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The object of the invention is a vacuum cleaner according to the preamble of patent claim 1.

Filter cleaning for a vacuum cleaner with a valve control for cleaning of at least one filter
5 has been disclosed with the German patent specification DE 101 01 219 B4 going back to the same applicant. Where the same parts are present, the same reference numbers as in DE 101 01 219 B4 have also been used in the present description so that with regard to the function and the control sequence of the present invention, reference may be made to the disclosure content of DE 101 01 219 B4.

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In the said patent specification, a single ring filter is present which is divided into two different filter halves by a separating bar. However, the said publication also permits the arrangement of more than one ring filter with associated separating bars so that two or more filters can already be seen from this publication.

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In the said publication, the fan is arranged in the housing of the vacuum cleaner, but which is associated with the disadvantage that the fan capacity is greatly limited. For this reason it is not possible with DE 101 01 219 B4 to equip vacuum cleaners with considerably greater suction capacities, because - in space-limiting manner - the fan is
20 arranged in the vacuum cleaner itself, and this limits the suction capacity.

A further disadvantage of the vacuum cleaner which is the basis of this patent specification is that operation of a vacuum cleaner separated from its housing is not possible. It led to the disadvantage that on the one hand - as explained above - high
25 suction capacities are not possible due to the over-sized fan and secondly, it is associated with the disadvantage that such a vacuum cleaner cannot be used as a pre-separator in stationary fan systems.

A further disadvantage consists in the fact that there is an undesirably high level of noise,
30 because the fan equipped with a motor running at high speed is arranged in the vacuum cleaner housing itself and thus produces a considerable level of sound.

Because in the known patent specification DE 101 01 219 B4, the fan is also integrated into the vacuum cleaner, only so-called ring filters are possible there and not individual filter cartridges which are arranged separately in themselves in the vacuum cleaner housing.

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Therefore, the known system has the following disadvantage that in principle only one single ring filter, which is divided into two filter halves by a separating bar, may be used and not a plurality of different filters which are to be cleaned respectively separately in themselves using the known cleaning control.

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The object of the invention is to design a vacuum cleaner of the type mentioned in the introduction and in particular its cleaning control to be simpler and more reliable.

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To achieve the set object, the invention is characterised by a vacuum cleaner having the features of claim 1.

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In the vacuum cleaner itself, it is now possible to dispense with the relatively large-structure ring filters and to use instead so-called filter cartridges which are arranged in a plurality of more than two separately actuatable filter cartridges in the vacuum cleaner housing.

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Hence, for example 2, 3 or a plurality of separately actuatable filter cartridges may be arranged in the vacuum cleaner housing, wherein the cleaning control of the invention is actuated so that respectively one or more filter cartridges are in the cleaning position, whereas the other filter cartridges are in the suction (working) position.

30

This is a considerable advantage with respect to the state of the art according to DE 101 01 219 B4, because only one single ring filter is always present there, the service life of which is of course limited and it is considerably more favourable instead of a single ring filter, to bring a plurality of filter cartridges respectively into a suction position or cleaning position.

Therefore, the service life of such a vacuum cleaner is considerably extended with any number of more than two filter cartridges arranged thereon, because the filter cartridges may all be cleaned separately in themselves and also may be interchanged separately according to the wear. However, the application should not be restricted to filter
5 cartridges, for example flat filters are likewise possible.

The novel valve control differs due to inventive features of patent DE 101 01 219 B4.

The advantage of the “old” valve control was so-called sequence control, as disclosed in DE 101 01 219 B4.

10 Sequence control is understood to mean that during cleaning, first of all the suction opening of the filter to be cleaned is closed, and only then – if this suction opening of the one filter is closed by a valve – is the other valve serving for purging opened. Hence, it has always been ensured that only if the one valve is closed, has the other valve been opened.

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Within the framework of the present invention it is claimed that the valve control for the one valve is simplified and is claimed independently of the control of the other valve.

Whereas in the state of the art, the valve discs were connected to the valve rod of the
20 lifting magnet in sliding manner, the novel valve control makes provision that the valve disc is firmly connected to the respective valve rod of the lifting magnet and is held in spring-loaded manner in its closed position by means of a compression spring. This is a difference with respect to the state of the art, in which the compression spring is there only to permit any displacement at all, wherein the closed position starts due to the action
25 of negative pressure on the valve disc.

In the present invention, a valve control is claimed in which the compression spring is required to produce the closed position and thus the valve disc is held in spring-loaded manner in the closed position. In order to bring the latter into the open position, the spring
30 must therefore be compressed accordingly by the lifting magnet.

The advantage of the valve construction of the invention is the simplicity of construction, because sliding fits are no longer necessary at the valve rods and only valve discs used

firmly with the valve rod are employed. As a result of this measure, it is necessary to reverse the suction side and pressure side of the entire valve control, as is then illustrated later using the further figures in the drawing.

- 5 The invention is illustrated in more detail below using the drawings. Further features and advantages of the invention can thus be seen from the drawings and their description.

The following are shown:

- 10 Figure 1: section through a vacuum cleaner with two filters, wherein both filters are in the working position. This embodiment does not correspond to the object of the invention and serves for the general description of a vacuum cleaner with filter cleaning.
- 15 Figure 2: the same section as Figure 1, wherein the right filter is cleaned. This embodiment does not correspond to the object of the invention and serves for the general description of a vacuum cleaner with filter cleaning.
- 20 Figure 3: a design of a vacuum cleaner with a valve control of the invention in which the valve discs are firmly connected to the respective valve rod, wherein the two filters are in the working position
- Figure 4: the same representation as Figure 3 with the cleaning position of the right filter
- 25 Figure 5: schematised the representation of the separate arrangement of a vacuum cleaner from a fan
- 30 Figure 6: the plan view of an embodiment modified with respect to Figure 5, in which a vacuum cleaner is operated using two fans operated in parallel operation

Figure 7: section through a vacuum cleaner with two filters, wherein both filters are designed as flat filters and are in the working position. This embodiment does not correspond to the object of the invention and serves for the general description of a vacuum cleaner with filter cleaning.

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Generally a vacuum cleaner housing 1, which has a container base 5 and is sealed at the top by a housing cover 2, is in Figure 1. The embodiment according to Figures 1 and 2 does not correspond to the object of the invention and serves for the general description of a vacuum cleaner with filter cleaning.

- 10 Two separate filters 3, 4 designed as filter cartridges are arranged in the vacuum cleaner housing 1. These filters 3, 4 may be designed as filter cartridges or also as separate ring filters.

The suction air charged with dirt is sucked into the interior of the vacuum cleaner housing 15 1 in arrow direction 11 via a suction connection 10 and flows in arrow direction 11 against the outer side of the filters 3, 4. The suction air may likewise also be designated below as untreated air.

A base 35, which also shows a part of the valve control described in Figure 1, is arranged 20 in the vacuum cleaner housing 1.

The base 35 is part of a suction chamber 13 in which the valves assigned to one another and operated parallel to one another are arranged.

- 25 Since the filters 3, 4 and their valve control are designed to be exactly the same, it suffices in principle to describe only the one side of Figures 1 and 2, because the opposite mirror-symmetrical side is designed to be exactly the same.

The same reference numbers have also been used for the same parts, wherein the letter a 30 has also been used additionally in some cases with reference to the left or right filter.

The working position can be seen in Figure 1, which shows that the suction air is sucked through the respective filter 3, 4 in arrow direction 12 and is cleaned accordingly. This

air reaches an inlet channel 14, 15, wherein it is also added that the interior of the respective filter 3, 4 is designated as filter chamber 9 which is connected respectively in air-tight manner to the inlet channels 14, 15.

- 5 The air thus flows into the suction chamber 13 in the marked arrow direction via the valves held in open position, wherein the suction chamber 13 is connected in air-tight manner to a circumferential annular chamber 23, into which the air flows, is collected there and leaves the inlet opening 20 in arrow direction 49.
- 10 The pure air drawn off there is supplied to the suction side of a fan 21 via a hose 24, which fan 21 compresses the air and blows it as compressed air via the outlet 22 into the hose 25, where the air flows under excess pressure in arrow direction 6 into the excess pressure chamber 8 in the region of the housing cover 2.
- 15 The air is collected there and leaves the blow-out filter 7 in the arrow direction drawn in and flows off into the atmosphere.

It is now important that the valve control is designed so that on the valve seat 18, 19, first of all the valve disc 31, 31a is raised from the valve seat, wherein the associated spring 33, 33a is compressed. This is achieved in that the two lifting magnets 26, 27 are without current and the associated valve rods 28, 29 actuated by the lifting magnets 26, 27 are held in open position solely by the dead weight of the valve rod 28, 29 and the pressure differences between the intermediate chamber 16, 17 and the suction chamber 13, wherein the spring 33, 33a is not yet tensioned. A valve disc 31, 31a which can be displaced on the respective valve rod 28, 29 with the aid of seals 39 is present and is raised from the valve seat 18, 19 in the position shown in Figure 1.

At the same time, in the position drawn in Figure 1, the upper valve disc 30, 30a, which sits on the valve rod 28, 29 in sliding manner likewise via a seal 39 and can be displaced there, is in closed position, because it sits on the valve seat 42 in sealing manner.

This closed position is effected solely by the pressure difference between the excess pressure chamber 8 and the suction chamber 13 so that the said valve discs 30, 30a, 31, 31a are thus automatically held in the working position by the applied negative pressure.

- 5 The driving discs 32, 32a firmly connected to the respective valve rod 28, 29 still have no function in the position shown in Figure 1.

However, if there is cleaning of the right filter according to Figure 2, while the left filter 4 remains in its working position, the following takes place:

10

The valve rod 29 is raised by actuating the lifting magnet 26, and the lower stop disc 38 compresses the spring 33, whereby the valve disc 31 is pressed against the valve seat 18. Hence, the inlet channel 14 is closed, the negative pressure in the inlet channel 14 thus rises, the valve rod 29 moves further upwards in vertical direction, compresses the spring
15 33, and the driving disc 32 drives the valve disc 30 on its sliding seat upwards on the valve rod 29, and thus the valve seat 42 is opened and purging air flows in arrow direction 41 into the inlet channel 14 and flows there directly into the interior (filter chamber 9) of the filter 3, where it flows through the filter under excess pressure and releases the dirt particles adhering to the outer side of the filter 3 and deposits them on the container base
20 5 in the interior of the vacuum cleaner housing 1.

The left filter 4 is thus shown now as before in the working position, that is, the air stream corresponds exactly to that as shown in Figure 1. This means that the purging air is likewise removed in arrow direction 41 and is drawn in by the filter 4 and reaches the
25 suction chamber 13 via the open valve disc 31a, runs into the annular chamber 23 from there and in arrow direction 49 reaches the suction hose 24, where it is drawn in by the fan 21 and compressed.

It can be seen in the working position according to Figure 1 that a distance 37 is set to 0
30 between the stop disc 34 and the valve disc 31, whereas in the same situation according to Figure 1, a distance 36 is present between the driving disc 32 and the valve seat 42.

It can thus be seen in the cleaning position according to Figure 2 that now the distance 37 has a certain size and conversely the distance 36 is set to 0.

When reversing the valve discs 30, 31 shown, the purging air or pure air thus suddenly
5 reaches the purging opening 40 and flows through the filter 3 in arrow direction 41.

Figures 3 and 4 show an exemplary embodiment of the invention, wherein it is also possible to exchange the suction side and pressure side of the connections of the fan 21 into the vacuum cleaner housing 1 of Figures 1 and 2, because a different valve control
10 is present.

The valves shown in Figures 3 and 4 comprise valve discs 30, 31 firmly connected to respectively the valves rod 28, 29, whereas in the state of the art, these valve discs were designed to be sliding on the valve rod.
15

The advantage of this measure is that sliding seals and displacement guides may be dispensed with, as can be seen from Figures 3 and 4. The consequence of this is that now the compressed air compressed by the fan 21 is introduced into the housing via first of all a sound absorber 43 via the hose 25, wherein the pressure chamber 8 now has a further
20 design than comparatively in Figures 1, 2.

Otherwise the same reference numbers apply to the same parts, where it can be seen from Figures 3 and 4 that now the air, which flows into the pressure chamber 8 in arrow direction 6, reaches the atmosphere as blow-out air via the excess pressure chamber 8
25 and the blow-out filter 7.

The suction air generated by the fan 21 is again sucked into the interior of the vacuum cleaner housing 1 via the suction connection 10 and acts upon the filters 3, 4 from their outer side.
30

However, differing from the representation in Figures 1 and 2, the suction connections and pressure connections of the fan 21 are interchanged for one another, because the suction air, which flows through the interior of the filters 3, 4 in arrow direction 12, flows

into the upper suction chamber 13 through the valve discs 31 now raised from the valve seat 18 in Figure 3 and in arrow direction 49 is drawn in by the hose 24 and supplied to the suction side of the fan 21.

- 5 In the position drawn according to Figure 3, the lower valve disc 30 is in closed position and is held in closed position by the spring 33 which rests on a stop 44 fixed to the housing and is supported there.

This is necessary, because excess pressure is present in the pressure chamber 8 and the
10 spring must bring about the open position in Figure 3.

The lifting magnets 26, 27 are not actuated and acted upon in the position shown in Figure 3.

- 15 On the other hand, should for example the right filter 3 according to Figure 4 be cleaned, the lifting magnet 26 is acted upon, and the valve rod 29 is raised, whereby the lower valve disc 30 is raised from the lower valve seat 42. Hence, purging air may flow out of the excess pressure chamber 8 into the now open inlet channel 14 and flow into the filter chamber 9 of the filter 3.

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It is thus assumed that the valve disc 31 rests on the upper valve seat 19 and closes this opening.

- At the moment when the lower valve seat 42 is opened, the upper valve seat 19 is
25 however not yet closed. This defines an intermediate position, but which is harmless for cleaning, because shortly thereafter, the one valve seat 19 and the other valve seat 42 is opened and thus then the filter 3 is effectively cleaned.

Figures 3 and 4 thus show a simplified valve design with regard to the valves.

- 30 In a further preferred embodiment, an arrangement of the spring 33 in the upper region of the tappet 28 or within the solenoid valves 26 and 27 should be claimed.

Figures 5 and 6 show as an exemplary embodiment, how a vacuum cleaner housing 1 may be arranged on a carriage 46 together with a fan 21 designed to be separate therefrom.

- 5 The carriage has wheels 47, with which it is designed to be movable.

Whereas Figure 5 shows the use of a single fan 21, which is driven in a manner known per se by a motor 45, Figure 6 shows that it is also possible to operate several fans 21, 21a parallel to one another.

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There is thus a fan 21a in addition to a fan 21, and the two fans 21, 21a generate respectively excess pressure air which is supplied to the single vacuum cleaner housing 1 via the hoses 25, 25a.

- 15 It can be seen there that a number of five filters are arranged in the vacuum cleaner housing, wherein only the filter 3 is marked, because the other four remaining filters are designed to be exactly identical.

- Each filter can be actuated using an assigned lifting magnet 26 or 27, and depending on
20 the actuation position, one or more filters 3 are held in working position and one or more filters in the cleaning position.

The suction air drawn off from the vacuum cleaner housing 1 is supplied to the suction side of the respective fan 21a, 21 via a branched hose pipe or tubing.

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It can also be seen from Figure 6 that the individual, annular lifting magnets arranged distributed uniformly on the circumference are attached to a central attachment 48 on the vacuum cleaner housing 1.

- 30 A vacuum cleaner housing 1 having at least two filters is shown with Figure 7. As an unusual feature in this embodiment, a flat filter, which is arranged to be separate in the vacuum cleaner housing, is used as filters 3, 4.

As the flat filter, for example a paper filter, a charcoal filter, a polyester non-woven or the like may be used here. However, the invention should not be restricted to these filter embodiments.

Drawing legend

	1	Vacuum cleaner housing
	2	Housing cover
5	3	Filter
	4	Filter
	5	Container base
	6	Arrow direction
	7	Blow-out filter
10	8	Excess pressure chamber
	9	Filter chamber
	10	Suction connection
	11	Arrow direction
	12	Arrow direction
15	13	Suction chamber (connected to 23)
	14	Inlet channel
	15	Inlet channel
	16	Intermediate chamber
	17	Intermediate chamber
20	18	Valve seat
	19	Valve seat
	20	Inlet opening
	21	Fan
	22	Outlet
25	23	Annular chamber (negative pressure chamber)
	24	Hose
	25	Hose
	26	Lifting magnet
	27	Lifting magnet
30	28	Valve rod
	29	Valve rod
	30	Valve disc 30a
	31	Valve disc 30a

	32	Driving disc 32a
	33	Spring 33a
	34	Connection disc
	35	Base
5	36	Distance
	37	Distance
	38	Stop disc 38a
	39	Seal
	40	Purging opening
10	41	Arrow direction
	42	Valve seat
	43	Sound absorber
	44	Stop
	45	Motor
15	46	Carriage
	47	Wheel
	48	Attachment
	49	Arrow direction

PATENTKRAV

1. Støvsuger med i det mindste to filtre (3, 4) anbragt i et støvsugerhus (1) og en ventilstyring for filterrensning af i det mindste et filter (3, 4), hvor, under renseprocessen,
 - 5 i det mindste en ventil placeret i sugeåbningen for et filter (3, 4), som skal renses, lukkes og i det mindste en ventil, som tjener til rensning af et filter (3, 4) åbnes, hvor ventilstyringen for hvert filter (3, 4) hver især har en løftemagnet (26, 27), en ventilstang (28, 29), som aktiveres af løftemagneten (26, 27) og to ventilskiver (30, 31),
 - kendetegnet ved, at** ventilskiverne (30, 31) er fast forbundet med den respektive
 - 10 ventilstang (28, 29) for den respektive løftemagnet (26, 27), hvor, når løftemagneten (26, 27) ikke er aktiveret, den ene ventilskive (30) er fastholdt på fjederbelastet måde i en lukket position ved hjælp af en fjeder (33) og hviler på et ventilsæde (42), medens den anden ventilskive (31) er i en åben position, og sugeluften genereret af en blæser (21) suges ind i det indre af støvsugerhuset (1) via en sugeforbindelse (10) og påvirker
 - 15 det tilknyttede filter (3, 4) fra ydersiden, og når løftemagneten (26, 27) er aktiveret, er den ene ventilskive (30) i sin åbne position, hvor skylleluft strømmer fra et overtryksskammer (8) igennem en indløbskanal (14) ind i et filterkammer (9) i filteret (3, 4), og filteret (3, 4) renses, medens den anden ventilskive (31) er i den lukkede position og hviler på et ventilsæde (19).
 - 20
2. Støvsuger med en ventilstyring ifølge krav 1, **kendetegnet ved, at** forskellige filterpatroner eller plane filtre kan aktiveres separat i forhold til hinanden af ventilstyringen.
- 25 3. Støvsuger med en ventilstyring ifølge ethvert af kravene 1 eller 2, **kendetegnet ved, at** fjederen (33) hviler på et stop (44), som er fastgjort til huset og er understøttet dér.
4. Støvsuger med en ventilstyring ifølge ethvert af kravene 1-3, **kendetegnet ved, at** mere end to løftemagneter (26, 27) er fastgjort ringformet og ensartet på en central
 - 30 fastgørelse (48) på støvsugerhuset (1), og et filter (3, 4) er knyttet til hver løftemagnet (26, 27).

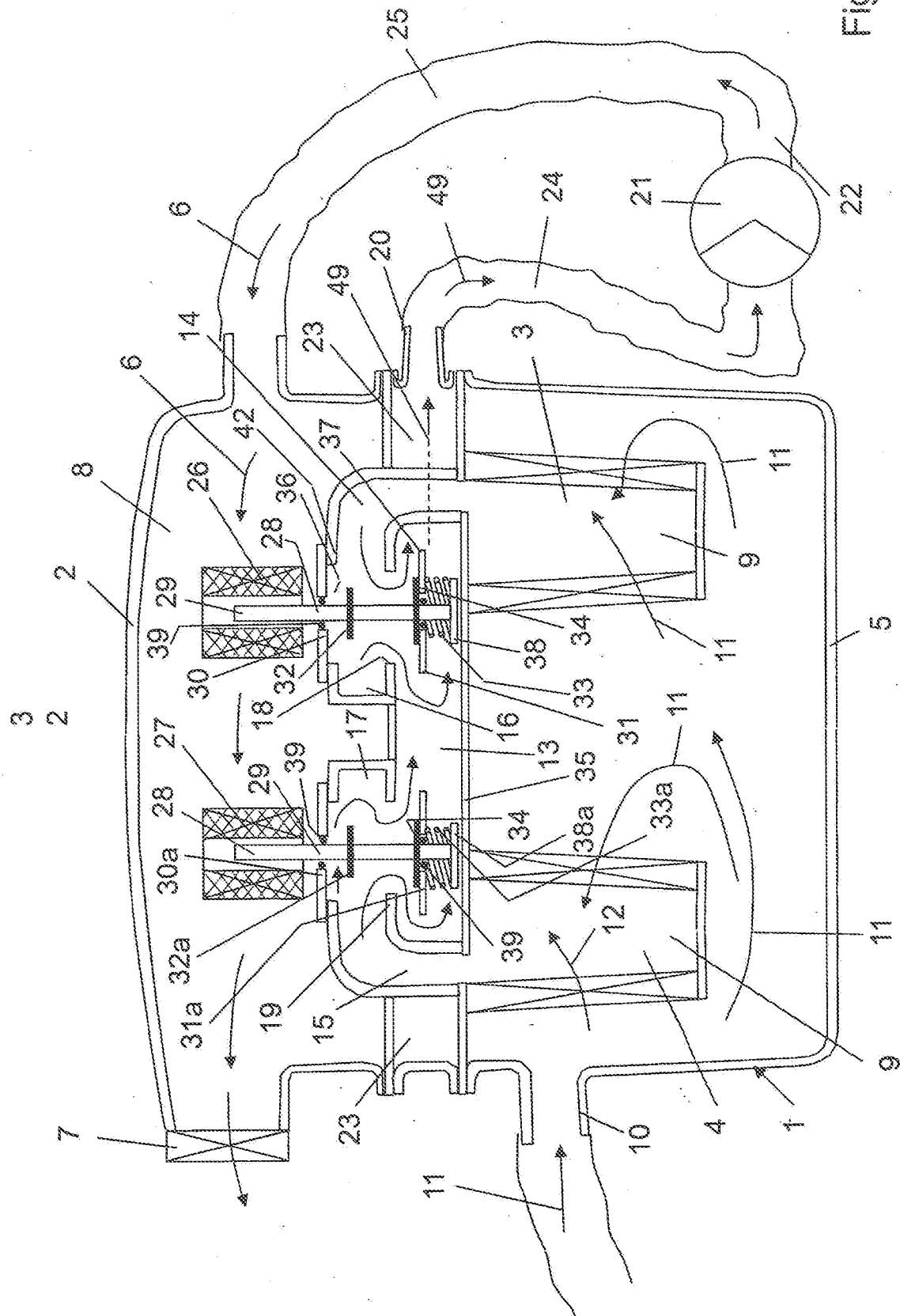


Fig. 1

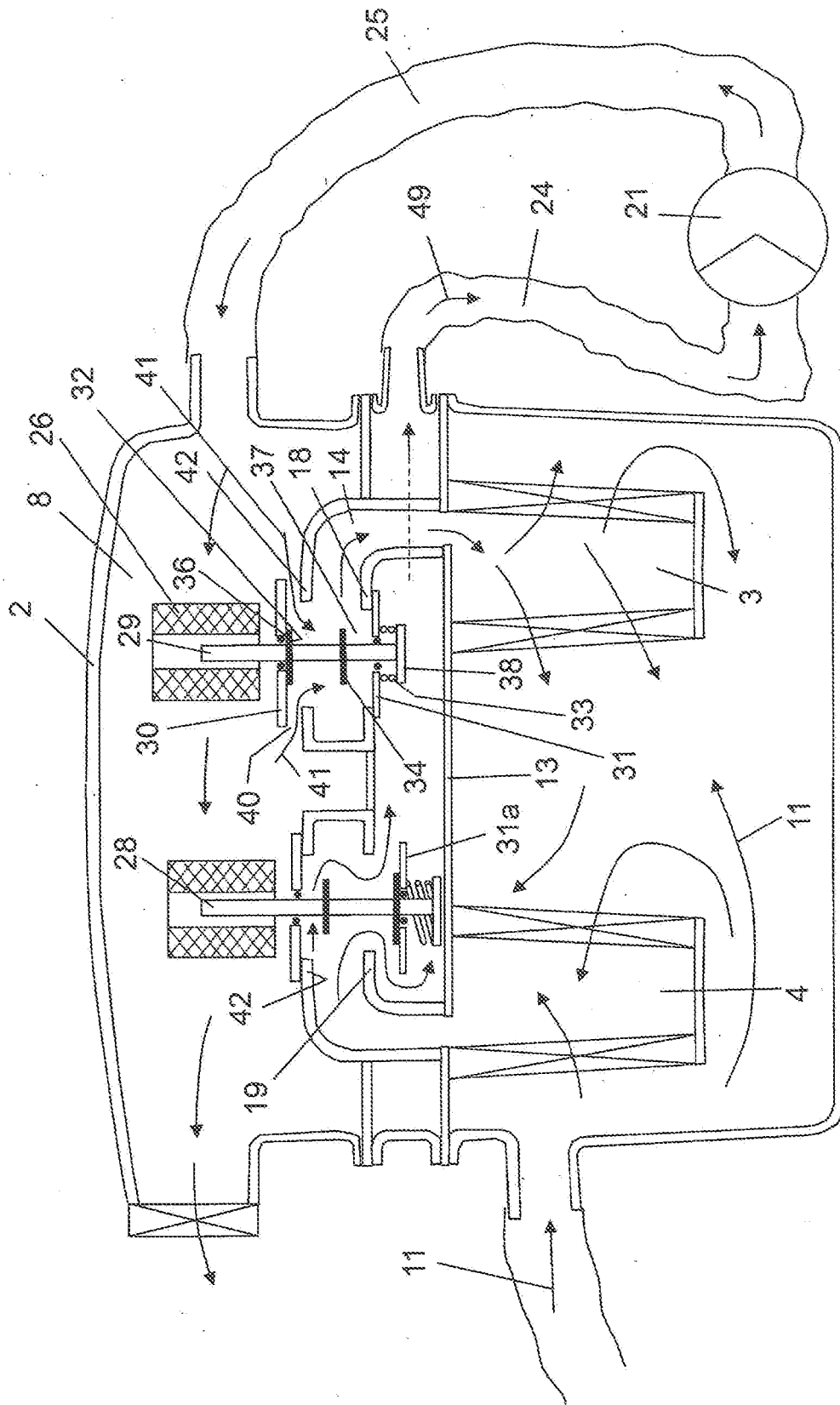


Fig. 2

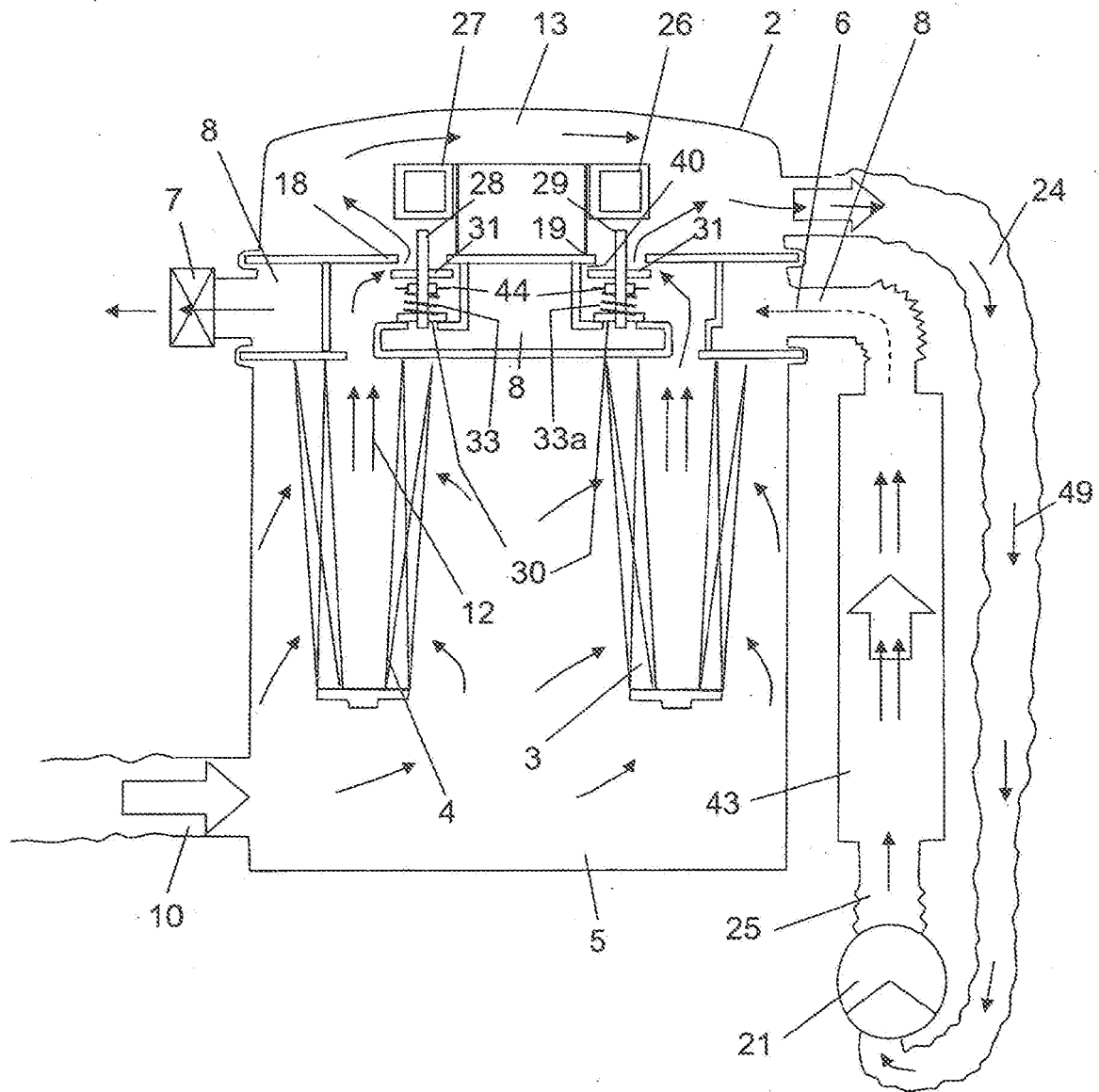


Fig. 3

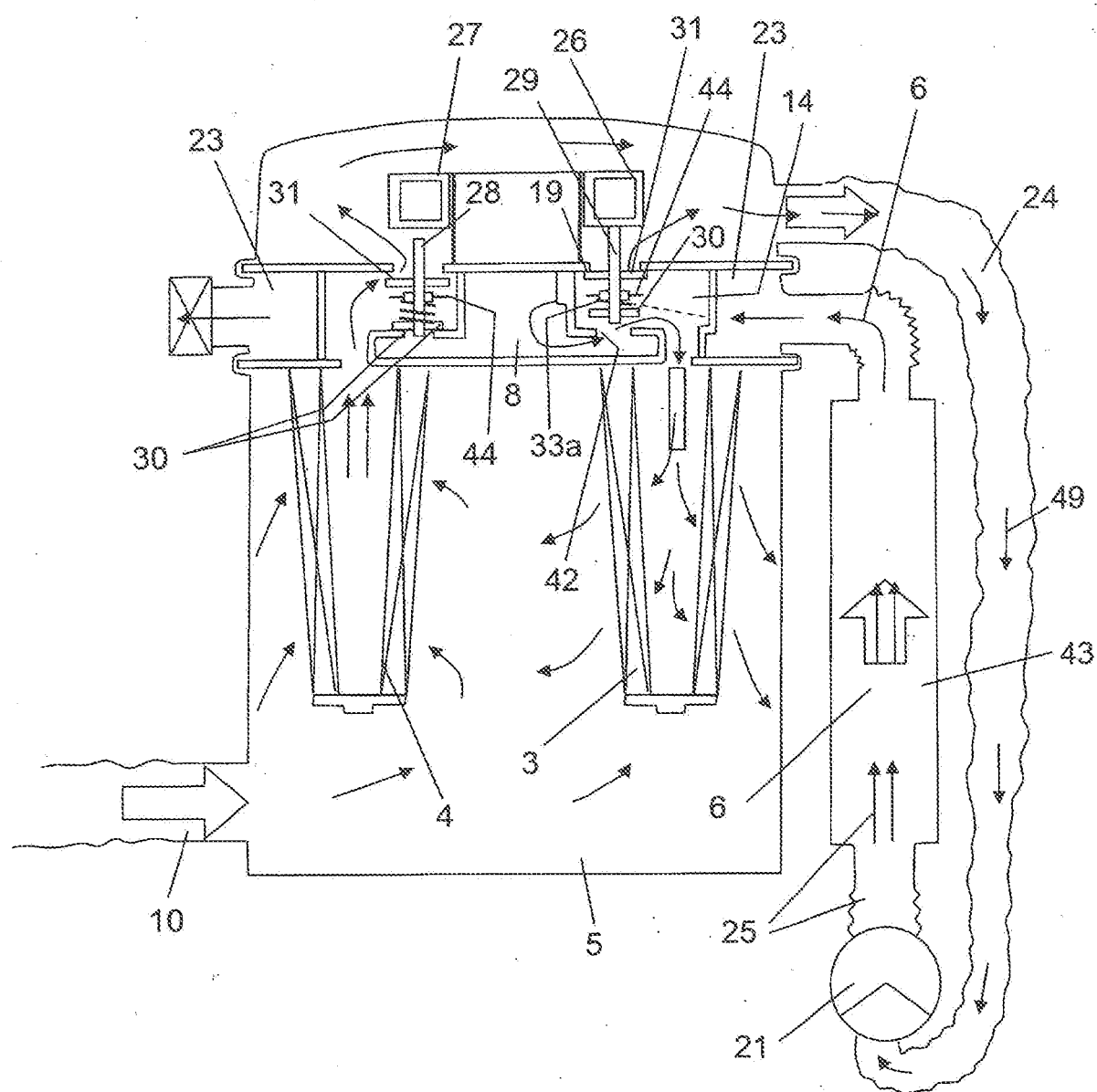


Fig. 4

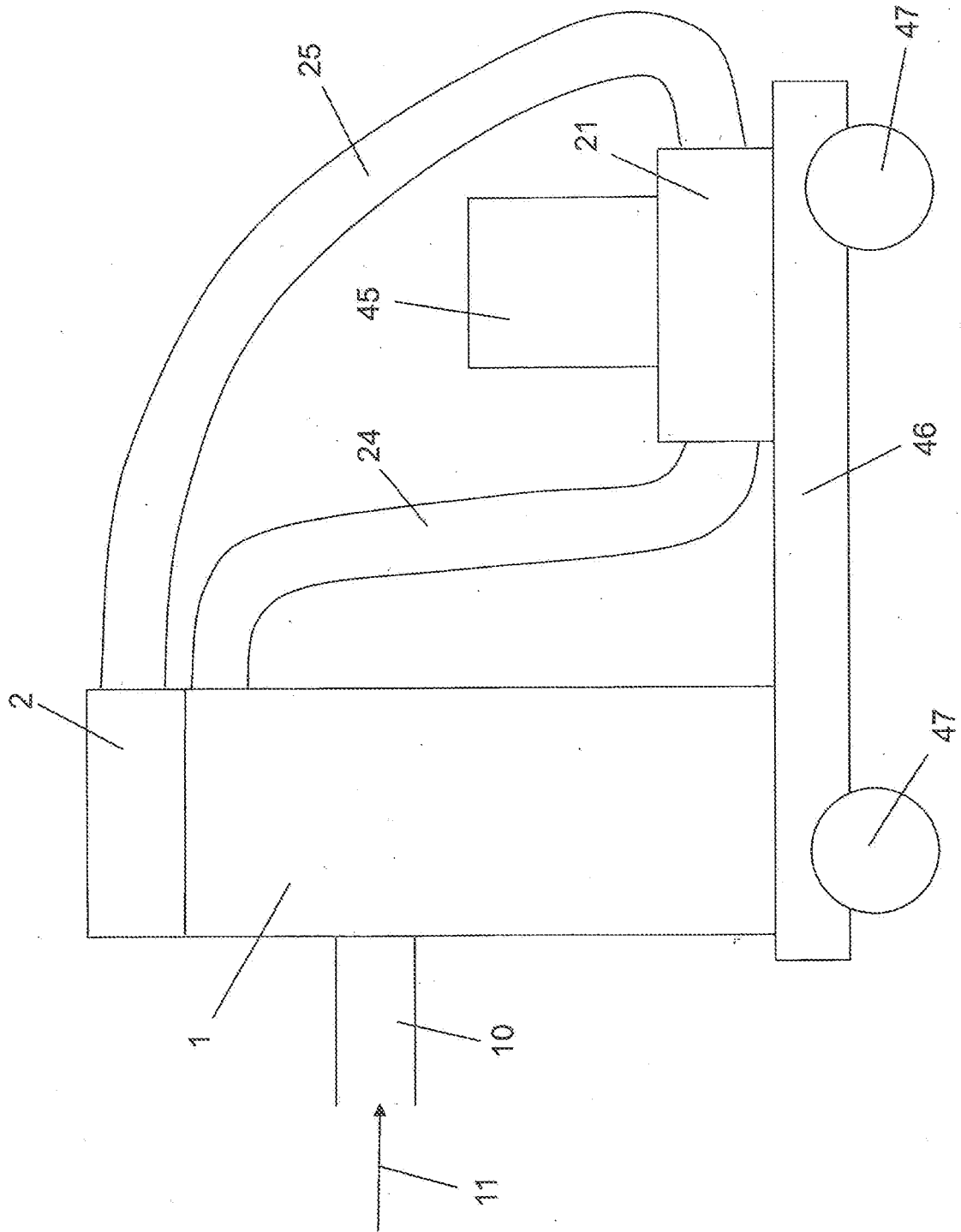


Fig. 5

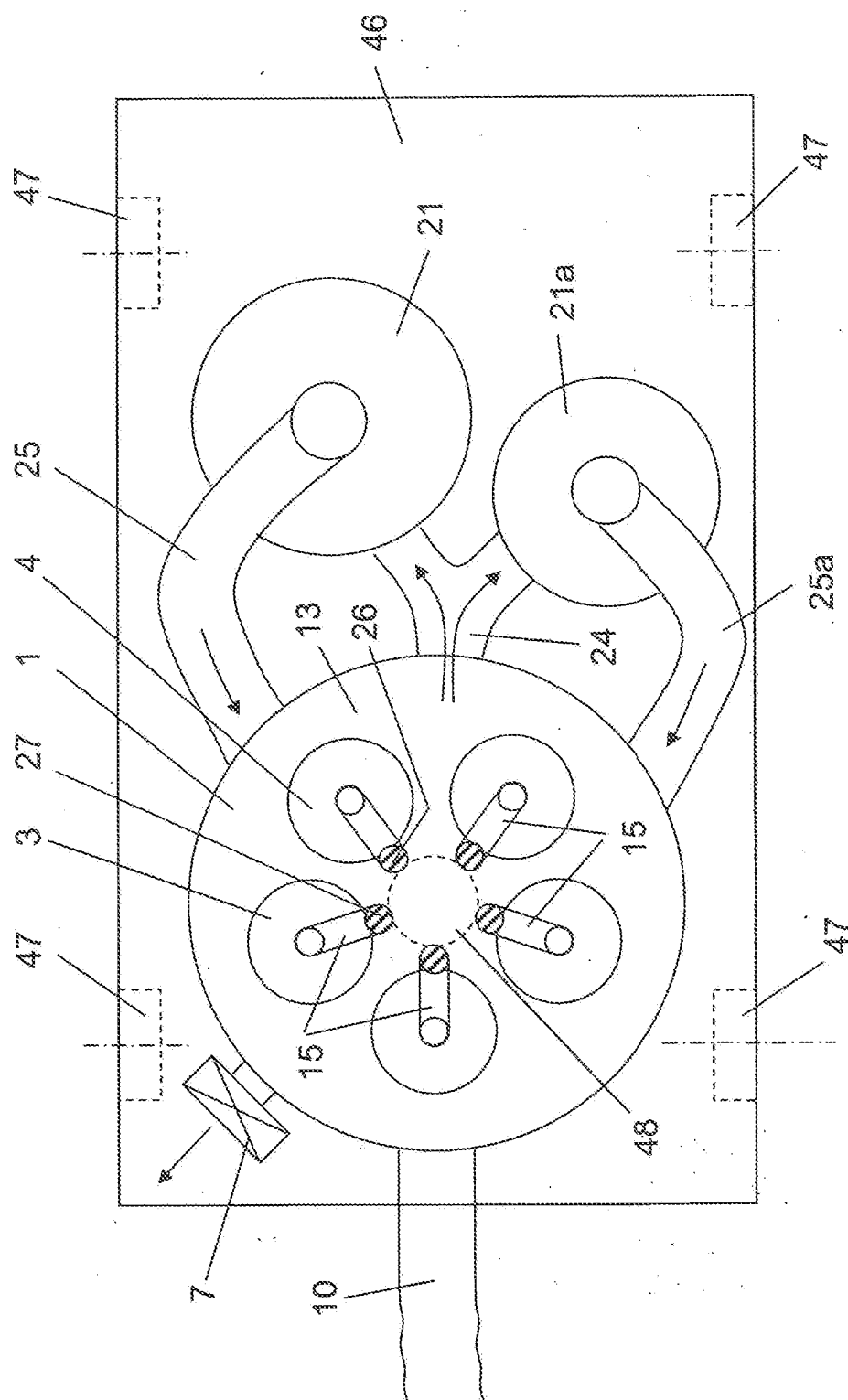


Fig. 6

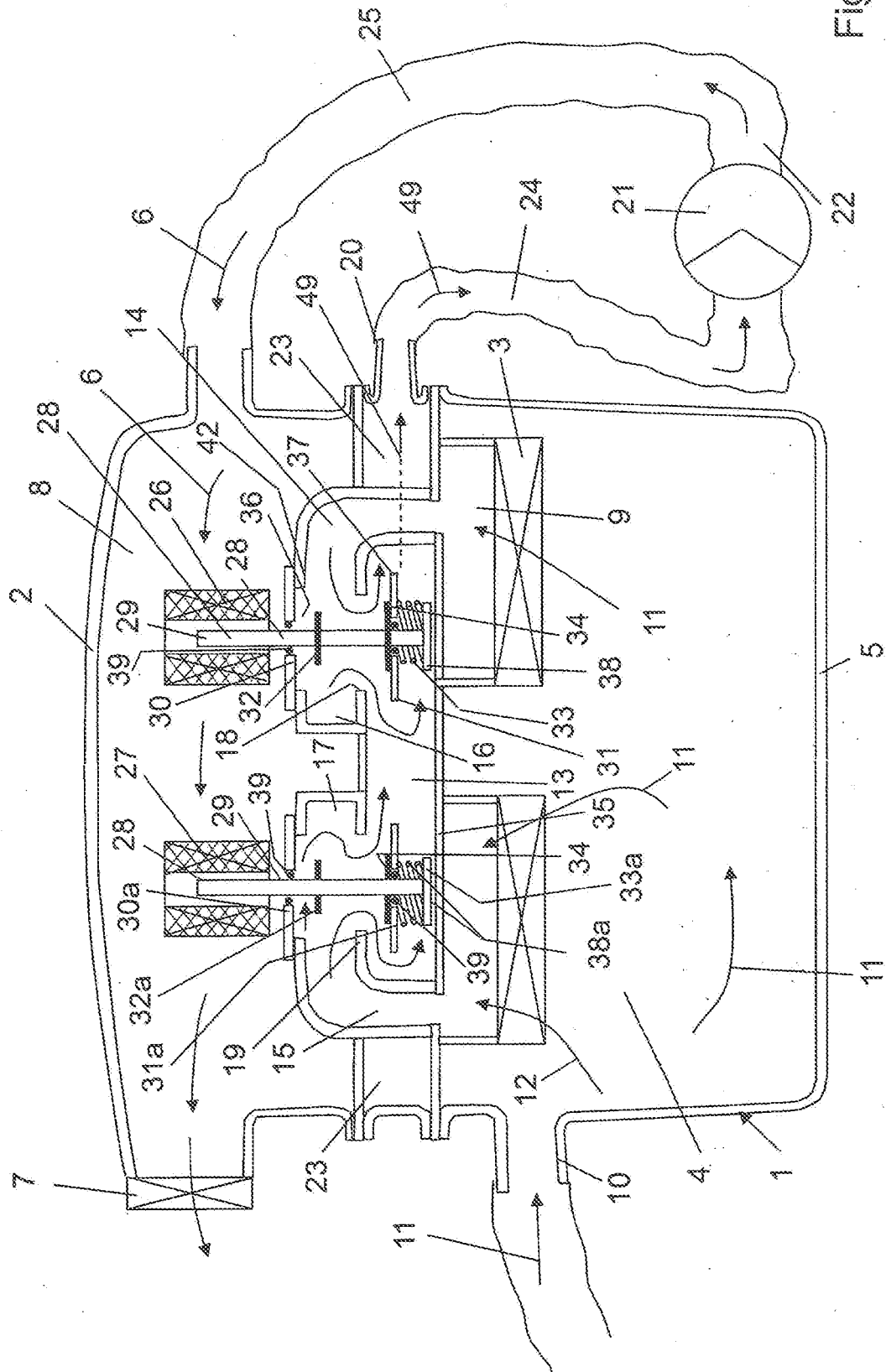


Fig. 7