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(54) **WATER PUMP**

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(57) **ABSTRACT**

The present disclosure relates to a water pump in which an upper casing and a lower casing are coupled to each other and an impeller is rotatably accommodated therein, in which the upper casing has an upper bulkhead formed to protrude at a position between an impeller accommodating space and a discharge channel in a radial direction, the lower casing has a lower bulkhead formed to protrude at a position between the impeller accommodating space and the discharge channel in the radial direction, and a gap (TcA) between an upper side of an outer side end of the impeller and the upper bulkhead in the radial direction is formed greater than a gap (TcB) between a lower side of the outer side end of the impeller and the lower bulkhead in the radial direction, thereby reducing a thrust generated when the impeller rotates.

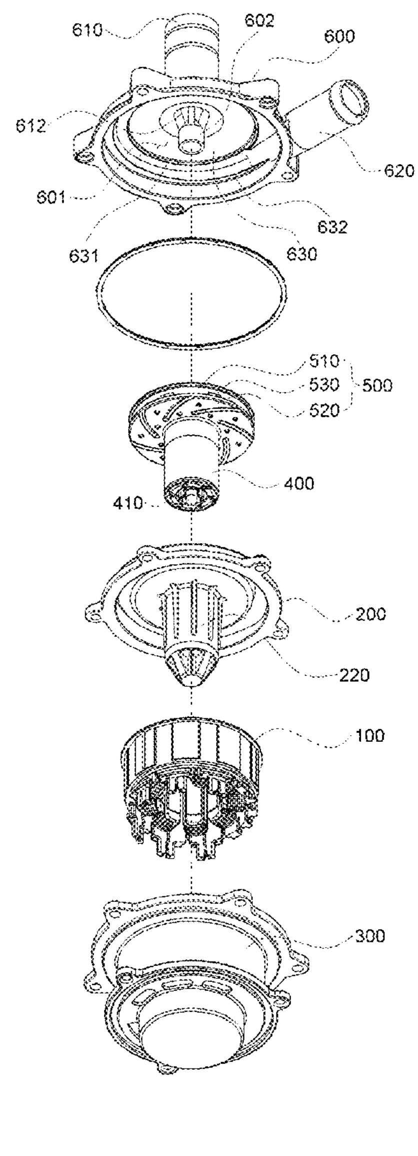


FIG. 1

RELATED ART

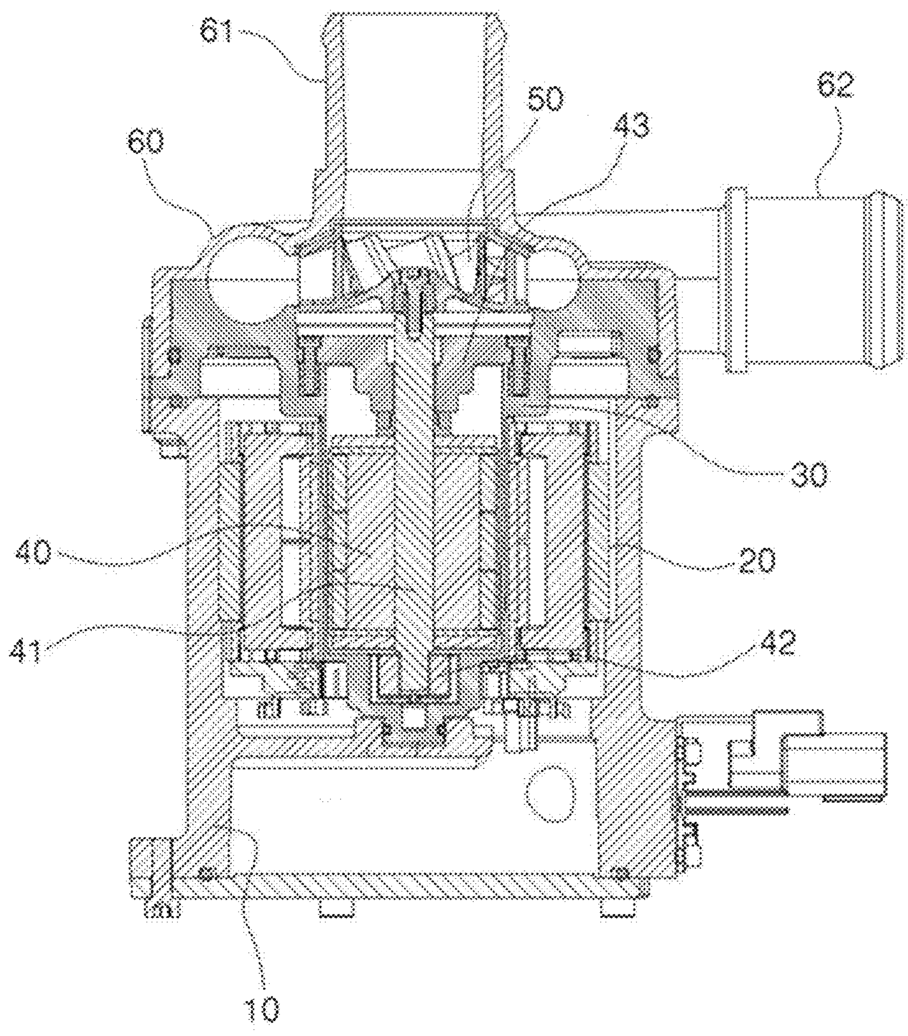


FIG. 2

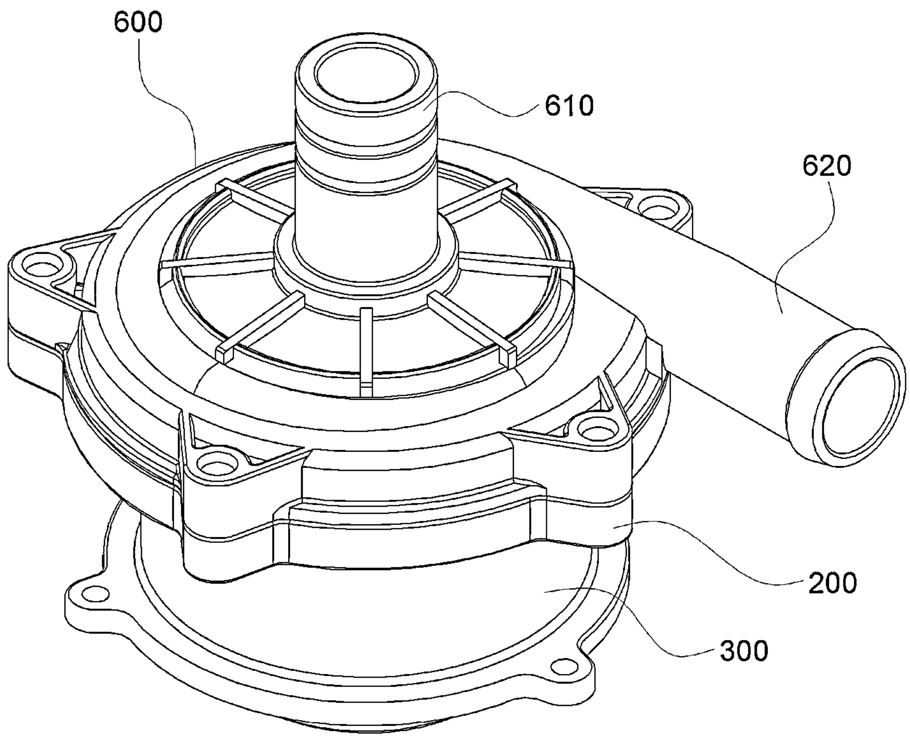


FIG. 3

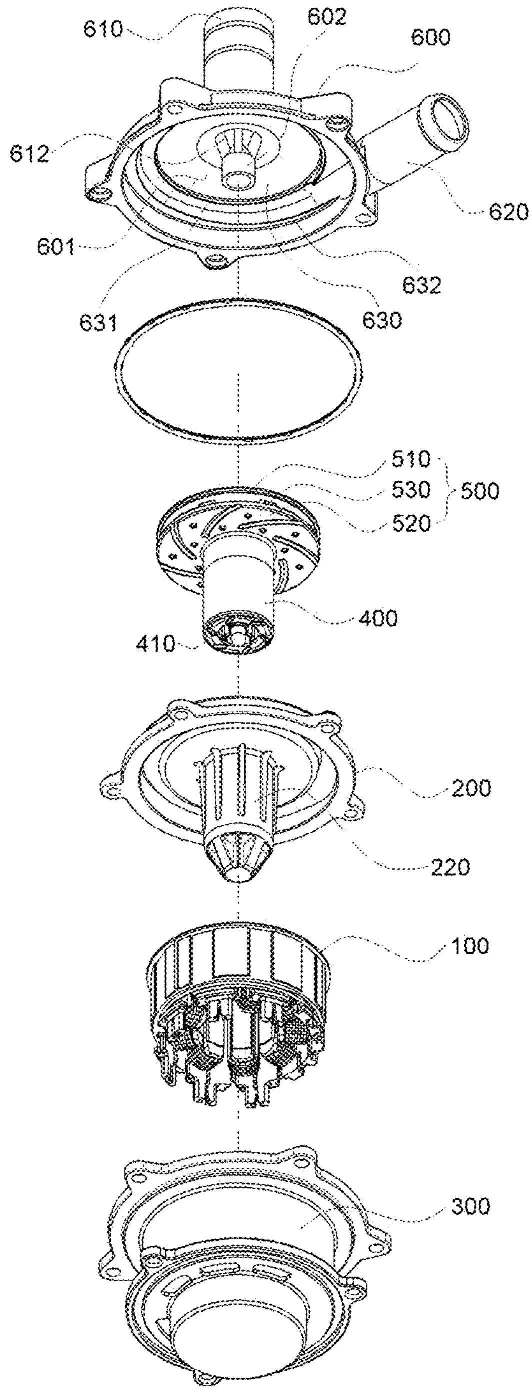

610
602
600
612
620
601
632
631
630
510
530
500
520
400
410
200
220
100
300

FIG. 4

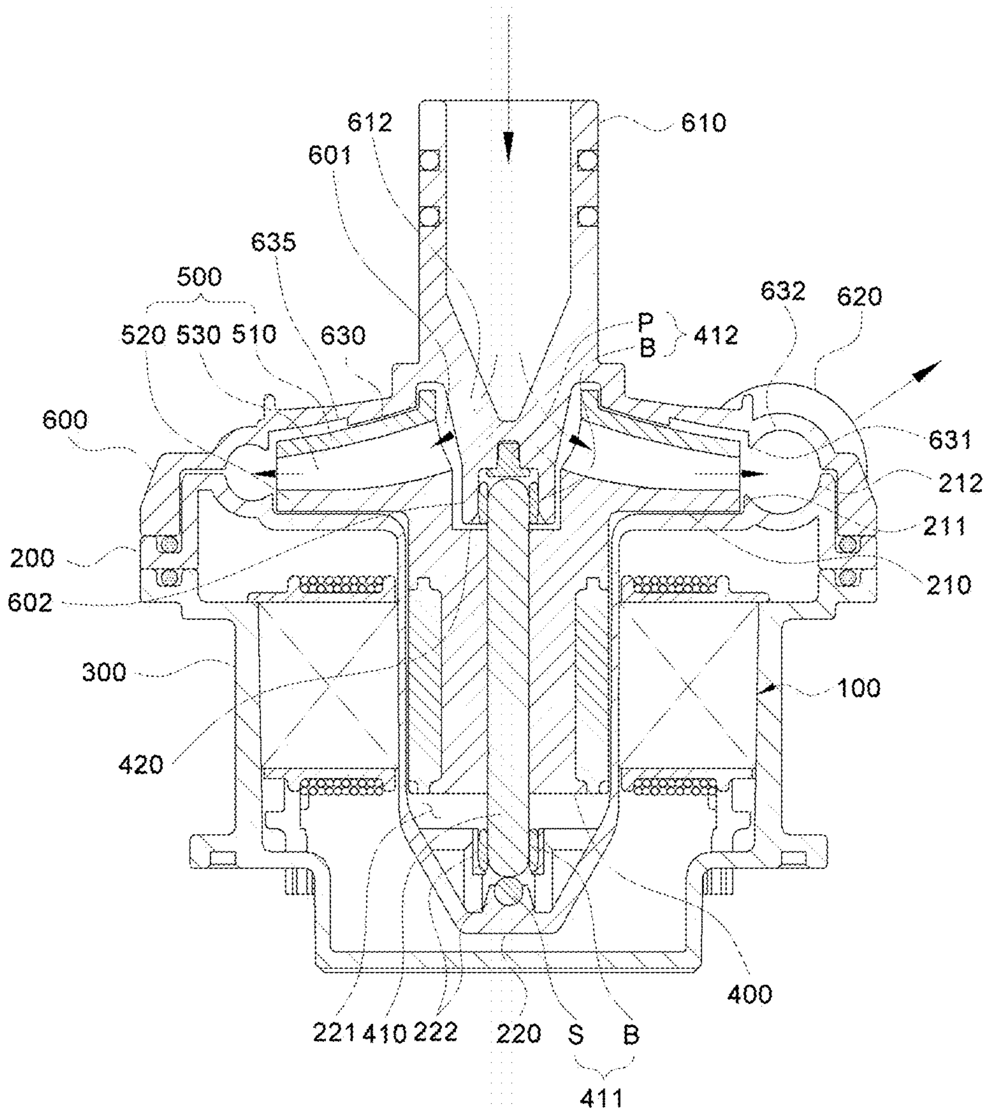

610
612
601
635
500
520 530 510
630
P
B
412
632
620
631
212
211
600
200
602
210
300
100
420
400
221 410 222
220
S
B
411

FIG. 5

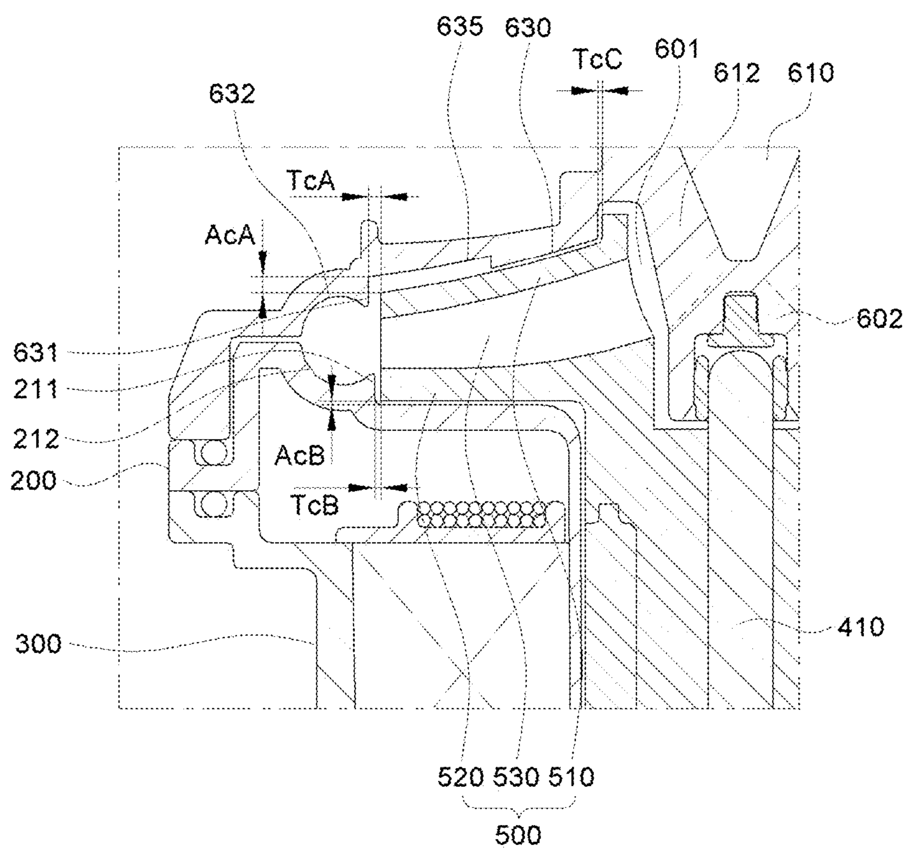

635
630
TcC
601
612
610
632
TcA
AcA
602
631
211
212
AcB
200
TcB
300
410
520
530
510
500

FIG. 6

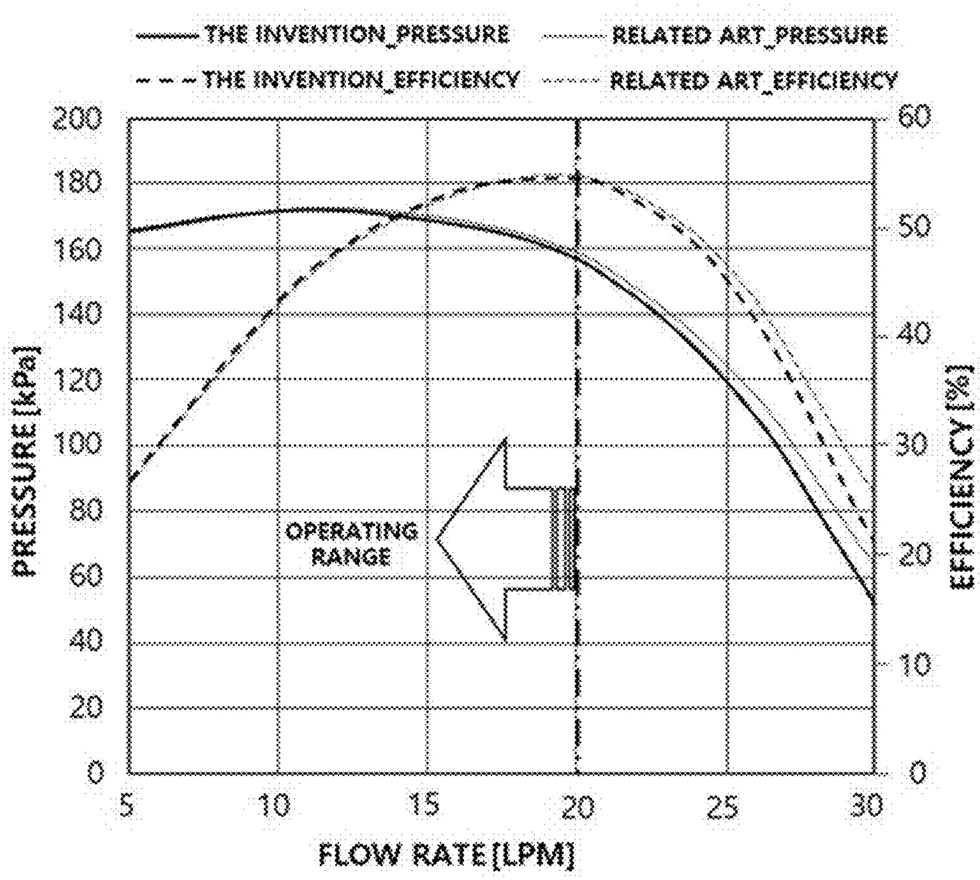

THE INVENTION_PRESSURE
RELATED ART_PRESSURE
THE INVENTION_EFFICIENCY
RELATED ART_EFFICIENCY
PRESSURE [kPa]
EFFICIENCY [%]
OPERATING RANGE
FLOW RATE [LPM]
200
180
160
140
120
100
80
60
40
20
0
60
50
40
30
20
10
0
5
10
15
20
25
30

FIG. 7

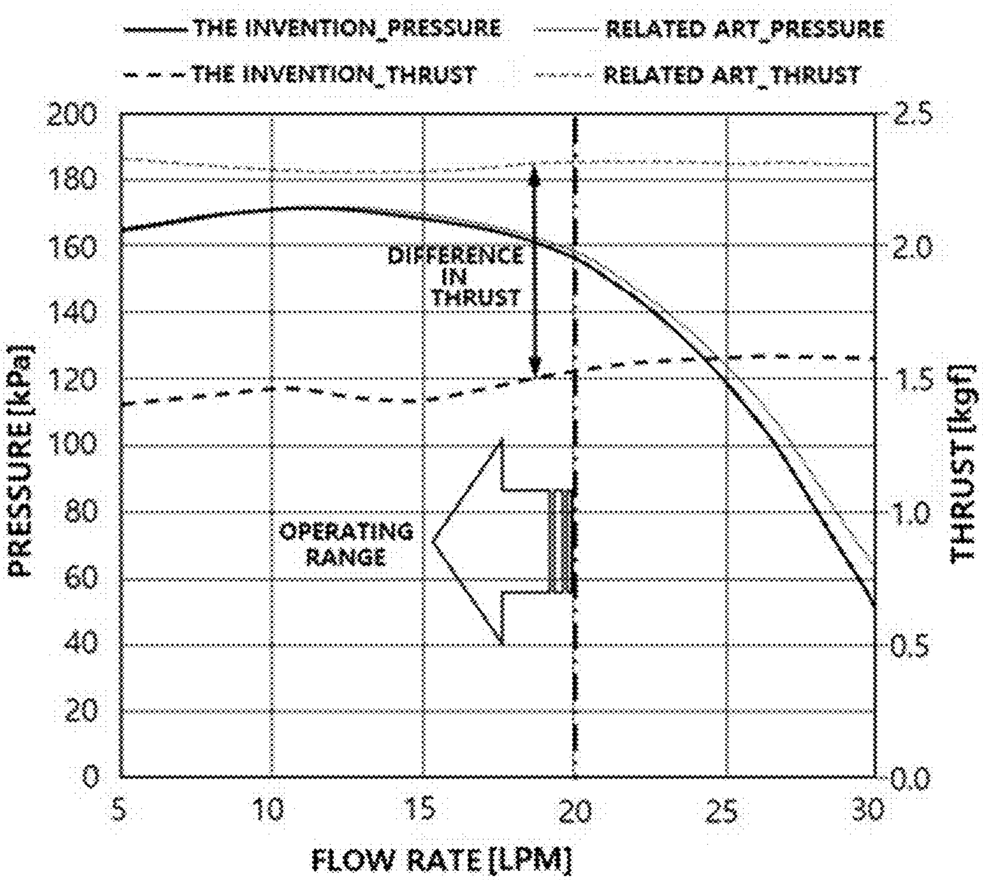
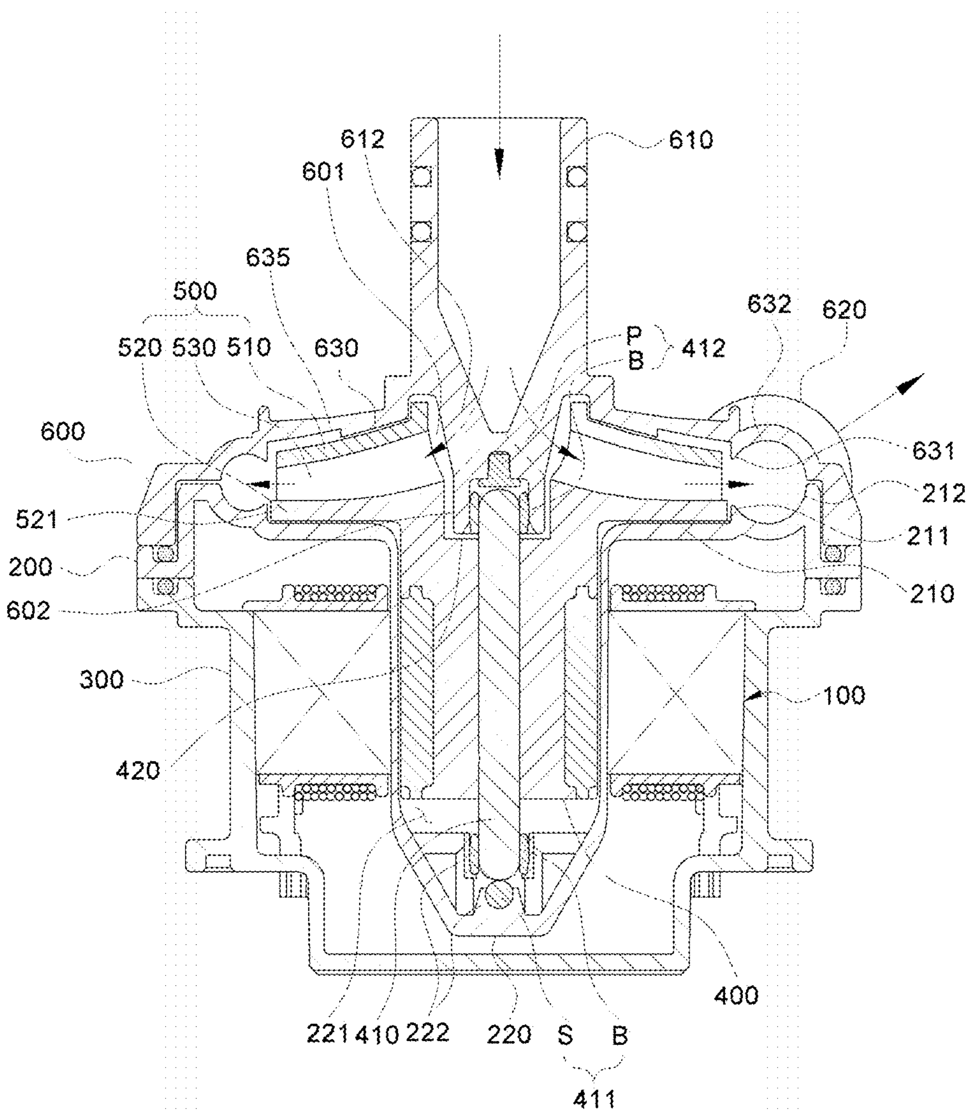
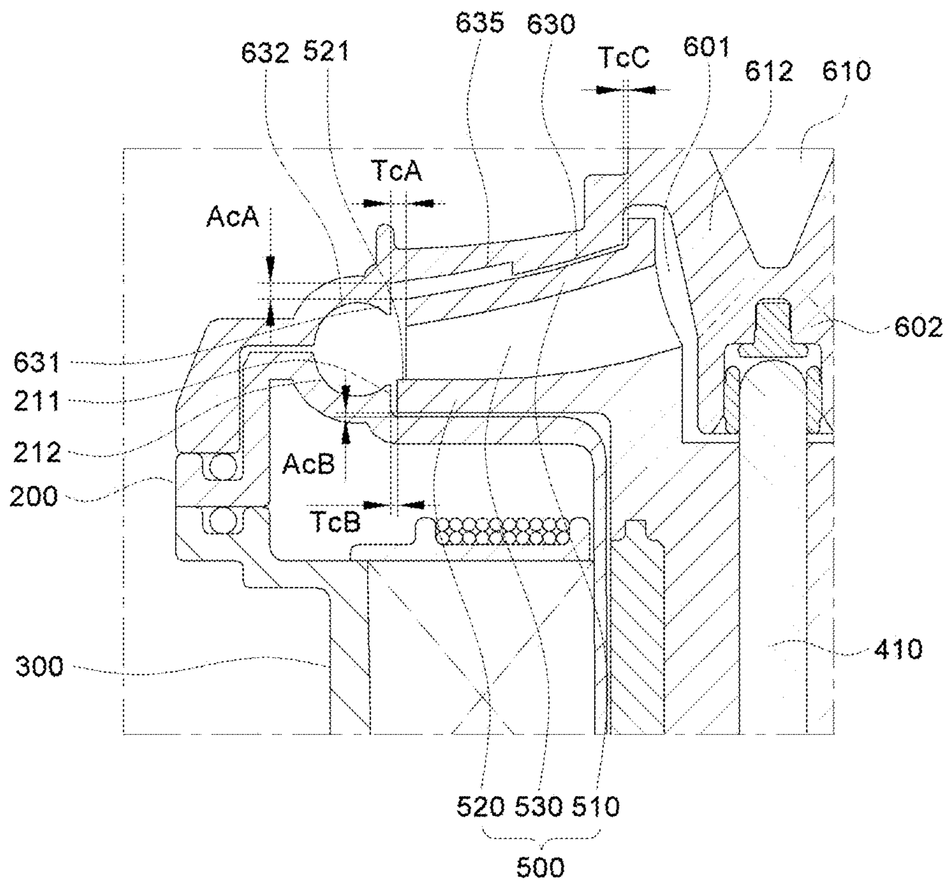

THE INVENTION_PRESSURE
RELATED ART_PRESSURE
THE INVENTION_THRUST
RELATED ART_THRUST
DIFFERENCE IN THRUST
OPERATING RANGE
PRESSURE [kPa]
THRUST [kgf]
FLOW RATE [LPM]
200
180
160
140
120
100
80
60
40
20
0
2.5
2.0
1.5
1.0
0.5
0.0
5
10
15
20
25
30

FIG. 8



612
610
601
635
500
632
620
520 530 510
630
P
B
412
600
631
521
212
211
200
210
602
300
100
420
400
221 410 222
220
S
B
411

FIG. 9



632
521
635
630
TcC
601
612
610
TcA
AcA
602
631
211
212
AcB
200
TcB
300
410
520
530
510
500

WATER PUMP

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C. § 119 to Korean Patent Application No. 10-2024-0023473, filed on Feb. 19, 2024, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The following disclosure relates to a water pump capable of pressure-feeding a coolant by rotating an impeller.

BACKGROUND

[0003] A water pump is a device for circulating a coolant to an engine or a heater in order to cool the engine or heat an interior. Such a water pump is mainly divided into a mechanical water pump and an electric water pump.

[0004] The mechanical water pump is a pump connected to a crankshaft of an engine and driven according to the rotation of the crankshaft, and the electric water pump is a pump driven by the rotation of a motor controlled by a control device.

[0005] FIG. **1** is a front cross-sectional view illustrating an example of a conventional electric water pump.

[0006] Referring to FIG. **1**, the conventional electric water pump largely includes a housing **10**, a stator **20**, a can **30**, a rotor **40**, a rotation shaft **41**, a lower bearing **42**, an upper bearing **43**, an impeller **50**, and an upper casing **60**.

[0007] More specifically, the stator **20** is provided inside a housing **10** in which a concave accommodating space is formed, a protrusion formed convexly downward of the can **30** is inserted so as to pass through a central portion of the stator **20**, and an upper portion of the can **30** is coupled to an upper end portion of the housing **10**. In addition, a concave space is formed on the inside of the protrusion portion of the can **30**, the rotor **40** is disposed inside the space, and both end portions of the rotation shaft **41** coupled to the rotor **40** are coupled to and supported by the lower bearing **42** and the upper bearing **43**. In addition, the upper casing **60** is coupled to the upper portion of the can **30**, the impeller **50** is provided in the internal space formed by the coupling of the can **30** and the upper casing **60**, and the impeller **50** is configured to be coupled to the rotation shaft **41** and rotate together with the rotor **40**. Thus, the fluid introduced into the inlet pipe **61** formed in the upper casing **60** by the rotation of the impeller **50** may be pressurized through the impeller **50** and then discharged through an outlet pipe **62** formed in the upper casing **60**.

[0008] However, when the impeller **50** rotates, some of the fluid discharged from the impeller **50** flows between a lower surface of the impeller **50** and the can **30**, and pressure is applied. Another portion of the fluid discharged from the impeller **50** flows between an upper surface of the impeller **50** and the upper casing **60** and returns to the inlet side of the impeller **50**. In this case, since the fluid pressure between the upper surface of the impeller **50** and the upper casing **60** is lower than that between the lower surface of the impeller **50** and the can **30**, an upward thrust is generated that causes the impeller **50** and the rotor **40** to move axially upward.

[0009] Due to the upward thrust, the performance and efficiency of the water pump are reduced, and friction increases in the bearings, etc., that support the rotation shaft of the rotor in the axial direction, resulting in a problem of reduced durability.

RELATED ART DOCUMENT

Patent Document

[0010] KR 10-2015-0052436 A (2015 May 14) "Water pump"

SUMMARY

[0011] An embodiment of the present disclosure is directed to providing a water pump capable of improving performance and efficiency by reducing a thrust generated when an impeller rotates.

[0012] In one general aspect, a water pump includes: an upper casing and a lower casing that are coupled to each other to form an impeller accommodating space in which an impeller is rotatably accommodated, provided with an inlet communicating with the impeller accommodating space on an upper side of the impeller accommodating space to allow fluid to be introduced, a discharge channel communicating with the impeller accommodating space on an outer side of the impeller accommodating space in a radial direction, and an outlet connected to the discharge channel to discharge the fluid to the outside; and an impeller that is rotatably provided in the impeller accommodating space, in which the upper casing has an upper bulkhead formed to protrude at a position between the impeller accommodating space and the discharge channel in the radial direction, and the lower casing has a lower bulkhead formed to protrude at a position between the impeller accommodating space and the discharge channel in the radial direction, and a gap (TcA, or "first" gap) between an upper side of an outer end of the impeller and the upper bulkhead in the radial direction is formed greater than a gap (TcB, or "second" gap) between a lower side of an outer side end of the impeller and the lower bulkhead in the radial direction.

[0013] A gap (TcC, or "third" gap) between an upper end of an inner side of the impeller and the upper casing in the radial direction may be formed to be smaller than or equal to the gap (TcB) between the lower side of the outer side end of the impeller and the lower bulkhead in the radial direction.

[0014] In an area adjacent to the position of the outer side end of the impeller in the radial direction, a gap (AcA, or "fourth" gap) between an upper surface of the impeller and a lower surface of the upper casing in an axial direction may be formed to be greater than or equal to a gap (AcB, or fifth) between a lower surface of the impeller and an upper surface of the lower casing in the axial direction.

[0015] A pressure chamber may be formed concavely upward from the lower surface of the upper casing in a portion of an area of the inside in the radial direction based on the upper bulkhead of the upper casing.

[0016] The upper bulkhead may be disposed radially outward from the lower bulkhead.

[0017] The lower side of the outer side end of the impeller in the radial direction may protrude radially outward from the upper side of the outer side end.

[0018] The impeller may include an upper plate and a lower plate spaced apart from each other, and a plurality of blades that are interposed and coupled between the upper plate and the lower plate and arranged spaced apart from each other along a circumferential direction, and the upper bulkhead may be formed with a height corresponding to the upper plate of the impeller, and the lower bulkhead may be formed with a height corresponding to the lower plate of the impeller.

[0019] An outer side end of the lower plate of the impeller in the radial direction may protrude radially outward from an outer side end of the upper plate in the radial direction and outer side ends of the plurality of blades in the radial direction.

[0020] The impeller may be a centrifugal impeller.

[0021] The water pump may further include a rotor that is provided in a rotor accommodating part and coupled to the impeller, in which the lower casing may have the rotor accommodating part formed concavely from the upper surface to a lower side in a central portion, and may be formed protruding downward.

[0022] The water pump may further include: a motor housing that is formed in a concave container shape with an open upper side and coupled to the lower casing; and a stator that is provided inside the motor housing and coupled to the rotor accommodating part of the lower casing inserted into a central portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. **1** is a front cross-sectional view illustrating an example of the conventional electric water pump in accordance with the prior art.

[0024] FIGS. **2** and **3** are an assembled perspective view and an exploded perspective view illustrating a water pump according to an embodiment of the present disclosure.

[0025] FIG. **4** is a front cross-sectional view illustrating the water pump according to a first embodiment of the present disclosure.

[0026] FIG. **5** is a partial enlarged view of FIG. **4**.

[0027] FIGS. **6** and **7** are graphs comparing the pressure, efficiency, and thrust of the water pump of the present disclosure and the conventional water pump according to the flow rate, which is analyzed by simulating the flow of the fluid using a computational fluid dynamics (CFD) program.

[0028] FIG. **8** is a front cross-sectional view illustrating the water pump according to a second embodiment of the present disclosure.

[0029] FIG. **9** is a partial enlarged view of FIG. **8**.

DETAILED DESCRIPTION OF MAIN ELEMENTS

[0030] **100**: Stator
[0031] **200**: Lower casing
[0032] **210**: Lower seating groove
[0033] **211**: Lower bulkhead
[0034] **212**: Lower flow path groove
[0035] **220**: Rotor accommodating part
[0036] **221**: Rotor accommodating space
[0037] **222**: Lower bearing mounting part
[0038] **300**: Motor housing
[0039] **400**: Rotor
[0040] **410**: Rotation shaft
[0041] **411**: Lower bearing
[0042] **412**: Upper bearing
[0043] **420**: Insertion groove
[0044] B: Bushing
[0045] P: Support pin
[0046] S: Ball
[0047] **500**: Impeller
[0048] **510**: Upper plate
[0049] **520**: Lower plate
[0050] **521**: Protrusion
[0051] **530**: Blade
[0052] **600**: Upper casing
[0053] **601**: Impeller accommodating space
[0054] **602**: Upper bearing mounting part
[0055] **610**: Inlet
[0056] **612**: Support
[0057] **620**: Outlet
[0058] **630**: Upper seating groove
[0059] **631**: Upper bulkhead
[0060] **632**: Upper flow path groove
[0061] **635**: Pressure Chamber DETAILED DESCRIPTION OF EMBODIMENTS

[0062] Hereinafter, a water pump according to the present disclosure will be described in detail with reference to the accompanying drawings.

[0063] FIGS. **2** and **3** are an assembled perspective view and an exploded perspective view illustrating a water pump according to an embodiment of the present disclosure, FIG. **4** is a front cross-sectional view illustrating the water pump according to a first embodiment of the present disclosure, and FIG. **5** is a partial enlarged view of FIG. **4**.

[0064] As illustrated, the water pump according to the first embodiment of the present disclosure may be largely configured to include a lower casing **200**, an upper casing **600**, and an impeller **500**. In addition, the water pump according to the first embodiment of the present disclosure may further include a rotor **400**, a motor housing **300**, and a stator **100**.

[0065] The upper casing **600** may have an upper seating groove **630** formed concavely upward from the lower surface so that a part of the impeller **500** may be inserted. On a lower surface of the upper casing **600**, an upper flow path groove **632** is concavely formed on an outer side of the upper seating groove **630** in a radial direction, so that the fluid discharged from the impeller **500** may flow along the upper flow path groove **632**. Here, the upper seating groove **630** and the upper flow path groove **632** may be formed adjacent to each other but spaced apart from each other. The upper seating groove **630** and the upper flow path groove **632** radially communicate with each other, but a part of the area may be partitioned in the vertical direction by an upper bulkhead **631** at a position therebetween. The upper casing **600** has the inlet **610** formed therein through which the fluid is introduced, and for example, an outlet **620** formed therein through which the fluid flows out may be formed in the upper casing **600**. In addition, the upper casing **600** is provided with the inlet **610** disposed in an upper central portion thereof, and the inlet **610** communicates with an impeller accommodating space **601**, and the outlet **620** may be connected to an end of the upper flow path groove **632** to communicate.

[0066] The lower casing **200** is coupled to a lower side of the upper casing **200**, and the impeller accommodating space **601** in which the impeller **500** may be accommodated is formed in the inside between the upper casing **600** and the lower casing **200** by the coupling between the upper casing

600 and the lower casing **200**. The lower casing **200** may have a lower seating groove **210** formed downwardly concavely from an upper surface thereof so that a lower portion of the impeller **500** may be accommodated therein, and may have a lower flow path groove **212** concavely formed outside the lower seating groove **210** in a radial direction so that a fluid discharged from the impeller **500** may flow. Here, the lower flow path groove **212** may be formed adjacent to but spaced apart from the lower seating groove **210**. In addition, the lower seating groove **210** and the lower flow path groove **212** may be radially connected, but a portion of the upper and lower area may be partitioned at a position therebetween by a lower bulkhead **211**.

[0067] The impeller **500** is provided in the impeller accommodating space **601**, which is an internal space formed by the combination of the upper casing **600** and the lower casing **200**, and the impeller **500** is connected to the rotor **400** so that the impeller **500** may rotate together with the driving of the rotor **400**. For example, the impeller **500** may be, for example, a centrifugal impeller. The impeller **500** may include an upper plate **510**, a lower plate **520**, and a plurality of blades **530**, and the plurality of blades **530** are arranged to be spaced apart from each other in a circumferential direction between the upper plate **510** and the lower plate **520** vertically spaced apart from each other. In addition, a through hole penetrating through both sides of the upper plate **510** vertically is formed in the central portion of the upper plate **510**, and the inside of the impeller **500** communicates with the inlet channel **611** through the through hole. In addition, an outer peripheral surface of the impeller **500** is disposed adjacent to the lower flow path groove **212** and the upper flow path groove **632**, which are discharge channels, an outer peripheral surface of the upper plate **510** and the upper bulkhead **631** may be spaced apart from each other with a specific gap in the radial direction, and the outer peripheral surface of the lower plate **520** and the lower bulkhead **211** may be spaced apart from each other with a specific gap in the radial direction. In addition, for example, the impeller **500** may be formed in a shape in which the blades **530** and the lower plate **520** are formed integrally with a core part of the rotor **400** and the upper plate **510** is coupled to upper sides of the blades **530**. In addition, the impeller may be formed in various shapes. Thus, the fluid introduced into the inlet **610** of the upper casing **600** may flow into the inside of the impeller **500** through the through hole formed in the upper plate **510** of the impeller **500**. Thereafter, the fluid pressurized by the centrifugal force resulting from the rotation of the impeller **500** may flow along the discharge channel formed by the upper flow path groove **632** of the upper casing **600** and the lower flow path groove **212** of the lower casing **200** and then be discharged to the outside through the outlet **620**. In addition, an upper surface of the upper plate **510** of the impeller **500** and the upper seating groove **630**, which is a lower surface of the upper casing **600**, may be spaced apart from each other with a specific gap in the axial direction, and a lower surface of the lower plate **520** of the impeller **500** and the lower seating groove **212**, which is an upper surface of the lower casing **200**, may be spaced apart from each other with a specific gap in the axial direction. The radial direction may be the radial direction of the impeller **500**, and the axial direction may be the direction of the rotation shaft **410**, which is the central axis of the impeller **500**.

[0068] Here, a gap TcA between an upper side of an outer side end of the impeller **500** and the upper bulkhead **631** in the radial direction may be formed to be greater than a gap TcB between a lower side of the outer side end of the impeller **500** and the lower bulkhead **211** in the radial direction (TcA>TcB). The upper side of the outer side end of the impeller **500** may be the outer peripheral surface of the upper plate **510**, and the lower side of the outer side end of the impeller **500** may be the outer peripheral surface of the lower plate **520**. In addition, the gap TcA may be a minimum gap between the upper side of the outer side end of the impeller and the upper bulkhead in the radial direction, and the gap TcB may be a minimum gap between the lower side of the outer side end of the impeller and the lower bulkhead in the radial direction.

[0069] Thus, when the impeller **500** rotates, the fluid introduced through the inlet **610** passes through the impeller **500** and then flows in the circumferential direction along the space formed by the upper flow path groove **632** and the lower flow path groove **212**, which are the discharge channels, and then is pressurized and discharged to the outside through the outlet **620**. The pressure of the fluid discharged from the impeller **500** and introduced between the lower plate **520** and the lower casing **200** of the impeller **500** generates an upward thrust that causes the impeller **500** and the rotor **400** to move axially upward. In this case, since the gap TcA between the outer peripheral surface of the upper plate **510** of the impeller **500** and the upper bulkhead **631** is greater than the gap TcB between the lower side of the outer side end of the impeller **500** and the lower bulkhead **211**, the pressure of the fluid flowing between the upper plate **510** of the impeller **500** and the upper casing **600** through the gap TcA between the outer peripheral surface of the upper plate **510** and the upper bulkhead **631** increases, thereby generating a downward thrust that pushes the impeller **500** and the rotor **400** axially downward. In other words, the upward thrust is offset by the downward thrust, and as a result, the generation of the thrust may be reduced.

[0070] FIGS. **6** and **7** are graphs comparing the pressure, efficiency, and thrust of the water pump of the present disclosure and the conventional water pump according to the flow rate, which is analyzed by simulating the flow of the fluid using a computational fluid dynamics (CFD) program.

[0071] As illustrated, it may be seen that the water pump of the present disclosure significantly reduces the thrust while the pressure and efficiency are hardly reduced compared to the conventional water pump within the operating range below a specific flow rate 20 LPM.

[0072] Therefore, the water pump of the present disclosure may improve the durability of the water pump by reducing the thrust generated when the impeller rotates, thereby reducing the friction between the rotation shaft of the rotor and the bearing that supports the rotation shaft in the axial direction.

[0073] In addition, the upper casing **600** may have an upper bearing mounting part **602** extended from the lower portion of the inlet **610** toward the impeller accommodating space **601**, and the upper bearing mounting part **602** may further include a plurality of supports **612**. The plurality of supports **612** may be disposed to be spaced apart from each other along the circumferential direction. The plurality of supports **612** may have upper ends connected to an inner wall of the lower end of the inlet **610** and lower ends connected to the upper bearing mounting part **602**, and may be formed to extend in a shape in which they are inclined in the inner diameter direction from the upper ends to the lower ends. In addition, the upper bearing mounting part **602** may be formed to be radially inwardly inclined with its upper end going upward, and the plurality of supports **612** may have their lower ends connected to an inclined upper surface of the upper bearing mounting part **602**. That is, the upper bearing mounting part **602** may be formed in a shape in which an outer diameter thereof gradually decreases from an approximately intermediate point in a vertical direction toward the upward direction. In addition, an upper bearing **412** may be coupled to the upper bearing mounting part **602**, and the upper bearing **412** may include the bushing B capable of radially supporting the upper end of the rotation shaft **410** of the rotor **400** and the support pin P capable of axially supporting the upper end of the rotation shaft **410**. In addition, the upper bearing mounting part **602** and the supports **612** may be formed integrally with the upper casing **600** by injection-molding.

[0074] In addition, the lower casing **200** may have a rotor accommodating part **220** formed to protrude downwardly from a central portion of the lower seating groove **210**, and the rotor accommodating part **220** may be formed in the shape of a container downwardly concave from an upper side thereof. In addition, the rotor accommodating part **220** may have a lower bearing mounting part **222** formed at a lower end of a rotor accommodating space **221**, which is a concave inner portion thereof, and a lower bearing **411** may be coupled to the lower bearing mounting part **222**. Here, the lower bearing **411** may include a bushing B that may support a lower end of a rotation shaft **410** of the rotor **400** in the radial direction and a spherical ball S that may support the lower end of the rotation shaft **410** in an axial direction. Thus, the rotor **400** may be inserted into and disposed in the rotor accommodating space **221**, which is the inner portion of the rotor accommodating part **220**, and an outer peripheral surface of the rotor **400** may be disposed to be spaced apart from an inner peripheral surface of the rotor accommodating part **220**. In addition, the rotor accommodating part **220** may be formed integrally with the lower casing **200** by injection-molding. In addition, the rotor accommodating part **220** of the lower casing **200** is inserted into a hollowed inside of the stator **100** and penetrates through the stator **100**, such that a lower end of the rotor accommodating part **220** may protrude downwardly beyond a lower end of the stator **100**, and the lower end of the rotor accommodating part **220** may be in a state in which it is spaced apart from a bottom surface of the motor housing **300**. In addition, an outer peripheral surface of the rotor accommodating part **220** may be coupled to an inner peripheral surface of the stator **100** in a state in which it is in contact with and closely adhered to the inner peripheral surface of the stator **100**.

[0075] In addition, a gap TcC between an outer peripheral surface of an upper end of an inner side of the impeller **500** in the radial direction and the upper casing **600** may be formed to be smaller than or equal to the gap TcB between the lower side of the outer side end of the impeller **500** and the lower bulkhead in the radial direction (TcC≤TcB). Accordingly, the amount of fluid discharged from the outer side end of the impeller **500** in the radial direction and returning to the inlet side of the impeller **500** through the gap between the upper plate **510** of the impeller **500** and the upper casing **600** is reduced, thereby further reducing the generation of the thrust.

[0076] In addition, at a position adjacent to the outer side end of the impeller **500** in the radial direction, a gap AcA between the upper surface of the impeller **500** and the lower surface of the upper casing **600** in the axial direction may be formed to be greater than or equal to a gap AcB between the lower surface of the impeller **500** and the upper surface of the lower casing **200** in the axial direction (AcA≥AcB). Thus, the pressure of the fluid between the upper surface of the impeller **500** and the lower surface of the upper casing **600** increases, and as the force of the fluid pressing the impeller **500** downward increases, the generation of the thrust may be reduced.

[0077] In addition, a pressure chamber **635** may be formed concavely upward from the lower surface of the upper casing **600** in a portion of the radially inner area based on the upper bulkhead **631** of the upper casing **600**. In this case, the pressure chamber **635** may be formed in a form that is concave upward from the upper seating groove **630**, and the pressure chamber **635** may be formed to extend radially inward from the upper bulkhead **631**. In addition, the pressure chamber **635** may be formed continuously over the entire circumferential direction. Thus, as the pressure of the fluid in the pressure chamber **635** increases, the force that the fluid in the pressure chamber **635** presses the impeller **500** downward increases, thereby reducing the generation of the thrust.

[0078] In addition, the upper bulkhead **631** may be disposed radially outward from the lower bulkhead **211**. That is, as illustrated, in order to form the gap TcA between the upper bulkhead **631** and the outer peripheral surface of the upper plate **510** of the impeller **500** to be greater than the gap TcB between the outer peripheral surface of the lower plate **520** of the impeller **500** and the lower bulkhead **211**, the upper bulkhead **631** may be formed in a form in which it is pushed outward in the radial direction compared to the lower bulkhead **211**.

[0079] FIG. **8** is a front cross-sectional view illustrating a water pump according to a second embodiment of the present disclosure, and FIG. **9** is a partial enlarged view of FIG. **8**.

[0080] As illustrated, in the water pump according to the second embodiment of the present disclosure, in order to form the gap TcA between the upper bulkhead **631** and the outer peripheral surface of the upper plate **510** of the impeller **500** to be greater than the gap TcB between the outer peripheral surface of the lower plate **520** of the impeller **500** and the lower bulkhead **211**, the lower plate **520** of the impeller **500** may be formed in the shape that it protrudes radially outwardly more than the upper plate **510** and the impeller **530**. Here, the protrusion **521** of the impeller **500** may be formed over the entire circumferential direction, and the outer diameter of the lower plate **520** may be formed to be slightly greater than the outer diameter of the upper plate **510** due to the protrusion **521**. Thus, the fluid discharged from the impeller **500** may easily flow between the upper surface of the impeller **500** and the lower surface of the upper casing **600**, and as the force of the fluid pressing the impeller **500** downward increases, the generation of the thrust may be reduced.

[0081] The motor housing **300** may be coupled to the lower casing **200**. The motor housing **300** may be formed in the shape of a concave container made of a metal material, and may be formed in a shape in which an inner portion thereof is empty and an upper side thereof is opened. In addition, the motor housing **300** has a lower end closed and a side surface formed in a cylindrical shape, and an upper end of the motor housing may be provided with a flange protruding outward in the radial direction from the outer circumferential surface.

[0082] The stator **100** may have, for example, a shape in which a plurality of teeth are formed to protrude from an inner peripheral surface of a cylindrical core in an inner diameter direction and are disposed to be spaced apart from each other in a circumferential direction, an insulator made of an electrically insulating material surrounds the core and teeth, and coils are wound on an outer side of the teeth surrounded by the insulator. In addition, the stator **100** may have a shape in which a central portion thereof is vertically penetrated. In addition, the stator **100** may be formed in various shapes and configurations. In addition, the stator **100** may be provided in the motor housing **300**, and an outer peripheral surface of the stator **100** may be coupled and fixed to an inner peripheral surface of the motor housing **300** in a state in which it is closely adhered to the inner peripheral surface of the motor housing **300**.

[0083] The rotor **400** may be provided in the rotor accommodating space **221** of the lower casing **200**, and the outer peripheral surface of the rotor **400** may be disposed to be spaced apart from the inner peripheral surface of the rotor accommodating part **220**, such that the rotor **400** may be rotatably provided. In addition, the rotor **400** has a permanent magnet coupled to an outer portion of the core in the radial direction, and has the rotation shaft **410** coupled to a central axis of the core. In addition, a lower end of the rotation shaft **410** of the rotor **400** may be rotatably coupled to the lower bearing **411**, and an upper end of the rotation shaft **410** of the rotor **400** may be rotatably coupled to the upper bearing **412**. In addition, a portion or entirety of the upper bearing mounting part **602** may be disposed in an inlet side of the impeller **500**. For example, an insertion groove **420** may be formed to be recessed downward at the central portion of the lower plate **520**, which is the lower end of the inlet side of the impeller **500**, the upper bearing mounting part **602** may be inserted into the insertion groove **420**, and the insertion groove **420** and the upper bearing mounting part **602** may be spaced apart from each other.

[0084] According to the present disclosure, it is possible to improve the performance and efficiency of the water pump by reducing the thrust generated when the impeller rotates.

[0085] In addition, it is possible to improve the durability of the water pump by reducing the friction between the rotation shaft of the rotor and the bearing supporting the rotation shaft in the axial direction.

[0086] The present disclosure is not limited to the embodiments described above, and may be applied to various fields. In addition, the present disclosure may be variously modified by those skilled in the art to which the present disclosure pertains without departing from the gist of the present disclosure claimed in the claims.

What is claimed is:

1. A water pump, comprising:

an upper casing and a lower casing that are coupled to each other to form an impeller accommodating space in which an impeller is rotatably accommodated, provided with an inlet communicating with the impeller accommodating space on an upper side of the impeller accommodating space to allow fluid to be introduced, a discharge channel communicating with the impeller accommodating space on an outer side of the impeller accommodating space in a radial direction, and an outlet connected to the discharge channel to discharge the fluid to the outside; and

an impeller that is rotatably provided in the impeller accommodating space,

wherein the upper casing has an upper bulkhead formed to protrude at a position between the impeller accommodating space and the discharge channel in the radial direction, and the lower casing has a lower bulkhead formed to protrude at a position between the impeller accommodating space and the discharge channel in the radial direction, and

a first gap between an upper side of an outer end of the impeller and the upper bulkhead in the radial direction is formed greater than a second gap between a lower side of an outer side end of the impeller and the lower bulkhead in the radial direction.

2. The water pump of claim **1**, wherein a third gap between an upper end of an inner side of the impeller and the upper casing in the radial direction is formed to be smaller than or equal to the second gap between the lower side of the outer side end of the impeller and the lower bulkhead in the radial direction.

3. The water pump of claim **1**, wherein, in an area adjacent to the position of the outer side end of the impeller in the radial direction, a fourth gap between an upper surface of the impeller and a lower surface of the upper casing in an axial direction is formed to be greater than or equal to a fifth gap between a lower surface of the impeller and an upper surface of the lower casing in the axial direction.

4. The water pump of claim **3**, wherein a pressure chamber is formed concavely upward from the lower surface of the upper casing in a portion of an area of the inside in the radial direction based on the upper bulkhead of the upper casing.

5. The water pump of claim **1**, wherein the upper bulkhead is disposed radially outward from the lower bulkhead.

6. The water pump of claim **1**, wherein the lower side of the outer side end of the impeller in the radial direction protrudes radially outward from the upper side of the outer side end.

7. The water pump of claim **1**, wherein the impeller includes an upper plate and a lower plate spaced apart from each other, and a plurality of blades that are interposed and coupled between the upper plate and the lower plate and arranged spaced apart from each other along a circumferential direction, and

the upper bulkhead is formed with a height corresponding to the upper plate of the impeller, and the lower bulkhead is formed with a height corresponding to the lower plate of the impeller.

8. The water pump of claim **7**, wherein an outer side end of the lower plate of the impeller in the radial direction protrudes radially outward from an outer side end of the upper plate in the radial direction and outer side ends of the plurality of blades in the radial direction.

9. The water pump of claim **1**, wherein the impeller is a centrifugal impeller.

10. The water pump of claim **1**, further comprising a rotor that is provided in a rotor accommodating part and coupled to the impeller, wherein the lower casing has the rotor accommodating part formed concavely from the upper surface to a lower side in a central portion, and is formed protruding downward.

11. The water pump of claim **10**, further comprising:

a motor housing that is formed in a concave container shape with an open upper side and coupled to the lower casing; and

a stator that is provided inside the motor housing and coupled to the rotor accommodating part of the lower casing inserted into a central portion.

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