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(54) **OUTBOARD MOTOR**

(57) An outboard motor (1) for propelling a ship, includes: a propeller unit (2) including a propeller shaft (4), a propeller (5) fixed to the propeller shaft, and a case (6) for rotatably supporting the propeller shaft; a support portion (8) formed in a columnar shape extending in an upper-lower direction and having a lower end portion to which the propeller unit is supported; a bracket (17) provided at an upper portion of the support portion and configured to attach the support portion to the ship; and a

fine dust capturing device (21) having a passage through which water around the outboard motor flows and configured to capture fine dust contained in the water flowing through the passage. The fine dust capturing device is provided between the lower end portion of the support portion and the case such that an extension direction of the passage is a front-rear direction of the outboard motor.

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Description

TECHNICAL FIELD

[0001] The present invention relates to an outboard motor for propelling a ship.

BACKGROUND ART

[0002] In recent years, contamination due to fine dust such as microplastic has become a problem in sea, lakes, rivers and the like, and it is desired to recover such fine dust from sea, lakes, rivers and the like to purify sea, lakes, rivers and the like.

[0003] JP2021-169240A (Patent Literature 1) describes an outboard motor capable of collecting fine dust contained in water such as sea, lakes, and rivers. The outboard motor disclosed in the above publication is provided with a fine dust capturing device that captures fine dust. The fine dust capturing device has a water intake, a capturer, and a water outlet. When a ship is sailing, water in the sea, lakes, rivers, and the like flows into the capturer from the water intake, passes through a filter provided in the capturer, and is then discharged to the sea, lakes, rivers, and the like from the water outlet. When water passes through the filter, fine dust contained in the water is captured by the filter.

CITATION LIST

PATENT LITERATURE

[0004] Patent Literature 1: JP2021-169240A

[0005] In order to promote purification of sea, lakes, rivers, and the like, it is desired to increase an amount of fine dust to be captured per unit sailing time of a ship or an amount of fine dust to be captured per unit sailing distance, thereby increasing a capturing efficiency of fine dust.

[0006] In the fine dust capturing device provided in the outboard motor of the related art described in JP2021-169240A, the water intake is disposed in a front portion of the outboard motor and in a portion positioned below a water surface, and the water outlet is disposed in a portion positioned above the water surface in the outboard motor. The fine dust capturing device is provided with a passage connecting the water intake and the water outlet, and the passage passes through the capturer. Further, the filter is disposed in the middle of the passage in the capturer. In addition, in the fine dust capturing device, the water intake is positioned below the water surface and the water outlet is positioned above the water surface, and thus the passage connecting the water intake and the water outlet extends in an upper-lower direction.

[0007] When the ship moves forward, water flows around the outboard motor in a front-rear direction from a front side to a rear side of the outboard motor. The fine

dust capturing device provided in the above outboard motor of the related art allows water to flow through the passage using a pressure of water generated by a water flow in the front-rear direction of the outboard motor. However, since while the water flow around the outboard motor is in the front-rear direction, an extension direction of the passage of the fine dust capturing device is in the upper-lower direction, it may be difficult for water to flow through the passage, making it difficult to increase a flow rate of water flowing through the passage, whereby it is difficult to increase the flow rate of water passing through the filter. As a result, it is difficult to increase the amount of the fine dust captured per unit sailing time or the amount of the fine dust captured per unit sailing distance, and it is difficult to increase the capturing efficiency of the fine dust.

[0008] In this regard, it is conceivable to add a pump to the fine dust capturing device and increase the flow rate of water flowing through the passage by sucking water from the water intake by the pump. However, the addition of the pump is not preferable because it complicates the structure of the fine dust capturing device, increases the size of the outboard motor, and increases manufacturing cost of the outboard motor.

SUMMARY

[0009] The present invention has been made in view of the problems described above, and an object of the present invention is to provide an outboard motor capable of increasing a capturing efficiency of fine dust while avoiding complication of a structure of the fine dust capturing device, an increase in the size of the outboard motor, and an increase in manufacturing cost of the outboard motor.

[0010] In order to solve the problems described above, according to the present invention, there is provided an outboard motor for propelling a ship, the outboard motor including: a propeller unit including a propeller shaft, a propeller fixed to the propeller shaft, and a case for rotatably supporting the propeller shaft; a support portion formed in a columnar shape extending in an upper-lower direction and having a lower end portion to which the propeller unit is supported; a bracket provided at an upper portion of the support portion and configured to attach the support portion to the ship; and a fine dust capturing device having a passage through which water around the outboard motor flows and configured to capture fine dust contained in the water flowing through the passage, in which the fine dust capturing device is provided between the lower end portion of the support portion and the case such that an extension direction of the passage is a front-rear direction of the outboard motor.

[0011] According to the present invention, it is possible to increase the capturing efficiency of the fine dust while avoiding complication of the structure of the fine dust capturing device, an increase in the size of the outboard motor, and an increase in the manufacturing cost of the

outboard motor.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 is a perspective view illustrating an outboard motor according to an embodiment of the present invention.

FIG. 2 is an explanatory view illustrating a state in which a lower portion of the outboard motor according to the embodiment of the present invention is viewed from the left.

FIG. 3A is an explanatory view illustrating a state in which the lower portion of the outboard motor according to the embodiment of the present invention is viewed from a front side, and FIG. 3B is an explanatory view illustrating a state in which the lower portion of the outboard motor is viewed from a rear side.

FIG. 4A is a front view of a fine dust capturing device in the outboard motor according to the embodiment of the present invention, FIG. 4B is a back view of the fine dust capturing device, FIG. 4C is a left side view of the fine dust capturing device, and FIG. 4D is a plan view of the fine dust capturing device.

FIG. 5 is a cross-sectional view illustrating a state in which the lower portion of the outboard motor taken along a cutting line V-V in FIG. 2 is viewed from the front side.

DESCRIPTION OF EMBODIMENTS

[0013] An outboard motor according to an embodiment of the present invention is an outboard motor for propelling a ship, the outboard motor including: a propeller unit; a support portion formed in a columnar shape extending in an upper-lower direction and having a lower end portion to which the propeller unit is supported; a bracket provided at an upper portion of the support portion and configured to attach the support portion to the ship; and a fine dust capturing device configured to capture fine dust. The propeller unit includes a propeller shaft, a propeller fixed to the propeller shaft, and a case for rotatably supporting the propeller shaft. The fine dust capturing device has a passage through which water around the outboard motor flows, and captures fine dust contained in the water flowing through the passage.

[0014] In the present embodiment, the fine dust capturing device is provided between the lower end portion of the support portion and the case of the propeller unit such that the extension direction of the passage through which water around the outboard motor flows is a front-rear direction of the outboard motor.

[0015] In a state in which the outboard motor is attached to the ship, the lower end portion of the support portion of the outboard motor and the propeller unit are positioned below a water surface. Since the fine dust

capturing device included in the outboard motor according to the present embodiment is provided between the lower end portion of the support portion and the case of the propeller unit, the fine dust capturing device is positioned below the water surface in a state in which the outboard motor is attached to the ship. When the ship moves forward, the water flows around the outboard motor in the front-rear direction from the front side to the rear side of the outboard motor. The fine dust capturing device included in the outboard motor according to the present embodiment is placed in a water flow. Further, the fine dust capturing device included in the outboard motor according to the present embodiment is disposed such that the extension direction of the passage through which the water around the outboard motor flows is the front-rear direction of the outboard motor, and the extension direction of the passage coincides with a direction of the water flow around the outboard motor when the ship moves forward. Therefore, according to the outboard motor of the present embodiment, the water around the outboard motor is more likely to flow through the passage of the fine dust capturing device than in an outboard motor of the related art provided with the fine dust capturing device in which the extension direction of the passage is the upper-lower direction. Accordingly, a flow rate of the water flowing through the passage of the fine dust capturing device can be increased, and thus the flow rate of the water passing through the filter can be increased. As a result, the amount of fine dust captured per unit sailing time and the amount of fine dust captured per unit sailing distance can be increased, and a capturing efficiency of fine dust can be increased.

[0016] According to the outboard motor of the present embodiment, since the flow rate of the water flowing through the passage of the fine dust capturing device can be increased without adding a pump, it is possible to prevent complication of the structure of the fine dust capturing device, an increase in size of the outboard motor, and an increase in manufacturing cost of the outboard motor due to the addition of the pump.

Embodiment

[0017] An outboard motor according to an embodiment of the present invention will be described with reference to the drawings. In the embodiment, when describing directions of upper (Ud), lower (Dd), front (Fd), rear (Bd), left (Ld), and right (Rd), arrows at the lower left and lower right in FIGS. 1 to 3B and 5 follow.

Outboard Motor

[0018] FIG. 1 illustrates a state in which an outboard motor 1 according to the embodiment of the present invention is viewed from the front upper left. FIG. 2 illustrates a state in which a lower portion of the outboard motor 1 is viewed from the left. FIG. 3A illustrates a state in which the lower portion of the outboard motor 1 is

viewed from the front side. FIG. 3B illustrates a state in which the lower portion of the outboard motor 1 is viewed from the rear side.

[0019] The outboard motor 1 is a device that is attached to a transom of a ship to propel the ship. As illustrated in FIG. 1, the outboard motor 1 includes a propeller unit 2, a battery case 7, a support portion 8, a transom bracket 17, a swivel bracket 18, a bar handle 19, and a fine dust capturing device 21.

[0020] The propeller unit 2 is disposed in a lower portion of the outboard motor 1, and is positioned below the water surface in a state in which the outboard motor 1 is attached to the ship. The propeller unit 2 is disposed at a center of the outboard motor 1 in the left-right direction. As illustrated in FIG. 2, the propeller unit 2 includes a motor 3, a propeller shaft 4, a propeller 5, and a propeller unit case 6. The motor 3 is disposed at a front portion in the propeller unit case 6. The propeller shaft 4 extends in the front-rear direction, and a front portion of the propeller shaft 4 is rotatably supported by a rear portion in the propeller unit case 6. The propeller shaft 4 is connected to an output shaft of the motor 3, or is integrally formed with the output shaft of the motor 3, and is rotated by power of the motor 3. The propeller 5 is fixed to a rear end portion of the propeller shaft 4 and rotates integrally with the propeller shaft 4. The propeller 5 includes a hub 5A and a plurality of blades 5B. The propeller unit case 6 is a sealed case having a cylindrical outer shape.

[0021] As illustrated in FIG. 1, the battery case 7 is disposed in an upper portion of the outboard motor 1, and is positioned above the water surface in a state in which the outboard motor 1 is attached to the ship. A battery that supplies electric power for driving the motor 3 to the motor 3 is accommodated in the battery case 7.

[0022] The support portion 8 is a member that connects the battery case 7 and the propeller unit 2 and supports both. The propeller unit 2 is supported by a lower end portion of the support portion 8, and the battery case 7 is supported by an upper portion of the support portion 8. Specifically, the support portion 8 is formed in a columnar shape extending in the upper-lower direction, and the propeller unit case 6 is fixed to the lower end portion of the support portion 8. An attachment plate portion 15 is fixed to an upper end portion of the support portion 8, and the battery case 7 is detachably attached to the attachment plate portion 15. In addition, an outboard motor carrying hand 16 for the user to carry the outboard motor 1 detached from the ship is provided at a rear portion of the support portion 8.

[0023] The transom bracket 17 is a clamp mechanism for attaching the outboard motor 1 to the transom of the ship. The transom bracket 17 is disposed at a front portion of the upper portion of the support portion 8.

[0024] The swivel bracket 18 is a bracket for making the outboard motor 1 attached to the transom rotatable in the left-right direction with respect to the ship, and is integrally formed with a rear portion of the transom bracket 17. A steering shaft (not illustrated) is rotatably at-

tached to the swivel bracket 18, and the steering shaft is fixed to the front portion of an upper portion of the support portion 8. The support portion 8 can rotate with respect to the swivel bracket 18 with an axis of the steering shaft as a rotation axis, and as a result, the outboard motor 1 is rotatable in the left-right direction with respect to the ship.

[0025] The bar handle 19 is a handle that rotates the outboard motor 1 in the left-right direction with respect to the ship in order to steer the ship. The bar handle 19 is disposed above and in front of the support portion 8. Specifically, a base end portion of the bar handle 19 is attached to the upper front end portion of the attachment plate portion 15. The user can rotate the outboard motor 1 to the right or left with respect to the ship by grasping a distal end portion of the bar handle 19 and moving the bar handle 19 to the left or right, and can change a direction of the propeller 5 to the right or left.

Configuration of Fine Dust Capturing Device

[0026] As illustrated in FIG. 2, the outboard motor 1 includes the fine dust capturing device 21. The fine dust capturing device 21 is a device that captures fine dust diffused in a water area such as sea, lakes, or rivers where the ship sails.

[0027] The fine dust is, for example, fine dust having an outer diameter or a maximum length of 0.1 mm or more and 5 mm or less. Plastic dust flows into the sea, lakes, rivers, and the like, and is crushed by waves or a water flow, or is decomposed by ultraviolet light or the like into minute plastic pieces. The minute plastic pieces may diffuse in water such as sea, lakes, and rivers. Such a minute plastic piece is generally called microplastic. The microplastic corresponds to fine dust.

[0028] FIGS. 4A to 4D illustrate the fine dust capturing device 21. Specifically, FIG. 4A is a front view of the fine dust capturing device 21, FIG. 4B is a back view of the fine dust capturing device 21, FIG. 4C is a left side view of the fine dust capturing device 21, and FIG. 4D is a plan view of the fine dust capturing device 21.

[0029] In FIGS. 4A to 4D, the fine dust capturing device 21 includes a main body portion 22, a water intake 26 for taking in water around the outboard motor 1, a passage 27 through which the water taken in from the water intake 26 flows, a filter 28 for capturing fine dust contained in the water by allowing the water flowing through the passage 27 to pass therethrough, and a water outlet 29 for discharging the water after passing through the filter 28 to a periphery of the outboard motor 1.

[0030] The main body portion 22 is formed of, for example, resin or metal. The main body portion 22 is formed in a tubular shape extending linearly as a whole. In the present embodiment, the main body portion 22 is formed in a tubular shape having a substantially triangular cross-sectional shape. In FIG. 4C or FIG. 4D, D is an axis of the main body portion 22. The main body portion 22 includes a passage forming portion 23, a water intake forming portion 24, and a water outlet forming

portion 25. The passage forming portion 23 is formed in a triangular tubular shape extending linearly. The water intake forming portion 24 is attached and fixed to a portion on one axial end side of the passage forming portion 23 so as to cover one axial end side of the passage forming portion 23. The water outlet forming portion 25 is attached and fixed to a portion on the other axial end side of the passage forming portion 23 so as to cover the other axial end side of the passage forming portion 23.

[0031] As illustrated in FIG. 4A, the water intake 26 is formed in the water intake forming portion 24. The water intake 26 is a hole penetrating the water intake forming portion 24. The water intake 26 is disposed such that a center thereof is positioned above the center of the water intake forming portion 24, and the center of the water intake 26 is positioned above the axis D of the main body portion 22. In the present embodiment, the water intake 26 has a substantially triangular shape obtained by reducing the substantially triangular cross-sectional shape of the main body portion 22.

[0032] As illustrated in FIG. 4B, the water outlet 29 is formed in the water outlet forming portion 25. The water outlet 29 is a hole passing through the water outlet forming portion 25, the water outlet 29 is disposed such that a center thereof is positioned below the center of the water outlet forming portion 25, and the center of the water outlet 29 is positioned below the axis D of the main body portion 22. In addition, in the present embodiment, the water outlet 29 has a rectangular shape in which each corner portion is chamfered, and extends in a direction parallel to a bottom side of the substantially triangular cross section of the main body portion 22.

[0033] As illustrated in FIG. 4C, the passage 27 is provided inside the passage forming portion 23 of the main body portion 22. One end of the passage 27 is connected to the water intake 26, and the other end of the passage 27 is connected to the water outlet 29. In addition, the passage 27 extends in an axial direction inside the passage forming portion 23 from the water intake 26 to the water outlet 29.

[0034] The filter 28 is provided in the middle of the passage 27 in the main body portion 22. The filter 28 is provided so as to block the entire cross section of the passage 27. The filter 28 is a filter capable of capturing fine dust, and is formed of, for example, a nonwoven fabric in a sheet shape or a plate shape. Water can pass through the filter 28, but fine dust cannot pass through the filter 28.

[0035] In the present embodiment, the filter 28 has a multi-layer structure. For example, the filter 28 includes a first layer having coarse openings and a second layer having fine openings. The filter 28 is disposed in the passage 27 such that the first layer is positioned on the water intake side and the second layer is positioned on the water outlet side. According to the structure and arrangement of the filter 28, when the water flows back through the passage 27 and flows in the direction from the water outlet 29 toward the water intake 26, it is possible to

prevent the fine dust captured by the filter 28 from diffusing away from the filter 28. That is, when the water flows in a forward direction from the water intake 26 toward the water outlet 29 in the passage 27, the fine dust contained in the water is captured by the first layer or the second layer, but continuing such a flow of water in the forward direction, the fine dust is accumulated in an intermediate portion between the first layer and the second layer, or inside the second layer. On the other hand, when the water flows backward in the passage 27 and flows in a reverse direction from the water outlet 29 toward the water intake 26, the fine dust accumulated inside the second layer or in the intermediate portion between the first layer and the second layer is pushed toward the water intake 26 by the water. However, at this time, since the fine dust cannot easily pass through the first layer, most of the fine dust remains inside the second layer or in the intermediate portion between the first layer and the second layer. Accordingly, the fine dust captured by the filter 28 is prevented from diffusing away from the filter 28 by the backflow of water.

[0036] A material of the filter 28 is not limited to the non-woven fabric, and may be woven fabric, sponge, glass mat, or the like. The filter 28 may be a single layer.

Arrangement of Fine Dust Capturing Device

[0037] As illustrated in FIG. 1, the fine dust capturing device 21 is provided between the lower end portion of the support portion 8 and the propeller unit case 6. As illustrated in FIG. 3A, the fine dust capturing device 21 is disposed at the center in the left-right direction of the lower end portion of the support portion 8, and is positioned at the center of the outboard motor 1 in the left-right direction. As illustrated in FIG. 2, the fine dust capturing device 21 is positioned rearward of a front end of the propeller unit 2 and forward of a rear end of the propeller unit 2. Specifically, the fine dust capturing device 21 is positioned rearward of a front end of the propeller unit case 6 and forward of the propeller 5. The fine dust capturing device 21 is provided outside the propeller unit case 6. In addition, in a state in which the outboard motor 1 is attached to the ship, the entire fine dust capturing device 21 is positioned below the water surface, and thus the entire passage 27 of the fine dust capturing device 21 is positioned below the water surface.

[0038] The lower end portion of the support portion 8 has a bifurcated structure branched in the left-right direction. FIG. 5 illustrates a state in which the cross section of the lower portion of the outboard motor 1 cut along a cutting line V-V in FIG. 2 is viewed from the front side (left side in FIG. 2), and a structure of the bifurcated portion of the lower end portion of the support portion 8 can be clearly grasped from FIG. 5. FIG. 5 illustrates a state in which the fine dust capturing device 21 is removed from the outboard motor 1, and in FIG. 5, illustration of components provided in the propeller unit case 6 is omitted. As illustrated in FIG. 5, two coupling portions 9 are

provided at the lower end portion of the support portion 8. One coupling portion 9 of the two coupling portions 9 couples the lower end portion of the support portion 8 and an upper left portion of the propeller unit case 6, and the other coupling portion 9 thereof couples the lower end portion of the support portion 8 and an upper right portion of the propeller unit case 6.

[0039] As viewed as a whole, the two coupling portions 9 have a shape that widens toward a lower side of the outboard motor 1. Specifically, the one coupling portion 9 of the two coupling portions 9 extends linearly downward from the lower end portion of the support portion 8 while inclining leftward to reach the upper left portion of the propeller unit case 6, and the other coupling portion 9 thereof extends linearly downward from the lower end portion of the support portion 8 while inclining rightward to reach the upper right portion of the propeller unit case 6. In addition, both an outer surface 9A and an inner surface 9B of the one coupling portion 9 extend downward while inclining to the left, and both the outer surface 9A and the inner surface 9B of the other coupling portion 9 extend downward while inclining to the right. Upper ends of the two coupling portions 9 are coupled to each other at a position P1 at the center in the left-right direction of the lower end portion of the support portion 8, a lower end of the one coupling portion 9 is coupled to the propeller unit case 6 at a position P2 at the upper left portion of the propeller unit case 6, and a lower end of the other coupling portion 9 is coupled to the propeller unit case 6 at a position P3 at the upper right portion of the propeller unit case 6. The two coupling portions 9 and the upper portion of the propeller unit case 6 have a triangular structure having the positions P1, P2, and P3 as vertices.

[0040] A space R is formed between the lower end portion of the support portion 8 and a central portion of the upper portion of the propeller unit case 6 in the left-right direction. The fine dust capturing device 21 is provided in the space R. When the outboard motor 1 is viewed from the front side, the space R has a substantially triangular shape whose sides are the inner surfaces 9B of the two coupling portions 9 and an upper surface 6A of the propeller unit case 6. Further, in the fine dust capturing device 21, the main body portion 22 is formed in a tubular shape having a substantially triangular cross-sectional shape as described above, and the triangular shape of the main body portion 22 corresponds to the triangular shape of the space R. The fine dust capturing device 21 is provided so as to fit into the space R so that the triangular cross-sectional shape of the main body portion 22 matches the triangular shape of the space R. In addition, in a state in which the fine dust capturing device 21 is provided in the space R, an outer peripheral surface of the fine dust capturing device 21 (specifically, an outer peripheral surface of the water intake forming portion 24 and an outer peripheral surface of the water outlet forming portion 25) is in contact with the inner surface 9B of each coupling portion 9 and the upper surface 6A of the propeller unit case 6.

[0041] The main body portion 22 of the fine dust capturing device 21 is disposed in the space R such that the water intake 26 faces the front side of the outboard motor 1 and an extension direction of the passage 27 is the front-rear direction of the outboard motor 1. In addition, the water outlet 29 faces the rear side of the outboard motor 1.

[0042] As illustrated in FIG. 3A, when the outboard motor 1 is viewed from the front side, the water intake 26 is disposed above the propeller unit case 6 and above a rotation center A of the propeller 5 in a vertical direction. The water intake 26 faces the front side of the outboard motor 1 and in a direction parallel to an axis E (see FIG. 2) of the propeller shaft 4.

[0043] As illustrated in FIG. 3B, when the outboard motor 1 is viewed from the rear side, the water outlet 29 is disposed above the propeller unit case 6 and above the rotation center A of the propeller 5 in the vertical direction. The water outlet 29 is positioned in front of the propeller 5. In addition, the water outlet 29 faces the rear side of the outboard motor 1, and in the direction parallel to the axis E of the propeller shaft 4.

[0044] In the present embodiment, the passage forming portion 23 is formed of a transparent resin. As illustrated in FIG. 2, each of the coupling portions 9 is provided with a window 31. The window 31 is formed as a through hole penetrating the coupling portion 9. In each coupling portion 9, the window 31 is disposed at a position corresponding to the passage forming portion 23 in a state in which the fine dust capturing device 21 is provided in the space R. Accordingly, the user can confirm the amount of fine dust accumulated in the filter 28 by looking through the window 31 when the outboard motor 1 is pulled up on the ground, for example.

[0045] In the present embodiment, the fine dust capturing device 21 can be removed from the space R. Further, in the main body portion 22 of the fine dust capturing device 21, the water outlet forming portion 25 is detachably attached to a rear portion of the passage forming portion 23. The filter 28 is detachably attached to the rear portion of the passage forming portion 23, a front portion of the water outlet forming portion 25, or between the passage forming portion 23 and the water outlet forming portion 25. When the user pulls up the outboard motor 1 to the ground and looks through the window 31 to confirm that a large amount of fine dust is accumulated in the filter 28, the user can remove the fine dust capturing device 21 from the outboard motor 1 and replace the filter 28.

Capturing of Fine Dust

[0046] In a state in which the outboard motor 1 is attached to the transom of the ship on water, the propeller unit 2 and the fine dust capturing device 21 sink below the water surface. When the propeller 5 rotates and the ship is moving forward by a propulsive force generated by the propeller 5, water flows around the outboard motor 1 in

the front-rear direction from the front side to the rear side of the outboard motor 1. The fine dust capturing device 21 is placed in the water flow. The water around the outboard motor 1 flows into the passage 27 from the front side of the outboard motor 1 through the water intake 26. The water flowing into the passage 27 flows rearward in the passage 27 toward the water outlet 29. The water flowing through the passage 27 toward the water outlet 29 passes through the filter 28. When the water passes through the filter 28, fine dust contained in the water is captured by the filter 28. The water passing through the filter 28 is discharged rearward from the water outlet 29.

[0047] The water intake 26 is positioned below the water surface, is disposed in a front portion of the outboard motor 1, is disposed at a position close to the propeller unit case 6, and faces the front side of the outboard motor 1. Therefore, the water smoothly flows into the passage 27 through the water intake 26 as the ship moves forward.

[0048] The entire passage 27 is positioned below the water surface and is disposed at a position close to the propeller unit case 6. In addition, the passage 27 extends in the front-rear direction of the outboard motor 1 as a whole from the water intake 26 to the water outlet 29. Therefore, a resistance (flow passage resistance) of the passage 27 is small, and the water flowing into the passage 27 smoothly flows through the passage 27.

[0049] The water outlet 29 is positioned below the water surface, is positioned in front of the propeller 5, is disposed at a position close to the propeller unit case 6, and faces the rear side of the outboard motor 1. Therefore, the water in the passage 27 is smoothly discharged from the water outlet 29 to the outside of the passage 27 by a negative pressure formed by the water flow generated by the rotation of the propeller.

[0050] The water around the outboard motor 1 smoothly flows through the passage 27 from the water intake 26 toward the water outlet 29 due to the pressure of the water flowing into the passage 27 through the water intake 26 and the negative pressure formed by the water flow generated by the rotation of the propeller 5. When the water passes through the filter 28, the fine dust is captured.

[0051] As described above, in the outboard motor 1 according to the embodiment of the present invention, the fine dust capturing device 21 is disposed between the lower end portion of the support portion 8 and the propeller unit case 6 such that the extension direction of the passage 27 is the front-rear direction of the outboard motor 1. With this configuration, in a state in which the outboard motor 1 is attached to the ship, the fine dust capturing device 21 is positioned below the water surface. The fine dust capturing device 21 is placed in a water flow flowing around the outboard motor 1 from the front side to the rear side of the outboard motor 1 when the ship moves forward. When the fine dust capturing device 21 is placed in the water flow, a direction of the water flow coincides with the extension direction of the

passage 27 of the fine dust capturing device 21. Therefore, according to the outboard motor 1 of the present embodiment, the water around the outboard motor 1 smoothly flows through the passage 27 of the fine dust capturing device 21 as compared with an outboard motor of the related art provided with the fine dust capturing device in which the extension direction of the passage is the upper-lower direction. Accordingly, the flow rate of the water flowing through the passage 27 of the fine dust capturing device 21 can be increased, and thus the flow rate of the water passing through the filter 28 can be increased. As a result, the amount of fine dust captured per unit sailing time and the amount of fine dust captured per unit sailing distance can be increased, and a capturing efficiency of fine dust can be increased. Further, in the outboard motor 1 according to the present embodiment, since the flow rate of the water flowing through the passage 27 of the fine dust capturing device 21 can be increased without adding a pump, it is possible to prevent complication of the structure of the fine dust capturing device 21, an increase in size of the outboard motor 1, and an increase in manufacturing cost of the outboard motor 1 due to the addition of the pump. As described above, according to the outboard motor 1 of the present embodiment, it is possible to increase the capturing efficiency of the fine dust while avoiding complication of the structure of the fine dust capturing device 21, an increase in the size of the outboard motor 1, and an increase in the manufacturing cost of the outboard motor 1.

[0052] In the outboard motor 1 according to the embodiment of the present invention, the fine dust capturing device 21 is disposed at the center in the left-right direction of the lower end portion of the support portion 8. Accordingly, the fine dust capturing device 21 can be reliably placed in the water flow in the front-rear direction formed around the outboard motor 1 when the ship moves forward. Accordingly, it is possible to increase the flow rate of the water flowing from the water intake 26 and flowing through the passage 27, and it is possible to increase the capturing efficiency of the fine dust.

[0053] In the outboard motor 1 according to the embodiment of the present invention, the two coupling portions 9 are provided at the lower end portion of the support portion 8, the one coupling portion 9 of the two coupling portions 9 couples the lower end portion of the support portion 8 and the left portion (specifically, the upper left portion) of the propeller unit case 6, and the other coupling portion 9 thereof couples the lower end portion of the support portion 8 and the right portion (specifically, the upper right portion) of the propeller unit case 6. Further, the space R is formed between the lower end portion of the support portion 8 and the central portion of an upper portion of the propeller unit case 6 in the left-right direction, and the fine dust capturing device 21 is provided in the space R. With such a configuration, the fine dust capturing device 21 can be disposed at the center in the left-right direction of the lower end portion

of the support portion 8.

[0054] In the outboard motor 1 according to the embodiment of the present invention, the one coupling portion 9 of the two coupling portions 9 extends downward from the lower end portion of the support portion 8 while inclining leftward to reach the left portion (specifically, the upper left portion) of the propeller unit case 6, and the other coupling portion 9 thereof extends downward from the lower end portion of the support portion 8 while inclining rightward to reach the right portion (specifically, the upper right portion) of the propeller unit case 6. With this configuration, as illustrated in FIG. 5, the two coupling portions 9 and the upper portions of the propeller unit case 6 have a triangular structure having the positions P1, P2, and P3 as vertices. Therefore, a coupling strength between the support portion 8 and the propeller unit case 6 can be increased. That is, a support strength of the propeller unit 2 by the support portion 8 is increased, and for example, when an external force is applied to the lower portion of the outboard motor 1 from the left side, the right side, the upper side, or the lower side, deformation or damage of a coupling portion between the support portion 8 and the propeller unit 2 can be prevented.

[0055] In the outboard motor 1 according to the embodiment of the present invention, the fine dust capturing device 21 is in contact with the upper surface of the propeller unit case 6. Accordingly, the fine dust capturing device 21 can be brought very close to the propeller unit 2, and the fine dust capturing device 21 can be reliably placed in the water flow formed around the outboard motor 1 when the ship moves forward.

[0056] In the outboard motor 1 according to the embodiment of the present invention, the shape of the space R when the outboard motor 1 is viewed from the front side is a triangular shape, the main body portion 22 of the fine dust capturing device 21 is formed in a tubular shape having a triangular cross-sectional shape, and the fine dust capturing device 21 is provided in the space R such that the triangular cross-sectional shape of the main body portion 22 matches the triangular shape of the space R. Accordingly, a cross-sectional area of the main body portion 22 can be substantially equal to an area of the space R when the outboard motor 1 is viewed from the front side, and the cross-sectional area of the main body portion 22 can be increased as much as possible. Accordingly, opening areas of the water intake 26 and the water outlet 29 of the fine dust capturing device 21 and a flow passage area of the passage 27 can be increased. Accordingly, the flow rate of the water flowing through the passage 27 can be increased.

[0057] In the outboard motor 1 according to the embodiment of the present invention, the fine dust capturing device 21 includes the main body portion 22 formed in a tubular shape, the water intake 26 provided on one axial end side of the main body portion 22, the passage 27 extending in the axial direction in the main body portion 22, the filter 28 provided in the middle of the passage in

the main body portion 22, and the water outlet 29 provided on the other axial end side of the main body portion 22. With this configuration, the structure of the fine dust capturing device 21 can be simplified, and the length of the passage 27 can be shortened. Accordingly, the resistance (flow passage resistance) of the passage 27 is reduced, and the water easily flows through the passage 27.

[0058] In the fine dust capturing device 21 of the outboard motor 1 according to the embodiment of the present invention, the passage forming portion 23 of the main body portion 22 is formed of a transparent material, the window 31 penetrating the coupling portion 9 is formed in each coupling portion 9, and the window 31 is disposed at a position corresponding to the transparent passage forming portion 23 in a state in which the fine dust capturing device 21 is provided in the space R. The user can easily confirm the amount of fine dust accumulated in the filter 28 by looking through the window 31 when the outboard motor 1 is pulled up on the ground, for example. Accordingly, the user can recognize that a large amount of fine dust is accumulated (for example, the filter 28 needs to be replaced) without providing a sensor or the like for detecting an accumulation state of the fine dust in the outboard motor 1.

[0059] In the above embodiment, the fine dust capturing device 21 is in contact with the upper surface of the propeller unit case 6, but the fine dust capturing device 21 may not be in contact with the upper surface of the propeller unit case 6 as long as the fine dust capturing device 21 is disposed between the lower end portion of the support portion 8 and the propeller unit case 6.

[0060] In the above embodiment, the shape of the main body portion 22 of the fine dust capturing device 21 is a triangular tubular shape, but the shape of the main body portion 22 is not limited thereto, and may be a cylindrical shape or a polygonal cylindrical shape in which the number of sides of the cross section is four or more.

[0061] In the above embodiment, the case where the water outlet 29 of the fine dust capturing device 21 faces directly behind the outboard motor 1 has been described as an example, but the direction of the water outlet 29 may be, for example, a lower rear side, an upper rear side, a left rear side, a right rear side, or a lower left rear side, or may be an upper side, a lower side, the left side, or the right side.

[0062] In the above embodiment, the window 31 is provided in each of the two coupling portions 9, but the window 31 may be provided in only one of the coupling portions 9.

[0063] The present invention can be appropriately changed without departing from the gist or concept of the invention which can be read from the claims and the entire specification, and an outboard motor with such a change is also included in the technical concept of the present invention.

REFERENCE SIGNS LIST

[0064]

1 outboard motor	5
2 propeller unit	
4 propeller shaft	
5 propeller	
6 propeller unit case (case)	
8 support portion	10
9 coupling portion	
17 transom bracket (bracket)	
21 fine dust capturing device	
22 main body portion	
23 passage forming portion	15
26 water intake	
27 passage	
28 filter	
29 water outlet	
31 window (through hole)	20
R space	

Claims

1. An outboard motor (1) for propelling a ship, the outboard motor comprising:

a propeller unit (2) including a propeller shaft (4), a propeller (5) fixed to the propeller shaft, and a case (6) for rotatably supporting the propeller shaft;

a support portion (8) formed in a columnar shape extending in an upper-lower direction and having a lower end portion to which the propeller unit is supported;

a bracket (17) provided at an upper portion of the support portion and configured to attach the support portion to the ship; and

a fine dust capturing device (21) having a passage through which water around the outboard motor flows and configured to capture fine dust contained in the water flowing through the passage, wherein

the fine dust capturing device is provided between the lower end portion of the support portion and the case such that an extension direction of the passage is a front-rear direction of the outboard motor.

2. The outboard motor according to claim 1, wherein the fine dust capturing device is disposed at a center in a left-right direction of the lower end portion of the support portion.

3. The outboard motor according to claim 1, wherein two coupling portions are provided at the lower end portion of the support portion, one coupling portion of

the two coupling portions couples between the lower end portion of the support portion and a left portion of the case, the other coupling portion thereof couples between the lower end portion of the support portion and a right portion of the case, a space is formed between the lower end portion of the support portion and a central portion of an upper portion of the case in a left-right direction, and the fine dust capturing device is provided in the space.

4. The outboard motor according to claim 3, wherein the one coupling portion of the two coupling portions extends downward from the lower end portion of the support portion while inclining leftward to reach the left portion of the case, and the other coupling portion thereof extends downward from the lower end portion of the support portion while inclining rightward to reach the right portion of the case.

5. The outboard motor according to claim 3 or 4, wherein the fine dust capturing device is in contact with an upper surface of the case.

6. The outboard motor according to claim 3 or 4, wherein when the outboard motor is viewed from a front side, a shape of the space is a triangular shape, the fine dust capturing device is formed in a tubular shape having a triangular cross-sectional shape, and the fine dust capturing device is provided in the space such that the triangular cross-sectional shape of the fine dust capturing device matches the triangular shape of the space.

7. The outboard motor according to claim 3 or 4, wherein

the fine dust capturing device includes

a main body portion that is formed in a tubular shape,

a water intake that is provided on one axial end side of the main body portion and allows water around the outboard motor to flow into the passage,

a filter that is provided in the middle of the passage in the main body portion and captures the fine dust contained in the water by allowing the water flowing through the passage to pass therethrough, and

a water outlet that is provided on the other axial end side of the main body portion and discharges the water after passing through the filter to a periphery of the outboard motor, and

the passage extends in the main body portion in

an axial direction of the main body portion.

8. The outboard motor according to claim 7, wherein at least a part of the main body portion is formed of a transparent material, at least one of the two coupling portions is formed with a through hole penetrating the coupling portion, and the through hole is disposed at a position corresponding to a portion formed of the transparent material in the main body portion in a state in which the fine dust capturing device is provided in the space.

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FIG. 1

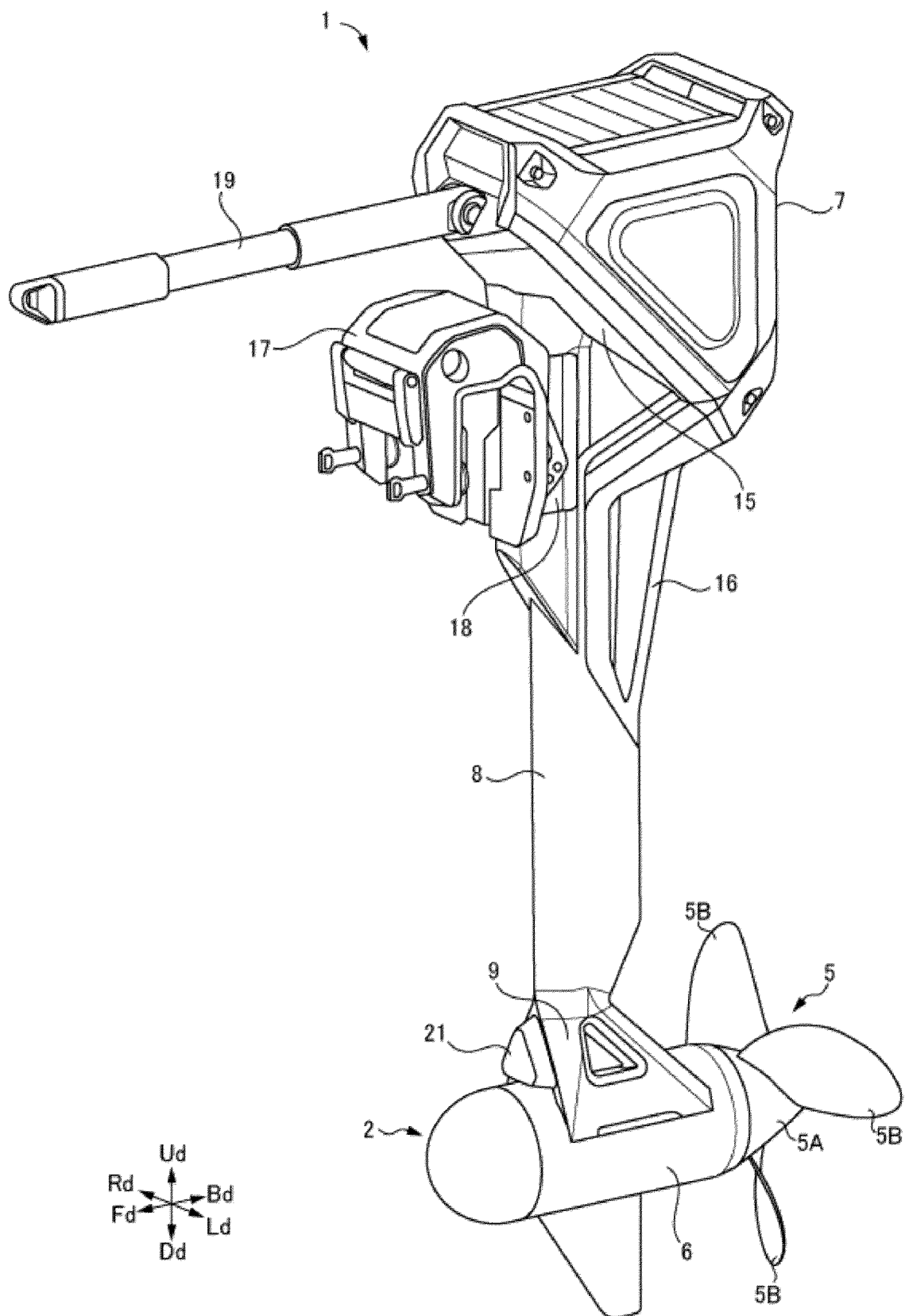


FIG. 2

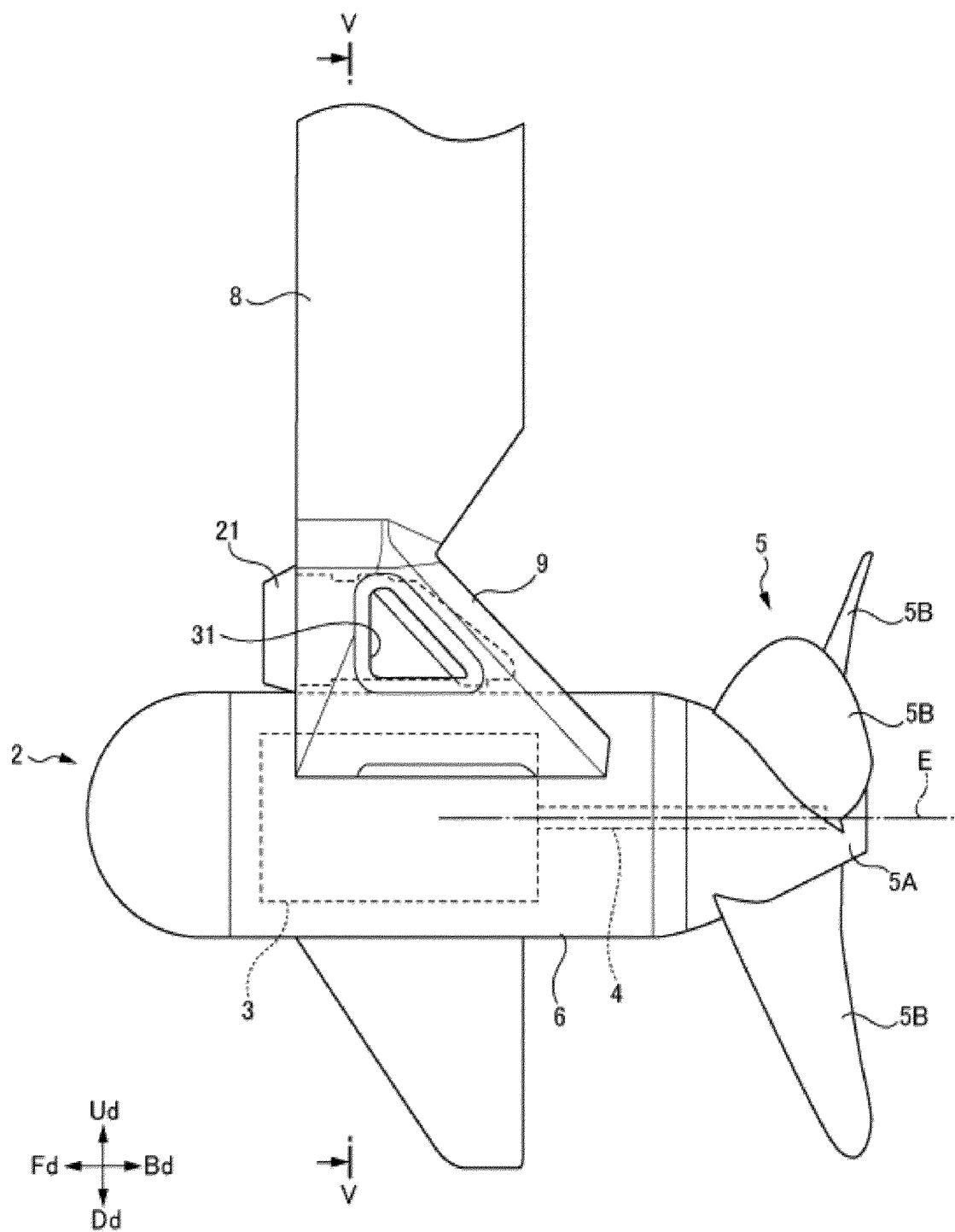


FIG. 3B

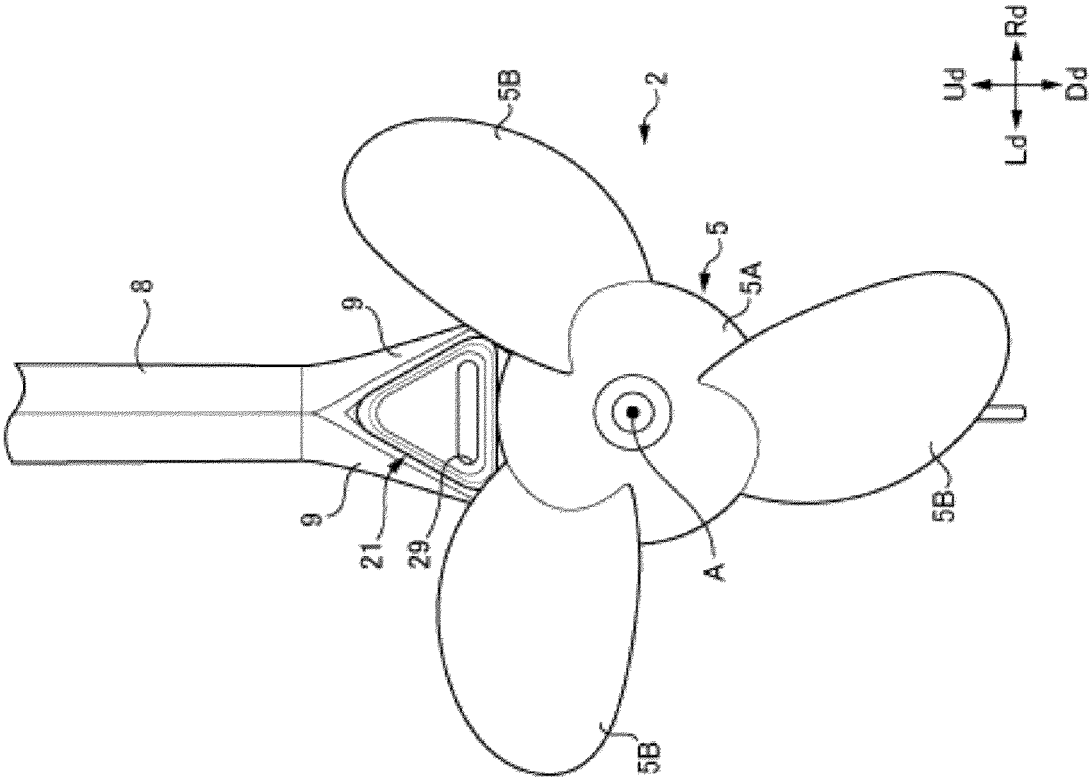


FIG. 3A

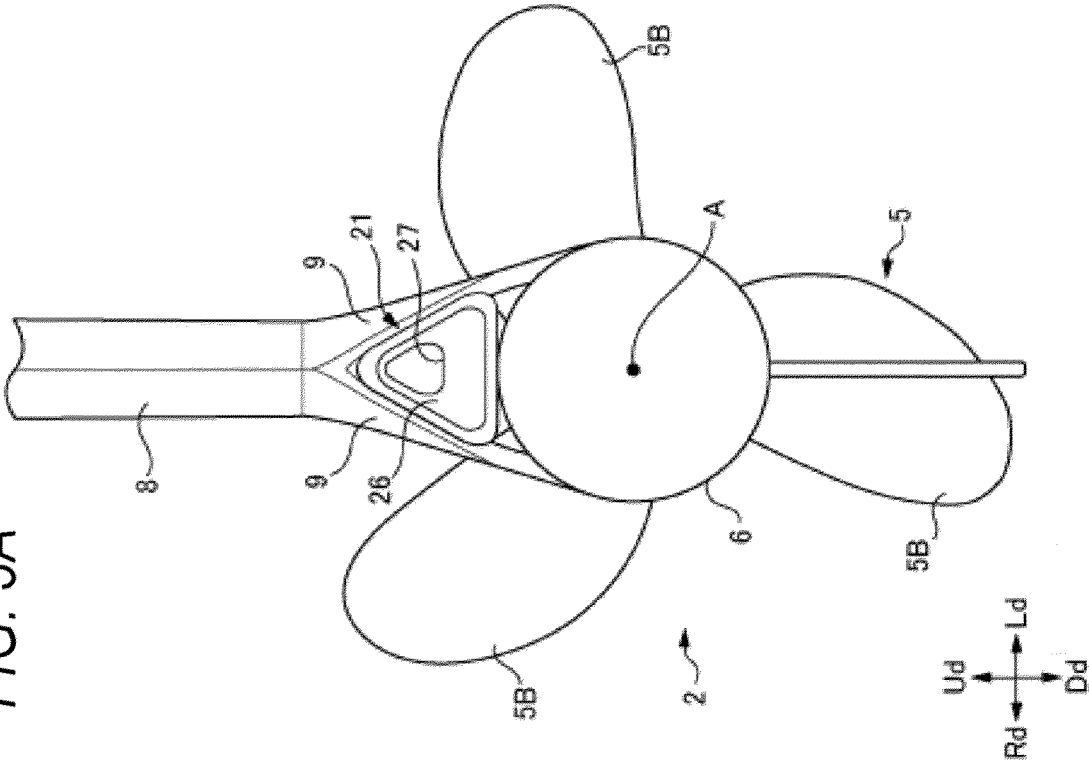


FIG. 4A

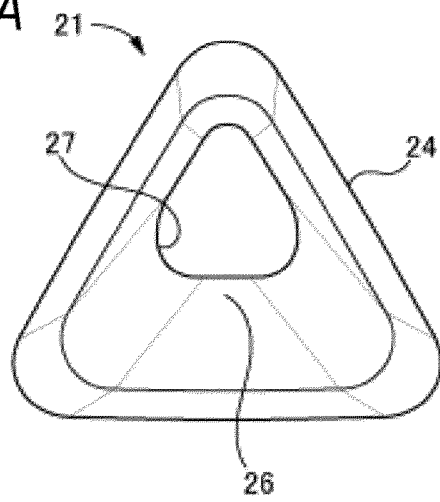


FIG. 4B

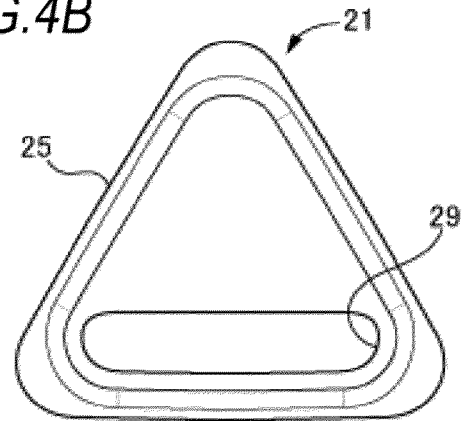


FIG. 4C

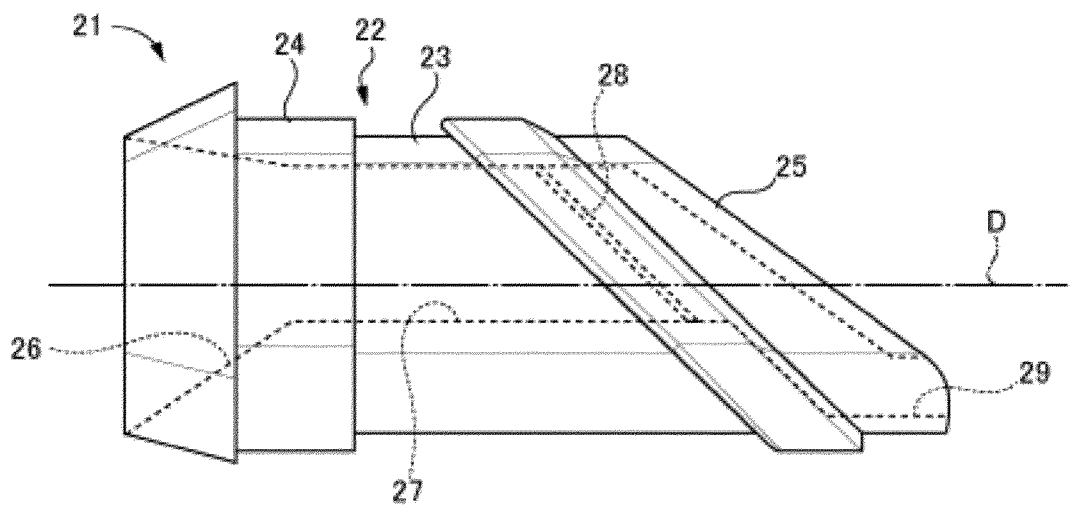


FIG. 4D

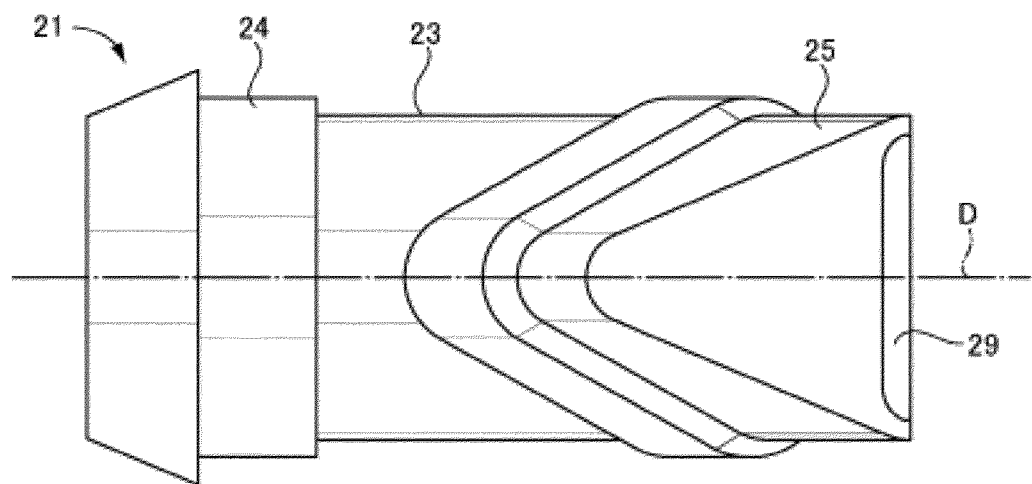
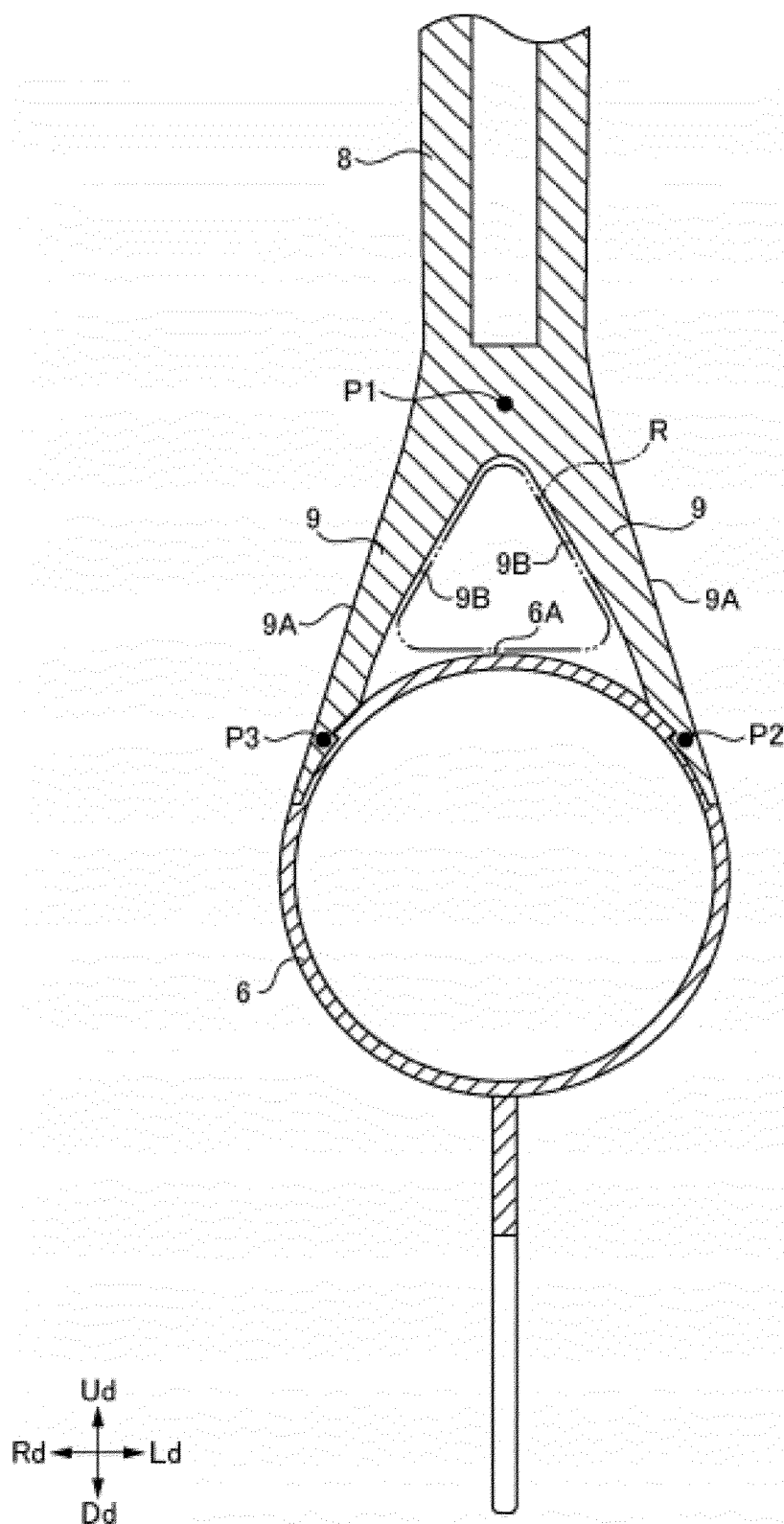


FIG. 5





EUROPEAN SEARCH REPORT

Application Number

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A	* column 4, line 36 - line 52 * * column 5, line 65 - column 6, line 35 * * figures *	7,8	B63H20/00 B63H21/17 E02B15/04
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A	* paragraph [0027] * * paragraph [0031] - paragraph [0036] * * figures *	7,8	
X	JP 2017 052326 A (SUZUKI MOTOR CORP) 16 March 2017 (2017-03-16)	1	
	* abstract * * figure 3 *		
X	JP S64 26000 U (N.A.) 14 February 1989 (1989-02-14)	1	
	* the whole document * * figure 3 *		
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		10 March 2025	Barré, Vincent
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