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(71) Applicant: **EXDL Co., Ltd.**
Chungcheongbuk-do 27466 (KR)

(72) Inventor: **Choi, Won Seok**
27466 Chungcheongbuk-do (KR)

(74) Representative: **Patentanwälte Munk**
Prinzregentenstraße 3
86150 Augsburg (DE)

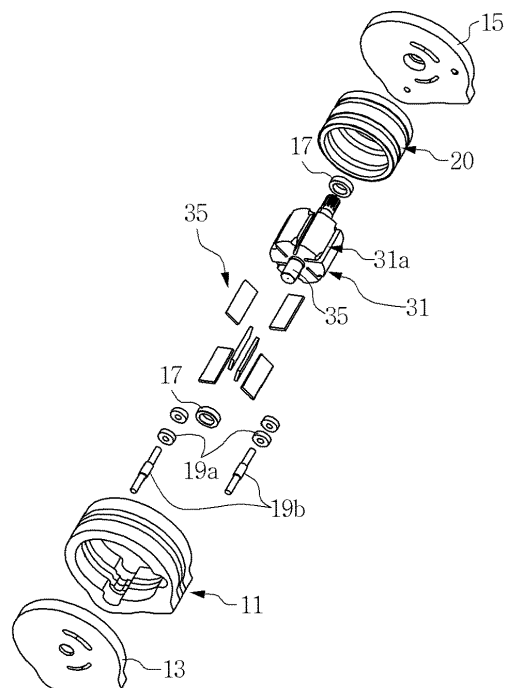
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(54) **VANE MOTOR**

(57) Disclosed is a vane motor including: a casing including a casing including an inlet port and an outlet port, through which a pressurized fluid comes in or out; a rotor being installed in the casing, turning around a rotational shaft by the pressurized fluid and including a rotor body which has a substantially cylindrical shape and an axis coinciding with an axis of the rotational shaft and a plurality of vanes which is installed in grooves formed on an outer circumferential surface of the rotor body and has a portion protruding from the groove and the portion having a length varied in accordance with a rotational phase, and an inner liner of a cylindrical shape which is installed in the casing and receives the rotor therein, in which a distal end of the vane comes into contact with an inner wall surface of the inner liner while the pressurized fluid is retained therein until the pressurized fluid flowing through the inlet port of the casing is discharged from the outlet port of the casing, and an imaginary rotational axis of the inner liner is spaced apart from a rotational axis of the rotational shaft in a parallel state, but is able to rotate together with the rotor when the rotor turns.

According to the present invention, when the rotor turns, the distal ends of the vanes contact against the inner wall surface of the casing, so that the inner wall surface of the casing and the vanes are worn out, to increase a frequency of replacement and repair and since the energy consumed by the abrasion is decreased and is used to generate the rotational force, the energy converting efficiency of the vane motor is improved.

[Fig. 3]



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a vane motor that can generate a rotational force by a hydraulic force to improve output efficiency.

Background of the Related Art

[0002] A vane motor is a mechanical actuator that converts hydraulic pressure into rotation power. FIG. 1 shows one example of a vane motor according to the related art.

[0003] Referring to FIG. 1, a rotor is rotatably installed in a casing 211. The casing 211 is provided with a fluid inlet 253 through which a fluid for generating pressure flows in, and a fluid outlet through which the fluid flows out. If the pressurized fluid flows in through the fluid inlet, the pressurized fluid acts on vanes 235 each of which spreads toward the outside of the rotor, and has a variable length. Accordingly, the vanes 235 are moving to the pressurized direction, the rotor turns within the casing 211. If the pressurized fluid for applying the pressure to the vanes 235 arrives at the fluid outlet 255 of the casing, the fluid is discharged through the fluid outlet 255 which is a low pressure side.

[0004] Specifically, if the pressurized fluid flowing in through the fluid inlet arrives at the fluid outlet which is the low pressure side, the fluid is discharged through the fluid outlet, and thus the pressurized fluid applies the pressure to the vanes in the path to turn the rotor.

[0005] The vanes 235 are engaged to a rotor body 231, and the length of the respective vanes protruding from the rotor body 231 is variable. For the variable feature, the vanes 235 are inserted in grooves 231a formed on an outer peripheral surface of the rotor body 231, and are able to move in a longitudinal direction of the groove. Since a gap between the inner wall surface of the casing 211 and a rotational shaft 233 of the rotor body 231 is varied according to a position of the inner wall surface of the casing, the vane 235 moves out from the groove 231a of the rotor body 231 at the wide gap to increase a protruding length of the vane 235, while the vane 235 moves in the groove of the rotor body at the narrow gap to decrease the protruding length of vane.

[0006] A resilient member, such as a spring, may be provided between a bottom portion of the rotor groove 231 and the vane 235 so that the vane can smoothly move in or out from the groove of the rotor body 231. Otherwise, since the vane can slide out from the groove by a centrifugal force of the rotor, a separate spring may not be provided.

[0007] At the narrow gap in which the gap between the rotor body 231 and the inner wall surface of the casing becomes narrow, when the rotor body 231 turns, a distal

end of the vane 235 is pressurized so that the vane moves in the groove 231a while contacting against the inner wall surface.

[0008] However, the vane motor of the related art has problems in that if the gap between the distal end of the vane 235 and the inner wall surface of the casing 211 is too wide, the fluid leaks through the gap to lead to a loss of pressure, and in that if the gap is too narrow, friction between the vane and the inner wall surface of the casing is increased, so that a lot of energy generated by the pressurized fluid is significantly lost, and thus maintenance costs are increased due to abrasion of the vanes and the inner wall surface. These problems are in a trade-off relation and cannot be completely solved in the vane motor of the prior art. Therefore, for vane motors of various materials and sizes, a proper size of the gap should be acquired on an experimental basis to increase the efficiency and the durability of each vane motor.

[0009] In order to increase the rotational force of the rotor by use of the pressurized fluid, the total amount of the force of the fluid acting on the vane should be increased. Since the total amount of the force is equal to the result obtained by multiplying the pressure, which is a force acting on a unit area, by an area of the inner wall surface, to which the pressure is applied, it is necessary to increase the area of the inner wall surface, with which the fluid and the vanes come into contact.

[0010] However, if the vane moves out too far from the groove, the vane may be completely released from the groove, or the vane may be vibrated or be in an unstable state while producing the friction between the vane and the inner wall surface of the casing. Therefore, the vane motor should be designed to increase the contact area with the fluid within a limit to keep the connection between the vanes and the rotor in stable.

Patent Literatures

[0011]

Patent Document 1: Korean Patent No.: 10-1116511, entitled "Air Vane Motor with Liner"

Patent Document 2: Korean Patent No.: 10-1874583, entitled "Vane Motor"

SUMMARY OF THE INVENTION

[0012] Therefore, the invention has been made in view of the above problems included in a vane motor of the related art, and one object of the invention is to provide a vane motor having configuration capable of improving efficiency.

[0013] According to one aspect of the present invention, there is provided a vane motor including: a casing including an inlet port and an outlet port, through which a pressurized fluid comes in or out;

a rotor being installed in the casing, turning around a rotational shaft by the pressurized fluid, the rotor including a rotor body which has a substantially cylindrical shape and an axis coinciding with an axis of the rotational shaft and a plurality of vanes which is installed in grooves formed on an outer circumferential surface of the rotor body and has a portion protruding from the groove and (the portion) having a length varied in accordance with a rotational phase, and an inner liner of a cylindrical shape which is installed in the casing and receives the rotor therein, in which a distal end of the vane comes into contact with an inner wall surface of the inner liner while the pressurized fluid is retained therein until the pressurized fluid flowing through the inlet port of the casing is discharged from the outlet port of the casing, and an imaginary rotational axis of the inner liner is spaced apart from a rotational axis of the rotational shaft in a parallel state, but is able to rotate together with the rotor when the rotor turns.

[0014] The imaginary rotational axis of the inner liner and the rotational shaft of the rotor can be maintained at constant positions. The vane motor includes a rolling member which, when the inner liner is rotated in the casing, is interposed between an outer surface of the inner liner and the inner wall surface of the casing to reduce friction therebetween

[0015] In the present invention, the casing is configured in such a way that both ends of an outer liner of a cylindrical shape larger than the inner liner are closed by disc-shaped finish plates.

[0016] At least one of the finish plates is configured in such a way that the rotational shaft pass through and is exposed out of the finish plate to transmit the rotational force, and a bearing is mounted between the rotational shaft and the finish plate.

[0017] According to the embodiment, there is a fine gap between the finish plates and other components like the inner liner, the vanes in axial (longitudinal) direction, so that the components are able to slide with the finish plates, but the pressurized fluid is hardly leaked through the gap.

[0018] At least one of the finish plates may be provided with a fluid inlet and a fluid outlet. The fluid inlet and the fluid outlet are formed in such a way that at least a portion of the fluid inlet and at least a portion of the fluid outlet is overlapped with a gap or space between the inner liner and the rotor body, when seen in an axial direction, and the fluid inlet and the fluid outlet are extended in an arc shape in a circumferential direction.

[0019] In the present invention, the inlet port and the outlet port may be located in the gap or space between an inner liner of a cylindrical shape and the rotor body, when seen from a cross-sectional view of the rotational shaft, and preferably, in both edges of the opening of the groove formed on the rotor body to receive the vane, enlarged portion through which a rear surface of the vane is more exposed may be formed at the rear side edge portion.

[0020] The enlarged portion may be provided on both ends thereof in the longitudinal direction. The enlarged portion may be formed at the portion in which the start portion of the arch-shaped fluid inlet is overlapped.

[0021] According to the present invention, the invention changes the structure of the vane motor of the prior art in which when the rotor turns, the distal ends of the vanes contact against the inner wall surface of the casing, so that the inner wall surface of the casing and the vanes are worn out, to increase a frequency of replacement and repair. Since the energy consumed by the abrasion is decreased and is used to generate the rotational force, the energy converting efficiency of the vane motor is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a cross-sectional view illustrating a configuration of a vane motor according to the related art;

FIG. 2 is a perspective view illustrating an exterior of a vane motor according to one embodiment of the invention;

FIG. 3 is an exploded perspective view illustrating a vane motor according to one embodiment of the invention;

FIG. 4 is a perspective view of the vane motor showing an assembled state of the rotor and the inner liner in FIG. 3;

FIG. 5 is a side view illustrating the assembled state of the rotor and the inner liner in FIG. 4;

FIG. 6 is a fluoroscopic side view illustrating a relationship of the rotor, the inner liner, a fluid inlet and a fluid outlet which are provided on a finish plate engaged to the rotor and the inner liner; and

FIG. 7 is a perspective view illustrating a rotor body including a rotational shaft of the vane motor.

[0023] Repeated use of reference characters throughout the present invention and appended drawings is intended to represent the same or analogous features or elements of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] Hereinafter, preferred embodiments of the invention will be explained in detail in conjunction with the accompanying drawings.

[0025] Referring to a vane motor according to the embodiment illustrated in FIGS. 2 to 7,

{29} the vane motor 1 of this embodiment includes a casing forming an exterior, an inner liner 20 of a cylindrical shape, and a rotor positioned in the inner liner 20.

[0026] The casing includes a casing body 11 formed of a substantially cylindrical shape, and finish plates 13 and 15 for finishing both ends of the casing body 11 in a longitudinal direction. The finish plates 13 and 15 are respectively provided with rotational shaft mounting holes 131 and 151, through which a rotational shaft 33 connected to the rotor passes, arc-shaped fluid inlets 135 and 155, through which a pressurized fluid comes in from the outside, and arc-shaped fluid outlets 133 and 153, through which the pressurized fluid comes out. A bearing 17 is installed in the rotational shaft mounting holes 131 and 151, so that the rotational shaft 33 does not come into direct contact with the finish plates 13 and 15, thereby reducing friction between the rotational shaft 33 and the finish plates 13 and 15.

[0027] The inner liner 20 is installed in the casing. The length of the inner liner 20 is substantially identical to that of the casing body 11, and both ends of the inner liner 20 contact against the inner surfaces of the finish plates 13 and 15 of the casing in a longitudinal direction, with a fine gap between both ends and the inner surfaces. When the inner liner 20 turns in the casing, the inner liner produces sliding friction between the inner surfaces of the finish plates 13 and 15 and the inner liner. The inner liner 20 is laid on a plurality of rolling members 19 which are disposed on a concave portion 119 formed on the inner wall of the casing wall 11, when the inner liner 20 is installed in the casing. The rolling member has a roller 19a and a rolling shaft 19b, and the rolling shaft 19b is formed in the shape of a cylinder or a rotational shaft, and is rotatably installed in parallel with the rotational shaft 33. If the inner liner 20 turns in the casing body 11, the rolling shaft coming into contact with the outer surface of the inner liner rotates, and thus there is no sliding friction between the turning inner liner 20 and the inner surface of the casing body 11.

[0028] The rotor is installed in the inner liner 20, and includes a cylindrical rotor body 31 having the rotational shaft 33, and a plurality of vanes 35 engaged with each groove 31a of the rotor body 31. The length of the cylinder forming the rotor body 31 is substantially identical to that of the casing body 11, and when the rotor turns, both ends of the cylinder come into contact with the inner surfaces of the finish plates 13 and 15 in the state in which a fine gap is therebetween, thereby producing sliding friction between the inner surfaces of the finish plates 13 and 15 and both ends thereof.

[0029] The connecting manner between the rotor body 31 and the vane 35 may be substantially identical to that of the vane motor of the prior art. Since the operation of the vane 35 in the groove 31a is widely known in the art, the detailed description will be omitted herein.

[0030] This embodiment is substantially identical to the first embodiment, except that the rotor is not installed to come into directly contact with the inner surface of the

casing body 11, but is installed to come into directly contact with the inner surface of the inner liner 20.

[0031] The rotational shaft 33 of the rotor is parallel with an imaginary rotational axis of the inner liner 20, but is spaced apart from the rotational axis of the inner liner at a distance. The finish plates 13 and 15 of the casing are respectively provided with a hole through which the rotational shaft 33 penetrates. The position of the hole is spaced apart from the rotational axis of the cylinder forming the casing at a distance.

[0032] With the above configuration, the rotor disposed in the casing body 11 pushes the inner liner 20 of the cylindrical shape against the rolling member 19 of the casing body 11, so that an imaginary rotational axis of the cylinder forming the casing body is spaced apart from the imaginary rotational axis of the inner liner 20 of the cylindrical shape at an interval. The distance between the rotor body 31 and the inner wall surface of the inner liner 20 is minimized at the position where the rotor pushes the inner liner 20, and thus the vane 35 is completely inserted in the groove 31a so that the rotor body 31 contacts against the inner liner 20, or a protruding length of the vane 35 from the rotor body 31 is decreased. At the opposite side (an opposite side on the basis of the rotational shaft), the distance between the rotor body 31 and the inner surface of the inner liner 20 is maximized, thereby increasing the protruding length of the vane 35 from the rotor body 31.

[0033] The groove 31a may be formed in various shapes, if necessary, and the vane 35 slidably moving in or out along the groove 31a may be provided in a direction perpendicular to a vertical plane of the cylindrical rotor body 31, but protrudes at a desired angle with respect to the vertical plane. In this embodiment, the groove is formed on an outer peripheral surface of the rotor body 31 along the entire length thereof in the longitudinal direction, and is slightly sloped at a desired angle with respect to a radial direction pointing along a radius from the rotational shaft 33 toward the rotational direction of the rotor. Therefore, the vane protrudes at a desired angle toward the rotational direction with respect to the vertical plane of the rotor body. (added)

[0034] The operation of components of the vane motor with the above configuration will now be described. A supplier for supplying the pressurized fluid to the fluid inlets 135 and 155 of the vane motor from the outside and a collector for receiving the pressurized fluid from the fluid outlets 133 and 153 may be connected to the vane motor of this embodiment, similar to the first embodiment, but the rotor body 31 and the vanes 35 of the rotor are not operated in the casing body 11, but is operated in the inner liner 20.

[0035] Specifically, explaining the operation of components in the vane motor with the above configuration, the fluid inlet of the vane motor is connected with the supplier (not illustrated) for supplying the pressurized fluid from the outside. Since both of the finish plates 13 and 15 installed to both sides of the vane motor are provided

with the fluid inlets 135 and 155 and the fluid outlets 133 and 153, the supplier is branched at any point to supply the pressurized fluid to both fluid inlets of the finish plates 13 and 15. Similarly, the collector is branched at any point to receive the pressurized fluid from both fluid outlets of the finish plates 13 and 15, of which the pressure of the fluid used in the vane motor is decreased.

[0036] Specifically, if the arc-shaped fluid inlets 135 and 155 are supplied with the pressurized fluid, the pressurized fluid passing through the arc-shaped fluid inlets of the finish plate flows in the space between the rotor body and the inner wall surface of the inner liner at that position. The pressurized fluid applies the pressure to the vane forming a portion of an interface of the space. If the pressure applied to the rear surface of the vane is higher than that applied to the front surface, the vane moves forward. Since the rotor provided with the vanes is rotatably fixed by the rotational shaft, the rotor does not move in parallel, but is just rotated. The space between the rotor and the inner wall surface of the inner liner 20 is gradually increased from the positions of the fluid inlets 135 and 155, and the vane 35 protrudes at the most from the groove 31a, so that the pressure applied to the vane is gradually increased. Since the arc-shaped fluid outlets 133 and 153 start to appear next to the position of the maximum gap, the pressurized fluid comes out through the fluid outlets, so that the pressure of the fluid is decreased.

[0037] The rotor of this embodiment is rotated by the pressure difference, similar to the rotor of the vane motor according to the prior art, but the inner liner 20 of the cylindrical shape forms the space in which the pressurized fluid operates, instead of the casing. Since the inner liner is not stationary, the rotational force is transferred to the inner liner 20 of the cylindrical shape which comes into contact with the distal end of the vane 35, due to the friction, when the rotor turns. The inner liner 20 is rotated at the nearly equal linear velocity at the position of the distal end of the respective vanes which forms the outermost circumference of the rotor.

[0038] The inner liner is rotated in the casing, and the rolling members 19, such as a rolling shaft, are interposed between the inner liner and the casing to reduce the sliding friction between the inner liner and the casing body 11.

[0039] As a result, the abrasion caused by the sliding between the vane and the inner wall surface of the inner liner and the energy consumed by the frictional heat are decreased, and thus the efficiency of producing the rotational force by the pressurized fluid is increased.

[0040] Of course, since the finish plates 13 and 15 of the casing are stationary, and the rotor and the inner liner 20 of the cylindrical shape which come into contact with the finish plates are rotated, both ends of the inner liner, the rotor body 31 and the vanes come into slidable contact with the finish plates to produce the frictional heat and consume the energy. As compared to the prior art, the energy consumed by the friction is decreased. In or-

der to further improve the efficiency, the size and surface of the finish plates, the rotor body and the vane should be maintained, similar to the prior art, and the bearing 17 is interposed between the finish plates of the casing and the rotational shafts to reduce the friction.

[0041] While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims.

[0042] It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

Brief Description of Reference Numerals

[0043]

11:	Casing body
13, 15:	Finish plate
17:	Bearing
19:	Rolling member
19a:	Roller
19b:	Rolling shaft
20:	Inner liner
31, 231:	Rotor body
31a, 231a:	Groove
31b:	Enlarged portion
33, 233:	Rotational shaft
35, 235:	Vane
119:	Concave portion
135, 155, 253:	Fluid inlet
133, 153, 255:	Fluid outlet
211:	Casing

Claims

1. A vane motor comprising:

a casing including an inlet port and an outlet port, through which a pressurized fluid comes in or out;

a rotor being installed in the casing, turning around a rotational shaft by the pressurized fluid and including a rotor body which has a substantially cylindrical shape and an axis coinciding with an axis of the rotational shaft and a plurality of vanes which is installed in grooves formed on an outer circumferential surface of the rotor body and has a portion protruding from the groove and (the portion) having a length varied in accordance with a rotational phase, and an inner liner of a cylindrical shape which is installed in the casing and receives the rotor therein, in which a distal end of the vane comes into contact with an inner wall surface of the inner liner while the pressurized fluid is retained therein until the pressurized fluid flowing through the

inlet port of the casing is discharged from the outlet port of the casing, and an imaginary rotational axis of the inner liner is spaced apart from a rotational axis of the rotational shaft in a parallel state, but is able to rotate together with the rotor when the rotor turns.

2. The vane motor according to claim 1, wherein the imaginary rotational axis of the inner liner and the rotational shaft of the rotor are maintained at constant positions and a rolling member which, when the inner liner is rotated in the casing, is interposed between an outer surface of the inner liner and the inner wall surface of the casing to reduce friction therebetween is included.

3. The vane motor according to claim 1 or 2, wherein

the casing is configured in such a way that both ends of an outer liner of a cylindrical shape larger than the inner liner are closed by disc-shaped finish plates,

at least one of the finish plates is configured in such a way that the rotational shaft pass through and is exposed out of the finish plate to transmit the rotational force, and a bearing is mounted between the rotational shaft and the finish plate. there is a fine gap in axial (longitudinal) direction between the finish plates and components including the inner liner and the vanes, so that the inner liner and the vanes are able to slide with the finish plates, but the pressurized fluid is hardly leaked through the gap.

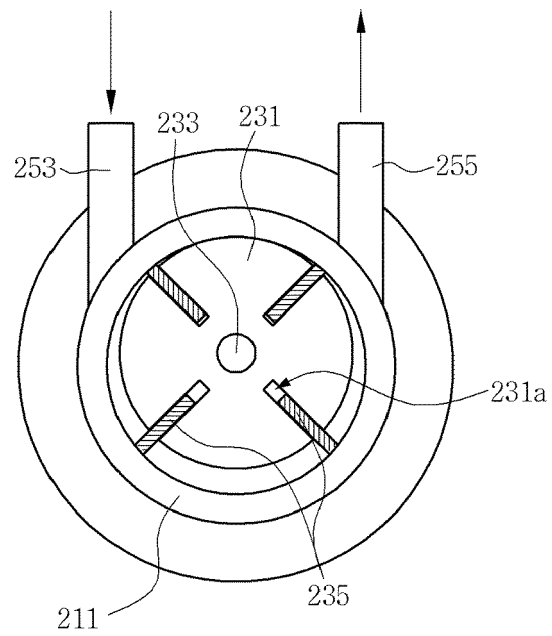
at least one of the finish plates may be provided with a fluid inlet and a fluid outlet. and the fluid inlet and the fluid outlet are formed in such a way that at least a portion of the fluid inlet and at least a portion of the fluid outlet are overlapped with a gap or space between the inner liner and the rotor body, when seen in an axial direction, and the fluid inlet and the fluid outlet are extended in an arc shape in a circumferential direction.

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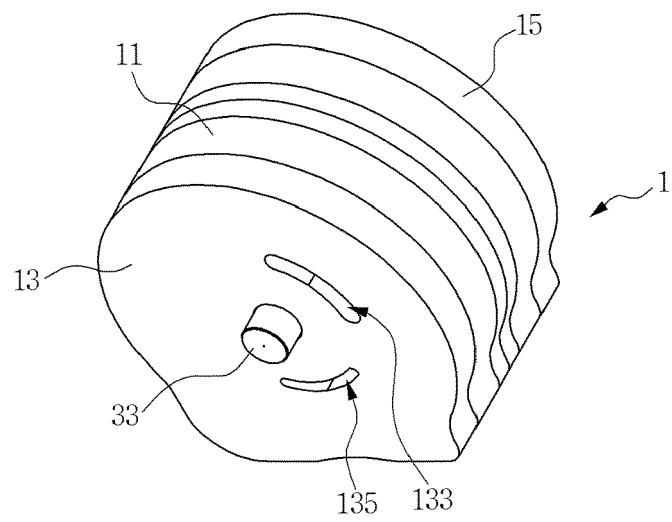
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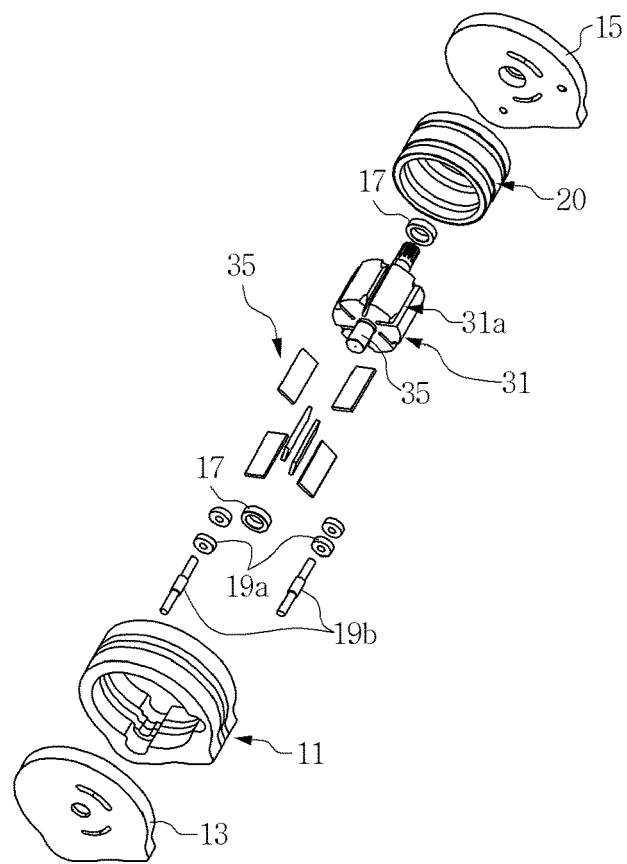
[Fig. 1]



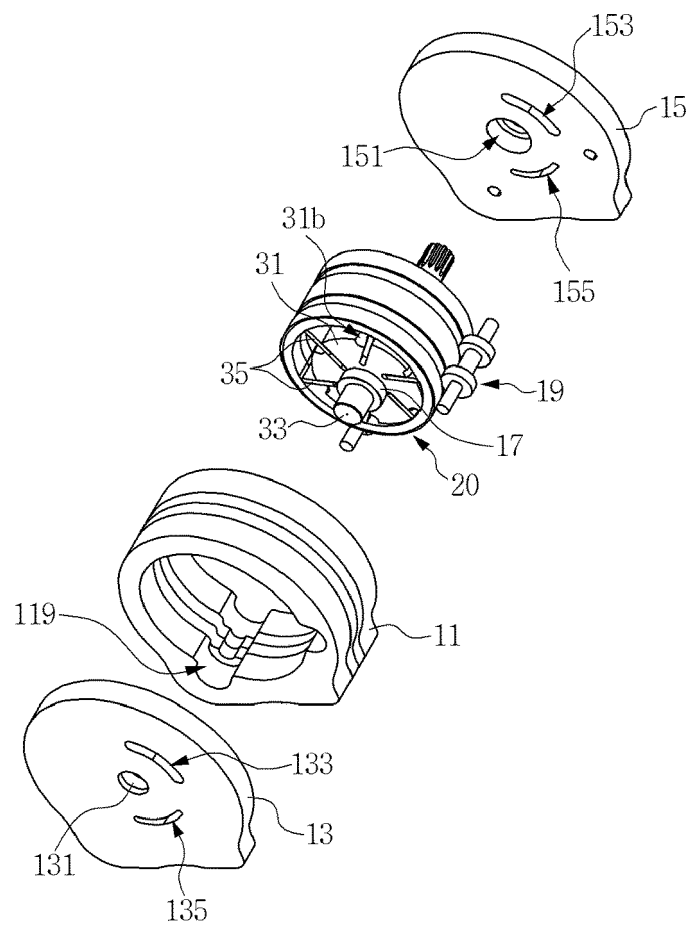
[Fig. 2]



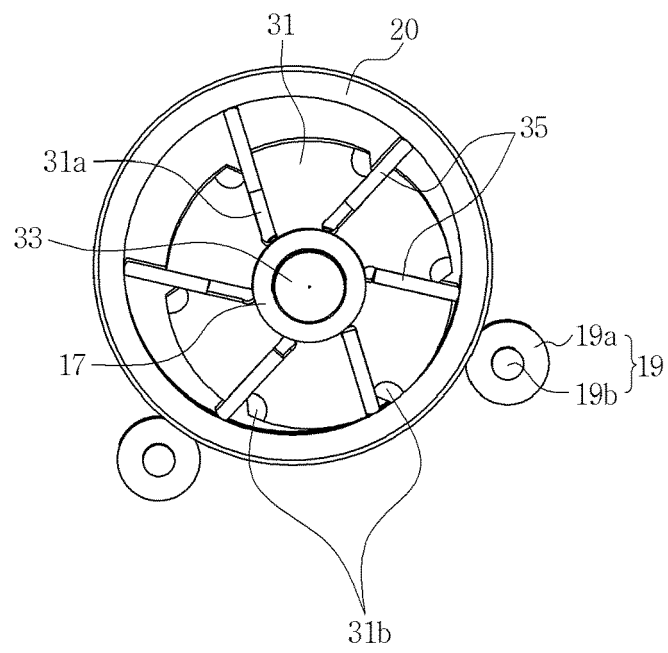
[Fig. 3]



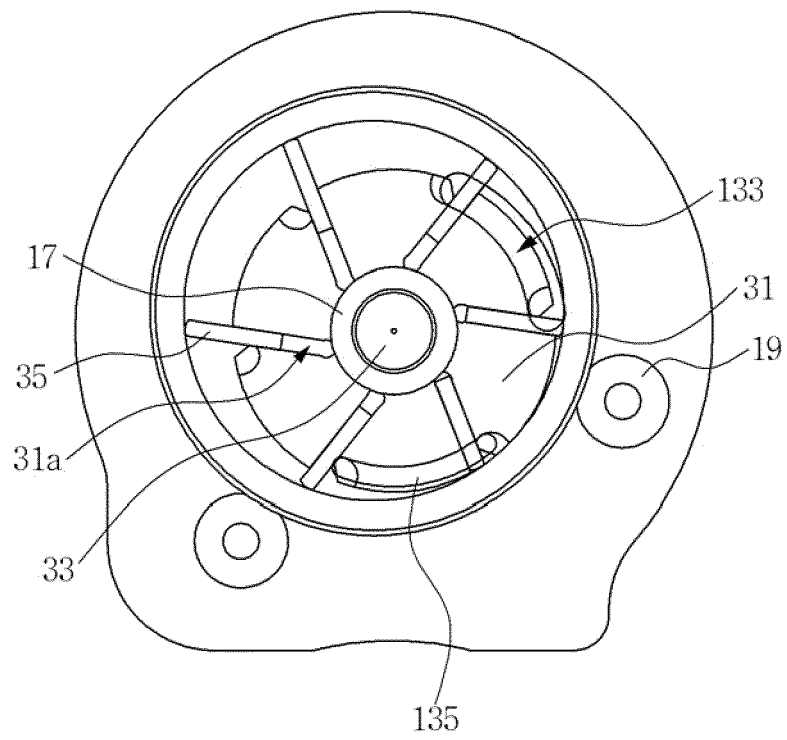
[Fig. 4]



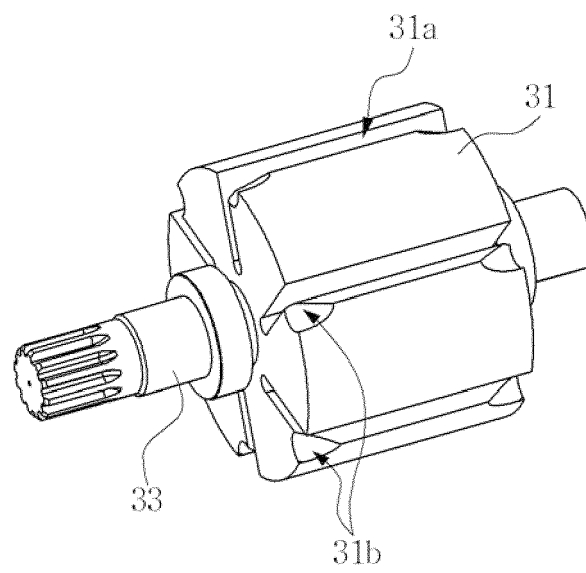
[Fig. 5]



[Fig. 6]



[Fig. 7]





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**ANNEX TO THE EUROPEAN SEARCH REPORT
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