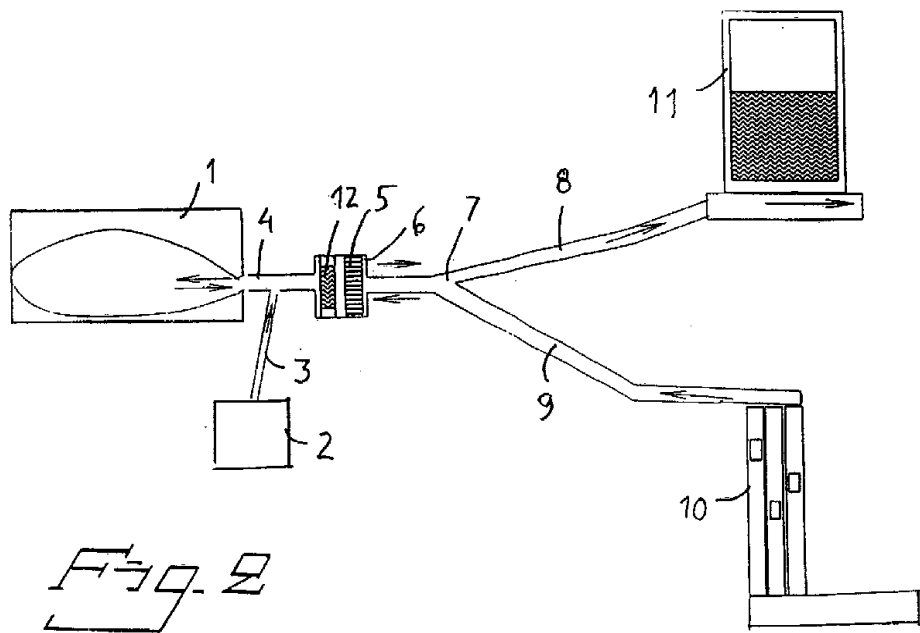
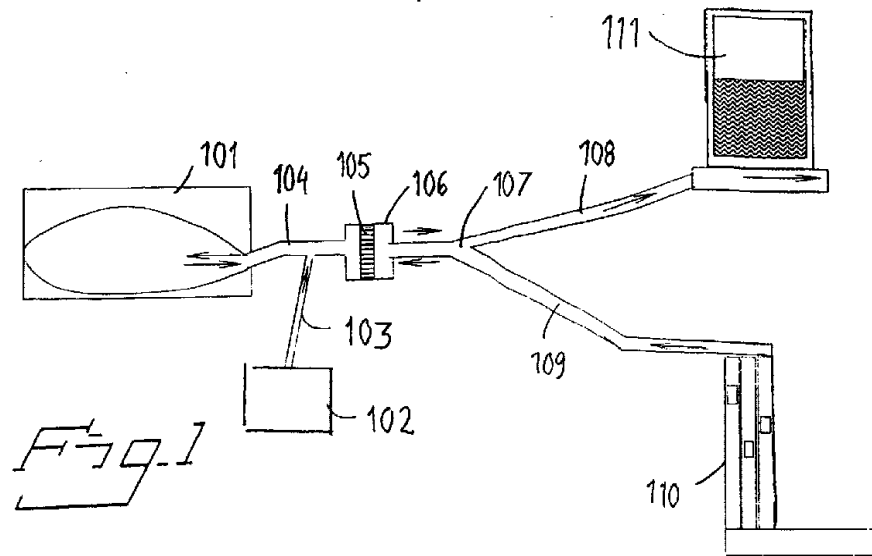
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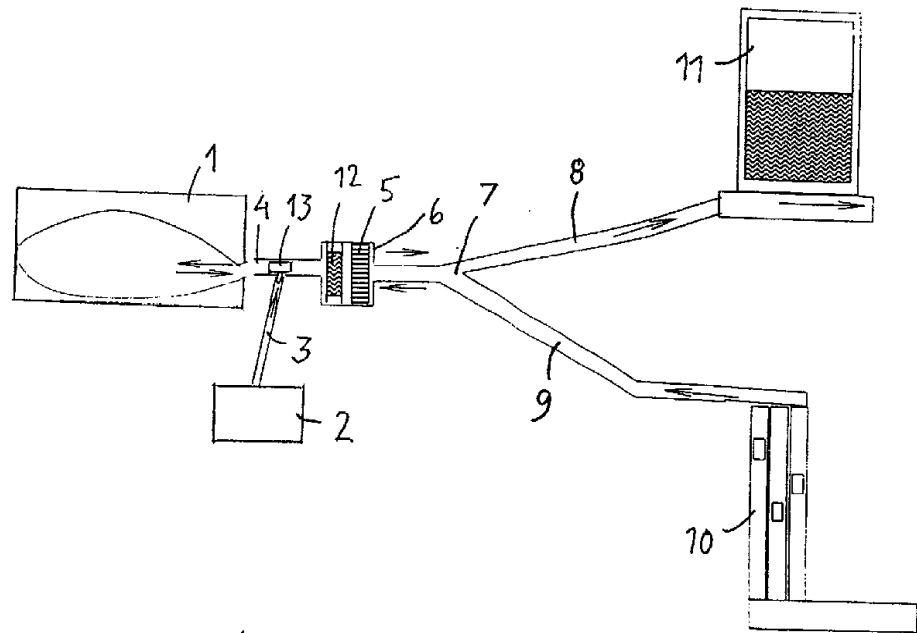


Fig. 3