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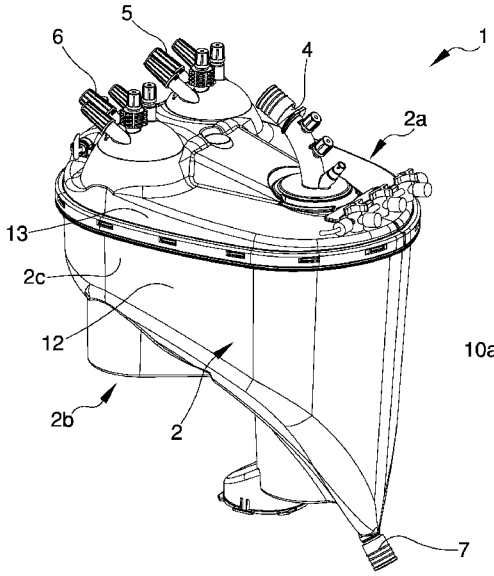


Fig.1

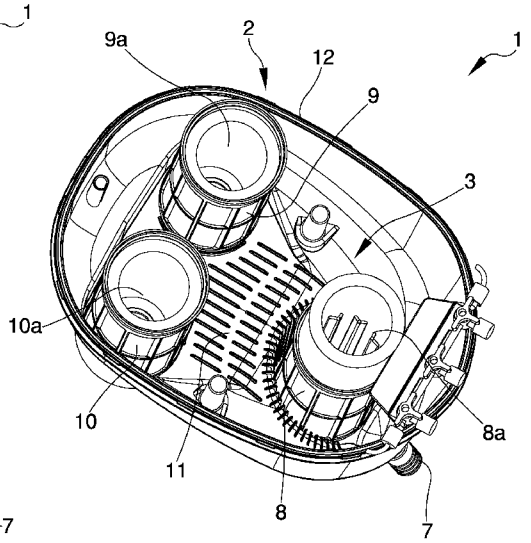


Fig.2

(57) Abstract: The blood filtering device (1), comprises a casing (2) defining a containment volume (3) and provided with at least a first inlet (4) for the venous blood, at least a second inlet (5) for the intracavitary blood, at least a third inlet (6) for the extracavitary blood and at least an outlet mouth (7) for the blood; blood filtering means (8, 9, 10) which are housed inside the containment volume (3) and delimiting at least one filtering volume (8a, 9a, 10a) communicating with the blood inlets (4, 5, 6) and at least one collecting volume (11) communicating with the outlet mouth (7); where filtering means (8, 9, 10) comprise: at least a first filtering element (8) defining a closed profile and delimiting a first filtering volume (8a) communicating with the first inlet (4); at least a second filtering element (9) defining a closed profile and delimiting a second filtering volume (9a) communicating with the second inlet (5); at least a third filtering element (10) defining a closed profile and delimiting a third filtering volume (10a) communicating with the third inlet

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(6); wherein the filtering elements (8, 9, 10) are separated and distinct from each other.

BLOOD FILTERING DEVICE

Technical Field

The present invention relates to a blood filtering device in extracorporeal blood circuit.

Background Art

As is known, during certain surgical operations, when the functions of the patient's heart are temporarily interrupted, extracorporeal blood circuits are made which use so-called "heart-lung" machines.

The heart-lung machines comprise a series of devices of which a filtering device (also referred to as "venous reservoir") adapted to filter the blood coming from the patient, a heat exchanger adapted to regulate the temperature of the blood leaving the filtering device, and an oxygenator adapted to provide the correct supply of oxygen to the blood intended to be reintroduced into the patient.

More particularly, during extracorporeal circulation (ECC) the blood drains by gravity or due to the effect of the application of a negative pressure inside the venous reservoir of the heart-lung machine passing through the cannulae positioned in the hollow veins or through a cannula positioned in the right atrium. From the venous reservoir the blood is pumped into the arterial system, usually through a cannula positioned in the ascending aorta, passing through a membrane oxygenator where the blood is oxygenated and decarboxylated.

This system can be used to provide total or partial circulatory and respiratory assistance.

The extracorporeal blood circuits are completed by the field aspiration lines (aortic root, vent, field aspirator), the cardioplegia infusion line, a filter for emboli and bubbles, and a heat exchanger.

The filtering devices present in the venous reservoir are used to eliminate the emboli in the extracorporeal circuit which can be either in gaseous or solid form.

The main sources of solid emboli are essentially the frustules of the surgical operation field that comprise atheromas, calcium, lipids, bone fragments, denatured proteins, suture materials, platelet and leukocyte aggregates.

The main source of the gaseous emboli that enter the extracorporeal circuit is the surgical field. Air can be aspirated from the site of venous cannulation, during aortic cannulation, during aspirations from the aortic root, from the vent, from the field aspirator.

The filtering devices known as of today comprise a rigid casing provided with an upper cover at which blood inlet unions are defined, of which a union adapted to receive the so-called "intracavitary" blood coming directly from the patient's heart and a union adapted to receive "extracavitary" blood. This device then has a further union adapted to receive the blood coming from a patient's vein, generally arranged at the bottom of the casing, and an outlet mouth of the filtered blood.

More particularly, inside the casing there is a filtering element, defining a closed profile, the internal volume of which is placed in communication with the above-mentioned blood inlet unions and the external volume of which is placed in communication with the outlet mouth of the filtered blood. The blood entering the casing then passes through the filtering element and exits from the outlet mouth.

These filtering devices of known type do have a number of drawbacks.

These in fact do not allow an effective filtration of the treated blood.

As known, in fact, the intracavitary blood and the extracavitary blood aspirated during the cardiac surgery operations have considerably different properties from each other, in fact, while the intracavitary blood is generally not very activated (i.e. without solid emboli) and with a reduced number of air bubbles, the extracavitary blood is very activated and rich in air bubbles.

Since in the devices of known type the intracavitary blood (with few gaseous emboli) and the extracavitary one (with many gaseous emboli) are mixed together before being filtered, it follows that this involves an activation of the intracavitary blood, which is then "contaminated" by the extracavitary one. The filtration carried out by the devices of known type is therefore not very effective since the filtering element, having to eliminate both emboli in the gaseous and those in the solid form, reduces the elimination capacity of gaseous micro-emboli and also the blood filtration capacity.

Description of the Invention

The main aim of the present invention is to devise a blood filtering device which allows improving the efficiency of filtration with respect to devices of known type.

In particular, the present invention intends to optimize the filtration for each flow of treated blood, so as to improve the quality of the output blood.

A further object of the present invention is to devise a blood filtering device which allows overcoming the aforementioned drawbacks of the prior art within the scope of a simple, rational, easy, efficient to use and cost-effective solution.

The aforementioned objects are achieved by the present blood filtering device according to claim 1.

Brief Description of the Drawings

Other characteristics and advantages of the present invention will become more evident from the description of a preferred, but not exclusive embodiment of a blood filtering device, illustrated by way of an indicative, but non-limiting example, in the attached drawings in which:

Figure 1 is an axonometric view of a device according to the invention, in a first embodiment;

Figure 2 is a top axonometric view of a part of the device of Figure 1;

Figure 3 is an axonometric view of a device according to the invention, in a second embodiment;

Figure 4 is a top axonometric view of a part of the device of Figure 3;

Figure 5 is a sectional view of a part of the device of Figure 3 along the track plane V-V;

Figure 6 is an axonometric view of a portion of the section of Figure 5;

Figure 7 is a further axonometric view, in partially exploded view, of the section of Figure 5;

Figures 8 and 9 are two cross-sections of the device of Figure 3 with the relative sleeve in the opening and closing configuration, respectively;

Figure 10 is an exploded view of a filtering element of a device according to the invention in an alternative embodiment;

Figure 11 is a plan view from above of the filtering element of Figure 10;

Figure 12 is a sectional view of the filtering element of Figure 11 according to the track plane XII-XII;

Figure 13 is a sectional view of the filtering element of Figure 11 according to the track plane XIII-XIII.

Embodiments of the Invention

With particular reference to these figures, reference numeral 1 globally indicates a blood filtering device.

The device 1 comprises a casing 2 which defines a containment volume 3 and (the casing) is provided with at least a first inlet 4 for the venous blood coming from the patient, at least a second inlet 5 for the intracavitary blood (with few gaseous emboli), at least a third inlet 6 for the extracavitary blood (rich in gaseous emboli) and at least an outlet mouth 7 for the blood.

Inside the containment volume 3 are housed blood filtering means 8, 9, 10 which delimit at least one filtering volume 8a, 9a, 10a communicating with the blood inlets 4, 5, 6 and at least one collecting volume 11 communicating with the outlet mouth 7.

According to the invention, the filtering means 8, 9, 10 comprise at least a first filtering element 8 which defines a closed profile and delimits a first filtering volume 8a communicating with the first inlet 4, a second filtering element 9, which defines a closed profile and delimits a second filtering volume 9a communicating with the second inlet 5, and a third filtering element 10 which defines a closed profile and delimits a third filtering volume 10a communicating with the third inlet 6, where the first, the second and the third filtering elements 8, 9, 10 are separated and distinct from each other.

As can easily be understood, depending on the specific requirements of the case, the filtering elements 8, 9, 10 may be of a different type, so that their filtering characteristics are selected according to the type of blood to be filtered.

The casing 2 has an upper portion 2a, a bottom wall 2b and a side wall 2c.

Preferably, the inlets 4, 5, 6 are defined at the upper portion 2a.

Conveniently, the outlet mouth 7 is defined at the bottom wall 2b.

As can be seen in Figures 1 and 3, the casing 2 comprises a body 12 open at the top, defining the side wall 2c and the bottom wall 2b, and a cover 13 to close

the body 12 defining the upper portion 2a at which are defined the inlets 4, 5, and 6.

More particularly, the second and third inlets 5, 6 are defined by a covering element 28 which engages with a corresponding supporting element 29 associated with the upper portion 2a, where at least one sealing element 30 is interposed between the covering element 28 and the supporting element 29.

Advantageously, the filtering elements 8, 9 and 10 have a tubular shape, the lower base of which is located at the bottom wall 2b and the upper base of which is placed in communication with the corresponding inlet 4, 5 and 6. A containment element 31 is located around the filtering elements 8, 9 and 10.

In the embodiments shown in the figures, the second and third filtering element 9, 10 are arranged side by side.

More particularly, the first filtering element 8 has a longer longitudinal extension than the second and the third filtering elements 9 and 10.

As can be seen from the figures, in fact, the bottom wall 2b has a first stretch, at which are located the bottom extremity of the first filtering element 8 and the outlet mouth 7, and a second stretch, at which are located the bottom extremities of the second and of the third filtering elements 9 and 10, where the first stretch is arranged, in use, at a lower level than the second stretch.

Preferably, the first filtering element 8 is interposed between the outlet mouth 7 and the second and third filtering element 9 and 10.

In the embodiment shown in Figures 10 to 13, the device 1 comprises a plurality of second and/or third inlets 5, 6 and comprises blood separation means 23 located at at least one of the second and third inlets 5, 6 and communicating with the corresponding filtering volume 9a, 10a, where these separation means 23 are adapted to keep the blood flows coming from the respective inlets 5, 6 separated from each other.

More particularly, the separation means 23 are the type of a body 24 defining a plurality of channels 25 having curvilinear extension, each of which is adapted to receive the flow of blood entering a relative inlet 5, 6 to convey it from a peripheral area towards the center.

The separation means 23 allow preventing the various blood flows entering

each inlet 5, 6 from mixing with each other and thus obtaining an initial separation of the air from the blood.

Preferably, the channels 25 have a section converging towards the center.

Advantageously, inside at least one of the second and the third filtering element 9, 10, at least one conveying element 26 is housed, which is adapted to guide the blood along a predefined path so as to convey it towards the corresponding filtering element 9, 10.

In the embodiment shown in the figures, the conveying element 26 is substantially screw-shaped.

More in detail, the conveying element 26 has a blood flowing surface 27 which defines a substantially helical path, the side edge of which is substantially tangent to the internal lateral surface of the corresponding filtering element 9, 10.

The conveying element 26 is arranged below the separation means 23 and is therefore adapted to receive the blood coming from the separation means.

More particularly, the conveying element 26 is interposed between the separation means 23 and the bottom wall 2b.

In the first embodiment shown in Figures 1 and 2, the external volumes of each filtering element 8, 9, 10 are communicating with each other. In other words, the collecting volume 11 externally surrounds each filtering element 8, 9, 10 without interruption. This entails the fact that the blood portions entering the casing 2 through the inlets 4, 5 and 6, once filtered, are mixed together, accumulating in the collecting volume 11, and then exit through the outlet mouth 7.

In the second embodiment shown in Figures 3 to 6, on the other hand, the device 1 comprises at least one separation wall 14 positioned inside the collecting volume 11, which operates in conjunction with the casing 2 to divide the collecting volume itself into a first collecting volume 11a surrounding the first and second filtering element 8, 9 and communicating with the outlet mouth 7, and into a second collecting volume 11b surrounding the third filtering element 10 and communicating with a blood drawing union 15 separate from the outlet mouth 7.

The separation wall 14 thus isolates the third filtering element 10 from the first

and the second filtering elements 8 and 9, thus avoiding the mixing of the relative filtered blood portions.

Conveniently, the drawing union 15 comprises a sleeve 16, the top extremity of which protrudes from the cover 13 and is accessible from the outside and the bottom extremity of which is arranged inside the second collecting volume itself.

The sleeve 16 comprises at least a first opening 17a communicating with the second collecting volume 11b and at least a second opening 17b adapted to place the sleeve itself in communication with the first collecting volume 11a, through a passage 22 defined on the separation wall 14 and positioned at the sleeve 16.

Conveniently, the sleeve 16 is operable in rotation around a relevant axis between an opening configuration, in which the second opening 17b is placed in communication with the passage 22, and a closure configuration, in which the second opening 17b is isolated from the passage 22, the latter being hindered by the wall of the sleeve itself, so as to maintain the first collecting volume 11a isolated from the second collecting volume 11b. Both in the opening configuration and closure configuration the first opening 17a is placed in communication with the second collecting volume 11b.

In the embodiment shown in the illustrations, the sleeve 16 comprises two first openings 17a and a second opening 17b, which is substantially aligned with one of the first openings 17a, the other first opening 17a being interposed therebetween.

In the opening configuration of the sleeve 16 the first and second collecting volumes 11a and 11b are communicating with each other, so that the operator can then aspirate the blood from the first collecting volume 11a, while in the closure configuration the first and second collecting volumes 11a and 11b are isolated from each other and the operator can aspirate the blood filtered by the third filtering element 10 through the sleeve itself.

Preferably, inside the second collecting volume 11b is provided an appendix 18 extending from the bottom wall 2b, which is adapted to operate in conjunction with the sleeve 16 and provided with at least one recess 19. In more detail, in the opening configuration of the sleeve 16, the first opening 17a and the second opening 17b which are aligned with each other, are positioned at the recess 19 and at the passage 22 respectively, so as to allow the flow of the filtered blood from

the second collecting volume 11b inside the sleeve itself and from this inside the first collecting volume 11a, while in the closure configuration the second opening 17b is isolated by the passage 22, which is therefore closed by the side wall of the sleeve 16, thus allowing the operators to aspirate the filtered blood and contained in the second collecting volume 11b through the sleeve itself.

Advantageously, in this second embodiment, inside the second collecting volume 11b at least two break walls 20a, 20b are provided, interposed between the third filtering element 10 and the drawing union 15. More particularly, the break walls 20a, 20b define respective passage gaps 21a, 21b of the blood filtered by the third filtering element 10 positioned at different heights with respect to the bottom wall 2b.

Preferably, the device 1 comprises a first and a second break wall, identified in the illustrations with reference numerals 20a and 20b respectively, which are arranged in succession to each other strating from the third filtering element 10 towards the drawing union 15, where the passage gap 21b defined by the second break wall 20b is arranged higher than the passage gap 21a defined by the first break wall 20a.

The break walls 20a and 20b allow retaining lipids and white blood cells present in the blood and which collect in the upper layer of the blood itself in the second collecting volume 11b.

The appendix 18 and the recess 19 are therefore interposed between the second break wall 20b and the sleeve 16, and make it possible to prevent the separated lipids and white blood cells from being aspirated through the sleeve 16 or ending inside the first collecting volume 11a, depending on the position taken by the sleeve itself, even in the case of maximum drawing of the blood contained in the second collecting volume 11b.

The operation of the present invention is as follows.

As can be easily understood on the basis of the description provided above, before using the device according to the invention, the operator connects the inlets 4, 5 and 6 to the respective blood conveying lines.

The intracavitary and extracavitary venous blood therefore enters the first filtering volume 8a, the second filtering volume 9a and the third filtering

volume 10a respectively, and flows through the corresponding filtering elements 8, 9 and 10. Each type of blood is then individually filtered.

In the embodiment shown in Figures 10 to 13, the blood entering the second and third inlets 5 and 6 meets the separation means 23, enters the corresponding channels 25 and is conveyed towards the conveying element 26. The blood thus travels the flowing surface 27, which pushes it towards the corresponding filtering element 9, 10 and progressively drops inside the corresponding filtering volume 9a, 10a.

In the device 1 according to the first embodiment, the blood thus filtered flows inside the collecting volume 11 and then flows out of the outlet mouth 7.

In the second embodiment, on the other hand, the blood that flows through the first and the second filtering element 8 and 9 collects in the first collecting volume 11a, flowing out of the outlet mouth 7, while the blood that flows through the third filtering element 10 collects in the second collecting volume 11b, to be then drawn, after having passed the break walls 20a and 20b, through the drawing union 15 or through the outlet mouth 7 depending on the position of the sleeve 16. As mentioned above, due to the sedimentation of the blood contained in the second collecting volume 11b, the break walls 20a and 20b allow retaining the lipids and white blood cells present therein.

It has in practice been found that the described invention achieves the intended objects and in particular the fact is emphasized that the device of the present invention allows using a specific filtering element for each type of blood to be filtered. This allows the filtration step to be optimized according to the properties of the blood to be filtered, thus improving the quality of the filtered blood with respect to known devices.

The separation wall in the second embodiment allows to further separate the blood components by retaining the lipids and white blood cells present therein.

CLAIMS

1) Blood filtering device (1), comprising:

- a casing (2) defining a containment volume (3) and provided with at least a first inlet (4) for the venous blood, at least a second inlet (5) for the intracavitary blood, at least a third inlet (6) for the extracavitary blood and at least an outlet mouth (7) for the blood;
- blood filtering means (8, 9, 10) which are housed inside said containment volume (3) and delimiting at least one filtering volume (8a, 9a, 10a) communicating with said blood inlets (4, 5, 6) and at least one collecting volume (11) communicating with said outlet mouth (7);

characterized by the fact that said filtering means (8, 9, 10) comprise:

- at least a first filtering element (8) defining a closed profile and delimiting a first filtering volume (8a) communicating with said first inlet (4);
- at least a second filtering element (9) defining a closed profile and delimiting a second filtering volume (9a) communicating with said second inlet (5);
- at least a third filtering element (10) defining a closed profile and delimiting a third filtering volume (10a) communicating with said third inlet (6);

wherein said filtering elements (8, 9, 10) are separated and distinct from each other.

2) Device (1) according to claim 1, characterized by the fact that said inlets (4, 5, 6) are defined at the upper portion (2a) of said casing (2).

3) Device (1) according to claim 1 or 2, characterized by the fact that said outlet mouth (7) is defined at the bottom wall (2b) of said casing (2).

4) Device (1) according to one or more of the preceding claims, characterized by the fact that said filtering volumes (8a, 9a, 10a) correspond to the inner volume defined by each filtering element (8, 9, 10) and that said collecting volume (11) is arranged externally to said filtering elements (8, 9, 10).

5) Device (1) according to one or more of the preceding claims, characterized by the fact that said second and third filtering element (9, 10) are arranged side by side.

6) Device (1) according to claim 5, characterized by the fact that said first filtering element (8) is interposed between said outlet mouth (7) and said second and third

filtering element (9, 10).

7) Device (1) according to one or more of the preceding claims, characterized by the fact that it comprises a plurality of said second and/or third inlets (5, 6) and by the fact that it comprises blood separation means (23) located at at least one of said second and third inlets (5, 6) and communicating with the corresponding filtering volume (9a, 10a), said separation means (23) being adapted to keep the blood flows separated from each other when entering the respective inlets (5, 6).

8) Device (1) according to claim 7, characterized by the fact that said separation means (23) comprise at least a body (24) on which are defined a plurality of channels (25) having curvilinear extension, where each of said channels (25) is adapted to receive the blood flowing from a respective inlet (5, 6) to convey it from a peripheral area towards the center.

9) Device (1) according to claim 8, characterized by the fact that said channels (25) have a converging section from the edge towards the center of said body (24).

10) Device (1) according to one or more of the preceding claims, characterized by the fact that inside at least one of said second and said third filtering element (9, 10), at least one conveying element (26) is housed which is adapted to guide the blood along a predefined path.

11) Device (1) according to claim 10, characterized by the fact that said conveying element (26) is substantially screw-shaped.

12) Device (1) according to claim 10 or 11, characterized by the fact that said conveying element (26) has a blood flowing surface (27) which defines a substantially helical path and the side edge of which is located at the internal wall of the corresponding filtering element (8, 9, 10).

13) Device (1) according to one or more of claims 7 to 9 and one or more of claims 10 to 12, characterized by the fact that said conveying element (26) is arranged below said separation means (23).

14) Device (1) according to claim 13, characterized by the fact that said conveying element (26) is interposed between said separation means (23) and the bottom wall (2b) of said casing (2).

15) Device (1) according to one or more of the preceding claims, characterized by

the fact that said collecting volume (11) surrounds externally each of said filtering elements (8, 9, 10) without interruption.

16) Device (1) according to one or more of claims 1 to 14, characterized by the fact that it comprises at least one separation wall (14) positioned inside said collecting volume (11) and operating in conjunction with said casing (2) to divide the collecting volume itself into a first collecting volume (11a) surrounding said first and second filtering element (8, 9) and communicating with said outlet mouth (7) and into a second collecting volume (11b) surrounding said third filtering element (10) and susceptible to being placed in communication with a blood drawing union (15) and/or with said first collecting volume (11a).

17) Device (1) according to claim 16, characterized by the fact that it comprises at least two break walls (20a, 20b) housed inside said second collecting volume (11b), interposed between said third filtering element (10) and said drawing union (15) and defining respective passage gaps (21a, 21b) of the filtered blood positioned at different heights with respect to the bottom wall (2b) of said casing (2).

18) Device (1) according to claim 17, characterized by the fact that said break walls (20a, 20b) comprise a first break wall (20a) and a second break wall (20b) arranged in succession to one another from said third filtering element (10) towards said drawing union (15) and by the fact that the passage gap (21b) defined by said second break wall (20b) is arranged higher than the passage gap (21a) defined by said first break wall (20a).

19) Device (1) according to one or more of claims 16 to 18, characterized by the fact that said drawing union (15) comprises at least one sleeve (16) accessible from the outside, provided with at least one or more first openings (17a) positionable in communication with said second collecting volume (11b) and provided with at least a second opening (17b) for the passage of blood, and by the fact that said separation wall (14) comprises at least one passage (22) communicating with said first collecting volume (11a), said sleeve (16) being operable in rotation between an opening configuration, in which at least one of said first openings (17a) is placed in communication with said second collecting volume (11b) and said second opening (17b) is located at said passage (22), so as

to place said first collecting volume (11a) in communication with said second collecting volume (11b), and a closure configuration, in which at least one of said first openings (17a) is placed in communication with said second collecting volume (11b) and said second opening (17b) is isolated from said passage (22).

20) Device (1) according to one or more of claims 17 to 19, characterized by the fact that it comprises at least an appendix (18) extending from said bottom wall (2b), housed inside said second collecting volume (11b) and provided with at least one recess (19), and by the fact that said sleeve (16) has at least two of said first openings (17a) and at least a second opening (17b), in the opening position of said sleeve (16) one of said first openings (17a) being positioned at said recess (19) and said second opening (17b) at said passage (22), in the closing position the other of said first openings (17a) being arranged at said recess (19) and said second opening (17b) being closed.

21) Device (1) according to one or more of the preceding claims, characterized by the fact that said filtering elements (8, 9, 10) have a tubular shape and by the fact that said first filtering element (8) has greater longitudinal extension than said second and third filtering element (9, 10).

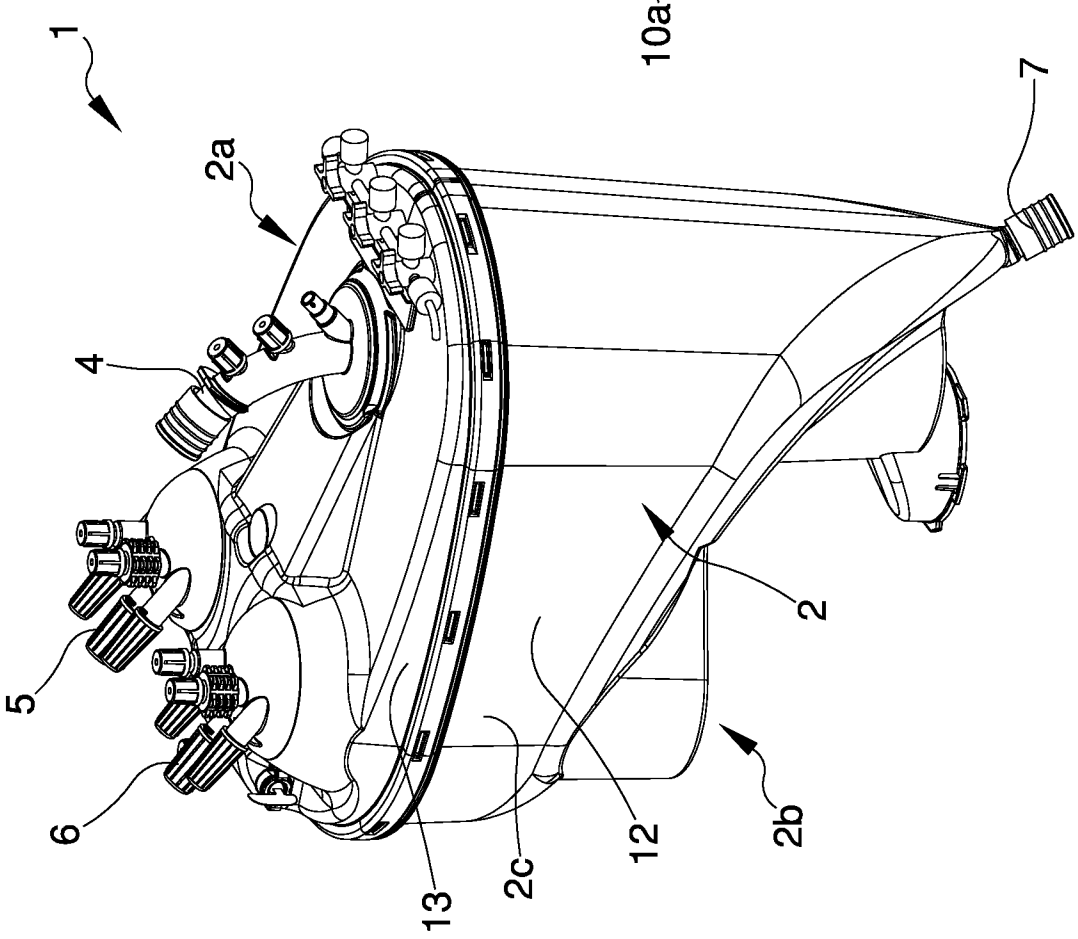


Fig.1

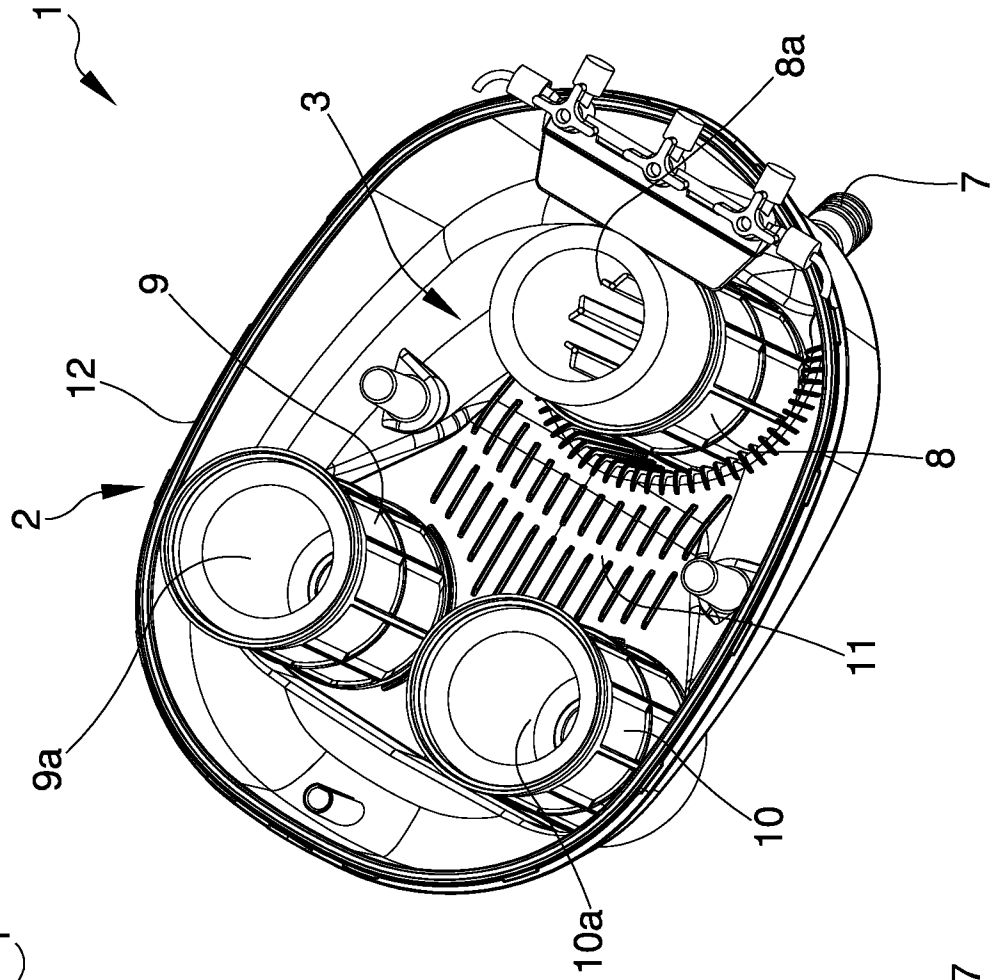


Fig.2

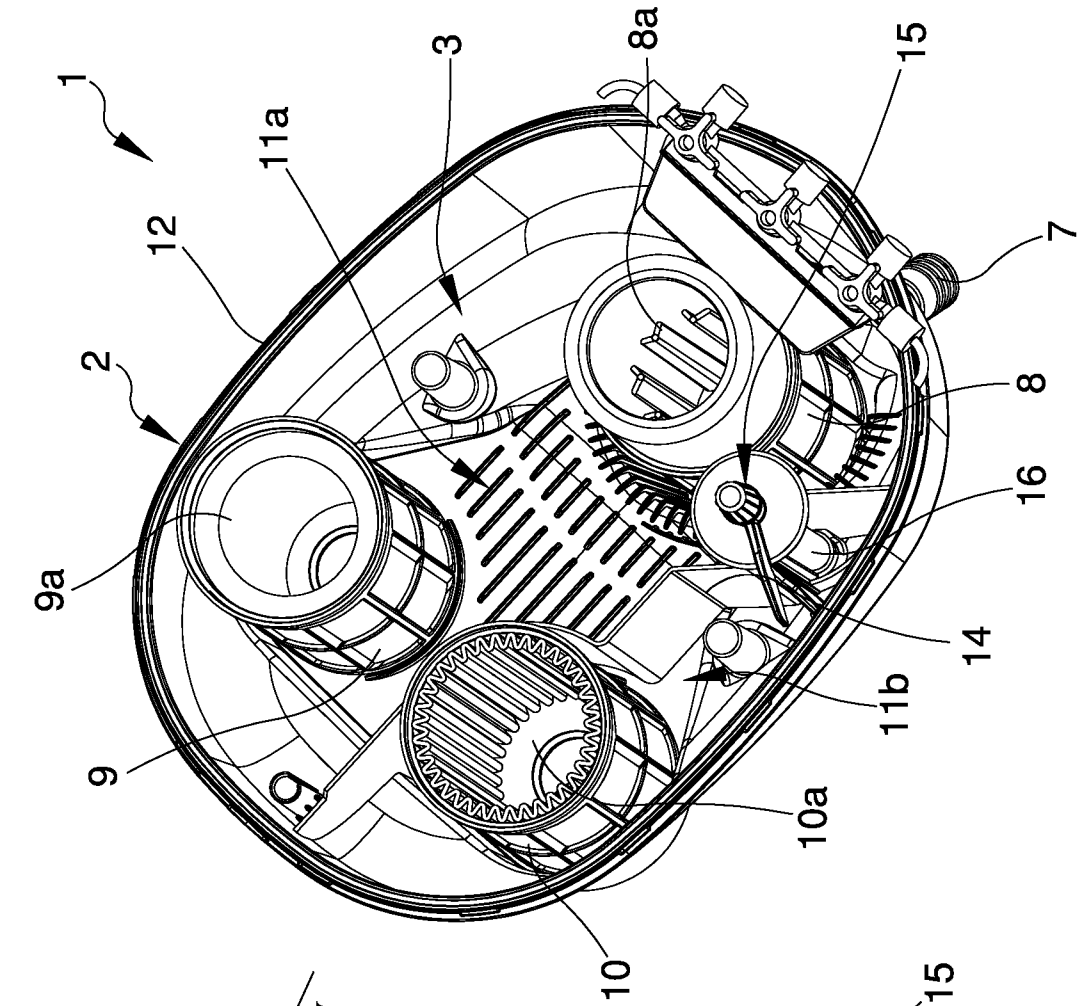

1
11a
3
8a
15
12
7
2
8
9a
16
14
11b
9
10a
10

Fig.4

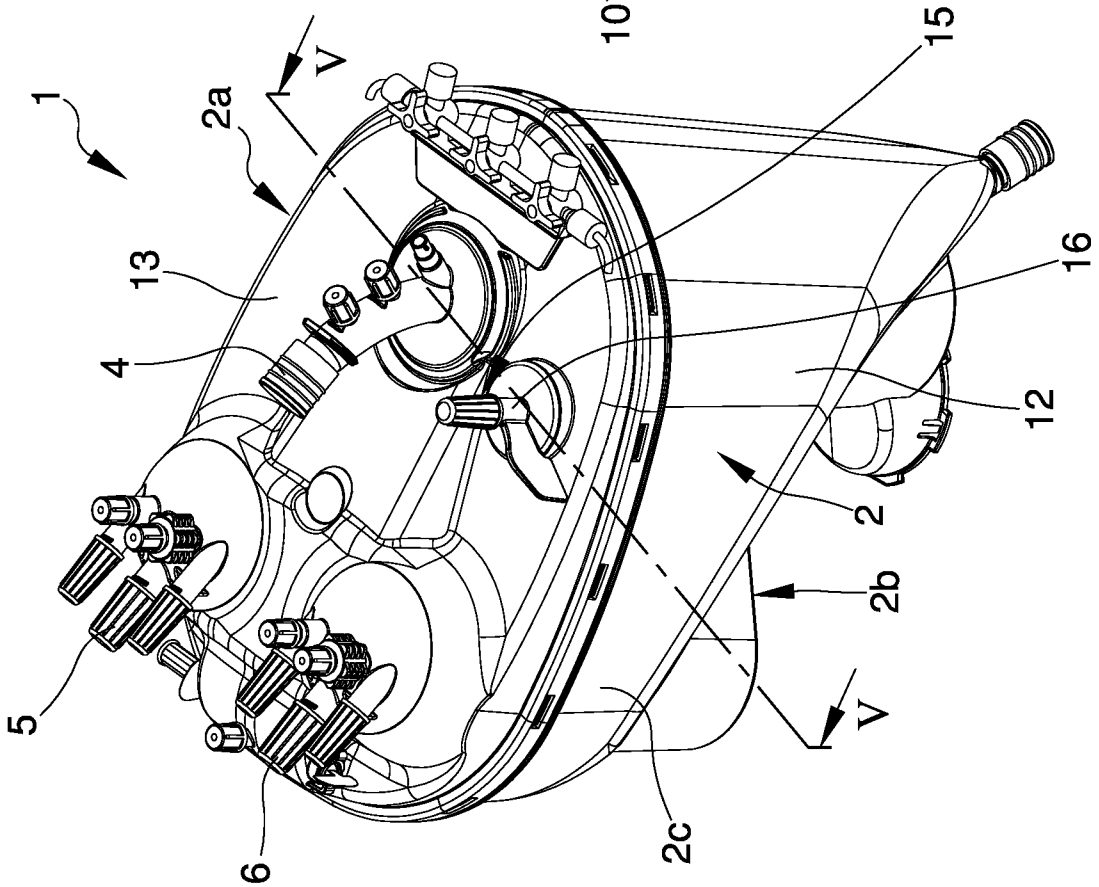

1
2a
V
15
13
16
4
12
2
2b
5
V
6
2c

Fig.3

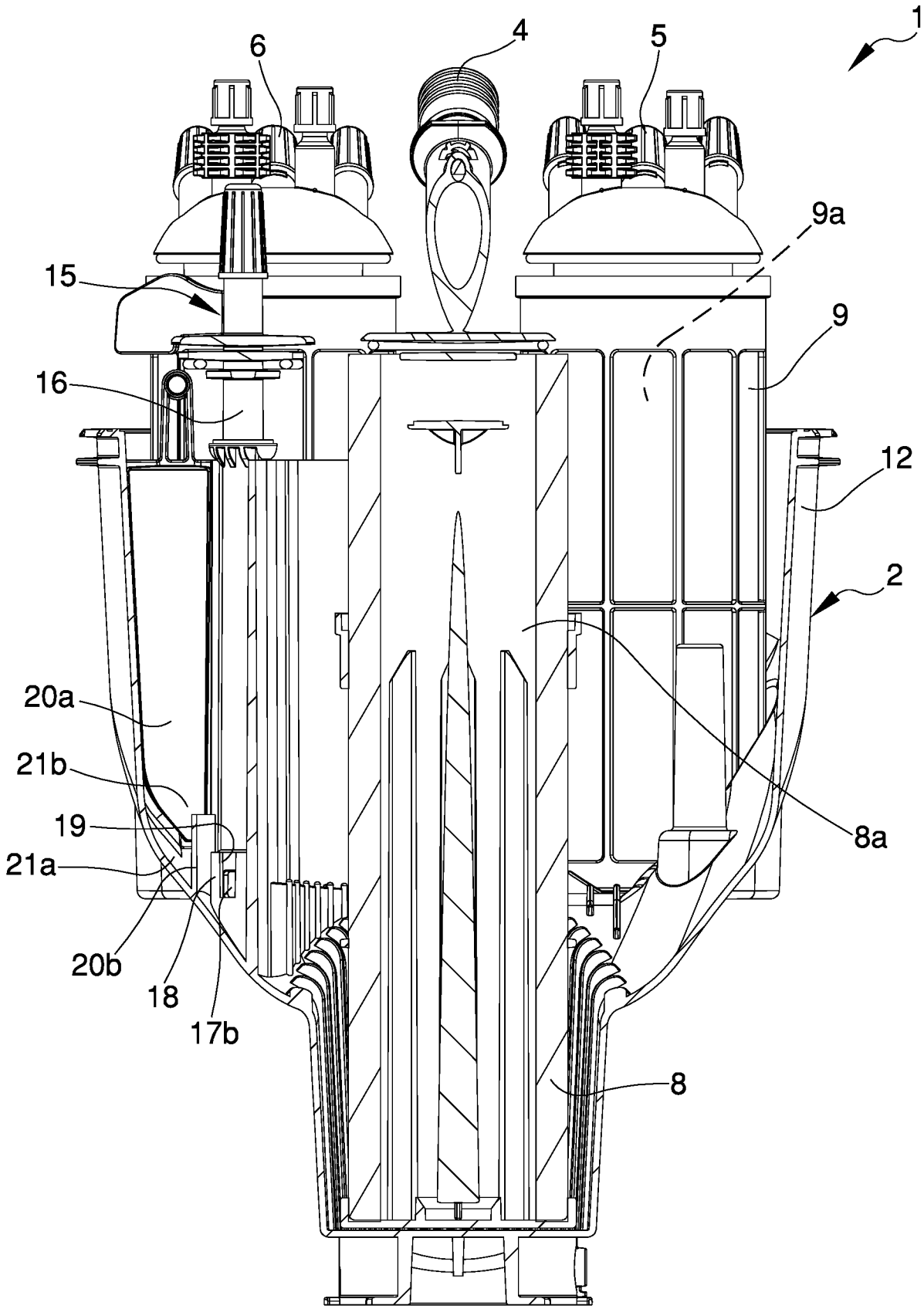


Fig.5

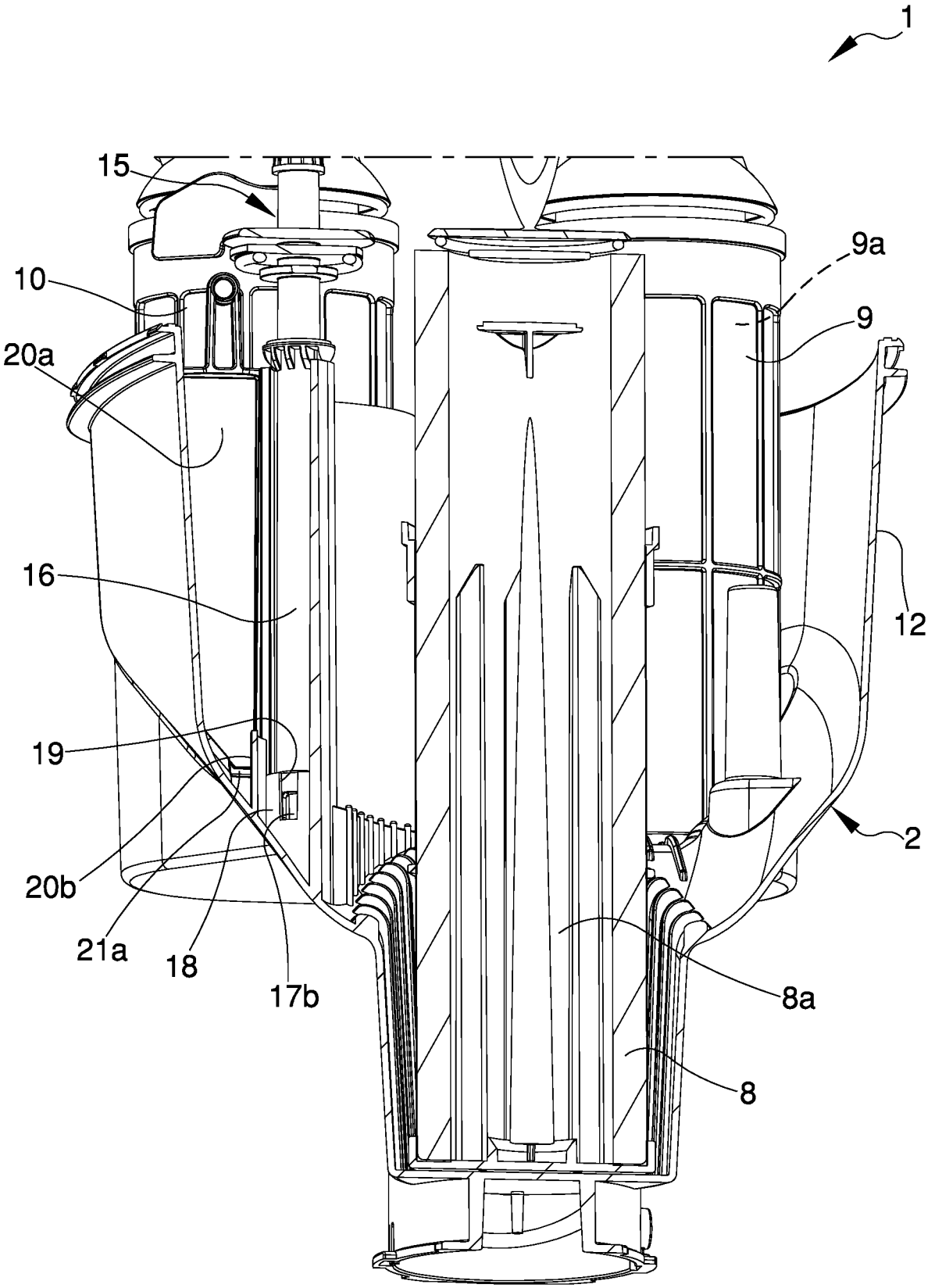


Fig.6

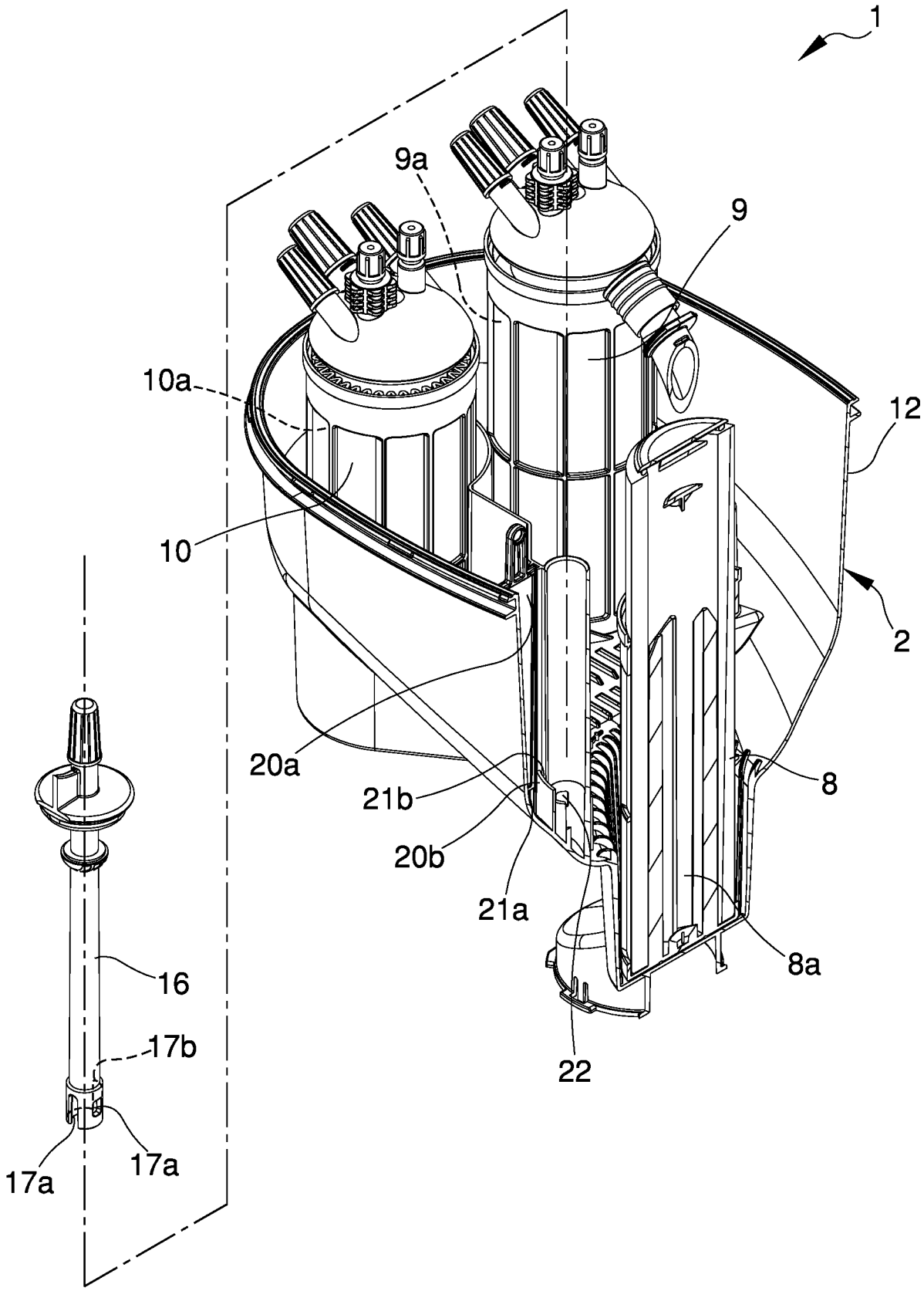


Fig.7

Fig.8

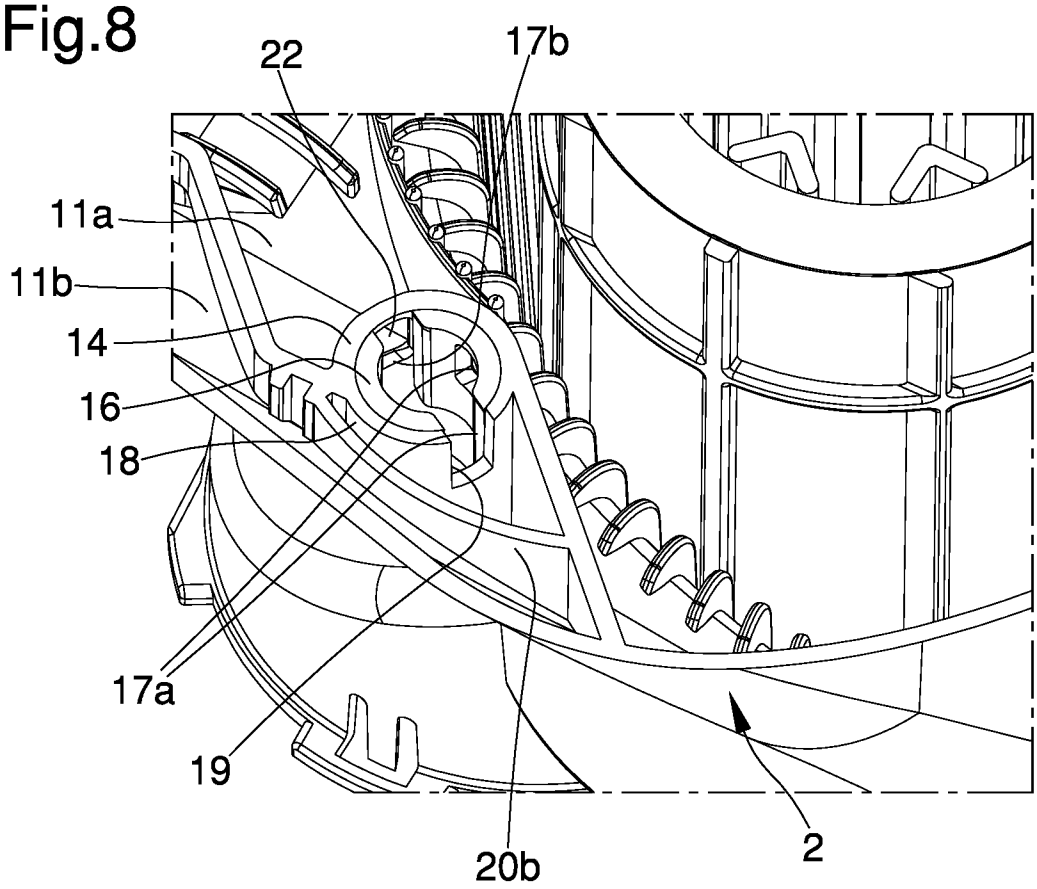

22
17b
11a
11b
14
16
18
17a
19
20b
2

Fig.9

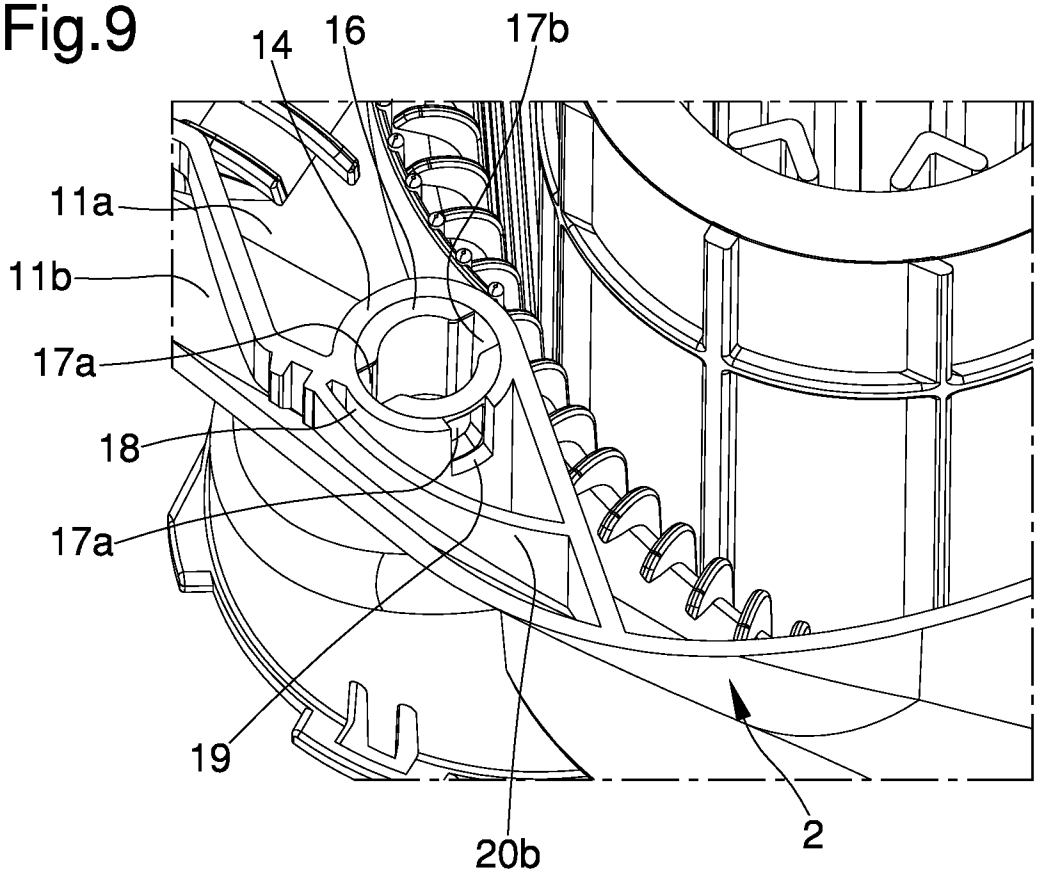
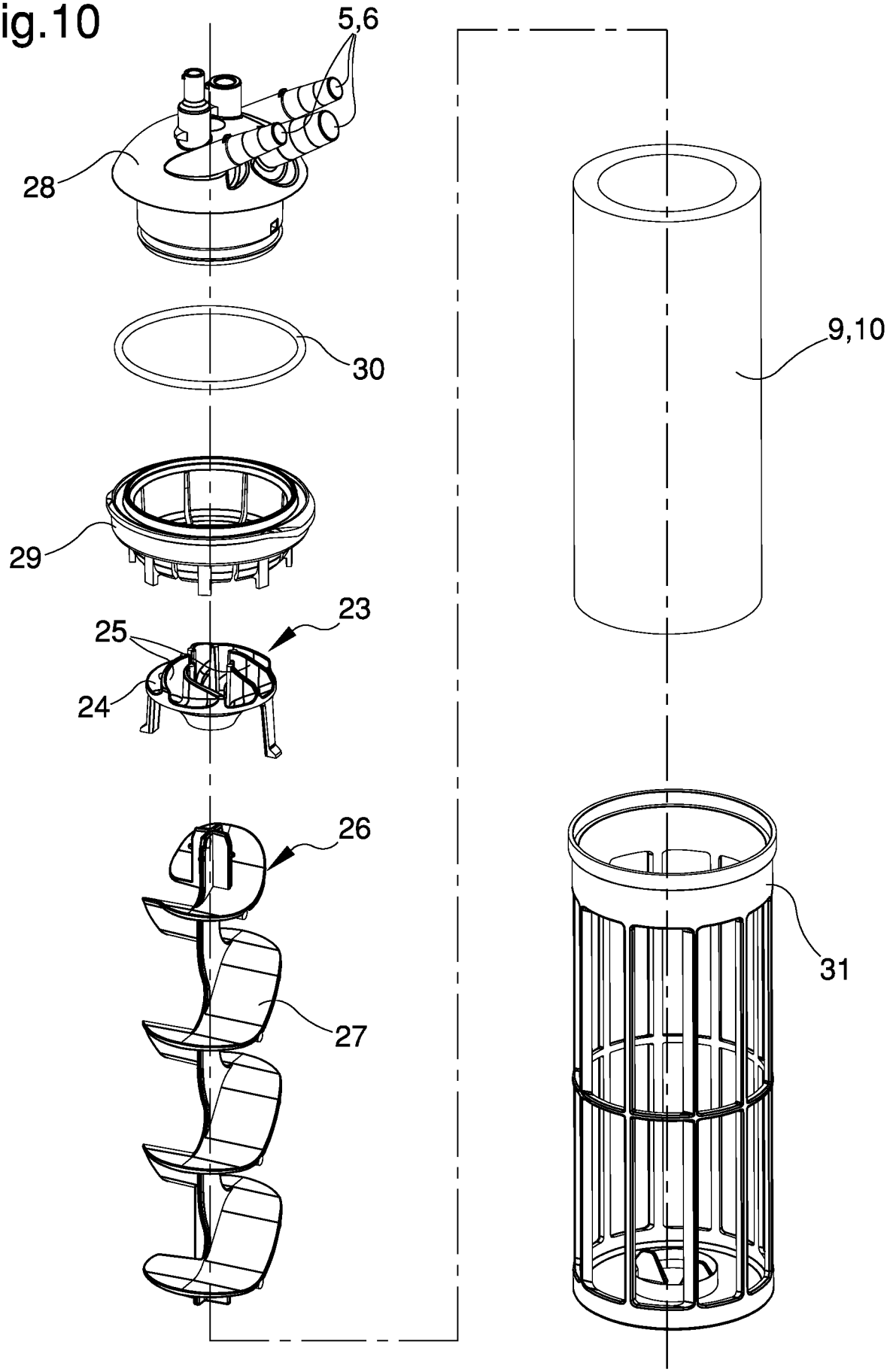

14
16
17b
11a
11b
17a
18
17a
19
20b
2

Fig.10



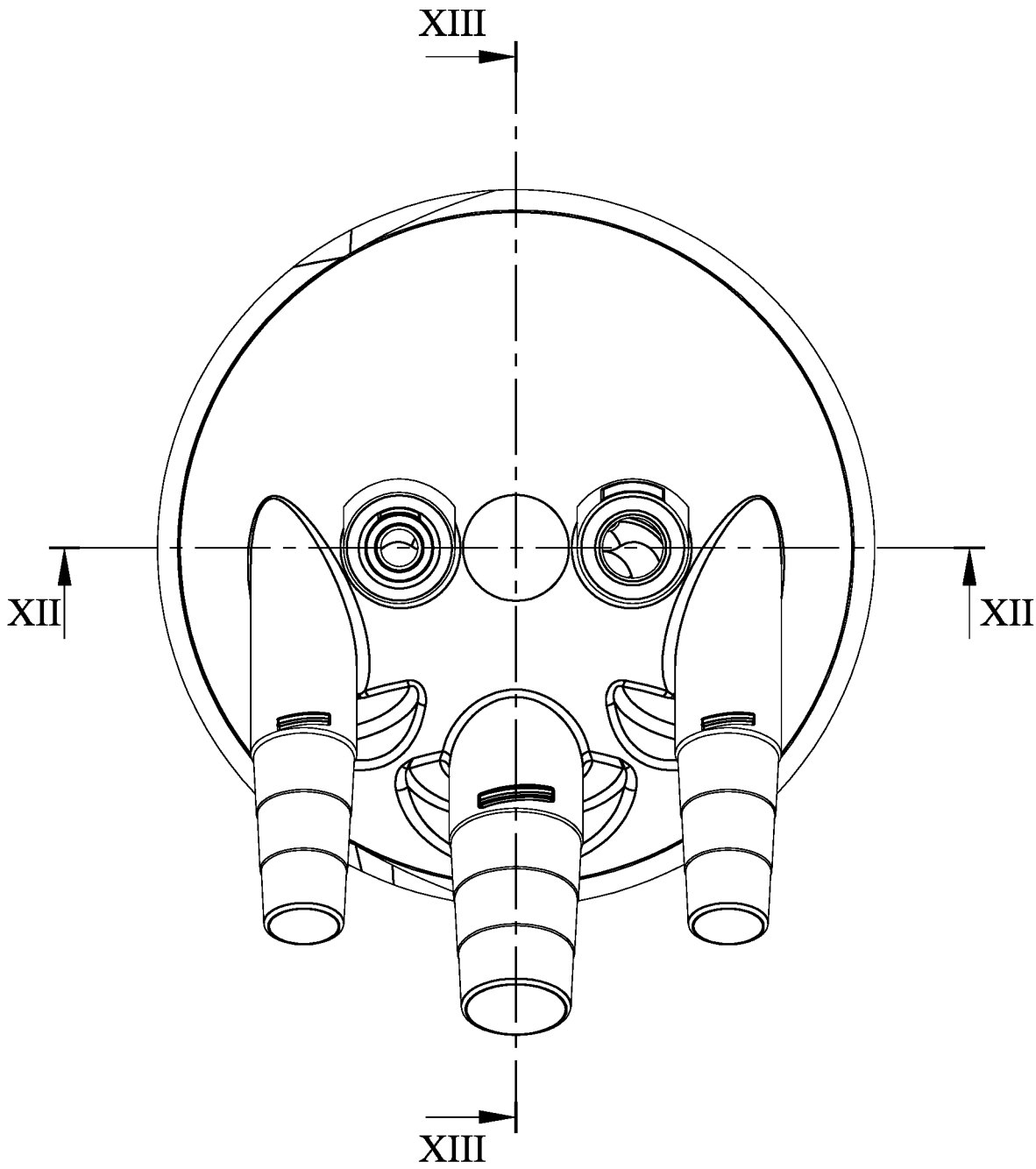


Fig.11

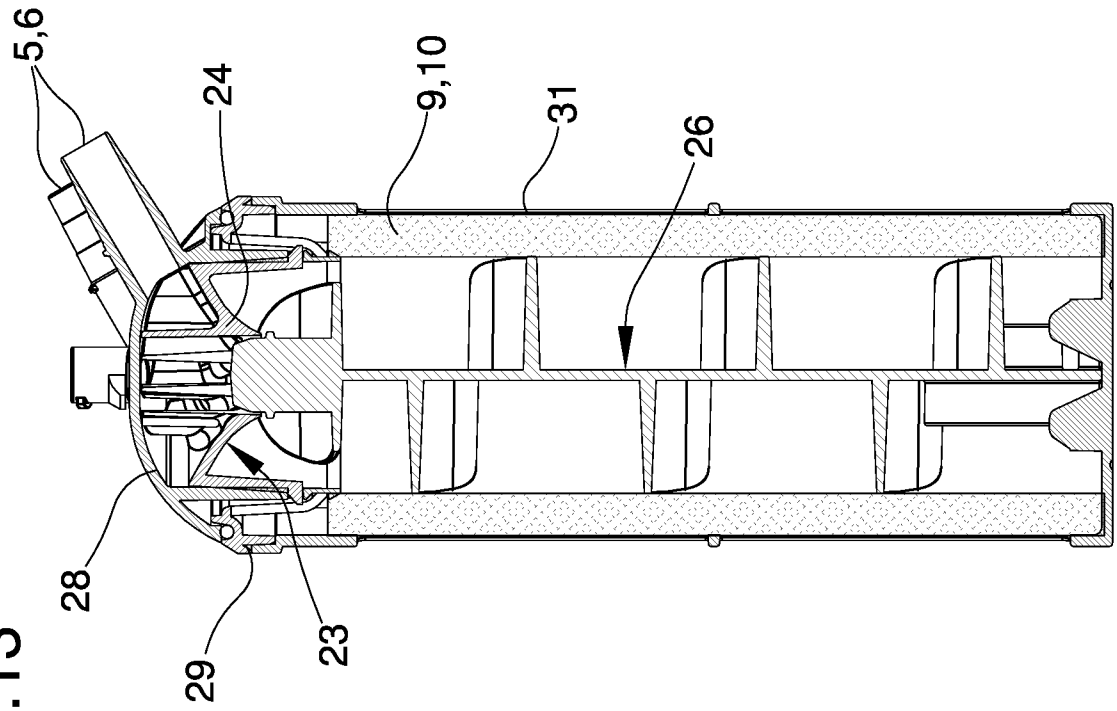


Fig.13

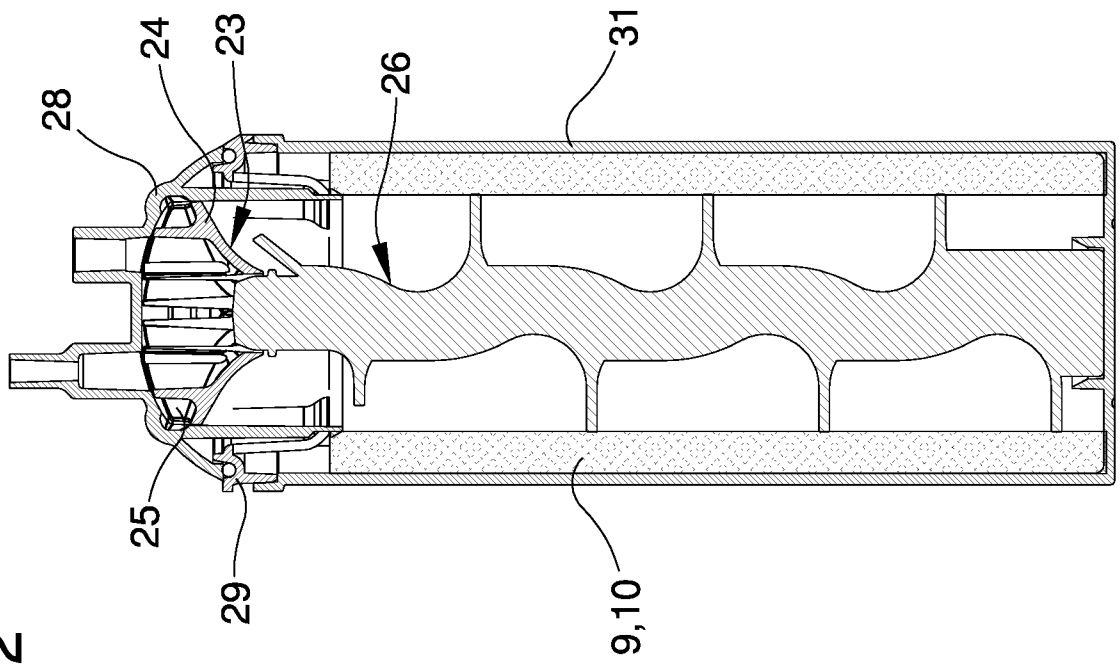


Fig.12

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/057402

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M1/36
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)
A61M B01D

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2002 165878 A (TERUMO CORP) 11 June 2002 (2002-06-11) abstract; figures 5-6 paragraphs [0025] - [0029], [0078] - [0086] -----	1-10,15, 21 16
Y	EP 2 545 948 A1 (SORIN GROUP ITALIA SRL [IT]) 16 January 2013 (2013-01-16) abstract; figures 3A-3C paragraphs [0047] - [0050] -----	16
A	US 5 411 705 A (THOR ERIC J [US] ET AL) 2 May 1995 (1995-05-02) abstract; figures column 5, line 38 - column 9, line 41 ----- -/--	1-21

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 January 2019	14/01/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kaden, Malte

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/057402

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 4 648 971 A (PABST RICHARD E [US]) 10 March 1987 (1987-03-10) abstract; figures column 3, lines 24-53 -----	10-12

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Information on patent family members

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