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(71) Applicant *(for all designated States except US)*: **MAERSK MEDICAL A/S** [DK/DK]; Unovej 1, DK-3390 Hundested (DK).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **SVENDSEN, Gunnar, N.** [DK/DK]; Dalvej 14, DK-4040 Jyllinge (DK).

(74) Agent: **HOFMAN-BANG A/S**; Hans Bekkevolds Allé 7, DK-2900 Hellerup (DK).

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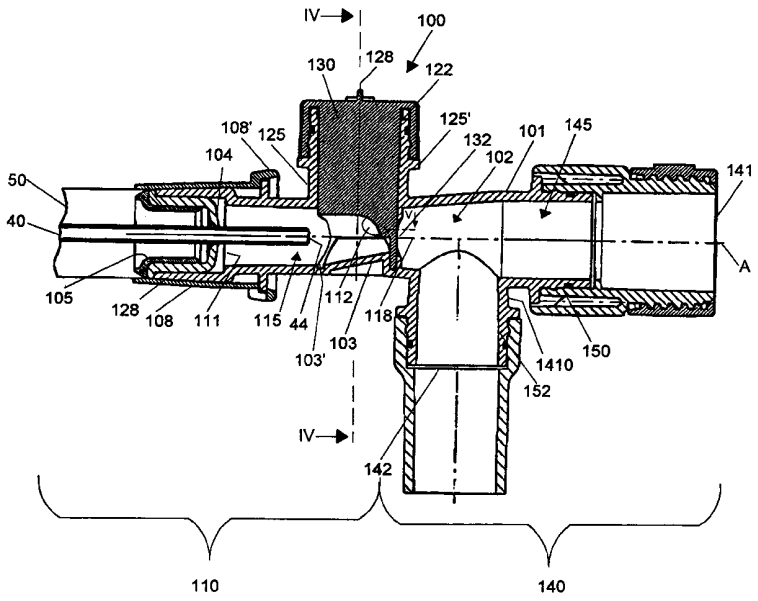
Published:
— *with international search report*

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: A MANIFOLD



(57) Abstract: The invention relates to a manifold (100) for a closed system (1) for endotracheal ventilation and aspiration of a patient, having a first section (115) and a second section (145), an opening (112) configured for allowing influx of a flushing medium to the first section (115), and a passage (118) configured for allowing advancement of the catheter from the first section (115) and into the second section (145). The invention is characterised by a valve body (132) arranged interiorly of the first section (115) and configured for optionally allowing blocking of the passage (118) in a first position and of the opening (112) in a second position.

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A manifold

The present invention relates to a manifold of the kind featured in the preamble to claim 1, and a system for endotracheal ventilation of a patient as featured in claim 14.

For instance, international patent application No WO98/33536 and US patent No 5,487,381 teach various types of manifolds.

US patent No 5,354,267, by reference incorporated herein in its entirety, discloses a manifold of the kind described in the preamble to claim 1. This manifold suffers from a number of inconveniences as regards manufacturing techniques and use. Among others, the prior art manifold does not enable supply of a fluid to the patient via the manifold while simultaneously the patient's respiratory tracts are sucked by means of a catheter advanced through the manifold. Thus, the invention aims to provide an improved manifold that can be manufactured in an inexpensive manner and that allows adjustment of a wide variety of operating states.

This is obtained as featured in the characterising part of claim 1. When desired, the described configuration of the valve body thus enables flushing of a first section of the manifold chamber without significant risk of the flushing fluid unintentionally penetrating into the second section of the manifold chamber that is in direct communication with the patient. Besides the invention enables an embodiment in which it is possible, in one of its operating states, to block the manifold relative to the supply source for the flushing fluid whereby the risk of unintentional influx of flushing fluid is to a large extent prevented when suction is performed on the patient's respiratory tracts.

By the embodiments featured in claims 2 and 3, the valve body can be caused to cooperate with the manifold chamber in a particularly simple manner for blocking the respective openings.

Claims 5 and 7 feature advantageous embodiments that allow supply of fluid to the patient while simultaneously a suction operation is performed by means of the catheter.

By the embodiment featured in claim 10 the manifold can be constructed by means of a number of separate components that are connected to each other. Also, and as featured in claim 11, the manifold may comprise a peripheral surface area and a bushing, whereby shrouding for the catheter can be secured to the manifold.

The invention will now be explained in further detail with reference to the embodiments shown in the drawing. The drawing shows the following:

Figure 1 shows a part of a system for endotracheal ventilation of a patient;

Figure 2 shows a manifold according to the invention, in a cross sectional view and featuring an exemplary valve body;

Figure 3 shows the manifold shown in Figure 2 in an exploded view, seen from the opposite side;

Figure 4 is a cross sectional view along the line IV-IV shown in Figure 2; and

Figure 5 is a schematical view of two other embodiments of the invention, seen in a cross sectional view along the line V shown in Figure 2.

In principle, the mode of operation of the system shown in Figure 1 corresponds to eg the mode of operation of the system described in Danish patent application No. 32/95. A flexible shrouding or pipe coupling 50 is thus, at its first end 52, coupled to a valve housing 200 and, at its other end 54, coupled to a manifold 100 according to the invention. Via a coupling 5, the valve housing 200 is configured for being connected to a not shown suction device for providing a sub-atmospheric pressure within the system. The manifold 100, which is preferably transparent, is configured for being – via a

coupling 300 – connected to a tubular member or 'tube' for endotracheal ventilation of a patient, ie a tubular member that is configured for being introduced into the respiratory tracts of the patient with a view to maintaining artificial ventilation of that patient. A ventilation stub 1410 allows ventilation of the patient by means of a not shown conventional apparatus.

Additionally and in a conventional manner, the system shown in Figure 1 comprises a catheter 40 that extends into the interior of the shrouding 50 and that can be introduced into the respiratory tracts of the patient for drawing out secretion. At its first end 42, the catheter 40 is securely connected to the valve housing 200 and, at its opposite end 44, it is displaceably received in the manifold 100, the catheter being, via a packing 104, sealed relative to the shrouding 50, which means that fluid cannot penetrate into the shrouding. The packing 104 also causes secretion to be scraped off the outside of the catheter 40 during withdrawal of the catheter from the patient. It will be understood that the opposite end 44 of the catheter forms a suction point that can, during simultaneous folding of the shrouding 50, be displaced through the interior of the manifold 100 and into the not shown hose for ventilation of the patient. By this movement, the end 44 of the catheter is thus moved to the right in Figure 1. Hereby it is possible to perform regular suction of secretion from the patient's respiratory tracts by the operator connecting the system to the suction device by operating a valve button 210 in the valve housing 200.

Figure 2 shows further constructive details of the manifold 100 according to the invention. In general terms, the manifold is formed of a manifold wall 101 tat defines an interior, elongate manifold chamber 102. A first part 110 of the manifold 100 forms a first section 115 of the manifold chamber 102, while a second part 140 of the manifold 100 forms a second section 145 of the manifold chamber 102. The manifold chamber 102 defines a through-going axis A that extends in extension of the catheter 40 and the shrouding 50 that is outlined to the left in the drawing. It will appear that the manifold wall 101 forms an elongate head part for the manifold 100, which head part is extends along the axis A and is interrupted by a cylindrical portion 125 in the first

manifold part 110, which part extends transversally to the axis A. The ventilation stub 1410 mentioned above is arranged in the other manifold part 140. The cylindrical portion 125 has a central axis 128 that preferably extends perpendicular to the axis A. The elongate head part is preferably configured as a cylindrical body manufactured by being cast integrally with the cylindrical portion 125 and the ventilation stub 1410.

To the left in Figure 2, the manifold 100 has a first opening (gate) 111, through which the catheter 40 can be introduced into the manifold 100. Opposite the opening 111 the manifold 100 has a second opening (gate) 141 for the introduction of the catheter into the patient's respiratory tracts. The ventilation stub 1410 forms a third opening (gate) 142 for the manifold 100 whereby gas is allowed to travel from the third opening 142 towards the second opening 141, and vice versa.

Additionally, the manifold 100 has a fourth opening (gate) 112 that allows introduction of a flushing fluid into the manifold chamber 102, the packing 104 preventing influx of flushing fluid into the shrouding 50. Flushing fluid can by conveyed from a not shown supply source to the fourth opening 112 of the manifold 100 via a connector element, generally designated by the reference numeral 160 in Figure 3, and that may comprise a valve arrangement. It will appear from Figure 3 that preferably said fourth opening 112 is in connection with a stub 113 that forms a lateral branch extending from the manifold 100.

More specifically the fourth opening 112 is formed in an area of the manifold wall 101 in the cylindrical portion 125 in a level that coincides with, or approximately coincides with, the axis A. It will be understood that said flushing fluid serves the purpose of cleaning the suction point 44 of the catheter 40 and the packing 104 in the position of the catheter 40 shown in Figure 2, flushing fluid advanced via the opening 112 being sucked out of the manifold chamber 102 by activation of the suction device, ie through the catheter 40.

Besides, the cylindrical portion 125 forms a fifth opening (gate) 122 in the manifold 100. This opening 122 is intended for the mounting within the interior of the cylindrical portion 125 of a turnable cylindrical valve 130 with a valve body 132 that is shown in further detail in Figure 3. It will appear from Figure 3 that the valve body 132 is configured as a segment of the face of a cylinder that extends from a cylindrical base portion that cooperates with the segment 132 to form the valve 130.

It will be understood that at the transition between the first section 115 and the second section 145, an area will appear whereto the valve body 132 can be turned in a first position. In the following this area will be designated "the passage" 118. The passage 118 may have any expanse along the axis A and also transversally to the axis A; by the solution shown in Figure 2 the passage can be perceived as that part of the manifold chamber 102 that extends from the valve body 132 to the valve stub 1410. The function of this passage is merely to provide access for the catheter to the second section 145 of the manifold chamber 102.

The valve body 132 has a peripheral expanse that is sufficient for the valve, in its first position, to cover the entire expanse of the passage 118 transversally to the axis A and for the valve, in the embodiment shown, to block the fourth opening 112 in a second position. The segment has an end 132' opposite the cylindrical base part.

The valve 130 shown in Figure 2 is in the first position. It is usually desired to maintain the described blocking of the first section 115 from the second section 145 while ventilation of the patient is performed via the ventilation stub 1410 without suction of the patient with the catheter 40. Besides, exactly in this position it is possible to supply flushing fluid for cleaning the suction point 44 and secretion that is scraped off by means of the packing 104 and that has thus collected in the first section 115 of the manifold chamber 102. The flushed-off secretion is conveyed along with the flushing fluid out through the catheter 40 as explained above. In this context, it is advantageous that, in

the first position of the valve 130, influx of flushing fluid into the second section 145 is avoided.

From said first position the valve 130 can be turned about 90° in a first direction to said second position, in which the first 115 and the second 145 sections of the manifold chamber 102 are in communication with each other, and wherein the catheter 40 can be advanced from the left to the right in Figure 2. In the exemplary embodiment the valve body 132 is located opposite the fourth opening 112 in said second position and thereby cuts off the fourth opening 112, with the result that, to a wide extent, it is possible to prevent influx of flushing fluid into the manifold chamber 102. Said second position of the valve body 132 is outlined in Figure 3 where the valve has been displaced outwards from the cylindrical portion 125. Turning of the valve in the direction opposite said first direction makes it possible to advance fluid while simultaneously performing a suction of the patient's respiratory tracts.

As mentioned the valve 130 is configured for being able to turn interiorly of the cylindrical portion 125, and to this end the cylindrical base portion of the valve 130 is provided with an operating face that the user can seize with a finger. The valve can be received in close abutment on the interior surface of the cylindrical portion 125 and secured to the cylindrical portion 125 by means of suitable, complementary securing means 125', eg by being clicked into position. Said securing means 125' that can be arranged on the outside of the cylindrical portion 125 preferably comprise a turning constrictor whereby the valve can be turned only between extreme positions that define the above-mentioned first and second positions. In the embodiment shown the extreme positions correspond to a turning of the valve of about 90°. Thereby it is possible to avoid unintentional supply of flushing fluid while in a position where the passage 108 is open.

It is possible to provide a solution whereby influx of flushing fluid through the fourth opening 112 is not possible until the segment 132 cuts off the passage 118 completely, ie when the segment 132 has been turned through a given

angle about the axis 128 in a direction towards the passage 118. This presupposes ia a mutual adaptation of the following parameters: The angulation of the opening 112 about the shaft 128 relative to the passage 118, the peripheral expanse of the segment 132, and the allowed turning movement of the valve 130.

Figures 2 and 4 also show that, on the inside of the manifold wall 101 opposite the fifth opening 122 an elevated portion 103 is arranged that combines with the manifold wall 101 to define a circular guide track 103' for the extreme end 132' of the valve body 132. The track 103' is thereby delimited by the interior surface of the cylindrical portion 125 and the exterior surface of the elevated portion 103, respectively, and thereby serves to ensure reliable conveyance of the valve body 132. The elevated portion 103 extends with a certain inclination towards the passage in order to thereby ensure reliable conveyance of the catheter while the latter is advanced through the manifold.

From Figure 3 it will appear more clearly that the first manifold portion 110 is provided with a packing 104 having a central, through-going opening that forms a close abutment on the catheter 104. The packing 104 is secured in abutment against the interior surface of a peripheral surface area 128 of the first manifold portion 110 in the area at the first opening 111. More specifically, the packing 104 is secured by means of an concealed sleeve 105 that is enclosed by the packing 104 and that may have a conical shape whereby pressing-in of the concealed sleeve 105 generates a pressure that is oriented radially from the axis A and ensures reliable securing of the packing 104. To secure the concealed sleeve 105, the manifold 100 is also provided with a sleeve 108 that comprises clicking means 108' whereby the sleeve 108 can be secured against being pulled off the manifold 100. Between the peripheral surface area 128 and the inside of the sleeve 108 an annular chamber is preferably provided, in which the end 54 of the shrouding 50 is received and secured.

It will be understood that the ventilation stub 1410 can preferably be provided with a screw thread 152 for coupling of a ventilation apparatus thereto. Also, a thread 150 can be arranged on the outside of the manifold wall 101 at the second opening 141 with a view to mounting of a coupling kit for an endotracheal tube, eg of the kind described in the applicant's co-pending patent application.

Figures 5a and 5b show an alternative embodiment of the invention wherein the extreme end 132' of the valve body 132 is received in the circular guide track 103'. The first position of the valve 130 shown in Figure 5a corresponds to the position shown in Figure 2. It will appear that the fourth opening 112 is exposed and that, to a wide extent, a medium supplied is unable to flow into the second manifold section 145. Figure 5b shows a second position of the valve 130, wherein the passage 118 is open. In this embodiment, the segment 132 is provided with a recess 132" that extends across a part of the side that faces towards the surface of the cylindrical portion 125. The recess 132" is configured such that fluid supplied via the opening 112 will be directionally oriented towards the passage 118 in the second position of the valve 130 shown in Figure 5b, as indicated by the arrow P. Hereby it is possible to introduce the catheter through the passage 118 and to perform a suction of the patient while simultaneously fluid is supplied to the patient via the fourth opening 112. Such option is desirable in certain cases to provoke a coughing attack and thus release secretion that is removed by sucking by means of the catheter.

Figure 5c illustrates a third embodiment of the invention, wherein the extreme end 132' of the valve body 132 has been received in the circular track 103' and wherein the valve body 132 is configured as shown in Figures 2-4. It will appear that in this embodiment the fourth opening of the manifold 112 is arranged offset opposite the passage 118 whereby, when the valve 130 is conveyed to the shown second position opposite the opening 112, it is also ensured that fluid supplied via the opening 112 will be directionally oriented towards the passage 118, as indicated by the arrow P, while simultaneously a catheter can be conveyed through the passage 118. The valve 130 may be

turned to the first position shown in Figure 2, and optionally to a further – third position, wherein the segment 132 is positioned in front of the opening 112 in order to prevent, to the widest possible extent, unintentional influx of fluid.

Albeit in the present text the guide track 103' is described as annular, the person skilled in the art will appreciate that the guide track 103' does not necessarily have to extend continuously around the interior surface of the cylindrical portion 125.

Claims

1. A manifold (100) for a closed system (1) for endotracheal ventilation and aspiration of a patient, which manifold (100) has an interior manifold chamber (102) that defines a through-going axis A through the manifold (100), and comprises:

- a first manifold portion (110) defining a first section (115) of the manifold chamber (102); and
- a second manifold portion (140) arranged in extension of said first manifold portion (110) and defining a second section (145) of the manifold chamber (102);
- a first opening (111) arranged in the first manifold section (110) and configured for allowing advancement of a catheter for aspiration of the patient into the first section (115);
- a second opening (141) arranged in the second manifold portion (140) opposite said first opening (111) and configured for allowing advancement of the catheter from the second section (145), preferably to an endotracheal tube;
- a third opening (142) arranged in the second manifold portion (140) and configured for allowing ventilation of the patient;
- a passage (118) arranged opposite said first opening (111) and configured for allowing advancement of the catheter from the first section (115) and into the second section (145);
- a turnable valve body (132) arranged interiorly of the first section (115) and configured for being movable between a first position in which the passage (118) is blocked and a second position;
- wherein the first manifold portion (110) also defines a substantially cylindrical portion (125) that extends substantially perpendicular to the axis A;
- which cylindrical portion (125) has a cylinder axis (128) about which said valve body (132) is able to turn between the first and the second position;
- a fourth opening (112) arranged in the cylindrical portion (125) and configured for allowing supply of fluid;

characterised in

- that the valve body (132) is configured as a segment of the face of a cylinder configured for abutting on the cylindrical portion (125).

2. A manifold according to the preceding claim, **characterised in** that
   - interiorly of the first manifold portion (110) a circular guide track (103') for the valve body (132) is a arranged.

3. A manifold according to the preceding claim, **characterised in**
   - that the valve body (132) has an extreme end (132'); and
   - that the guide track (103') is configured for receiving this extreme end (132').

4. A manifold according to one of the preceding claims, **characterised in** that – the valve body (132) is configured such that the fourth opening (112) is open in said first position of the valve body (132).

5. A manifold according to one of the preceding claims 1-3, **characterised in**
   - that the valve body (132) is configured such that the passage (118) and the fourth opening (112) are open in said second position; and
   - that the segment (132) comprises a guide face (132") configured for conveying the fluid supply from the fourth opening (112) in a direction through the passage (118).

6. A manifold according to the preceding claim, **characterised in**
   - that the guide face (132") forms a flow passage in combination with the interior face of the manifold (100).

7. A manifold according to one of the preceding claims 1-3, **characterised in**
   - that the valve body (132) is configured such that the passage (118) and the fourth opening (112) are open in said second position; and

- that the fourth opening (112) is so arranged relative to the passage (118) that the supplied fluid flows through the passage (118).

8. A manifold (100) according to any one of the preceding claims, **characterised in**

- that the interior manifold chamber (102) is configured as a cylindrical body interrupted by the cylindrical portion (125) that extends transversally to the axis A.

9. A manifold (100) according to any one of the preceding claims, **characterised in**

- that the first manifold portion (110) is formed integrally with the second manifold portion (140); and
- that the passage (118) is defined by an area that is shared by the first section (115) and the second section (145).

10. A manifold (100) according to any one of claims 1-8, **characterised in**

- that the first manifold portion (110) and the second manifold portion (140) constitute separate portions of the manifold;
- that the first manifold portion (110) comprises a further opening (111') arranged opposite the first opening (111);
- that the second manifold portion (140) comprises a further opening (141') arranged opposite the second opening (141);
- - which further openings (111', 141') combine to form mouthings for said passage (118);
- that the first manifold portion (110) and the second manifold portion (140) comprises mutually complementary connecting means (110', 141'); and
- that said complementary connecting means (110', 140') are configured for forming a tight connection.

11. A manifold (100) according to any one of the preceding claims, **characterised in**

- that, at the first opening (111), the first manifold portion (110) comprises a peripheral surface area (128) configured for forming a direct abutment for a compressible shrouding (50) for the catheter (40); and
- that the manifold (100) also comprises a sleeve (108) configured for securing the shrouding in abutment on said surface area (128).

12. A manifold (100) according to any one of the preceding claims, **characterised in**

- that the first manifold portion (110) and the second manifold portion (140) comprises means (150,152), whereby it is possible to directly connect, at the second opening (141), the third opening (142) and the fourth opening (112), an endotracheal tube, a tube for ventilating the patient and a tubing for the supply of fluid, respectively.

13. A manifold (100) according to any one of the preceding claims, **characterised in**

- a fifth opening (122) arranged in the cylindrical portion (125);
- wherein the valve body (132) is connected to the exterior of the manifold chamber (102) via the fifth opening (122).

14. A system (1) for endotracheal ventilation and aspiration of a patient and comprising a catheter (40) that extends interiorly of a collapsible shrouding (50), being at its first end (52) connected to a vacuum source, and at its other end (54) is connected to a manifold (100), **charactaerised in** that the manifold (100) is configured as featured in one of claims 1-13.

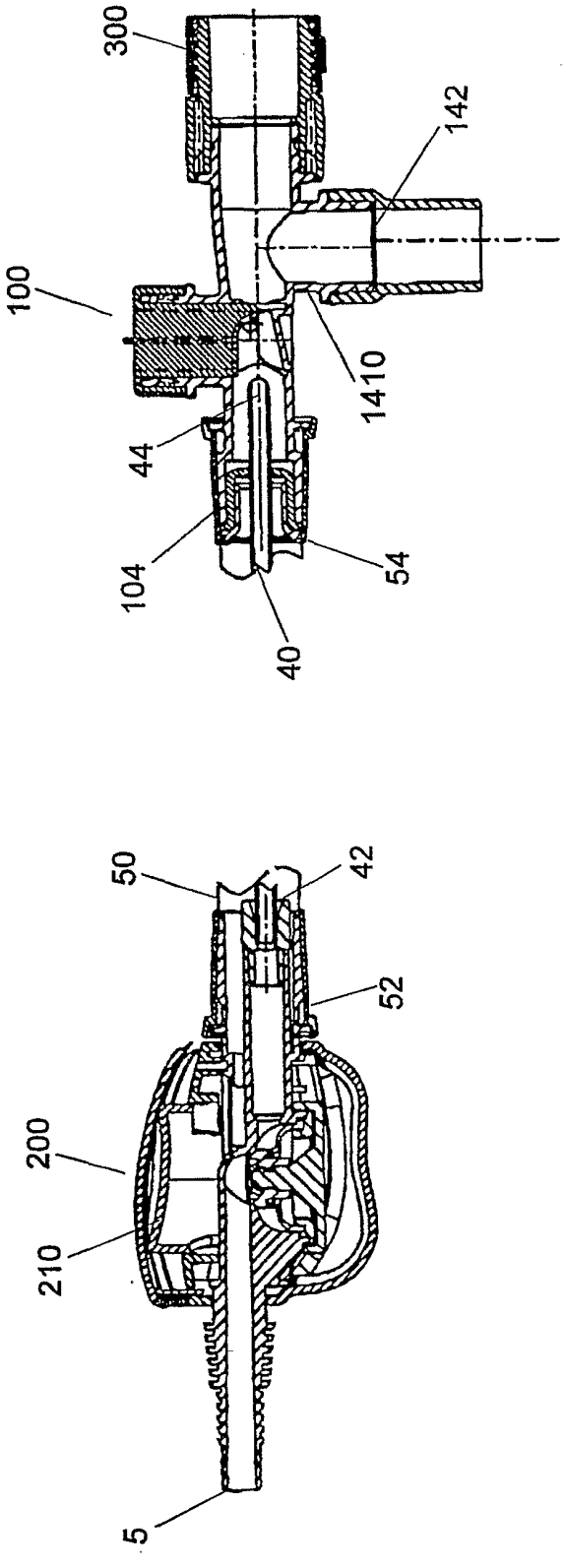
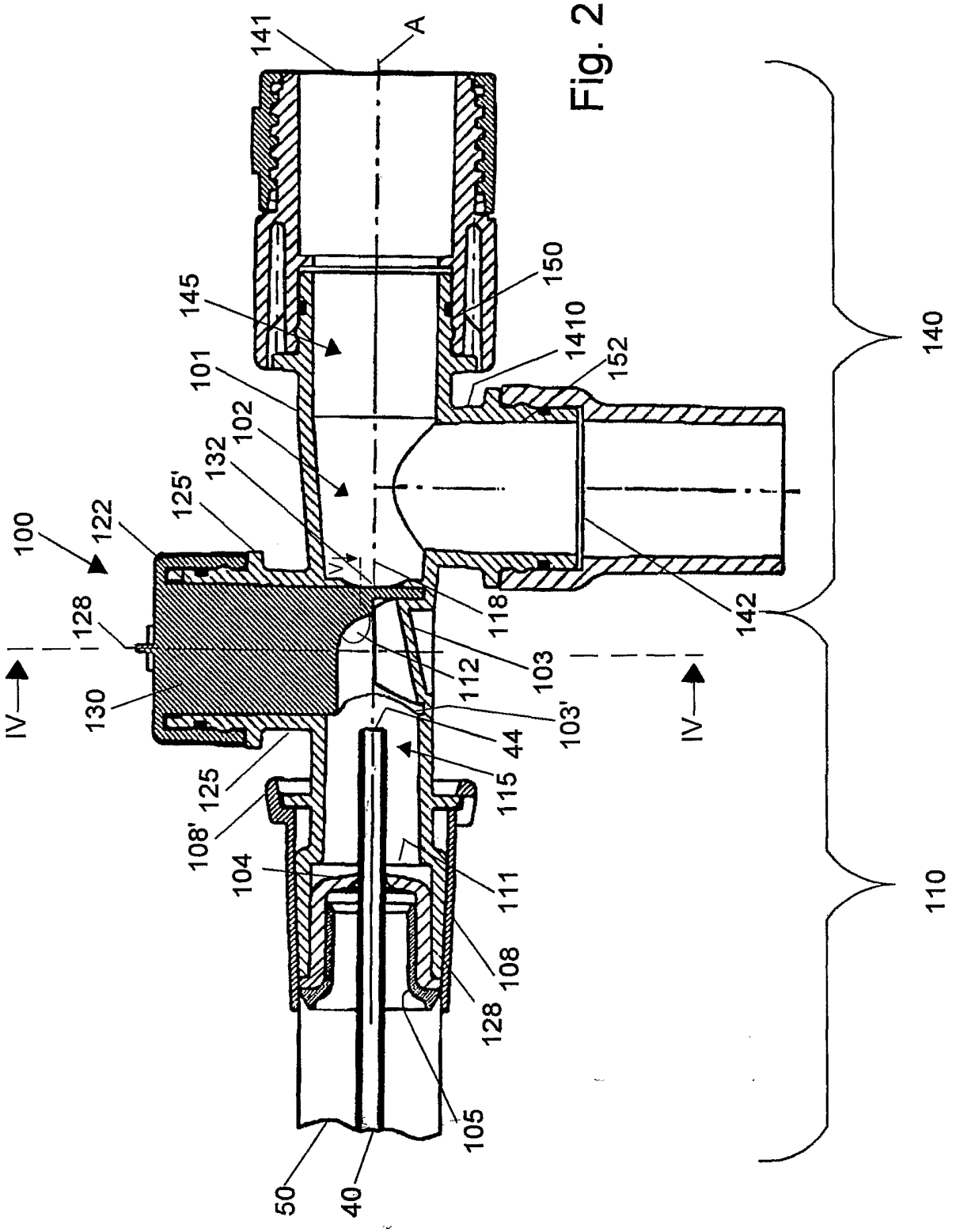


FIG. 1


141
A
145
150
1410
152
101
102
132
125'
122
100
128
130
118
112
103
103'
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115
125
108'
104
111
108
128
105
50
40
140
142
110
IV
IV

Fig. 2

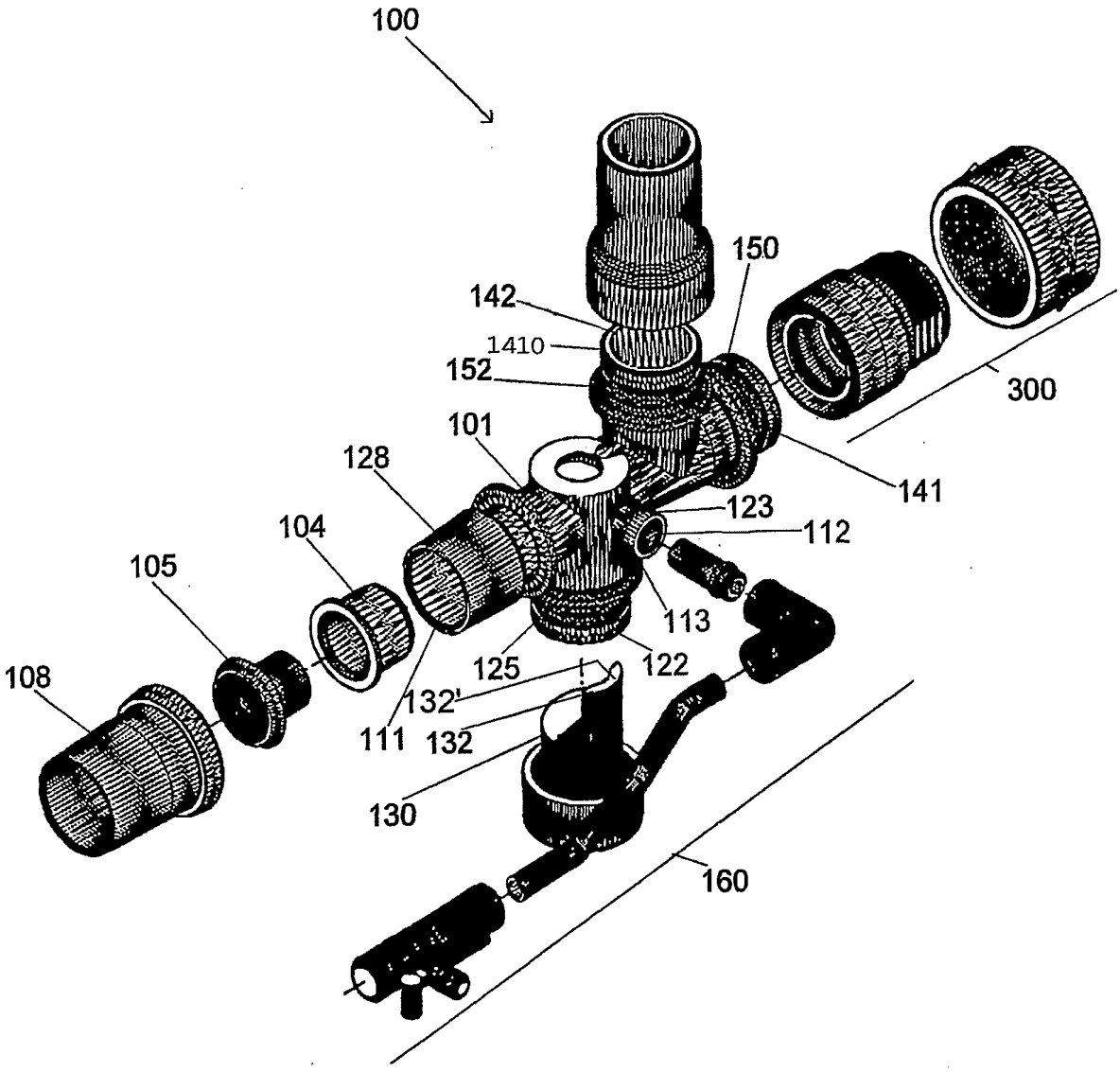
100
150
142
1410
152
300
101
141
128
123
104
112
105
113
125
122
108
132'
111
132
130
160

FIG. 3

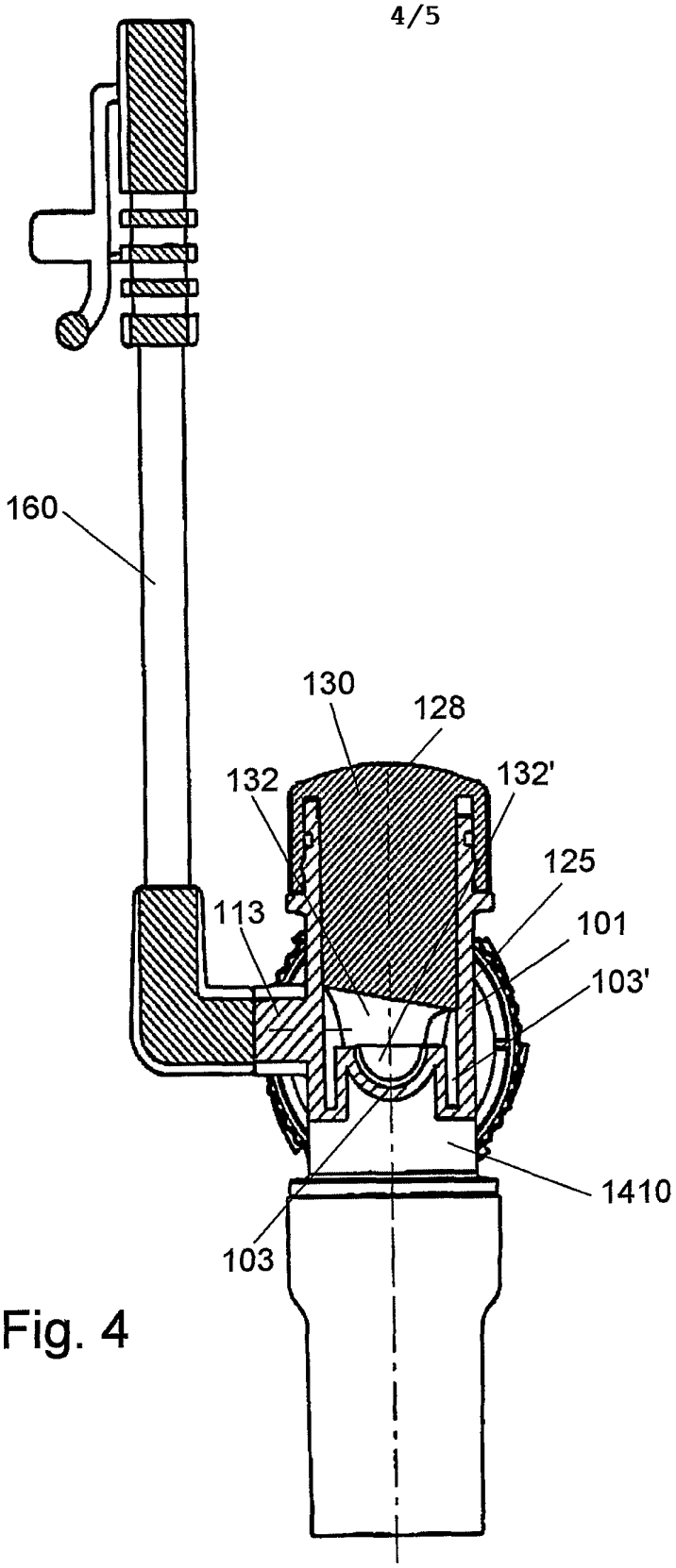

Fig. 4

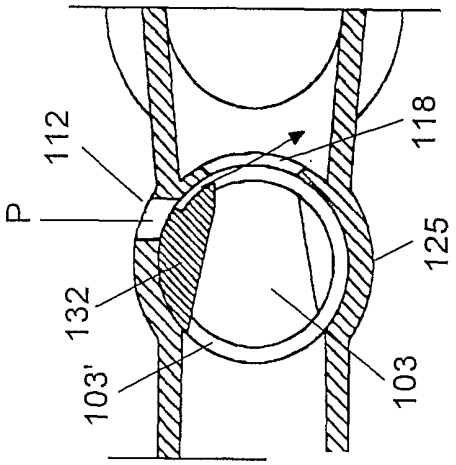

Fig. 5b

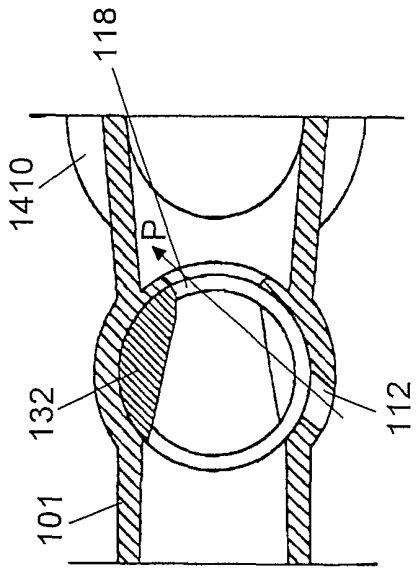

Fig. 5c

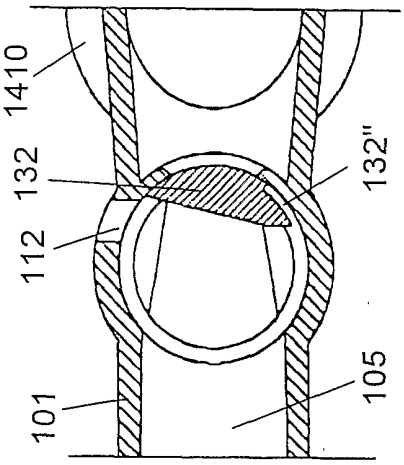

Fig. 5a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 01/00118

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61M 1/00, A61M 5/00, F16K 5/00, F16K 5/10, F16K 31/00
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)

IPC7: A61M, F16K

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)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9833536 A1 (SORENSON CRITICAL CARE, INC.), 6 August 1998 (06.08.98), figures 1-5, claims 1-20 --	1-13,14
A	US 5354267 A (V. NIERMANN ET AL.), 11 October 1994 (11.10.94), column 3, line 9 - line 28; column 4, line 6 - line 22; column 5, line 2 - line 34, figures 1-4 --	1-13,14

☐ 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
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"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	Date of mailing of the international search report
16 July 2001	18 -07- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Agneta Änggård/AE Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/07/01

International application No.
PCT/DK 01/00118

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9833536 A1	06/08/98	DE 19882044 T	27/01/00
		GB 2336113 A,B	13/10/99
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		US 5882348 A	16/03/99
US 5354267 A	11/10/94	NONE	