



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 816 222 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.01.1998 Bulletin 1998/02

(51) Int. Cl.⁶: **B63H 20/06**, B63H 23/24

(21) Application number: **97110587.9**

(22) Date of filing: **27.06.1997**

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**

(30) Priority: **27.06.1996 JP 188152/96**
27.06.1996 JP 188153/96

(71) Applicant:
Moriyama Kogyo Kabushiki Kaisha
Shizuoka 437-02 (JP)

(72) Inventor: **Hideaki, Takahashi**
Shuchi-gun, Shizuoka 437-02 (JP)

(74) Representative:
Grünecker, Kinkeldey,
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) **Watercraft propulsion unit**

(57) A watercraft propulsion unit (4) comprises a bracket (6) mountable to a hull (2), a motor drive unit (8) mounted to the lower end of the bracket (6) and locatable in the body of water (7) and having an electric motor (23) provided with a motor case (27) for driving a propeller (24). Said motor drive unit (8) comprises a casing (16) forming an outer shell thereof and mounted to said bracket (6), and said electric motor (23) is accommodated in said casing (16) and mounted thereto.

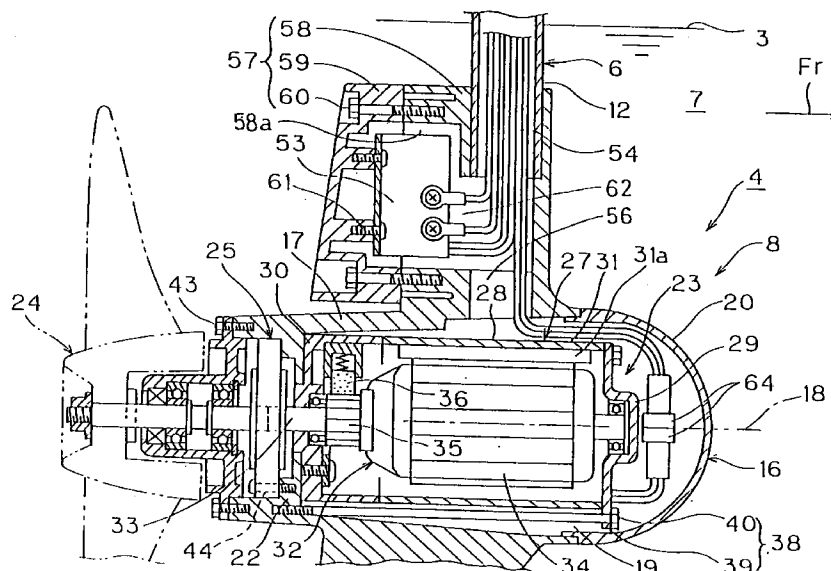


FIGURE 1

EP 0 816 222 A2

Description

The present invention relates to a watercraft propulsion unit comprising a bracket mountable to a hull, a motor drive unit mounted to the lower end of the bracket and locatable in the body of water and having an electric motor provided with a motor case for driving a propeller.

A system as shown in Fig. 7 has been commonly utilized for the afore-mentioned watercraft propulsion unit.

The system will be described with reference to the accompanying drawings

Numerals 81 designates the watercraft propulsion unit mounted on a watercraft, and the arrow Fr shows the running direction of the water craft.

The watercraft propulsion unit 81 is provided with a bracket 82 mounted to the hull of the watercraft, and the bracket 82, made of a long pipe and extending vertically, is mounted, at the upper end, to the hull. The watercraft propulsion unit 81 is also provided with a motor drive unit 83 mounted to the lower end of the bracket 82 and located in the body of water.

The motor drive unit 83 is comprised of a casing 85 mounted to the lower end of the bracket 82, an electric motor 86 mounted removably to the casing 85 so as to project forwardly from the casing 85, and a propeller 87 supported by the casing 85 and driven by the electric motor 86.

The electric motor 86 has a cylindrical motor case 89 constituting its outer shell, the axis 90 of which extends longitudinally, and the motor case 89 is mounted detachably, at the rear end, to the front end of the casing 85. The electric motor 86, housed in the motor case 89, has a rotor 91 supported by the casing 85 and the motor case 89 for rotation about the axis 90. Also provided are a commutator 92 rotatable around the axis 90 with the rotor 91, and a brush 93 mounted on the motor case 98 for slidably engaging the commutator 92.

A control device 95 for electronically controlling the electric motor 86, and a power source 96, a battery for the control device 95, are provided on the hull. Also provided is a drive means 97 for electronically controlling the rotational speed of the electric motor 86 through control of the control device 95; and the electric motor 86, control device 95, power source 96, and drive means 97 are connected to each other with electric wires 98.

The drive means 97 is housed in the casing 85. If the electric motor 86 is removed from the casing 85 so as to open the opening at the front end of the casing 85, the drive means 97 can be inserted or removed with respect to the casing 85.

When a rider operates the control device 95, a given electric power is supplied to the electric motor 86 through the drive means 97, so that the rotational speed of the electric motor 86 is controlled. Then, the propeller 87 is rotated in association with the electric motor 86, so

that the watercraft is propelled at a desired speed.

However, the foregoing conventional system has a following problem.

First, for reasons described below, the electric motor 86, which has a special construction, can not be replaced with a general purpose type, so that molding of the watercraft propulsion unit 81 for housing the electric motor 86 as a component, is very complicated, posing a problem of a higher production cost.

The first reason: the motor case 89 of the electric motor 86, as described above, has a special construction for mounting to the casing 85.

The second reason: since the electric motor 86 is exposed in the body of water, there is a possibility of the electric motor 86 striking against the bottom of the water during propulsion of the watercraft, and the impact force is applied directly to the electric motor 86 in case of collision, which might damage the electric motor 86 easily. Thus the wall thickness of the motor case 89 of the electric motor 86 is increased to provide adequate impact strength.

The third reason: the motor case 89 of the electric motor 86, which is exposed to water, tends to be oxidized, so that materials and structures are selected to prevent corrosion.

For reasons described above, a general purpose electric motor 86 can not be incorporated in the conventional watercraft propulsion unit 81, thereby posing a problem of complicated molding.

Secondly, in view of the first problem, an idea can be suggested that the electric motor 86 is housed in the casing 85 so as to cover the same so that a general purpose type motor can be utilized for the electric motor 86.

However, if the electric motor 86 is simply covered by the casing 85, the work of maintenance and inspection of the electric motor 86 is hindered by the casing 85, causing a difficulty in this work.

Further, when the electric motor 86 is operated, an electric current flows between the commutator 92 and the brush 93 which are in sliding contact with each other, so that the commutator 92 and the brush 93 tend to generate heat. Therefore, as described above, if the electric motor 86 is simply covered by the casing 85, heat release into the body of water is prevented by the casing 85, which may cause a higher temperature of the electric motor 86.

Thirdly, the electric motor 86 is protruded from the casing 85, as a whole, and the casing 85 is mounted to the lower end of the bracket 82, so that the electric motor 86 is protruded forwardly from the bracket 82, as a whole. In this construction, however, at the time of, for example, "shell gathering" when a fisherman on the watercraft 2 gathers, with a fishing pole, abalones or sea urchins on the bottom of the sea, the fishing pole may interfere with the electric motor 86, thereby raising a problem of the electric motor 86 hindering manipulation of the fishing pole.

Accordingly, it is an objective of the present inven-

tion to provide a watercraft propulsion unit as indicated above which always ensures with simple technical means an always reliable use of said unit under all running conditions simultaneously enhancing the performance of maintenance and inspection and reduces the production costs.

According to the present invention, this objective is solved for a watercraft propulsion unit as indicated above in that said motor drive unit comprising a casing forming an outer shell thereof and mounted to said bracket, and that said electric motor accommodated in said casing and mounted thereto.

In order to further enhance the performance of maintenance and inspection, it is advantageous when the motor drive unit comprises an electrical equipment case mounted to said casing for accommodating drive means controlling the rotational speed of said electric motor.

The reason for this will be explained with respect to Fig. 7.

That is, when the drive means 97 is to be removed from the casing 85 in case of replacement with a new one, or for maintenance or inspection, it is necessary that the electric motor 86 is first removed from the casing 85 beforehand, and accordingly, the opening at the front end of the casing 85 is opened.

However, since the work of removing the electric motor 86 from the casing 85, is complicated, the work required for maintenance or inspection of the drive means 97 is also complicated.

For this reason, a method is suggested in which an electrical equipment case for removably housing the drive means 97, is provided in addition to the casing 85 so as to enable maintenance or inspection of the drive means 97 regardless of the electric motor 86 being attached or detached with respect to the casing 85.

However, a mere installation of the electrical equipment case will result in an increased fluid resistance of the motor drive unit 83 during running, which may prevent smooth propulsion of the watercraft.

According to an advantageous embodiment of the present invention, the casing is provided with an opening openable and closable by a cover. In that case, it is advantageous for a further improvement of the maintenance and inspection when said opening and said cover are provided at a front end of said motor drive unit opposite to said propeller.

In order to further enhance the cooling effects of the present invention, it is advantageous when said electric motor comprises a rotor housed in said motor case and supported by said motor case for rotation, an commutator rotatable with said rotor, and a brush mounted on said motor case for slidably engaging said commutator, said motor case being joined to said casing in the vicinity of said brush.

In that case, it is optional to provide said commutator within the casing such that it faces to the front or to the rear as seen in the normal driving direction.

Further advantageous embodiments are given below.

According to another embodiment of the present invention, the watercraft propulsion unit having a bracket 6 mounted to a hull 2 and a motor drive unit 8 mounted to the lower end of said bracket 6 and located in the body of water 7, wherein said motor drive unit 8 comprising a casing 16 forming an outer shell thereof and mounted to said bracket 6, an electric motor 23 housed in said casing 16 and mounted thereto, and a propeller 24 supported by said casing 16 and driven by said electric motor 23.

A further embodiment of the present invention is given by a watercraft propulsion unit, wherein said casing 16 is formed with an opening 19 and provided with a cover 20 for opening and closing said opening 19 so that said electric motor 23 can be inserted removably into said casing 16 through said opening 19, and said electric motor 23 is mounted removably to said casing 16.

Moreover, a watercraft propulsion unit is possible, wherein on the hull 2 is provided a control device 47 for controlling said electric motor 23, through said bracket 6 are provided electric wires 54 for connecting said electric motor 23 and control device 47, said wires 54 being cut at the middle portion thereof, and in said casing 16 are provided couplers 64 for disconnectably connecting said cut ends of said wires 54, said couplers 64 being located within said opening 19 when viewed from the front of said opening 19.

In addition, it is possible that said electric motor 23 comprises a motor case 27 constituting its outer shell, a rotor 32 housed in said motor case 27 and supported by said motor case 27 for rotation, an commutator 35 rotatable with said rotor 32, and a brush 36 mounted on said motor case 27 for slidably engaging said commutator 35, said motor case 27 being joined to said casing 16 in the vicinity of said brush 36.

In order to further enhance the performance of said watercraft propulsion unit, it is advantageous when said electric motor 23 is located right under said bracket 6.

Other preferred embodiments of the present invention are laid down in further dependent claims.

In the following, the present invention is explained in greater detail with respect to several embodiments thereof in conjunction with the accompanying drawings, wherein:

Fig. 1 is a partial enlarged sectional view of a first embodiment of a watercraft propulsion unit shown in Fig. 2;

Fig. 2 is a general diagrammatic view of the first embodiment of the watercraft propulsion unit;

Fig. 3 is a partially broken away rear view of the first embodiment of the watercraft propulsion unit;

Fig. 4 is a partially broken away plan view of the first embodiment of the watercraft propulsion unit;

Fig. 5 is an exploded view of the first embodiment

shown in Fig. 1;

Fig. 6 is a view of a second embodiment, corresponding to Fig. 1; and

Fig. 7 is a view of a conventional system, corresponding to Fig. 1.

Fig. 1 through Fig. 5 show a first embodiment of this invention.

In the figure, numeral 1 designates a watercraft, and the arrow Fr shows the running direction of the watercraft 1.

The watercraft 1 is provided with a hull 2 and a watercraft propulsion unit 4 for propelling the hull 2 forwardly or backwardly on the surface of water 3. The water propulsion unit 4 is comprised of a bracket 6 mounted to the rear end of the hull 2, a motor drive unit 8 mounted to the lower end of the bracket 6 and located in the body of water 7, and a steering handle 9 mounted to the upper end of the bracket 6.

In Fig. 2, the bracket 6 is provided with a bracket body 11 mounted detachably to the rear end of the hull 2, and a mounting pipe 12 supported by the bracket body 11. The mounting pipe 12 extends vertically, and supported at the lengthwise middle portion by the bracket body 11 for rotation about its axis. The motor drive unit 8 is mounted to the lower end of the mounting pipe 12, and the steering handle 9 to the upper end of the same.

The steering handle 9 has a box-like handle body 13 fixed to the upper end of the mounting pipe 12, and a handle grip 14 protruding forwardly from the handle body 13; and the handle grip 14 is supported by the handle body 13 for rotation about the axis extending longitudinally.

In Fig. 1 through Fig. 5, the motor drive unit 8 is provided with a casing 16 constituting its outer shell. Since the casing 16 is located in the body of water 7, it is made of corrosion resisting alloy such as aluminum alloy. The casing 16 has a cylindrical casing body 17 mounted to the lower end of the mounting pipe 12 of the bracket 6, and the axis 18 of the casing body 17 extends longitudinally. The casing body 17 has, at the front end, an opening 19 for providing communication between the inside and outside of the casing body 17, and the opening 19, located on the axis 18, has a substantially circular shape when viewed from the front. Also, a semi-spherical cover 20 for openably closing the opening 19 is provided, and fastened detachably to the front end of the casing body 17 with a pair of right and left fist fasteners 21, while at the rear of the casing body 17 and on the inside circumferential surface of the same is formed integrally a partition 22 for separating the inside of the casing body 17 from the outside.

The motor drive unit 8 is provided with an electric motor 23 housed in the casing 16 and mounted removably to the same, a propeller 24 supported by the casing 16 at the rear and driven by the electric motor 23, and a planetary gear type reduction gear 25 supported by the

casing 16 and interposed between the electric motor 23 and the propeller 24 for transmitting power of the electric motor 23 to the propeller 24.

The electric motor 23, of a general purpose type, has a metal motor case 27 constituting its outer shell. The motor case 27 is comprised of a cylindrical motor case body 28 on the axis 18, a front closing plate 29 for closing the front opening of the motor case 27, and a rear closing plate 30 for closing the rear opening of the same.

The motor case body 28 is made of ferrous ferromagnetic material; on the inside surface of the motor case body 28 are attached magnets 31a circumferentially at regular intervals; and the motor case body 28 and magnets 31a constitute a stator 31.

A rotor 32 is housed in the motor case 27. The rotor 32 is supported by the front and rear closing plates 29, 30 of the motor case 27 for rotation about the axis 18, and is comprised of an output shaft 33 supported on the axis 18 by the motor case 27, and an armature 34 fitted on the output shaft 33. Also provided is a commutator 35 rotatable around the axis 18 with the rotor 32. The commutator 35 is mounted to the rear of the output shaft 33, and disposed axially in serial relation with the armature 34, while on the motor case 27 is mounted a brush 36 for slidably engaging the commutator 35.

The electric motor 23 is inserted removably in the casing 16 through the opening 19, and fastened detachably to the casing 16 with second fasteners 39. In this case, the commutator 35 and the brush 36 of the electric motor 23 are located at the rear end of and inside of the motor case 27, and the rear end of the motor case, or the rear closing plate 30, is put into surface contact with the partition 22 of the casing 16, that is, the rear end portion of the motor case 27 in the vicinity of the brush 36 is joined to the casing 16.

The second fasteners 38 is comprised of a support piece 39 formed at the front end of the motor case 27, and a bolt 40 passing through the support piece 39 and screwed into the partition plate 22 of the casing 16. The electric motor 23 extends on and along the axis 18, and the bolt 40 extends substantially parallel to the axis 18, both of the electric motor 23 and the bolt 40 being positioned within the opening 19 in front view of the same (ie, the front view of the watercraft propulsion unit 4 when viewed from the front).

As a result, insertion and taking out of the electric motor 23 with respect to the casing 16, is performed easily through the opening 19, and mounting of the electric motor 23 to the casing 16, is also performed easily through the opening 19 by manipulating the bolts 40 of the second fasteners 38.

Thus, assembling of the motor drive unit 8, or dismantling of the unit as shown in Fig. 5, can be performed easily, as well as maintenance or inspection, for example, at the time of replacement of the electric motor 23 inside the casing 16 with a new one.

The propeller 24 is fastened removably to the cas-

ing 16 with third fasteners 43, and the reduction gear 25 removably to the casing with fourth fasteners 44.

Inside the handle body 13 of the steering handle 9 on the hull is provided a control device 47 for electronically controlling the electric motor 23. The control device 47 is provided with a control unit 48, a grip angle sensor 49 for detecting the rotation angle of the handle grip 14, and a rotation switching device 50 for switching the direction of rotation of the electric motor 23 to a normal or a reverse one. These components 48, 49, 50 are electrically connected to each other.

Also, a battery for supplying power to the control unit 48 of the control device 47, or a power source 52, is provided on the hull. Also provided is a drive means 53 for electronically controlling the rotational speed of the electric motor 23 through control of the control device 47; and the electric motor 23, control device 47, power source 52, and drive means 53 are connected to each other with electric wires 54. Numeral 55 designates a motor current sensor.

In the upper wall of the casing body 17 of the casing 16 is formed a communication hole 56 for providing communication between inside spaces of the mounting pipe 12 and the casing 16. As a result, inside spaces of the bracket body 11 of the bracket 6, the mounting pipe 12 of the bracket 6, the handle body 13 of the steering handle 9, and the casing 16 of the steering handle 9, are in communication with each other, and the electric wires 54 for connecting the electric motor 23 and the control device 47, runs through the inside space of the mounting pipe 16 of the bracket 6, and the communication hole 56.

The motor drive unit 8 has an electrical equipment case 57 mounted to the lower end of the mounting pipe 12 of the bracket 6, and the drive means 53 is housed detachably in the electrical equipment casing 57. The electrical equipment case 57 is comprised of an electrical equipment case body 58 formed integrally with the upper wall of the casing body 17 of the casing 16, and opening 58a for opening the inside of the electrical equipment body 58 rearwardly, a cover 59 for openably closing the opening 58a, and fifth fasteners 60 for fastening the cover 59 detachably to the electrical equipment case 58.

In the electrical equipment case 59 houses the drive means 53, which is fastened detachably on the inside wall of the cover 59 with sixth fasteners 61. The electrical equipment case body 58 is formed with a communication hole 62 for providing communication between the inside spaces of the mounting pipe 12 and the electrical equipment case 57. As described above, one ends of the electric wires 54 on the drive means side which run down from the control device 47 through the mounting pipe 12 of the bracket 6, reach the inside of the electrical equipment case 57, where they are connected disconnectably to the drive means 53.

As shown in Fig. 5, if the fifth fasteners 60 are loosened, the drive means 53 can be taken out from inside

the electrical equipment case 57 in one body with the cover 59 and the sixth fasteners 61. In this case, the electric wires 54 have a little slack, which allows taking in and out of the drive means 53.

The electric wires 54 are cut at the lengthwise middle portion, and a couplers 64 are provided for coupling the cut ends disconnectably. The couplers 64 are disposed at the inside front portion of the casing 16 between the cover 20 of the casing 16 and the front end of the electric motor 23, and positioned within the opening 19 in front view.

The electric motor 23 is located right under the mounting pipe 12. The electrical equipment case 57, and the drive means 53 housed therein are located rearwardly of the lower end of the mounting pipe 12 of the bracket 6 and upwardly of the casing 16 and the electric motor 23.

When a driver operates the handle grip 14 of the steering handle 9 so as to propel the watercraft 1, detected signals of rotation angles from the grip angle sensor 49, and detected signals of rotational direction from the rotation switching device 50 are input to the control unit 48, a given power is supplied to the electric motor 23 through the drive means 53 controlled by the control unit 48 according to these signals. In this case, an electric current flows from the brush 36 to the armature 34 through the commutator 35 in sliding contact with the brush 36, and the rotor 32 is rotated about the axis 18. In this way, the electric motor 23 is controlled of its speed, and normal and reverse rotational directions.

The propeller 24 is rotated in association with the motor 23, so that the watercraft 1 is propelled at a desired speed forwardly or backwardly on the surface of water 3.

In the construction described above, the electric motor 23 is housed in the casing 16 and protected from the outside, as a whole, so that the electric motor 23 needs only to be of a type for simply driving the propeller 24, that is, there is no need for a motor case 27 etc with a special structure, and thus a general purpose type is utilized for the electric motor 23 as described above.

Further, since the electric motor 23 is covered by the casing 16 so as not to be exposed to the body of water 7, the casing 16 will prevent the electric motor 23 from directly striking against the bottom of water during running. Therefore, it is not necessary for the motor case 27 of the electric motor 23 to be thick enough to withstand the impact at the time of the collision, and thus a general purpose type is utilized for the electric motor 23.

Furthermore, the electric motor 23 is covered by the casing 16 so as not to be exposed to the body of water 7, thereby preventing the motor case 27 from being corroded by the water. Therefore, it is not necessary for a motor case 27 of the electric motor 23 to be made of special corrosion resistant material or to assume a corrosion proof structure, and thus an electric motor of a

general purpose type is utilized.

Moreover, as described above, especially in Fig. 5, the electric motor 23 can be taken out from the casing 16 through the opening 19 if only the opening 19 is opened by loosening the first fasteners 21 and removing the cover 20.

Therefore, although the electric motor 23 is housed in the casing 16, maintenance and inspection of the electric motor 23 can be performed easily, for example, at the time of replacement of the motor with new one.

Further, especially as shown in Fig. 5, when maintenance or inspection is performed of the electric motor 23 housed in the casing 16, the opening 19 is first opened by manipulating the cover 20. Then, the couplers 64, which are located inside the opening 19 as described above, can be disconnected easily through the opening 19.

If the couplers 64 are disconnected, the electric motor 23 can be taken out from the casing 16 through the opening 19 without any interference with electric wires 54 connecting the electric motor 23 and the control device 47.

Therefore, maintenance and inspection of the electric motor 23 can be performed easily regardless of the existence of the electric wires 54.

Yet further, when the electric motor 23 is operated, an electric current flows between the commutator 35 and the brush 36 which are in sliding contact with each other, so that the commutator 35 and the brush 36 tend to generate heat, thereby causing a higher temperature of the electric motor 23.

As described above, the motor case 27 is joined to the casing 16 in the vicinity of the brush 36. Therefore, the heat generated between the commutator 35 and the brush 36 is transmitted smoothly to the casing 16 from the motor case 27 in the vicinity of the brush 36, and further, released efficiently into the body of water 7 from the casing 16.

Therefore, although the electric motor 23 is housed in the casing 16, a higher temperature of the electric motor 23 is prevented.

Further, the electric motor 23 is located right under the bracket 6 together with the casing 16, and the electrical equipment case 57 rearwardly of the lower end of the bracket 6.

Therefore, the casing 16, electric motor 23, and electrical equipment case 57 are located longitudinally at substantially the same place as the bracket 6, thereby preventing large forward or rearward projection of the casing 16, electric motor 23, and electrical equipment case 57 from the bracket 6.

Thus, interference of the electric motor 23 etc with the fishing pole during "shell gathering" is prevented, providing smooth "shell gathering."

Still further, as described above, the electric motor 23 is located right under the bracket 6, so that the length of the electric wires 54 which run from the control unit 47 to the electric motor 23 through the bracket 6, can be

kept small, thereby effecting easy wiring.

Yet further, as described above, the motor drive unit 8 has the electrical equipment case 57 mounted to the casing 16, and the drive means 53 is housed detachably in the electric equipment case 57.

Therefore, when the drive means 53 is to be detached for maintenance or inspection, conventional preparatory work of removing the electric motor 23 is not necessary.

Thus, the drive means 53 can be attached or detached whether the electric motor 23 is mounted or not, so that maintenance and inspection of the drive means 53 can be performed easily.

Further, the electrical equipment case 57 is located rearwardly of the lower end of the bracket 6.

Therefore, when the electrical equipment case 57 is provided, it is covered behind the lower end of the bracket 6, thereby preventing increased fluid resistance of the electrical equipment case 57 during propulsion of the watercraft 1.

Thus, as described above, although the drive means 53 is arranged so that its maintenance and inspection can be performed easily, smooth propulsion of the watercraft 1 is ensured.

In addition, the electrical equipment case 57 is located upwardly of the casing 16, so that the casing 16 prevents the electrical equipment case 57 from striking the bottom of the water during propulsion of the watercraft 1.

Therefore, the drive means 53, which is housed in the electrical equipment case 57 and whose impact resistance is small, is protected reliably from the impact force due to the collision.

Fig. 6 shows a second embodiment.

Referring to the figure, the commutator 35 of the electric motor 23 is mounted to the front end of the output shaft 33, so that the commutator 35 and the brush 36 is located at the front end portion inside the motor case 27. On the other hand, the support piece 39 is formed integrally on the outer surface of the motor case 27 in the vicinity of the brush 36, and joined to the front end of the casing body 17 of the casing 16 in surface contact relation. That is, the front portion of the motor case 27 in the vicinity of the brush 36 is joined to the casing 16.

Other structures and functions of the embodiment are the same as those of the first embodiment, thus like parts are designated by like reference numerals, and descriptions are omitted.

Effects of this invention are as follows:

According to one embodiment of the invention, a watercraft propulsion unit having a bracket mounted to a hull and a motor drive unit mounted to the lower end of said bracket and located in the body of water, is characterized in that said motor drive unit comprising a casing forming an outer shell thereof and mounted to said bracket, an electric motor housed in said casing and mounted thereto, and a propeller supported by said cas-

ing and driven by said electric motor.

Therefore, the electric motor needs only to be of the type for simply driving the propeller, that is, there is no need for a special construction, and thus a general purpose electric motor can be utilized.

Further, since the electric motor is covered by the casing so as not to be exposed to the body of water, the casing will prevent the electric motor from directly striking against the bottom of water during running. Therefore, it is not necessary for the motor case of the electric motor to be thick enough to withstand the impact at the time of the collision, and thus a general purpose electric motor can be utilized.

Furthermore, the electric motor is covered by the casing so as not to be exposed to the body of water, thereby preventing the motor case from being corroded by the water. Therefore, it is not necessary for a motor case of the electric motor to be made of special corrosion resistant material or to assume a corrosion proof structure, and thus a general purpose electric motor can be utilized.

For reasons as described above, since a general purpose electric motor can be utilized, easy molding can be achieved of the motor drive unit for housing the electric motor as a component, as well as a lower production cost.

According to another embodiment of the invention, a watercraft propulsion unit is characterized in that said casing is formed with an opening and provided with a cover for opening and closing said opening so that said electric motor can be inserted removably into said casing through said opening, and said electric motor is mounted removably to said casing.

Therefore, the electric motor, which is housed in the casing, can be taken out from the casing through the opening if only the opening is opened by removing the cover.

Thus, although the electric motor is housed in the casing, maintenance and inspection of the electric motor can be performed easily, for example, at the time of replacement of the motor with new one.

According to a further embodiment of the invention, a watercraft propulsion unit is characterized in that on the hull is provided with a control device for controlling said electric motor, through said bracket are provided electric wires for connecting said electric motor and a control device, said wires being cut at the middle portion thereof, and in said casing are provided couplers for disconnectably connecting said cut ends of said wires, said couplers being located within said opening when viewed from the front of said opening.

Therefore, when maintenance or inspection of the electric motor housed in the casing, is to be performed, if the opening is first opened by manipulating the cover, the couplers, which are located inside the opening as described above, can be disconnected easily through the opening.

If the couplers are disconnected, the electric motor

can be taken out easily outside of the casing through the opening without interference with the wires connecting the electric motor and the control device.

Therefore, maintenance and inspection of the electric motor can be performed easily regardless of the existence of the electric wires.

According to a still further embodiment of the invention, a watercraft propulsion unit is characterized in that said electric motor comprises a motor case constituting its outer shell, a rotor housed in said motor case and supported by said motor case for rotation, an commutator rotatable with said rotor, and a brush mounted on said motor case for slidably engaging said commutator, said motor case being joined to said casing in the vicinity of said brush.

In this case, when the electric motor is operated, an electric current flows between the commutator and the brush which are in sliding contact with each other, so that the commutator and the brush tend to generate heat, thereby causing a higher temperature of the electric motor.

However, as described above, the motor case is joined to the casing in the vicinity of the brush.

Thus, the heat generated between the commutator and the brush is transmitted smoothly to the casing from the motor case in the vicinity of the brush, and further, released efficiently into the body of water from the casing.

As a result, the electric motor, though housed in the casing, is cooled down effectively without hindrance by the casing, preventing a higher temperature of the electric motor.

According to still another embodiment of the invention, a watercraft propulsion unit is characterized in that said electric motor is located right under said bracket.

Therefore, the bracket and electric motor are located longitudinally at substantially the same place, thereby preventing large forward projection of the electric motor from the bracket.

Thus, interference of the electric motor with the fishing pole during "shell gathering" is prevented, which provides smooth "shell gathering."

Still further, as described above, the electric motor is located right under the bracket, so that the length of the electric wires which run from the control unit to the electric motor through the bracket can be kept small, thereby effecting easy wiring.

Effects of this invention are as follows:

According to another embodiment of the invention, a watercraft propulsion unit provided with a bracket mounted to a hull and a motor drive unit mounted to the lower end of said bracket and located in the body of water, said motor drive unit having a casing mounted to said bracket, an electric motor mounted removably to said casing, a propeller mounted to said casing and driven by said electric motor, and drive means for controlling the rotational speed of said electric motor, is characterized in that said motor drive unit is provided

with an electrical equipment case mounted to said casing, and said drive means is housed detachably in said electrical equipment case.

Therefore, when the drive means is to be detached for maintenance or inspection, conventional preparatory work of removing the electric motor is not necessary.

Thus, the drive means can be attached or detached whether the electric motor is mounted or not, so that maintenance and inspection of the drive means can be performed easily.

According to a further embodiment of the invention, a watercraft propulsion unit is characterized in that said electrical equipment case is located rearwardly of the lower end of said bracket and upwardly of said casing.

Therefore, when the electrical equipment case described in the invention of claim 1, is provided, it is covered behind the lower end of the bracket, thereby preventing increased fluid resistance of the electrical equipment case during propulsion of the watercraft.

Thus, as described above, notwithstanding the drive means being arranged so that its maintenance and inspection can be performed easily, smooth propulsion of the watercraft is ensured.

Further, as described above, the electrical equipment case is located upwardly of the casing, so that the casing prevents the electrical equipment case from striking the bottom of the water during propulsion of the watercraft.

Therefore, the drive means, which is housed in the electrical equipment case and whose impact resistance is small, is protected reliably from the impact force due to the collision.

Claims

1. A watercraft propulsion unit (4) comprising a bracket (6) mountable to a hull (2), a motor drive unit (8) mounted to the lower end of the bracket (6) and locatable in the body of water (7) and having an electric motor (23) provided with a motor case (27) for driving a propeller (24), **characterized in that** said motor drive unit (8) comprising a casing (16) forming an outer shell thereof and mounted to said bracket (6), and that said electric motor (23) accommodated in said casing (16) and mounted thereto.
2. A watercraft propulsion unit, in particular according to claim 1, **characterized in that** the motor drive unit (8) comprising an electrical equipment case (57) mounted to said casing (16) for accommodating drive means (53) controlling the rotational speed of said electric motor (23).
3. A watercraft propulsion unit according to claim 1 or 2, **characterized in that** said casing (16) being provided with an opening (19) openable and closable by a cover (20).
4. A watercraft propulsion unit according to claim 3, **characterized in that** said opening (19) and said cover (20) are provided at a front end of said motor drive unit (8) opposite to said propeller (24).
5. A watercraft propulsion unit according to at least one of the preceding claims 1 to 4, **characterized by** a control device (47) providable on the hull (2) for controlling said electric motor (23) via electric wires (54) arranged in said bracket (6).
6. A watercraft propulsion unit according to claim 5, **characterized in that** said wires (54) are detachably connectable via couplers (64) positioned within said case (16) close to said opening (19).
7. A watercraft propulsion unit according to at least one of the preceding claims 1 to 6, **characterized in that** said electric motor (23) comprises a rotor (32) housed in said motor case (27) and supported by said motor case (27) for rotation, an commutator (35) rotatable with said rotor (32), and a brush (36) mounted on said motor case (27) for slidably engaging said commutator (35), said motor case (27) being joined to said casing (16) in the vicinity of said brush (36).
8. A watercraft propulsion unit according to at least one of the preceding claims 1 to 7, **characterized in that** said electric motor (23) is located right beneath said bracket (6).
9. A watercraft propulsion unit according to at least one of the preceding claims 2 to 8, **characterized in that** said electrical equipment case (57) is located between the lower end of said bracket (6) and said propeller (24) and upwardly of said casing (16).
10. A watercraft propulsion unit according to at least one of the preceding claims 3 to 9, **characterized in that** said opening (19) has a substantially circular shape and that said cover (20) has a semi-spherical shape.
11. A watercraft propulsion unit according to at least one of the preceding claims 1 to 10, **characterized in that** said motor case (27) comprising a cylindrical motor case body (28) having the same longitudinal axis (18) as the motor drive unit (8), a front closing plate (29) and a rear closing plate (30).
12. A watercraft propulsion unit according to at least one of the preceding claims 2 to 11, **characterized in that** said electrical equipment case (57) comprising an electrical equipment case body (58) detachably closable by a cover (59), said drive means (53) are detachably connected to said cover (59).

13. A watercraft propulsion unit according to claim 12, **characterized in that** said electrical equipment case body (58) is integrally formed with the upper wall of a casing body (17) of said casing (16).

5

14. A watercraft propulsion unit according to at least one of the preceding claims 7 to 13, **characterized in that** said commutator (35) is located at the side of said electric motor (23) facing the propeller (24) or at the side of the electric motor (23) opposite to said propeller (24).

10

15. A watercraft propulsion unit according to at least one of the preceding claims 1 to 14, **characterized in that** said electric motor is a customary electric motor (23).

15

20

25

30

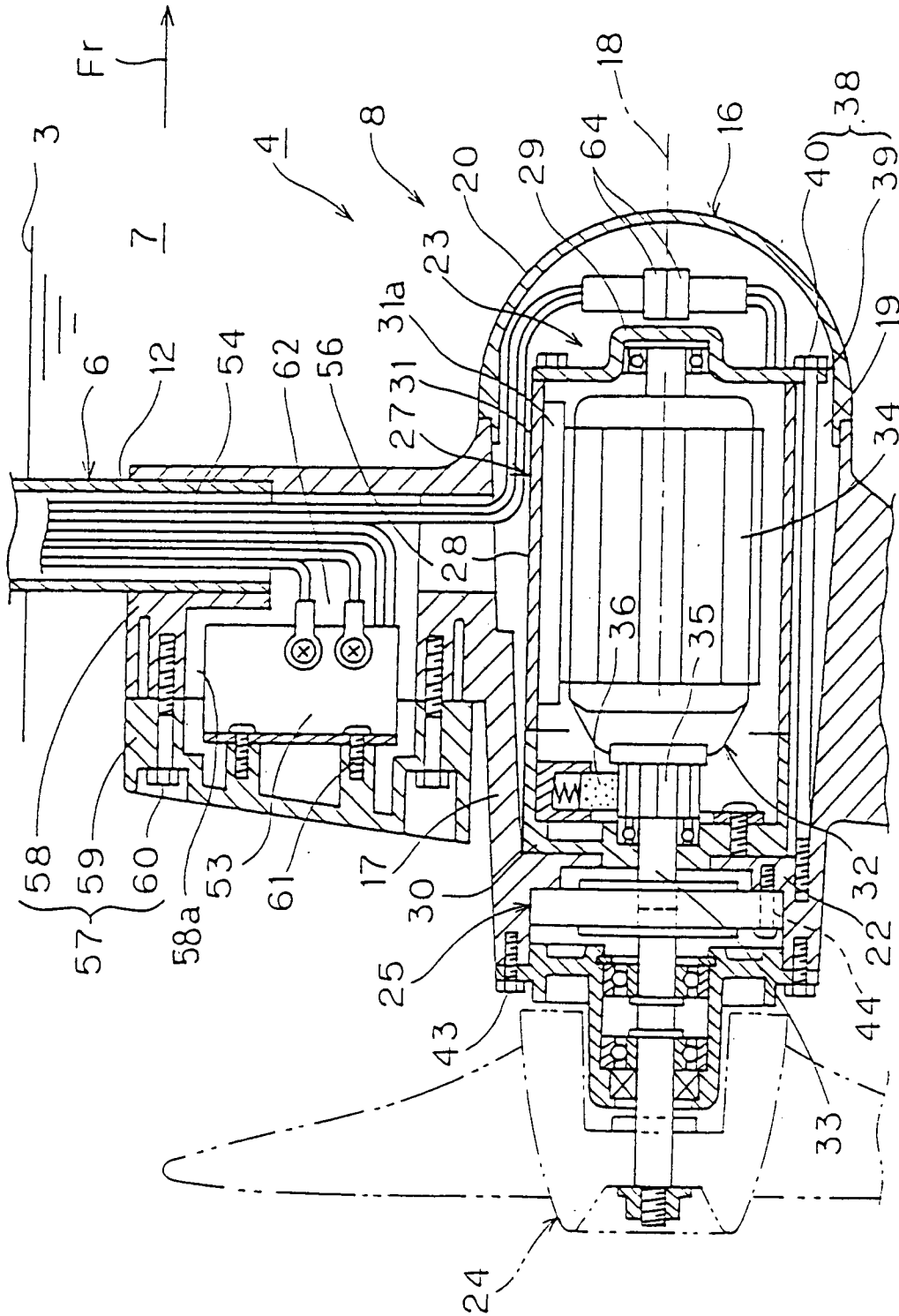
35

40

45

50

55



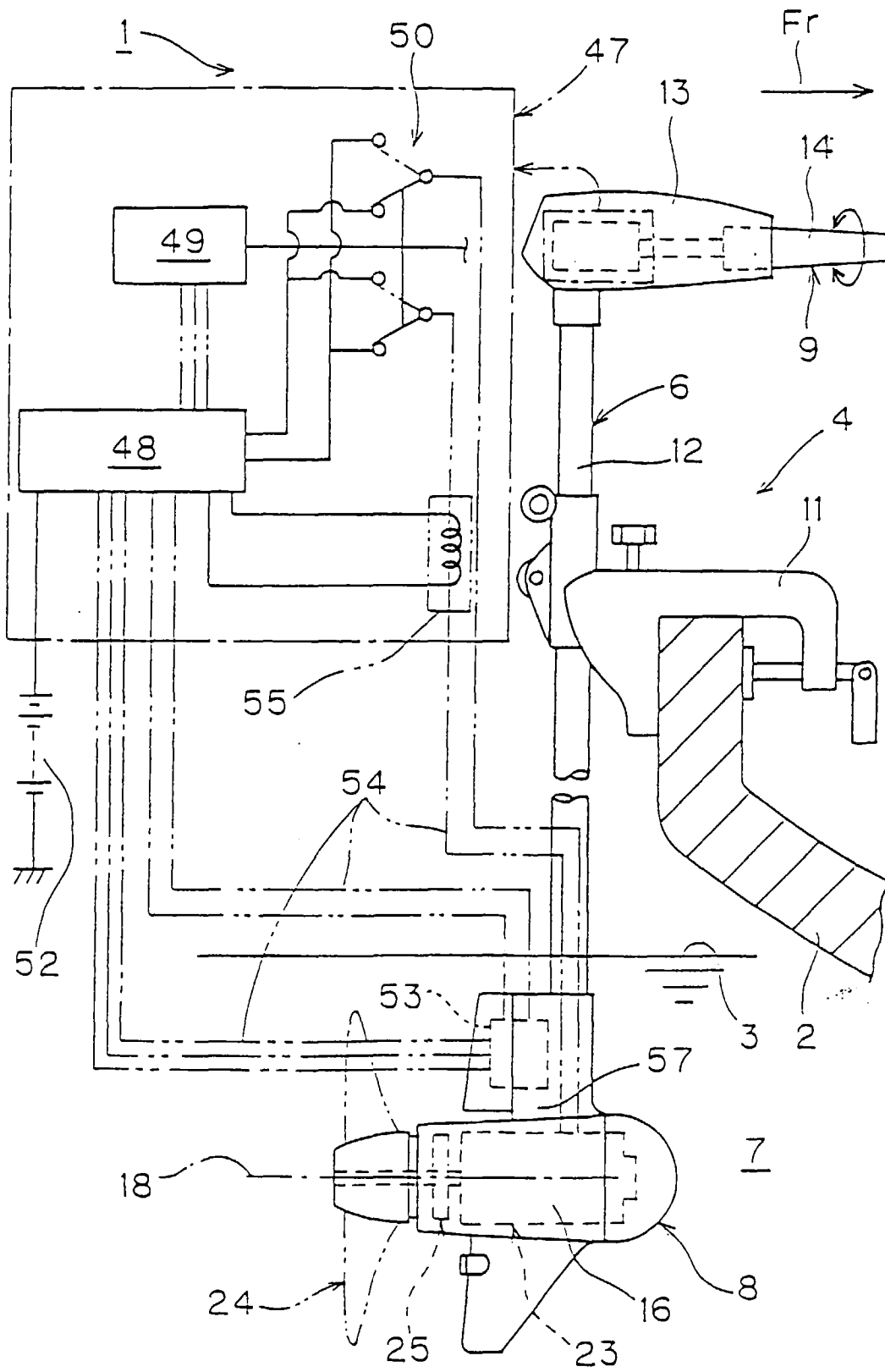


FIGURE 2

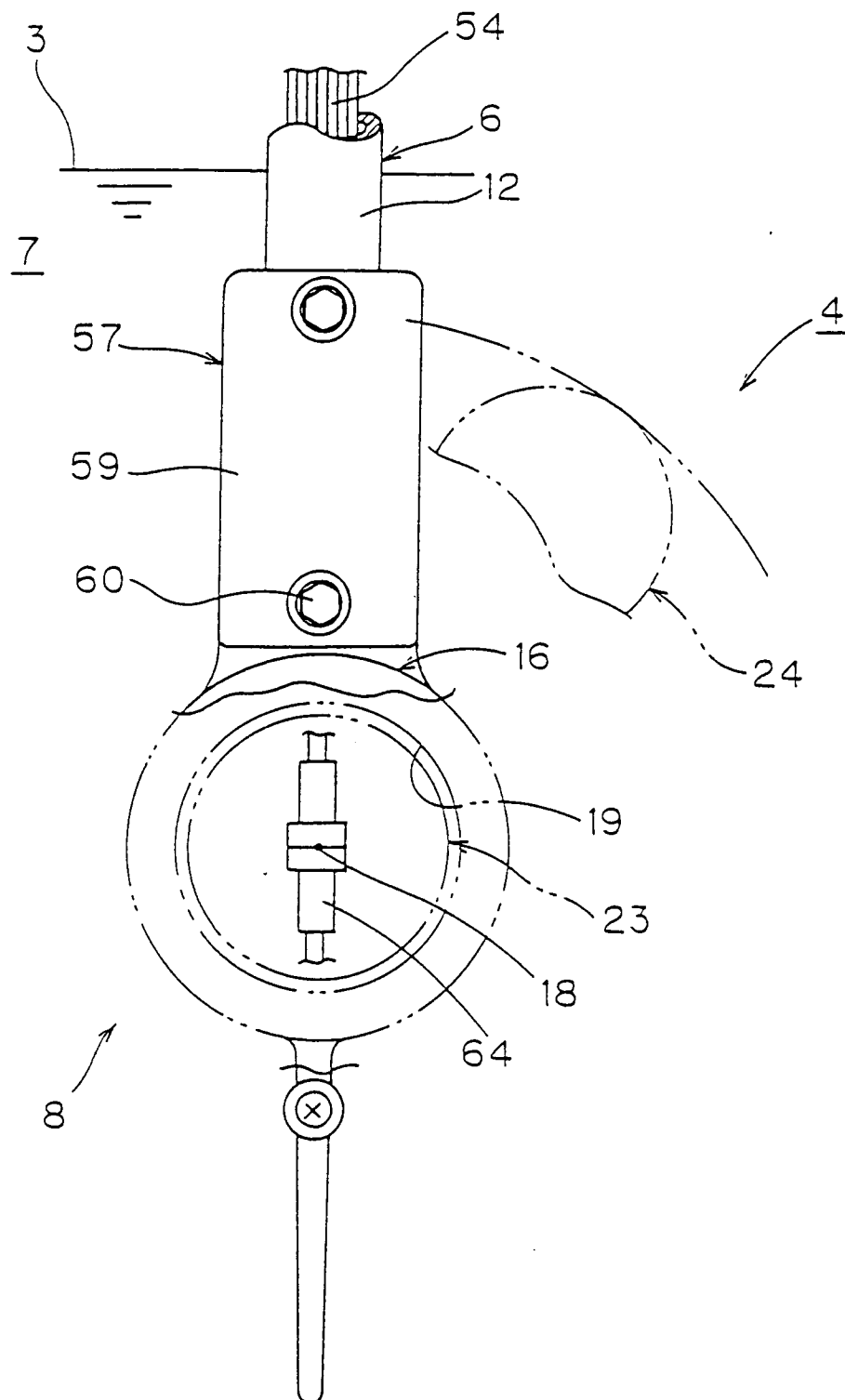


FIGURE 3

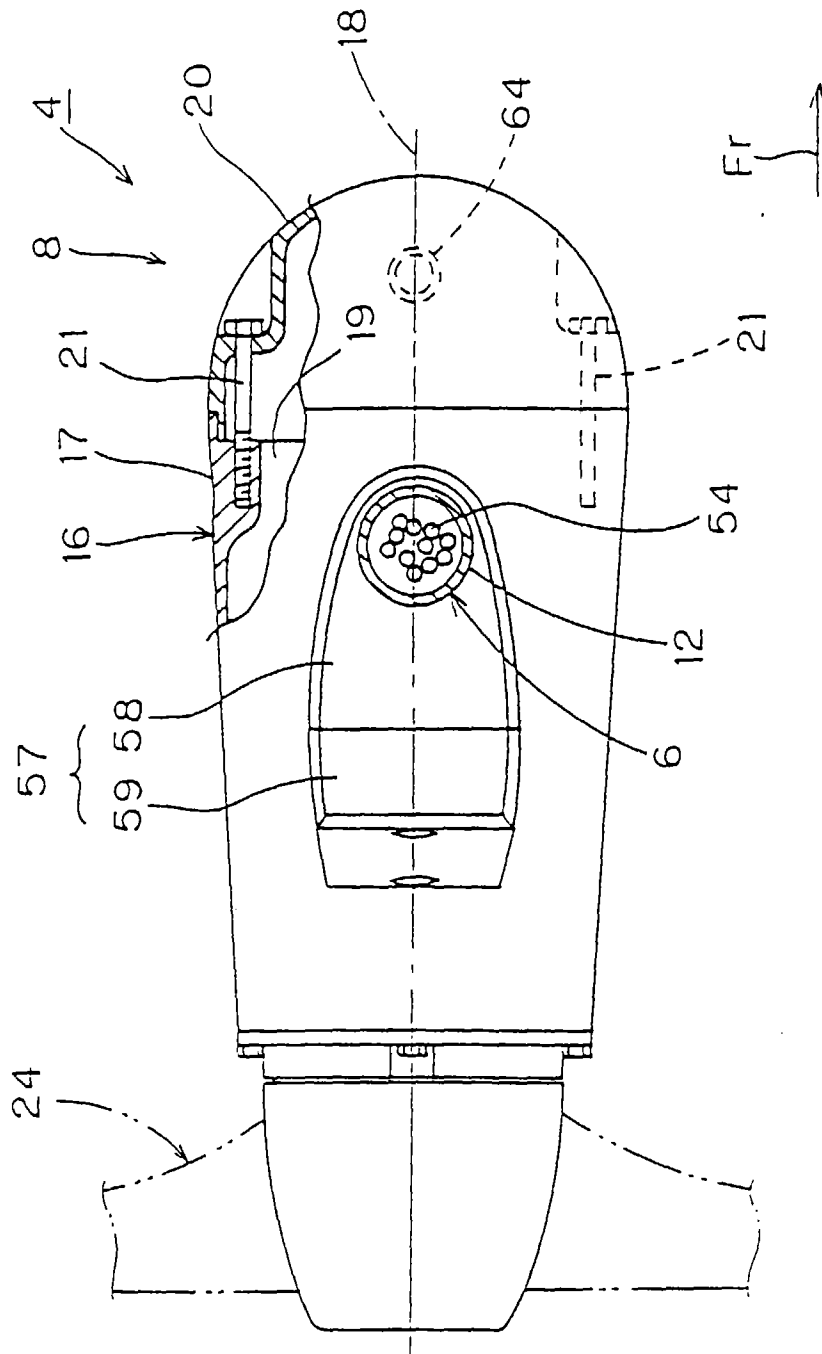
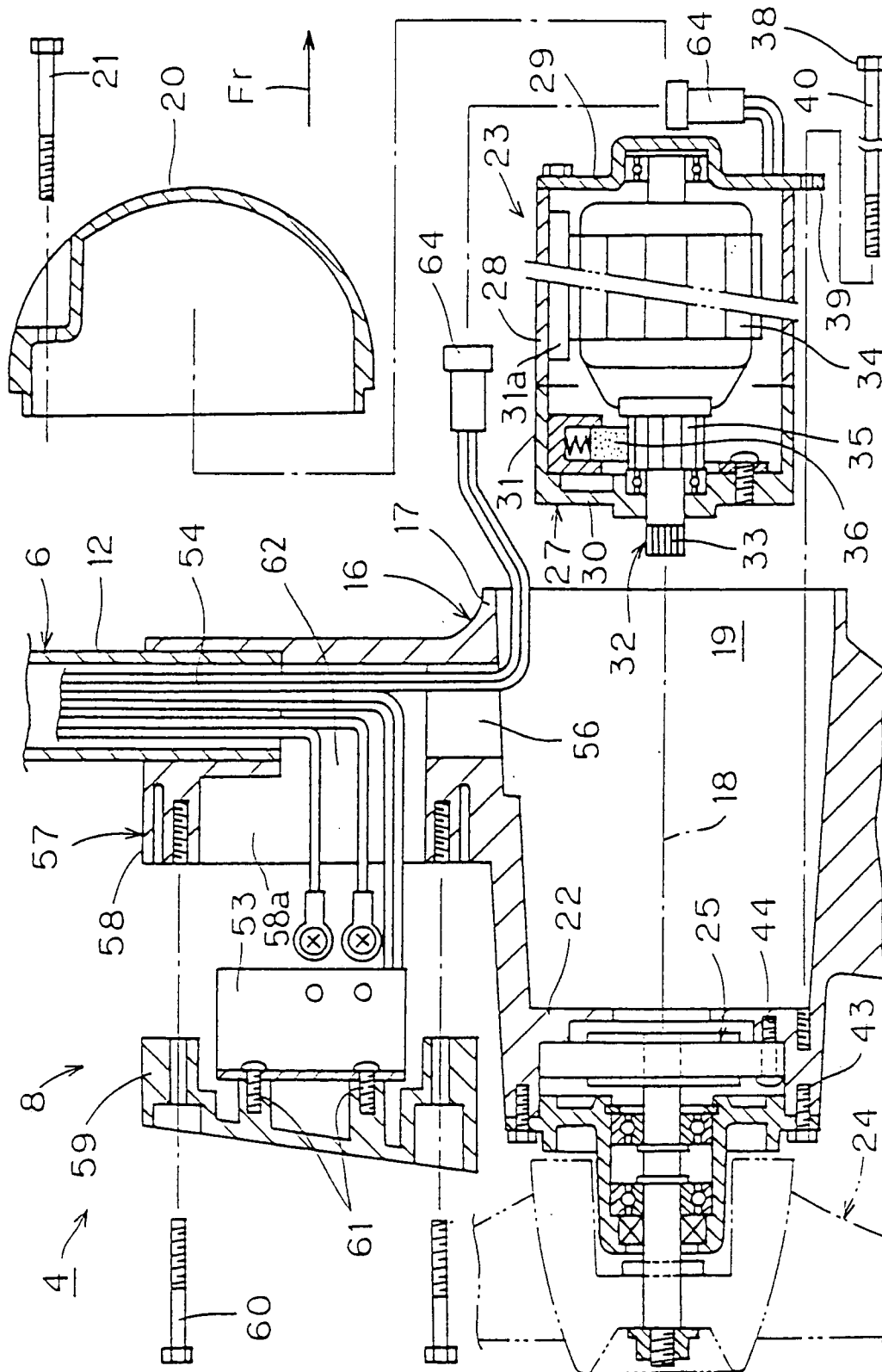


FIGURE 4



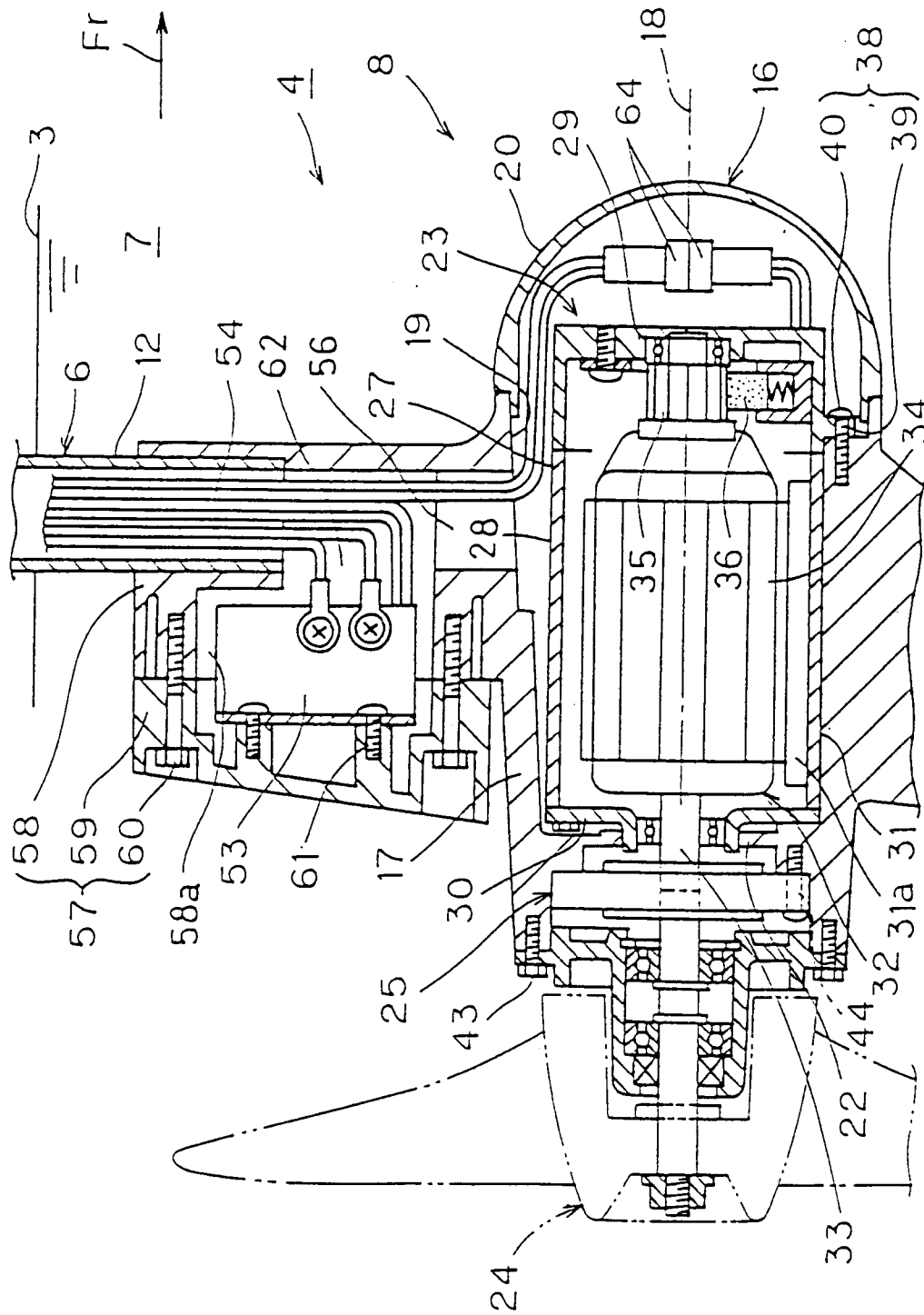


FIGURE 6

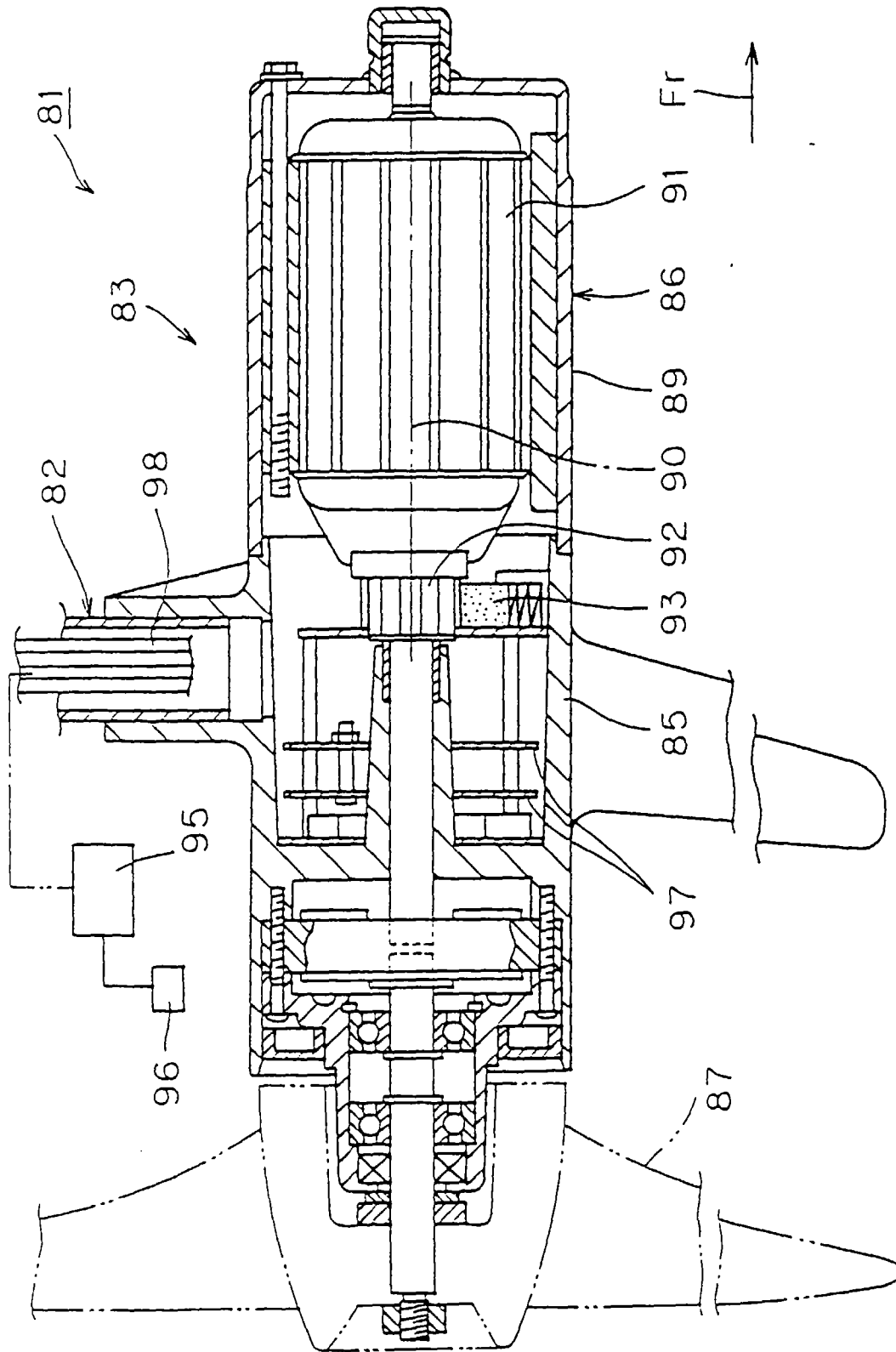


FIGURE 7