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(54) Titre : ENSEMBLE PALIER EQUIPE D'UN DISPOSITIF FILTRANT
(54) Title: BEARING ASSEMBLY HAVING FILTER DEVICE

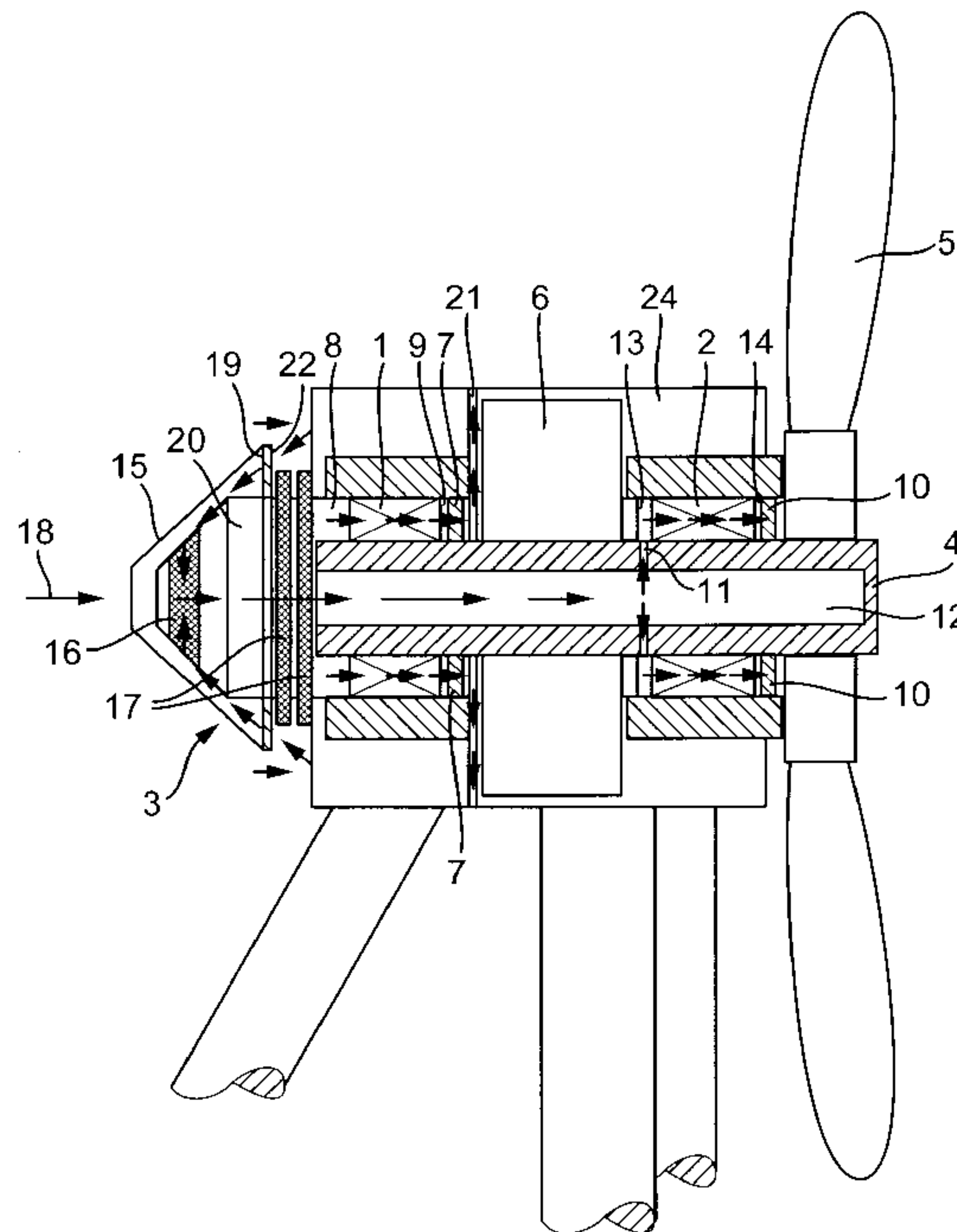


Fig. 1

(57) Abrégé/Abstract:

The invention relates to a bearing assembly, comprising a bearing (1, 2), through which a medium, in particular water, flows, a shaft (4) received in the bearing (1, 2), a filter device (3) which is connected upstream of the bearing (1, 2) on the inflow side and

(57) **Abrégé(suite)/Abstract(continued):**

removes particles from the medium, wherein the filter device (3) comprises a protective cap (15) and a fine mesh filter (17), wherein the protective cap (15) is connected upstream of the fine mesh filter (17) on the inflow side, and a delivery device (22) for the medium, which is disposed between the protective cap (15) and the fine mesh filter (17). According to the invention, said bearing assembly addressed the problem of providing a bearing assembly that maintains the filter effect for a long time.

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(54) Title: BEARING ASSEMBLY HAVING FILTER DEVICE

(54) Bezeichnung : LAGERANORDNUNG MIT FILTEREINRICHTUNG

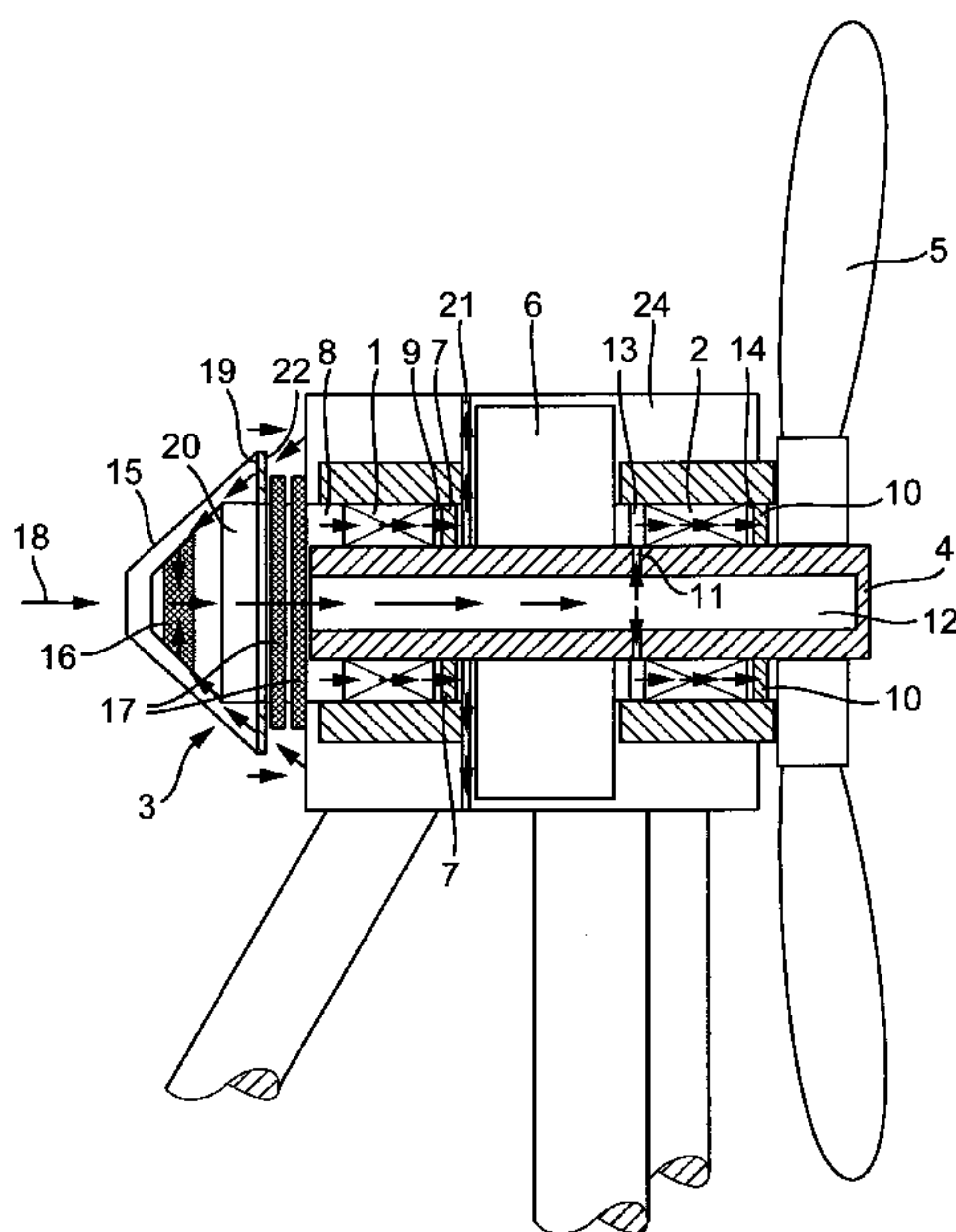


Fig. 1

(57) Abstract: The invention relates to a bearing assembly, comprising a bearing (1, 2), through which a medium, in particular water, flows, a shaft (4) received in the bearing (1, 2), a filter device (3) which is connected upstream of the bearing (1, 2) on the inflow side and removes particles from the medium, wherein the filter device (3) comprises a protective cap (15) and a fine mesh filter (17), wherein the protective cap (15) is connected upstream of the fine mesh filter (17) on the inflow side, and a delivery device (22) for the medium, which is disposed between the protective cap (15) and the fine mesh filter (17). According to the invention, said bearing assembly addressed the problem of providing a bearing assembly that maintains the filter effect for a long time.

(57) Zusammenfassung: Die Erfindung betrifft eine Lageranordnung, umfassend ein Lager (1, 2), das von einem Medium, insbesondere Wasser, durchströmt ist, eine Welle (4), die in dem Lager (1, 2) aufgenommen ist, eine Filtereinrichtung (3), die dem Lager (1, 2) einströmseitig vorgeschaltet ist, und die Partikel aus dem Medium entfernt, wobei die Filtereinrichtung (3) eine Schutzkappe (15) und einen Feinfilter (17) umfasst, wobei die Schutzkappe (15) dem Feinfilter (17) einströmseitig vorgeschaltet ist, und eine Fördereinrichtung (22) für das Medium, die zwischen der Schutzkappe (15) und dem Feinfilter (17) angeordnet ist. Die genannte Lageranordnung löst erfindungsgemäß die Aufgabe, eine Lageranordnung anzugeben, die die Filterwirkung für eine lange Zeit aufrechterhält.

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— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

BEARING ASSEMBLY HAVING FILTER DEVICE

Description

Scope of the invention

The invention relates to a bearing arrangement having a bearing transversed by a medium, in particular water.

For bearing arrangements having a bearing transversed by a medium, for example water, it is common in the practice to filter the medium flowing through the bearing, in particular water in the case of a water-lubricated bearing, to keep particles away from the bearing. For this purpose, filter systems with a particle filter are for example provided which are set up downstream of the inflow side of the bearing so that the medium only enters the bearing after passing the particle filter. The flow-through of the medium, i.e. the quantity of medium flowing through the bearing per time unit decreases to the same extent in which the particle filter absorbs particles and becomes contaminated. Highly contaminated particle filters can virtually bring the flow-through of the medium through the bearing to a halt, thus severely impairing the lubrication or cooling of the bearing by the medium. This disadvantage in particular occurs, if the contaminated particle filter cannot be readily exchanged, for example in tidal current power stations, whose main tube bearings are submerged under water and not readily accessible.

Furthermore, the structural integration of filter systems into the bearing of the bearing arrangement is known.

DE 1 132 738 A describes a bearing arrangement for the end section of the counter shaft of a counter, in particular a fluid counter, wherein the end section of the shaft is arranged in a bearing box transversed by water and wherein a filter system is assigned to a face of the storage box which comprises a ring made of a filter

material, wherein the ring surrounds a shaft. The ring prevents both the inflow into the bearing box as well as the outflow of the medium out of the bearing box.

JP 2003042159 AA (Abstract) describes a bearing arrangement for a dynamic thrust bearing, wherein a centrifugal separation chamber is provided which is arranged at a distance from the rotational axis of the shaft, wherein the separation chamber has a fluid connection with an inflow and an outflow area of the bearing arrangement.

JP 08338425 AA (Abstract) describes a bearing arrangement with a shaft positioned in a bearing, wherein the bearing is integrated in a bearing case. The bearing arrangement is provided to retain a shaft submerged under water, wherein the water serves as lubricant of the shaft. An inflow area is provided on the inflow side, in which a means of motion directs the water into a filter of a filter system. An outflow area is provided on the outflow side which the water enters into after flowing through the bearing. The means of motion has a torque-resistant connection with the shaft and is essentially designed as a radially protruding section. The means of motion comprises an inlet opening, from which the water either flows through the fine filter or past the fine filter toward the outflow area. The fine filter is rigidly connected to the means of motion.

JP 08135653 AA (Abstract) describes a bearing arrangement for a shaft submerged under water which is integrated in a bearing transversed by water. A motion plate is arranged between the bearing and the bearing retainer of the bearing on the inflow side which directs the water radially outward to a diversion plate arranged underneath an angle from where the water is directed either radially inward to the fine filter or parallel to the shaft into an outflow area. The filter of the filter system has a distance to the shaft to allow the particles to pass the filter. If the shaft stops moving, the motion plate stops moving too and no water passes the fine filter.

DE 10 2007 003 618 A1 describes a bearing arrangement in a first exemplary embodiment (Fig. 3), in which a cartridge filter is provided on the inflow side. After the water has passed said filter, it flows into a conically tapered area.

DE 10 2007 003 618 A1 describes a bearing arrangement in a second exemplary embodiment (Fig. 2) in which a cartridge filter with a downstream filter pump is provided on the inflow side.

The subsequently filed patent application DE 10 2008 052 287.2 dated October 18, 2008 describes a bearing arrangement having a bearing transversed by a medium, in particular water, a filter system comprising a protective cap arranged on the inflow side and a fine filter arranged downstream of the protective cap. Furthermore, the bearing arrangement comprises a conveyor system for the medium arranged downstream of the bearing on the outflow side and which controls the flow of the medium through the bearing.

Object of the invention

The object of the invention is to specify a bearing arrangement which sustainably maintains the filter efficiency.

Abstract of the invention

The object for the bearing arrangement according to claim 1 is in particular solved according to the invention in that the conveyor system is arranged between the protective cap and the fine filter. Consequently, the conveyor system is arranged within the filter system, namely between the protective cap and the fine filter and ensures that a pressure difference is built up in front of the fine filter, so that the fine filter can be transversed by an adjustable quantity of lubricant, even if the permeability of the fine filter decreases due to increasing contamination of the filter material.

The conveyor system has the additional advantage that it suppresses the penetration of particles into the gap between the protective cap and the fine filter.

The invention, its properties and advantages as well as advantageous embodiments of the invention are described below with reference to water as the medium flowing through the bearing; however, it is understood, that a different medium than water, specifically a different fluid can be provided to flow through the bearing.

The conveyor system preferably has a torque-resistant connection with the shaft. Then, the quantity of medium, specifically the water, flowing through the bearing is dependent on the rotational speed of the shaft which acts as drive for the conveyor system.

The conveyor system is preferably designed as perforated ring wheel. In addition to the perforation, it may comprise shovel-like structures to support or increase the water conveyed toward the fine filter. The ring wheel is particularly suitable to suppress the penetration of contaminated water to the fine filter if the bearing is stopped.

Alternatively or in addition to the design of the conveyor system as perforated ring wheel, the conveyor system is preferably designed as conveyor propeller. The conveyor propeller has a shovel-like structure which allows the aspiration of water from the area surrounding the protective cap. It is understood that the conveyor propeller can be provided in addition to the ring wheel, wherein the conveying effect on the water is essentially achieved with the conveyor propeller, while the covering pane essentially prevents the re-penetration of contaminated water to the fine filter, if the conveyor propeller is stopped. In this case, the covering pane can be designed as a flat disk with holes.

Again alternatively or in addition to a design of the conveyor system as perforated ring wheel or as conveyor propeller, the conveyor system is preferably arranged on a side of the protective cap facing away from the area of the protective cap approached by the flow. This allows the exploitation of the rotation of the protective cap to convey the water, especially in the case where a particularly preferably embodiment provides that the conveyor system is designed as a worm conveyor.

In a preferred embodiment of the invention, the conveyor system, in particular the worm conveyor can also be attached to the fine filter, especially in the event that the protective cap is not arranged in such a way that it rotates along with the shaft.

Preferably, the shaft is designed as sleeve shaft at least in sections and the sleeve shaft comprises a radial borehole which opens into an inflow area provided downstream on the inflow side of the bearing. The motion of the water inside the filter toward the axis of the shaft can develop the effect of a rotational filter, with which in particular heavy components of the medium such as particles can be kept away. The design of the shaft as sleeve shaft allows the conveyance of the filtered water to the single bearing of the bearing arrangement or to two or a plurality of bearings arranged at a distance from each other, wherein the water exits the sleeve shaft at the site of the radial borehole and enters the inflow area provided downstream on the inflow side of the bearing. It is in particular possible to provide a single filter system for a bearing arrangement which comprises two or more bearings arranged at a distance from each other in the direction of the shaft, so as to simplify the set up as well as the maintenance of the bearing arrangement.

Further advantages and properties of the invention can be gathered from the dependent claims as well as the description of exemplary embodiments.

The invention is described and explained in detail below with reference to the enclosed drawings.

Brief description of the drawings

Fig. 1 shows a schematic section through a first exemplary embodiment of a bearing arrangement according to the invention,

Fig. 2 shows a schematic section through a second exemplary embodiment of a bearing arrangement according to the invention, and

Fig. 3 shows a schematic section through a third exemplary embodiment of a bearing arrangement according to the invention.

Detailed description of the drawings

Fig. 1 shows a bearing arrangement comprising a first bearing 1 transversed by water as medium and a second bearing 2 arranged at a distance from the first bearing 1 as well as a common filter system 3 assigned to both bearings 1, 2 as well as a shaft 4 pivotably integrated in both bearings 1, 2. The filter system 3 is arranged downstream of the inflow side of both bearings 1, 2 in the sense that the water first needs to pass the filter system 3 in order to reach the respective bearing 1, 2. A torque-resistant connection is provided between the shaft 4 and a rotor 5 which is driven by the water flowing around the bearing assembly and whose kinetic energy is converted into electrical energy by a generator 6. As a result, the bearing arrangement is designed as a component of a tidal current power station not illustrated further and submerged under water.

The second bearing 2 is arranged at a considerable distance from the common filter system 3 in the direction of the shaft 4. To allow the inflow of filtered water from the filter system 3 to the second bearing 2, the shaft 4 is designed as sleeve shaft in sections, so that filtered water is carried to a radial borehole 11 in the corpus of the hollow section 12 along said section of the shaft 4. The radial borehole 11 opens into an inflow area 13 arranged downstream in relation to the flow of the second bearing

2, whereby the water enters an outflow area 14 after flowing through the second bearing 2 and exits the bearing arrangement.

The filter system 3 is designed in three parts and comprises a protective cap 15, a screen filter 16 and a fine filter 17. The protective cap 15 has a conical, in particular obtuse conical shape in the direction of the approaching medium (arrow 18). Coarse particles such as for example smaller stones carried along in the approaching medium bounce off of said protective cap 15. The protective cap 15 comprises an inlet opening 19, facing away from the direction 18 of the approaching water and through which water can enter into the filter system 3. After passing the inlet opening 19, the water flows along the obtuse conical inner wall area of the protective cap 15 in the direction of the axis of the shaft 4 and reaches the screen filter 16, which is essentially arranged in the direction of the axis of the shaft 4. The screen filter 16 retains larger particles contained in the water. After passing the screen filter 16, the water reaches a collecting area 19, arranged downstream relative to the flow of the fine filter 17. From the collecting area 20, the water runs through the fine filter 17 which is designed with two layers and comprises two filter fleece layers which can easily be exchanged independently of each other and have a solid consistence, either directly into an inflow area 8 of the first bearing 1 or – in an alternative flow pathway – into the section 12 of the shaft 4 designed as sleeve shaft toward the radial borehole 11, which leads into the inflow area 13 of the second bearing 2.

The water that passed the first bearing 1 enters into an outflow area 9 and is subsequently directed away from the shaft 4 via a radial borehole 21 provided in a case 24 in which the bearing 4 is positioned. A covering pane 7 is provided on the outflow area 9 of the first bearing, which is designed as perforated circular ring and prevents the penetration of contaminated water into the first bearing 1, in particular in the event that the shaft 4 is stopped and no water is conveyed through the filter system 3. The covering pane 7 of the first bearing 1 has a torque-resistant connection with the shaft 4 and develops a conveying effect in the direction of the flow (arrow 18).

Another covering pane 10 is arranged on the outflow area 14 of the second bearing 2, which also has a torque-resistant connection with the shaft and is designed to prevent the penetration of contaminated water into the second bearing 2 if the shaft 4 is stopped.

Furthermore, the bearing arrangement comprises a conveyance system 22 for the water which is arranged between the protective cap 15 and the fine filter 17.

In the first exemplary embodiment illustrated in Fig. 1, the conveyance system 22 is designed as perforated ring wheel arranged on the inlet opening 19 fastened on the protective cap 15, which covers the inlet opening 19 and prevents the penetration of contaminated water into the area between the protective cap 15 and the screen filter 16. The protective cap 15 has a torque-resistant connection with the shaft 4, so that the perforated ring wheel develops a conveying effect for the water toward the fine filter 16 when the shaft 4 is rotated. The borehole diameter of the perforations of the ring wheel decrease in the flow direction, resulting in a conveying effect toward the fine filter 17 when the ring wheel is turned. Alternatively or in addition to the perforated ring wheel, the conveyance system 22 can also comprise a conveyance propeller arranged on the protective cap 15 with a torque-resistant connection.

In the following description of the second or third exemplary embodiment based on Fig. 2 and Fig. 3, identical reference numbers refer to identical properties or properties with a comparable technical effect. The purpose is in particular to emphasize the differences compared to Fig. 1 with respect to the arrangement of the conveyance system 22.

Fig. 2 shows a bearing arrangement with a conveyance system 22 arranged on a side 23 of the protective cap 15 facing away from the area of the protective cap 15 approached by the flow. The cross-sectional profile of the side 23 facing away from the area of the protective cap approached by the flow conically expands toward the

shaft 4, wherein the conveyance system 22 is designed as worm conveyor, whose six channels on the side 23 are designed as spiral shaped circumferential elevations. The protective cap 15 and hence the conveyance system 22 has a torque-resistant connection with the shaft 4, and as a result the worm conveyor transports water from the inlet opening 19 toward the fine filter 17 when the shaft 4 is turned.

Fig. 3 shows a bearing arrangement in which no torque-resistant connection is provided between the protective cap 15 and the shaft 4, but in which the protective cap is fixed in relation to the shaft 4. The protective cap 15 is rigidly connected with the case 24. The screen filter 16 is arranged in a filter retainer 25, concentrically arranged with and within the conical protective cap 15 and has a torque-resistant connection with the shaft 4. A passage is provided between the filter retainer 25 and the side 23 facing away from the area of the protective cap 15 approached by the flow, within which the conveyance system 22 is provided. The conveyance system 22 is designed as three-channel worm conveyor, whose channels are designed as spiral-shaped elevations surrounding the circumference of the filter retainer 25 facing the side 23. A major difference in the relative speed between the protective cap 15 and the conveyance system 22 occurs when the shaft 4 is turned and a high pressure difference is built up as a result, thus allowing especially the selection of a particularly fine pored material for the fine filter 17.

Reference list

- 1 First bearing
- 2 Second bearing
- 3 Filter system
- 4 Shaft
- 5 Rotor
- 6 Generator
- 7 Covering pane of the first bearing 1
- 8 Inflow area of the first bearing 1
- 9 Outflow area of the first bearing 1
- 10 Covering pane of the second bearing
- 11 Radial borehole
- 12 Hollow section
- 13 Inflow area of the second bearing 2
- 14 Outflow area of the second bearing 2
- 15 Protective cap
- 16 Screen filter
- 17 Fine filter
- 18 Direction of the approaching water
- 19 Inlet opening
- 20 Collecting area
- 21 Radial borehole
- 22 Conveyance system
- 23 Side of the protective cap 15
- 24 Case
- 25 Filter case

Patent claims

1. Bearing arrangement, comprising:
a bearing (1, 2) transversed by a medium, in particular water,
a shaft (4) integrated in the bearing (1, 2),
a filter system (3) provided downstream on the inflow side of the bearing (1, 2)
and which removes particles from the medium, wherein the filter system (3)
comprises a protective cap (15) and a fine filter (17),
wherein the protective cap (15) is arranged downstream on the inflow side of
the fine filter (17), and
a conveyance system (22) for the medium arranged between the protective
cap (15) and the fine filter (17).
2. Bearing arrangement according to claim 1, characterized in that the
conveyance system (22) is designed as perforated ring wheel.
3. Bearing arrangement according to claim 1 or 2, characterized in that the
conveyance system (22) is designed as conveyance propeller.
4. Bearing assembly according to any one of claims 1 to 3, characterized in that
the conveyance system (22) has a torque-resistant connection with the shaft (4).
5. Bearing assembly according to any one of claims 1 to 4, characterized in that
the conveyance system (22) is arranged on a side (23) of the protective cap (15)
facing away from the area of the protective cap (15) approached by the flow.
6. Bearing arrangement according to any one of claims 1 to 4, characterized in
that the conveyance system (22) is attached to a filter case (25).
7. Bearing assembly according to any one of claims 4 to 6, characterized in that
the conveyance system (22) is designed as worm conveyor.

8. Bearing arrangement according to any one of claims 1 to 7, characterized in that the shaft (4) is designed as sleeve shaft (12) at least in sections and that the sleeve shaft (12) comprises a radial borehole (11) which opens toward an inflow area (13) arranged downstream of the inflow side of the bearing (2).

9. Bearing arrangement according to any one of claims 1 to 8, characterized in that a first bearing (1) and a second bearing (2) arranged at a distance from the first bearing (1) are provided, wherein the filter system (3) is assigned jointly to both bearings (1, 2).

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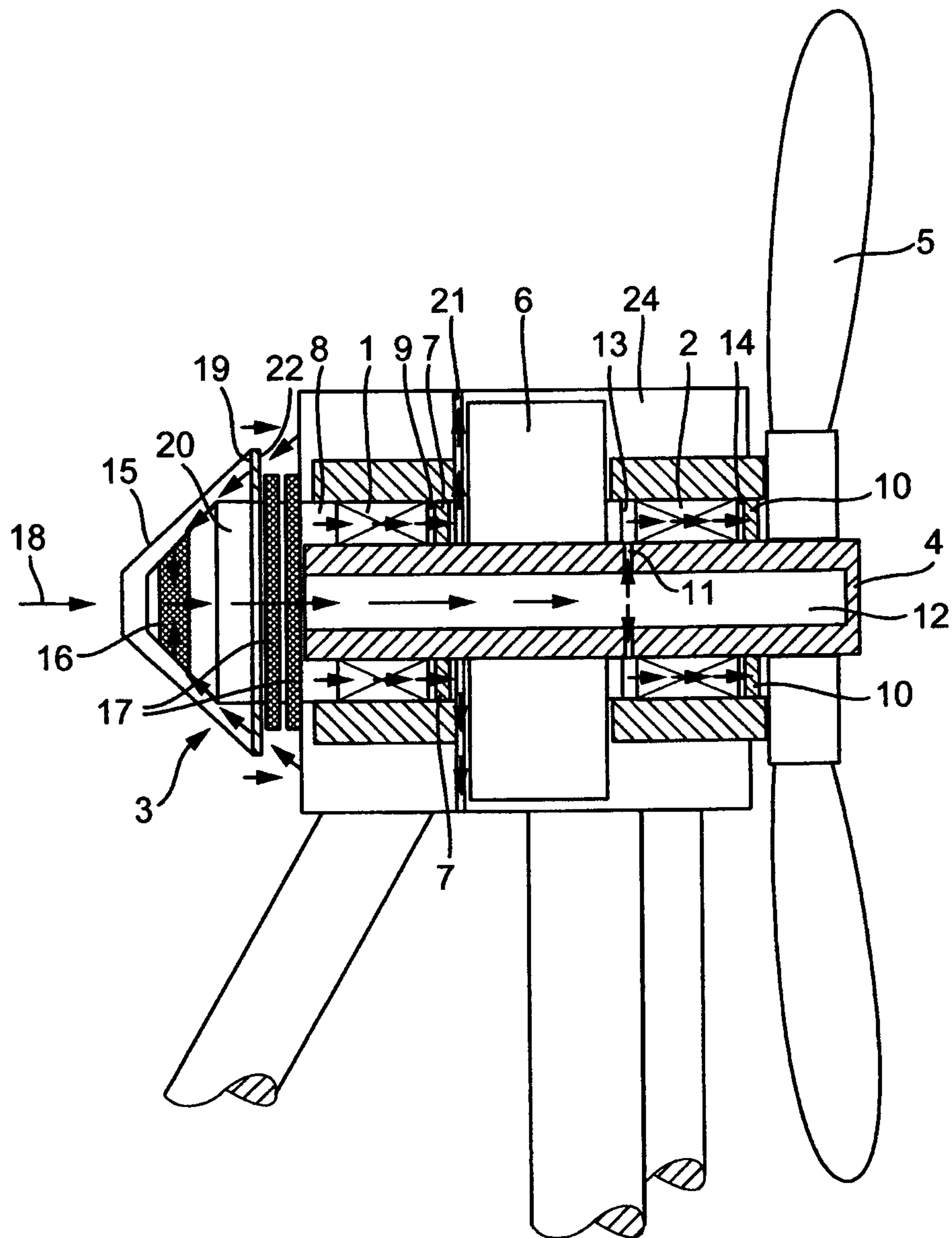


Fig. 1

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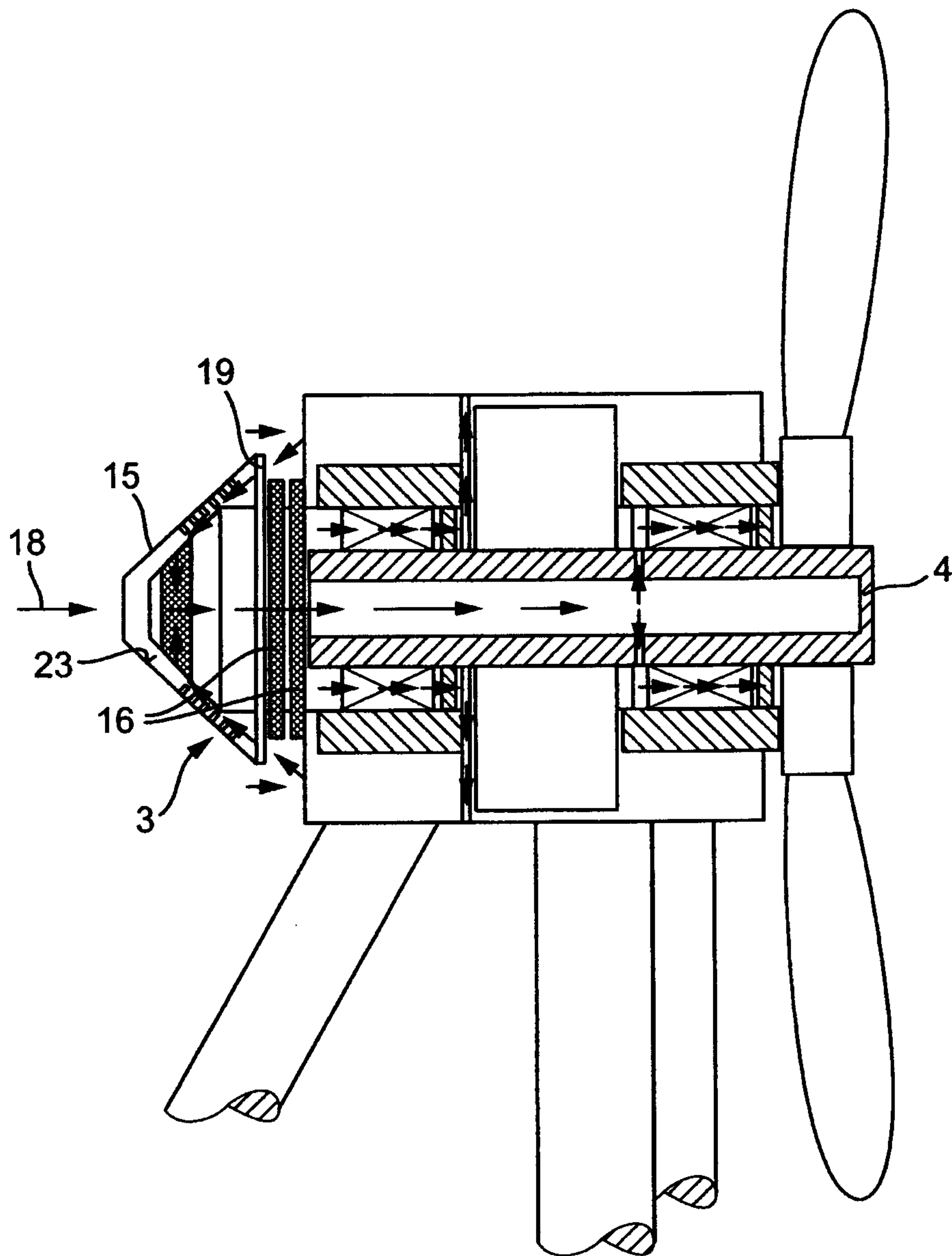


Fig. 2

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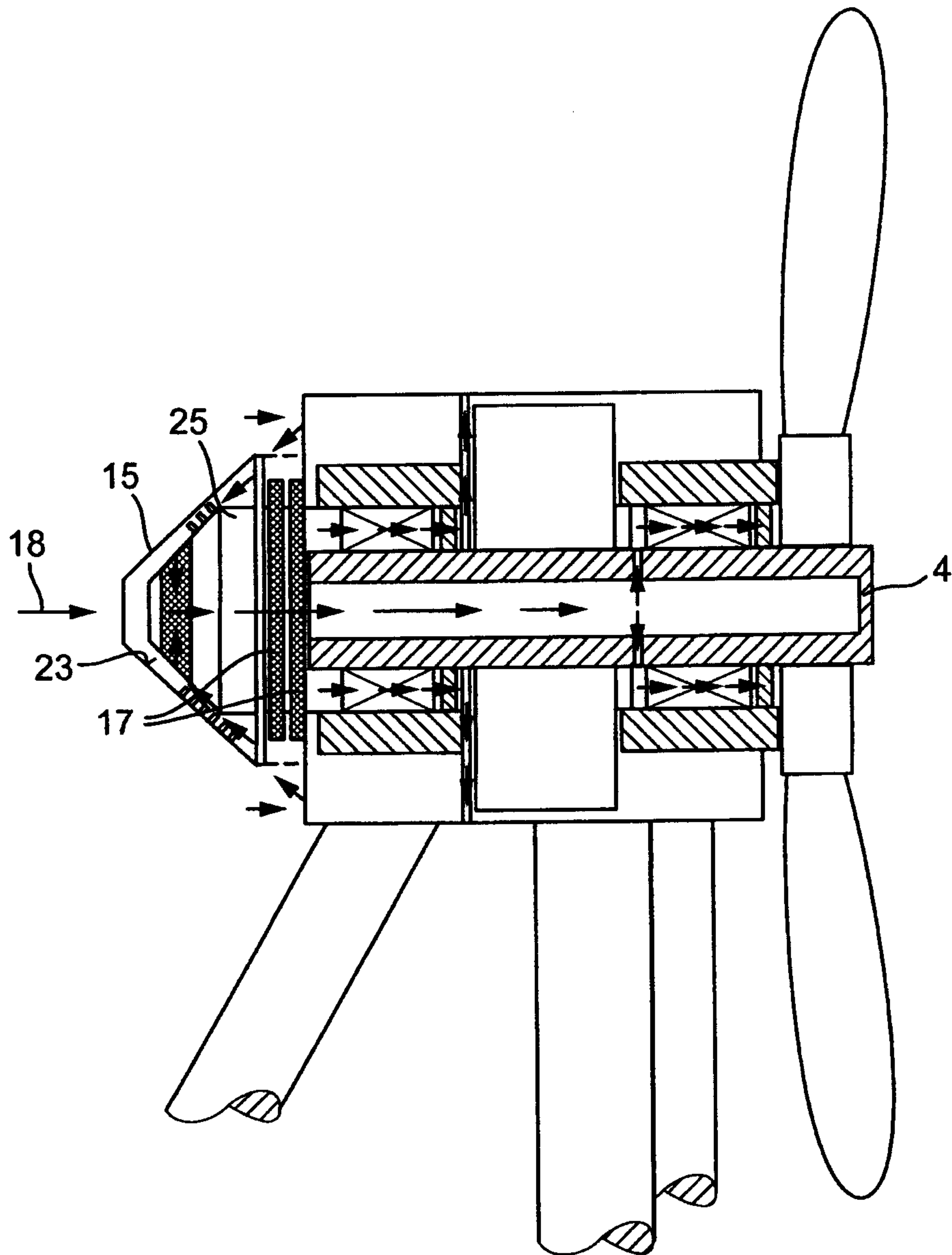


Fig. 3



Fig. 1