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VENTING DEVICE FOR PUMP IN A CONTAINER

Description

The invention relates to a system comprising a container for the temporary storage of wastewater and an assembly, which has a centrifugal pump that is arranged in the container, wherein the centrifugal pump pumps a medium into a line element forming a pressure branch.

In particular, such systems can be designed as wastewater raising systems. These drain off water which arises below the flood level in a manner secure against backup. They are used to pump faeces-free and faeces-containing wastewater arising in the cellars of domestic premises. The wastewater which arises is collected in a container. The filling level is generally detected by means of a level sensor. When a certain limit is reached, a centrifugal pump switches on and pumps the wastewater out of the container.

The container has a receptacle for an assembly. The assembly, which comprises a centrifugal pump driven by a motor, is submerged in the wastewater. The motor projects from the container. The impeller of the centrifugal pump is surrounded by a housing part.

DE 10 2007 008 692 A1 shows a wastewater raising system having a container in which wastewater collects. At the top of the container there is an opening, into which an assembly having a centrifugal pump with a motor projects.

The centrifugal pump comprises a housing part in which an impeller is arranged. The housing part with the impeller projects into the wastewater. The wastewater is drawn in via an intake branch and is pumped out of the container by the centrifugal pump. The motor of the assembly is connected to the impeller by a shaft.

The assembly comprising the pump housing with the impeller and the motor connected by a shaft forms a unit. The motor component projects from the container. The assem-

bly is supported by flange rings or plates. Sealing devices are arranged between the flange rings or plates and the container, ensuring that neither wastewater nor unpleasant odors can escape from the container to the outside.

DE 199 13 530 A1 contains a description of a wastewater raising system having a container which holds liquid that flows to the container at irregular intervals and in different quantities. The system comprises an assembly having a pump and a drive component. By means of the pump, liquid is pumped out of the container into a sewer system. The pump housing with the intake branch projects into the container. The drive component of the pump projects from the container.

In systems with self-priming pumps which are integrated into a container, air often accumulates in the pump. There is therefore a need for evacuation, which serves to remove gas or air accumulations and thus enables the required filling with a pumping medium before the centrifugal pump is started up.

In the case of conventional wastewater pumps, evacuation is ensured by means of open lines of appropriately large diameter, for example. The leakage waterflow which occurs in this case is accepted or fed back to the inlet chamber. If centrifugal pumps are set up above the suction-side water level and the suction line thereof has a foot valve, they are filled up by hand by means of filling funnels on the pump intake branch or via an evacuation system if they are not capable of self-priming.

Particularly during initial commissioning and at low container filling levels, the pump chamber may fill partially or completely with air. The accumulated air must be discharged before or during the starting of the system.

In the case of conventional systems according to the prior art, this is achieved, for example, by means of holes, which are made in such a way that they either lie within the container or are connected to the container by a hose or the like.

In DE 29 13 967 A1, a wastewater raising system is described in which a hole, to which a branch connected to a pump evacuation hose is connected, is arranged in a main chamber cover plate. The pump evacuation hose opens into a manifold screwed to the pressure flange of the centrifugal pump.

In DE 29 13 970 A1, a wastewater raising system having a container for storing wastewater that arises at irregular intervals is described. The wastewater raising system comprises a pump, which is driven by means of a vertical shaft. The pump housing comprises an evacuating device, which has a protection device to prevent blockages due to solids in the wastewater.

In conventional systems, holes are often made in the pressure line for the purpose of evacuation. One example of this is GB864 620 A. In this case, blocking of the evacuation holes may occur, especially in the case of solids which contain fibres.

If the evacuation vent is arranged in the space behind the impeller, a reduced pressure may form in the case of impellers with ribs on the rear side, as a result of which air is drawn in.

Further pump assemblies having evacuating devices are known from the documents JP 2003 014250 A, EP 2 918 842 A1 and EP 2 573 288 A1.

It is the object of the invention to specify a system which features reliable operation and maximum efficiency, even when pumping media that contain solids, especially fibres. The system is to be characterized by a design which is as simple as possible and is to have little susceptibility to faults. Furthermore, the system is to be as economical as possible to manufacture and is to entail only the minimum possible operating costs.

According to the invention, this object is achieved by a system having the features of Claim 1. Preferred versions can be found in the dependent claims, the description and the drawings.

According to the invention, a gap of annular design for evacuation of the centrifugal pump is arranged between the line element of the system and the passage of the flanged bearing end shield (28). Thus, no additional evacuation holes are required for evacuation of the centrifugal pump in the design according to the invention. It proves particularly advantageous here if the line element and the component have a circular cross section or are of hollow-cylindrical design.

A leakage flow, which produces a liquid layer, passes through the annular gap for evacuation.

In the design according to the invention, there is no longer a need for a seal between the line element and the component. As a result, a simple and reliable design is provided which ensures reliable evacuation of the system and thereby ensures high efficiency of the system. In comparison with conventional systems, in the case of the annular gap evacuating device according to the invention, no holes can become clogged by solids.

In a particularly advantageous version, the line element and the component are arranged spaced apart from one another. For this purpose, the transition between the line element and the component is used, giving rise to a defined annular gap.

They preferably have an axial and/or radial spacing with respect to one another. In an advantageous embodiment, the spacing is less than 2 mm, preferably less than 1 mm, in particular less than 0.5 mm. It has proven particularly advantageous if the spacing is more than 0.01 mm, preferably more than 0.05 mm, in particular more than 0.08 mm.

It has proven particularly advantageous if the line element and/or the component have/has a nonplanar surface delimiting the gap. For this purpose, it is possible, for example, to introduce apertures into the abutting ends of the line element and/or the component. Such a design ensures reliable evacuation without the possibility of a reduction in the evacuation effect of the gap due to the capillary action of the medium or due to surface tension. In one version of the invention, the annular gap has one or more

notches. The notches are formed by the introduction of apertures into the line element and/or the component directly adjoining the latter.

The apertures in the line element and/or in the component directly adjacent thereto can have different shapes, e.g. polygonal, round, half, triangular and/or rectangular.

According to the invention, the line element is designed as a pressure branch, into which the centrifugal pump pumps the medium. According to the invention, the component is embodied as a passage of the flanged bearing end shield, which passage is used as a pressure line. The transition between the two parts is embodied as a butt joint of two cylindrical pipe sections and is situated within the container. This gives rise to an annular gap which can be used as an evacuation feature and which simultaneously produces laminar flow in the form of a fluid layer. In a particularly advantageous embodiment of the invention, the gap is aligned in such a way that a leakage flow from the gap impinges upon an element which is arranged in the container. This can be the float of a level control system, for example. The liquid layer is used to prevent or remove deposits on the level measuring device.

The assembly is preferably designed as a centrifugal pump assembly which forms a unit which can be installed and uninstalled as a complete unit.

It proves advantageous if the motor is arranged at least partially outside the container. In one version, the motor is positioned completely outside the container.

The impeller of the centrifugal pump is connected to the motor by a vertical shaft assembly.

Further features and advantages of the invention will become apparent from the description of an illustrative embodiment with reference to drawings and from the drawings themselves.

In the drawings:

Figure 1 shows a perspective view of the container of the system,

Figure 2 shows a side view of the assembly,

Figure 3 shows a perspective view of the assembly from below,

Figure 4 shows a section through the system,

Figure 5 shows an axial section through the container,

Figure 6 shows an enlarged detail view of region B from figure 5.

Figure 1 shows a container 1 of a wastewater raising system. In the illustrative embodiment, the container is a plastic container, which is designed for unpressurized operation. Wastewater which arises is stored temporarily in the container 1 and is then pumped into a wastewater sewer.

The container 1 has a region of greater overall height with two inlets 2 and a region of lower overall height. The container 1 furthermore has an emptying connection 3 and a handhole 4, which is closed by a cover (not shown in figure 1).

In figure 1, it is possible to see that part of a sensor module 5 which projects from the container 1, the sensor being designed as a level measuring device for detecting the filling level in the illustrative embodiment. A float switch is used in this case, for example.

The container 1 furthermore has an evacuation connection 6. The wastewater collected in the container 1 is pumped out via an outlet arranged on the container 1.

That part of the container 1 which is of lower overall height has a receptacle 8 for an assembly 9 shown in figure 2. In the illustrative embodiment, the receptacle 8 is embodied as a circular opening in a top side of the container 1.

The assembly 9 illustrated in figure 2 comprises a motor 13 and a centrifugal pump 10 having a first housing part 11 designed as a volute housing and a further housing part 12 designed as a pressure cover.

Adjoining a line element 14 is a pipe conduit 15 for carrying away the medium collected in the container 1. The line element 14 is designed as a pressure branch.

In the version illustrated in figure 2, the assembly has a further evacuation feature 30, which is provided in addition to the annular gap. The evacuation feature 30 is arranged above or at the level of an impeller 24 in the first housing part 11. In the illustrative embodiment, the evacuation feature 30 is embodied as a mutually aligned arrangement of openings, which are introduced in a region 25 of the first housing part 11 and in a region of the further housing part 12, which is embodied as a pressure cover fitting feature.

Gases in the pump escape through the evacuation feature 30 and, in the process, flow through the first opening in the first housing part 11 and then through the second opening, aligned parallel thereto, in the outer, further housing part 12 into the container 1.

Figure 3 shows a perspective view of the assembly from below. The assembly 9 has a cutting mechanism 16 for cutting up solid constituents of the medium. The medium flows into the centrifugal pump 10 through openings 17 in a housing part 18. Housing part 18 is embodied as an impeller body.

The further housing part 12 has regions 19, by means of which the assembly rests on the upper container wall.

Figure 4 shows a longitudinal section through the wastewater raising system. The assembly 9 rests on an upper container wall by means of region 19, which is formed by the further housing part. The assembly 9 is connected to the container 1 by fastening means 20. The fastening means 20 can be screws, for example.

The motor 13 is surrounded by a motor housing 21. The motor 13 is an electric motor, which has a stator and a rotor. The motor 13 drives a shaft 22, which is supported by a bearing assembly 23.

The shaft 22 is connected to an impeller 24.

The medium flows through openings 17 to the impeller 24. The impeller 24 is surrounded by a first housing part 11, which is embodied as a volute housing. The first housing part 11 has a region 25, which is designed as an impeller fitting feature in the illustrative embodiment. The first housing part 11 furthermore has an intake region 26. The intake region 26 is of hollow-cylindrical design and at least partially surrounds the cutting mechanism 16.

The impeller 24 is designed as a radial impeller and pumps the medium into a pipe conduit 15 via an angled line element 14.

Figure 5 shows an axial section through the container 1. The first housing part 11, which is designed as a volute housing, is connected to the line element 14, which is designed as a pressure branch. In the illustrative embodiment, the pressure branch is cast onto the volute housing.

The line element 14 is adjoined downstream by a component 27. The component 27 is part of a flanged bearing end shield 28. The component 27 is designed as a passage, which is used as a pressure line.

Figure 6 shows an enlarged detail of region B from figure 5. A gap 29 is formed between the line element 14 and the component 27. In this illustrative embodiment, the

transition between the line element 14 and the component 27 is designed in the manner of a butt joint. The line element 14 and the component 27 are arranged spaced apart. They preferably have an axial and/or radial spacing with respect to one another. In an advantageous embodiment, the spacing is less than 2 mm, preferably less than 1 mm, in particular less than 0.5 mm. It has proven particularly advantageous if the spacing is more than 0.01 mm, preferably more than 0.05 mm, in particular more than 0.08 mm.

In the region of the transition, the line element 14 and the component 27 have hollow-cylindrical pipe sections which form an annular gap by virtue of an axial and/or radial spacing with respect to one another.

List of reference signs

1	container
2	inlets
3	emptying connection
4	cover
5	sensor module
6	evacuation connection
8	receptacle
9	assembly
10	centrifugal pump
11	first housing part
12	further housing part
13	motor
14	line element
15	pipe conduit
16	cutting mechanism
17	openings
18	housing part
19	regions
20	fastening means
21	motor housing
22	shaft
23	bearing assembly
24	impeller
25	region
26	intake region
27	component
28	flanged bearing end shield
29	gap
30	evacuation features

P A T E N T K R A V

1. Anlæg med en beholder (1) til mellemlagring af afløbsvand, en anordning (9), som omfatter en centrifugalpumpe (10), der er anbragt i beholderen (1), og en komponent (27) som er del af et flangelejeskjold (28), hvor komponenten er indrettet som en passage, som anvendes som trykledning, og hvor centrifugalpumpen (10) pumper et medie ind i et ledningselement (14), som danner en trykstuds, og passagen i tilslutning dertil, **kendetegnet ved, at**

et ringformet mellemrum (29) er dannet mellem ledningselementet (14) og passagen til ventilation af centrifugalpumpen (10).

2. Anlæg ifølge krav 1, **kendetegnet ved, at** ledningselementet (14) og komponenten (27) danner mellemrummet (29) ved aksial og/eller radial afstand til hinanden.

3. Anlæg ifølge krav 2, **kendetegnet ved, at** den aksiale og/eller radiale afstand mellem ledningselementet (14) og komponenten (27) er mindre end 2 mm, fortrinsvis mindre end 1 mm, især mindre end 0,5 mm.

4. Anlæg ifølge krav 2 eller 3, **kendetegnet ved, at** den aksiale og/eller radiale afstand mellem ledningselementet (14) og komponenten (27) er større end 0,01 mm, fortrinsvis større end 0,05 mm, især større end 0,08 mm.

5. Anlæg ifølge et af kravene 1 til 4, **kendetegnet ved, at** ledningselementet (14) og/eller komponenten (27) omfatter en ikke-plan overflade, som afgrænser mellemrummet (29).

6. Anlæg ifølge et af krav 5, **kendetegnet ved, at** recesser er indført i ledningselementet (14) og/eller i komponenten (27).

7. Anlæg ifølge et af kravene 5 eller 6, **kendetegnet ved, at** mellemrummet (29) omfatter riller.

8. Anlæg ifølge et af kravene 1 til 7, **kendetegnet ved, at** ledningselementet (14) og/eller komponenten (27) omfatter rørformede områder.

9. Anlæg ifølge et af kravene 1 til 8, **kendetegnet ved, at** mellemrummet (29) er indrettet således, at en lækagestrøm fra mellemrummet (29) strømmer til et element, som er anbragt i beholderen (1).

10. Anlæg ifølge et af kravene 1 til 9, **kendetegnet ved, at** mellemrummet (29) er indrettet således, at en lækagestrøm fra mellemrummet (29) strømmer til et element, som er en niveaumålingsindretning.

11. Anlæg ifølge et af kravene 1 til 10, **kendetegnet ved, at** ventilationen virker i en radial retning.

12. Anlæg ifølge et af kravene 1 til 11, **kendetegnet ved, at** motoren (13) er anbragt mindst delvist, fortrinsvis fuldstændigt, uden for beholderen (1).

13. Anlæg ifølge et af kravene 1 til 12, **kendetegnet ved, at** motoren (13) er forbundet via en vertikal aksel (22) til løbehjulet (24) af centrifugalpumpen (10).

14. Anlæg ifølge et af kravene 1 til 13, **kendetegnet ved, at** beholderen (1) omfatter et modtagekar for anordningen (9).

Fig. 1

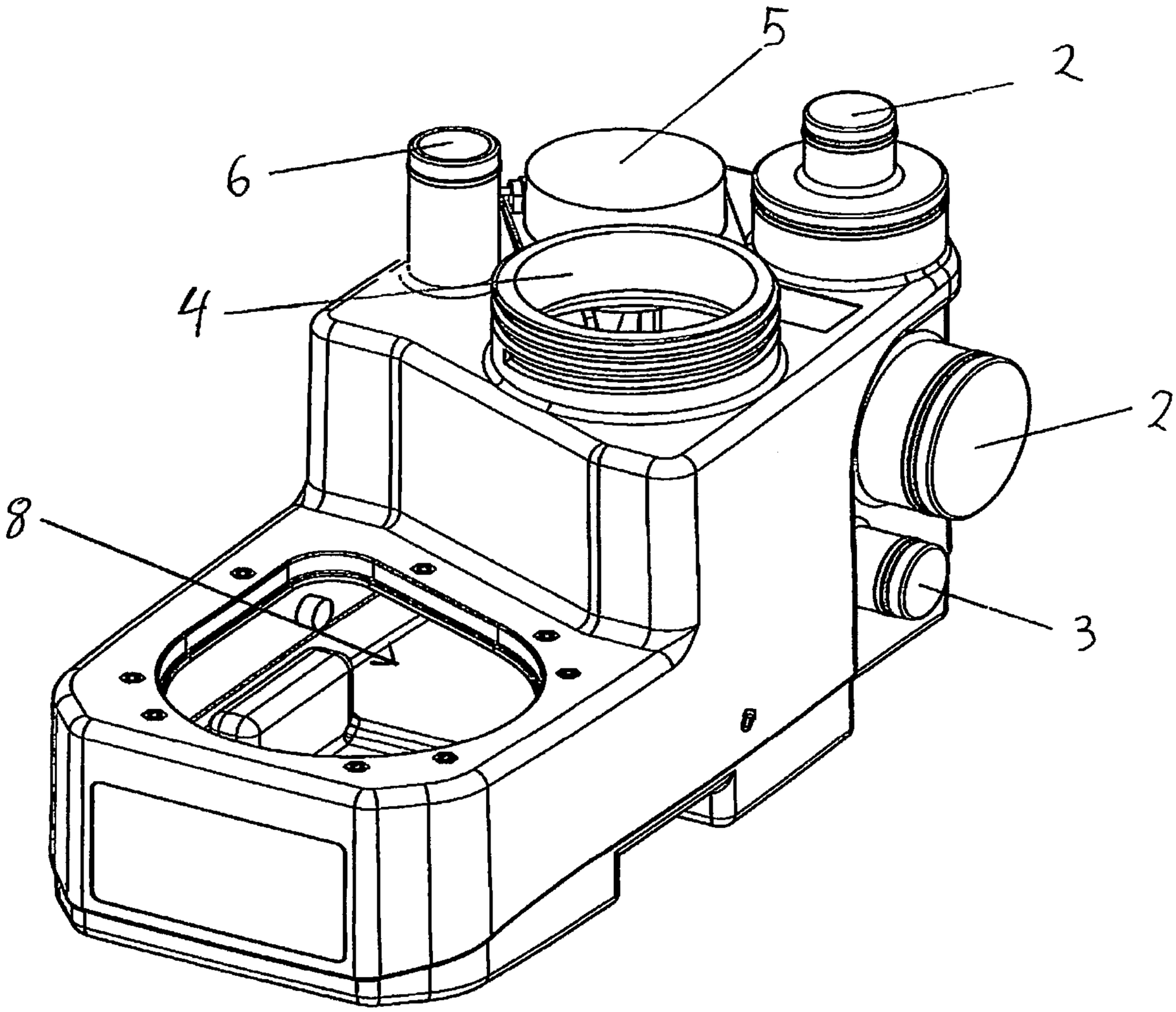

Fig. 2

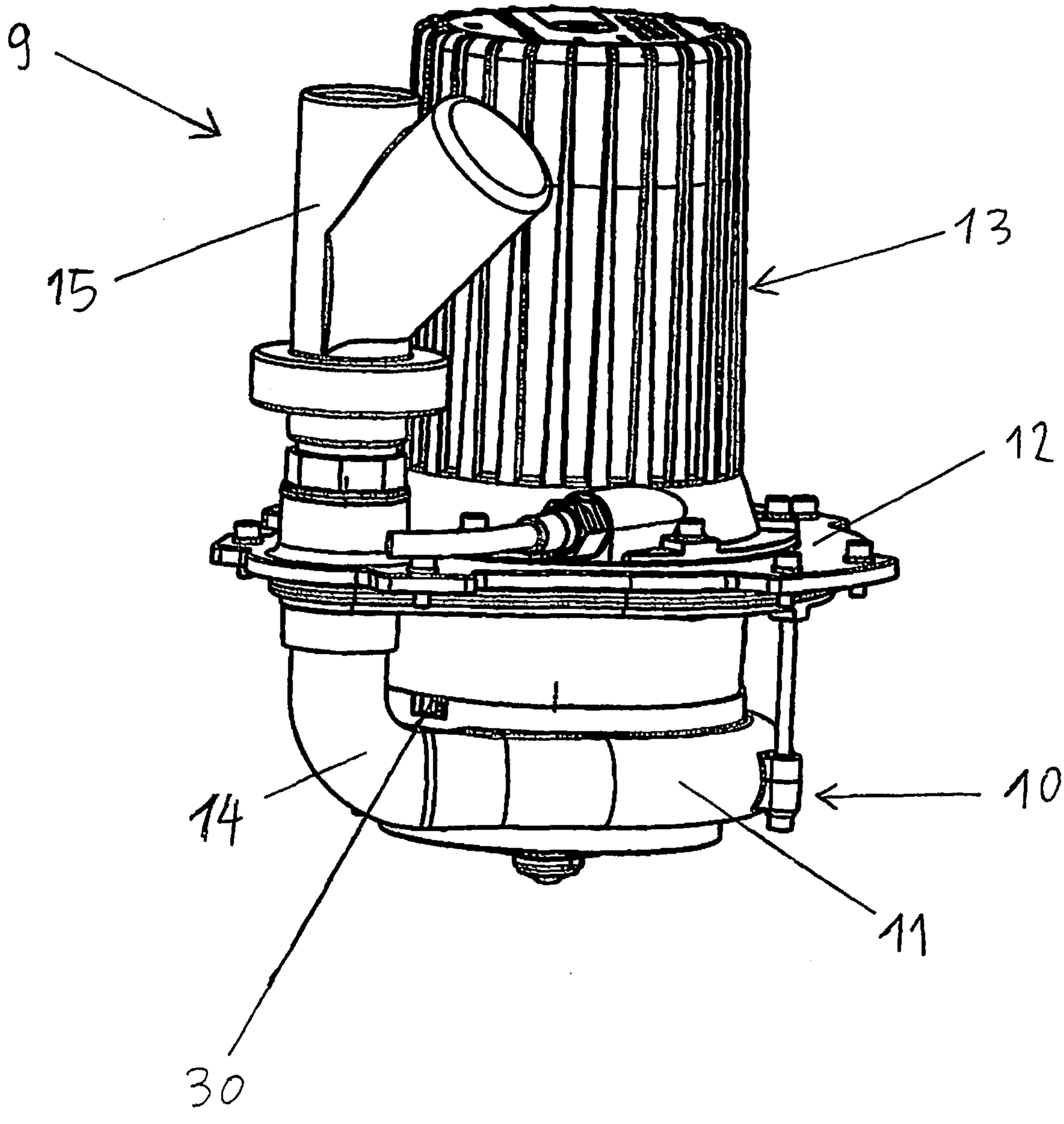

Fig. 3

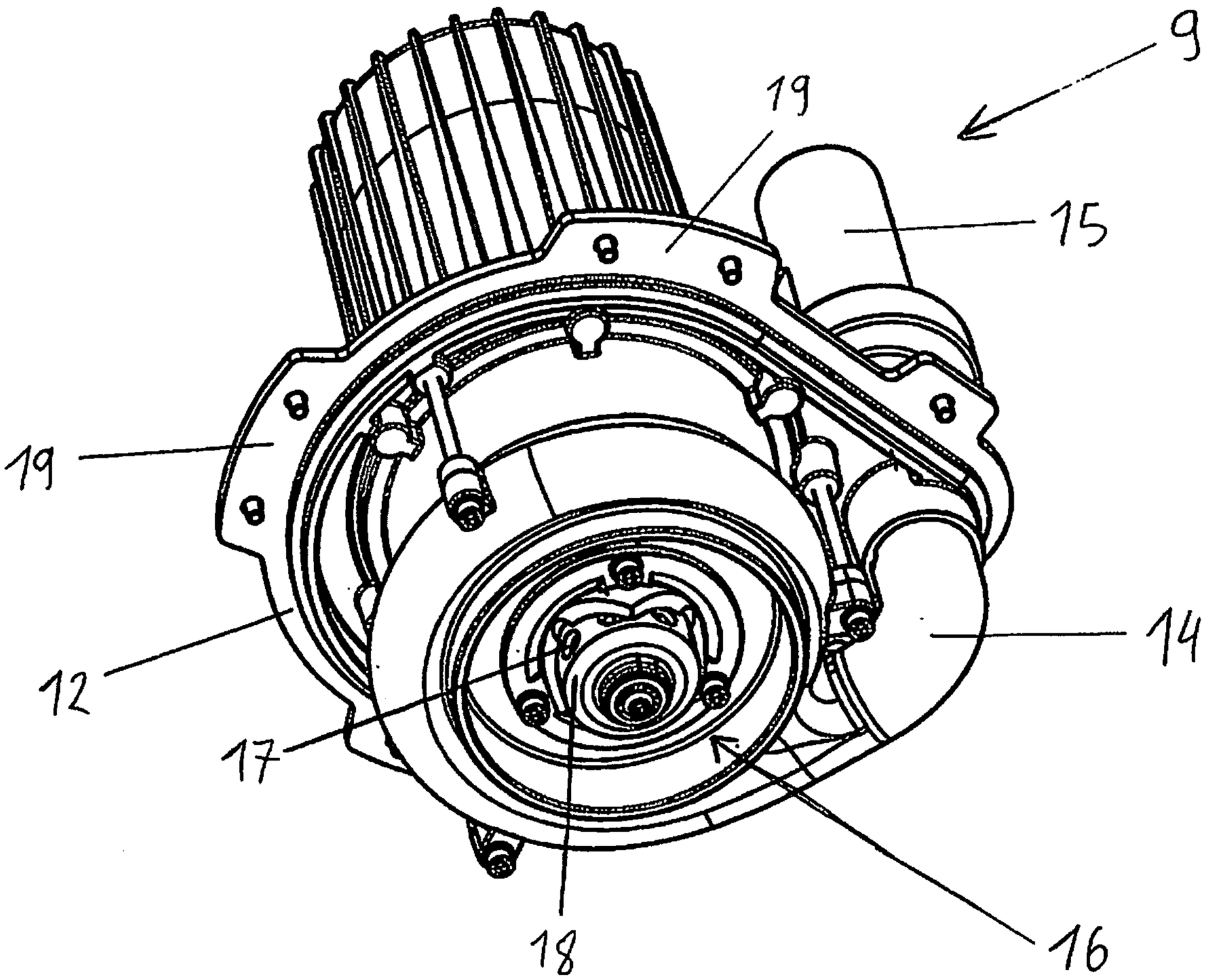

Fig. 4

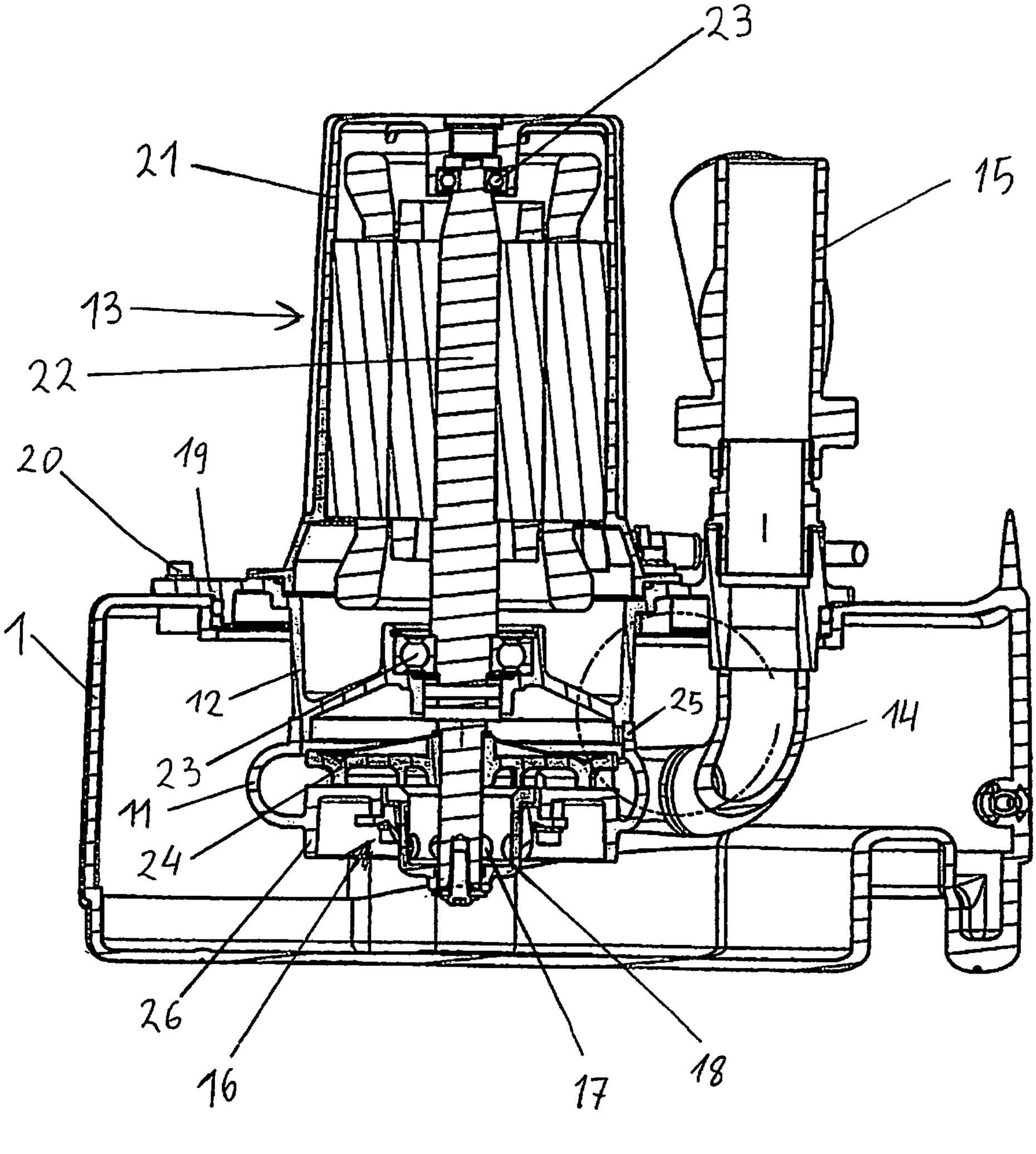

Fig. 5

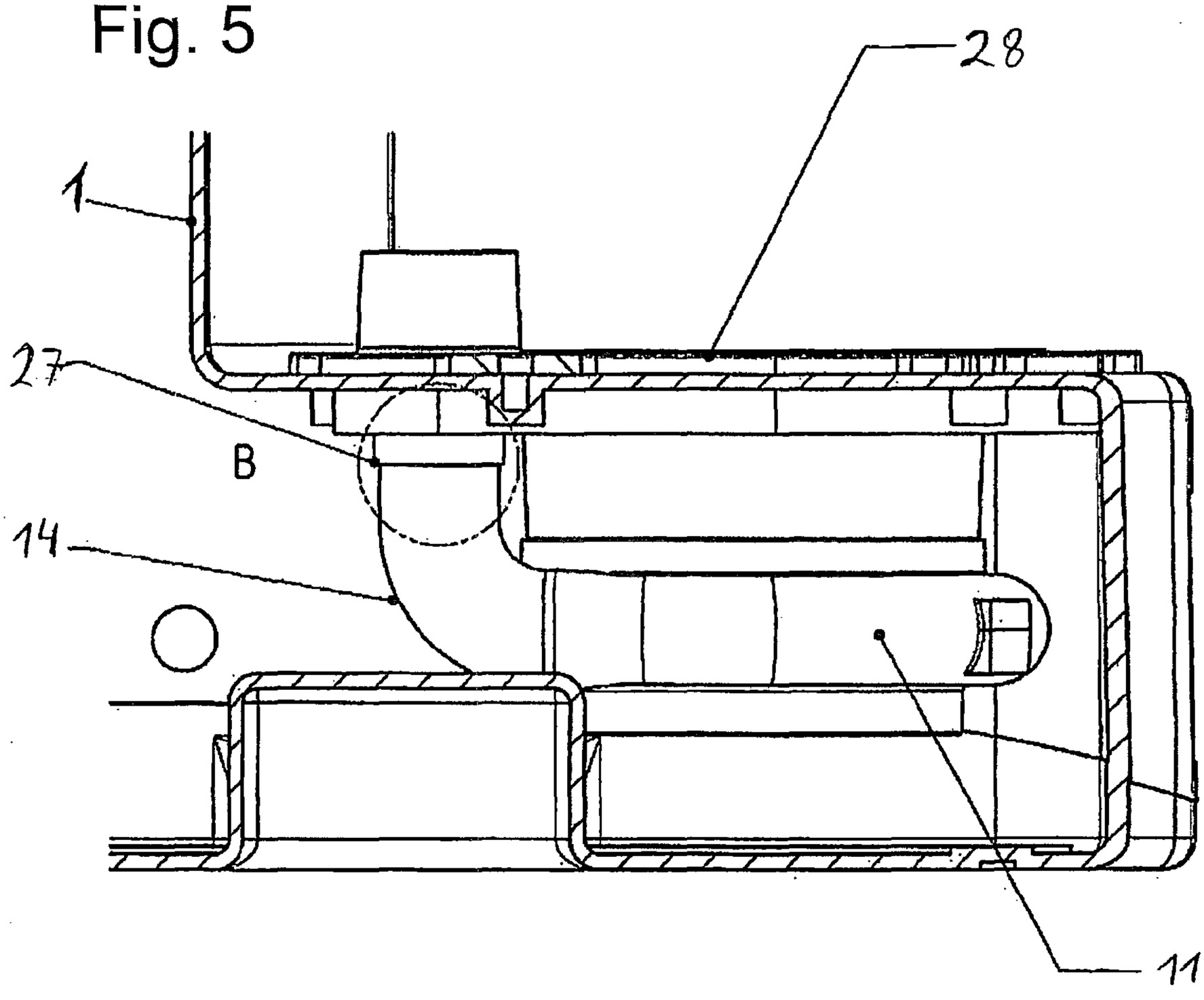

Fig. 6