US 20090203272A1

(19) **United States**

(12) **Patent Application Publication**

**OKABE**

(10) **Pub. No.: US 2009/0203272 A1**

(43) **Pub. Date: Aug. 13, 2009**

(54) **OUTBOARD MOTOR**

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(21) Appl. No.: **12/365,959**

(22) Filed: **Feb. 5, 2009**

(30) **Foreign Application Priority Data**

Feb. 8, 2008 (JP) ..... 2008-028851

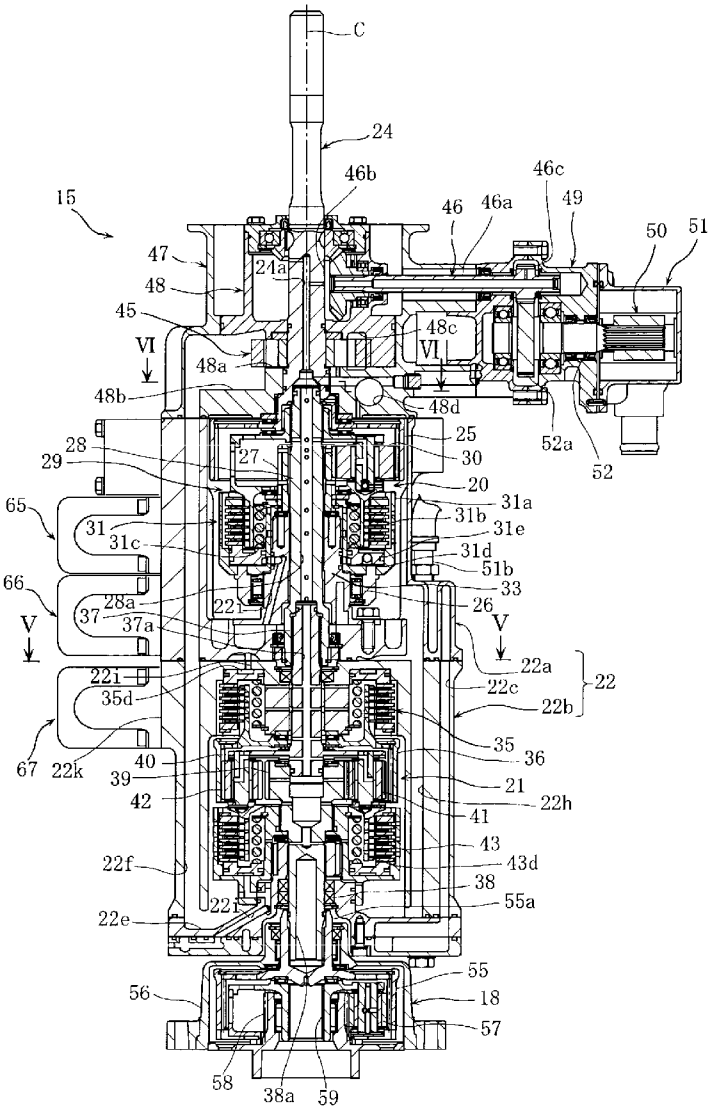
**Publication Classification**

(51) **Int. Cl.**
***B63H 21/38*** (2006.01)
***B63H 20/14*** (2006.01)

(52) **U.S. Cl.** ..... **440/75**; 184/6.5

(57) **ABSTRACT**

A power transmitting portion of an outboard motor has a power transmitting shaft connected to an output shaft of an engine to rotate together therewith, an oil pump disposed on the power transmitting shaft, and a driving force acquisition mechanism arranged to acquire driving force from the power transmitting shaft. The power transmitting portion is able to provide an outboard motor capable of ensuring a pump discharge amount without incurring an increase in the pump size and the oil amount.



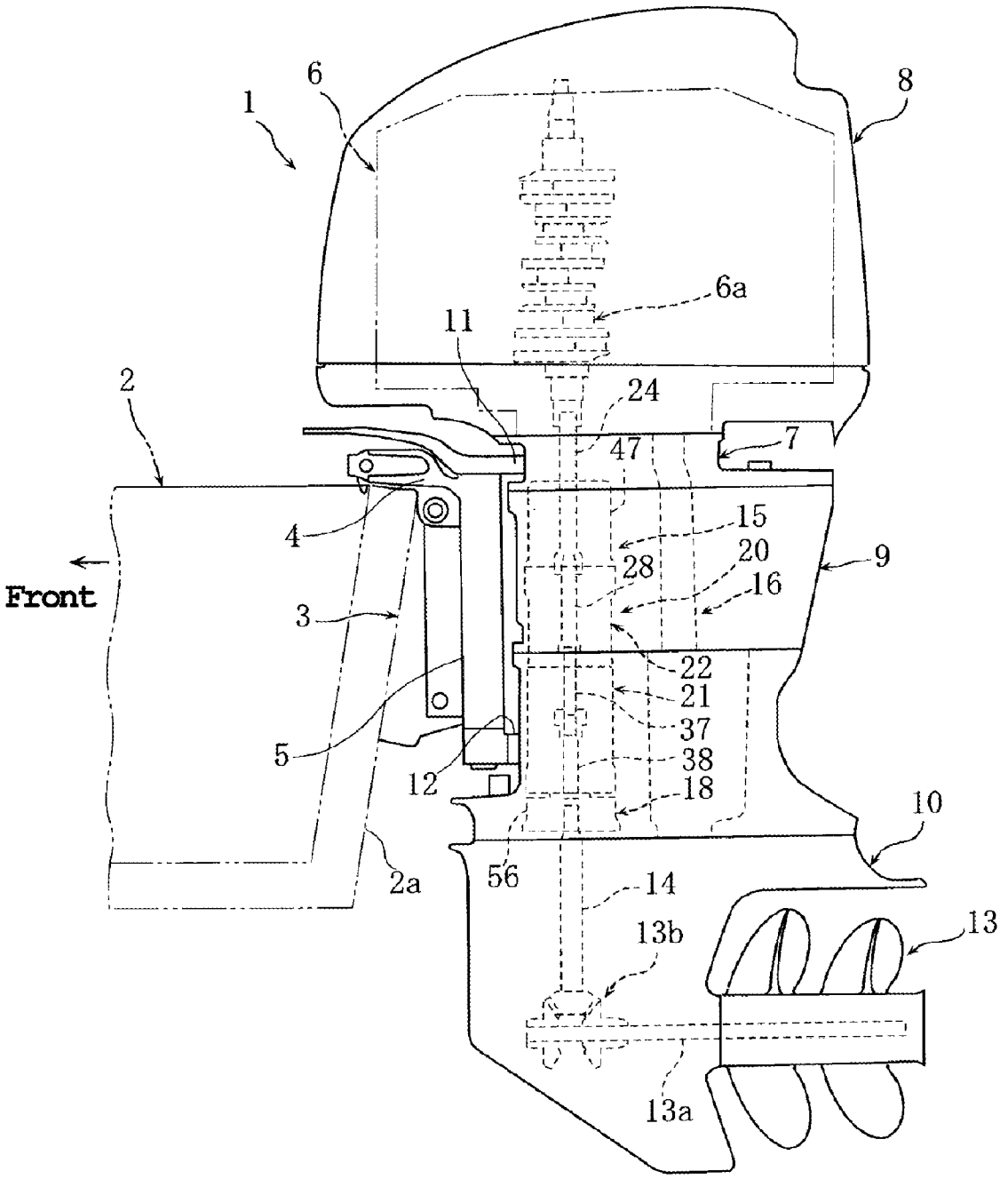

1
6
8
6a
11
2
24
47
7
4
15
20
28
9
16
Front
3
22
21
37
38
5
12
18
10
56
14
2a
13b
13
13a

FIG. 1

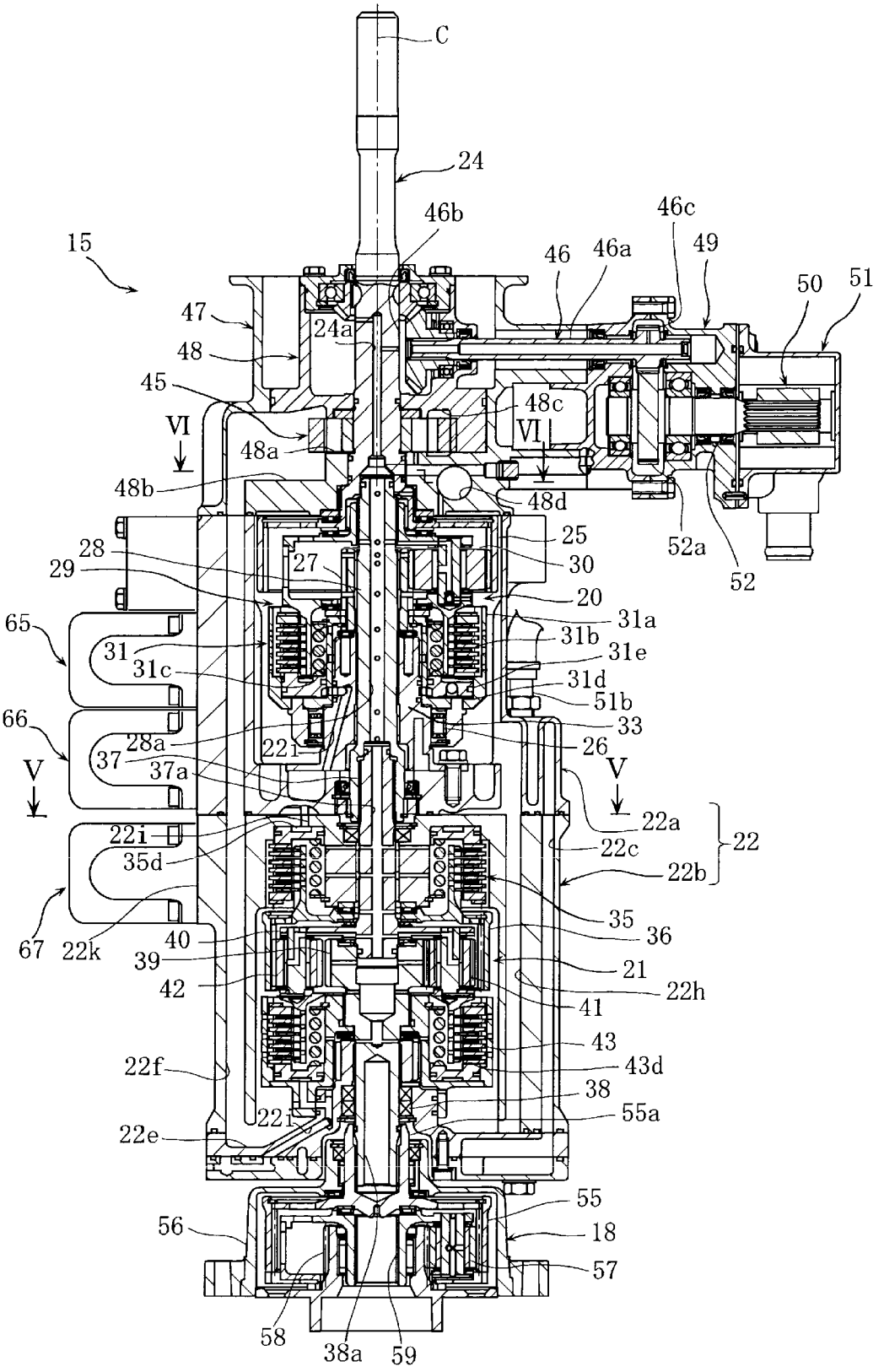

C
24
46b
46c
15
46
46a
49
50
51
47
24a
48
45
48c
VI
VI
48a
48b
48d
25
52a
28
27
30
52
29
20
65
31a
31
31b
31e
31c
31d
51b
66
33
28a
22i
26
37
37a
V
V
22a
22i
22c
22
35d
22b
35
36
67
22k
40
39
21
42
22h
41
43
22f
43d
38
22i
55a
22e
55
56
18
57
58
38a
59

FIG. 2

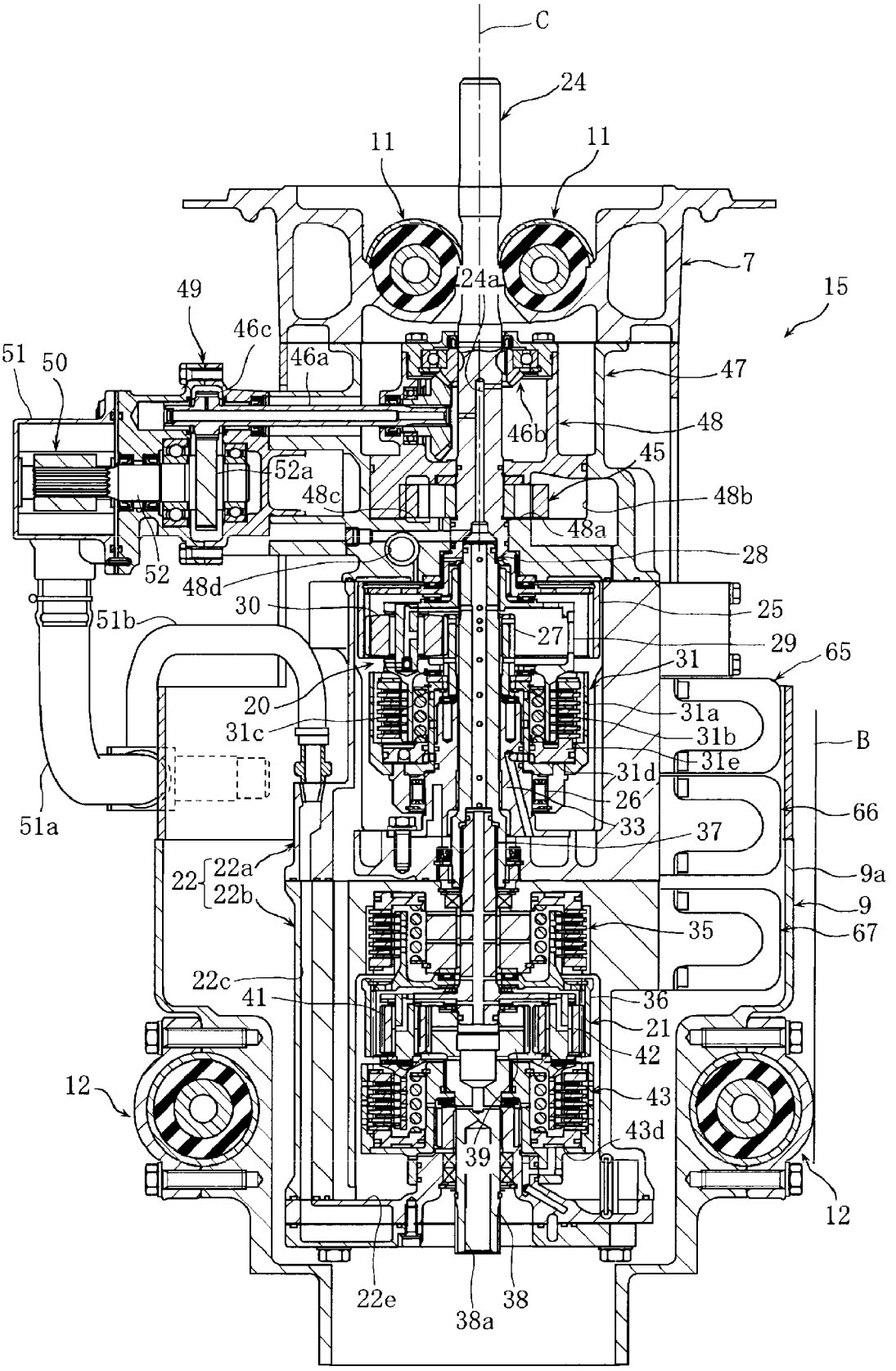

C
24
11
11
7
15
49
46c
46a
24a
51
50
47
46b
48
45
52a
48c
48b
48a
28
52
48d
30
25
51b
27
29
65
31
20
31a
31c
31b
B
31e
31d
26
66
51a
33
37
22
22a
22b
9a
9
35
67
22c
41
36
21
42
12
43
43d
39
12
22e
38
38a

FIG. 3

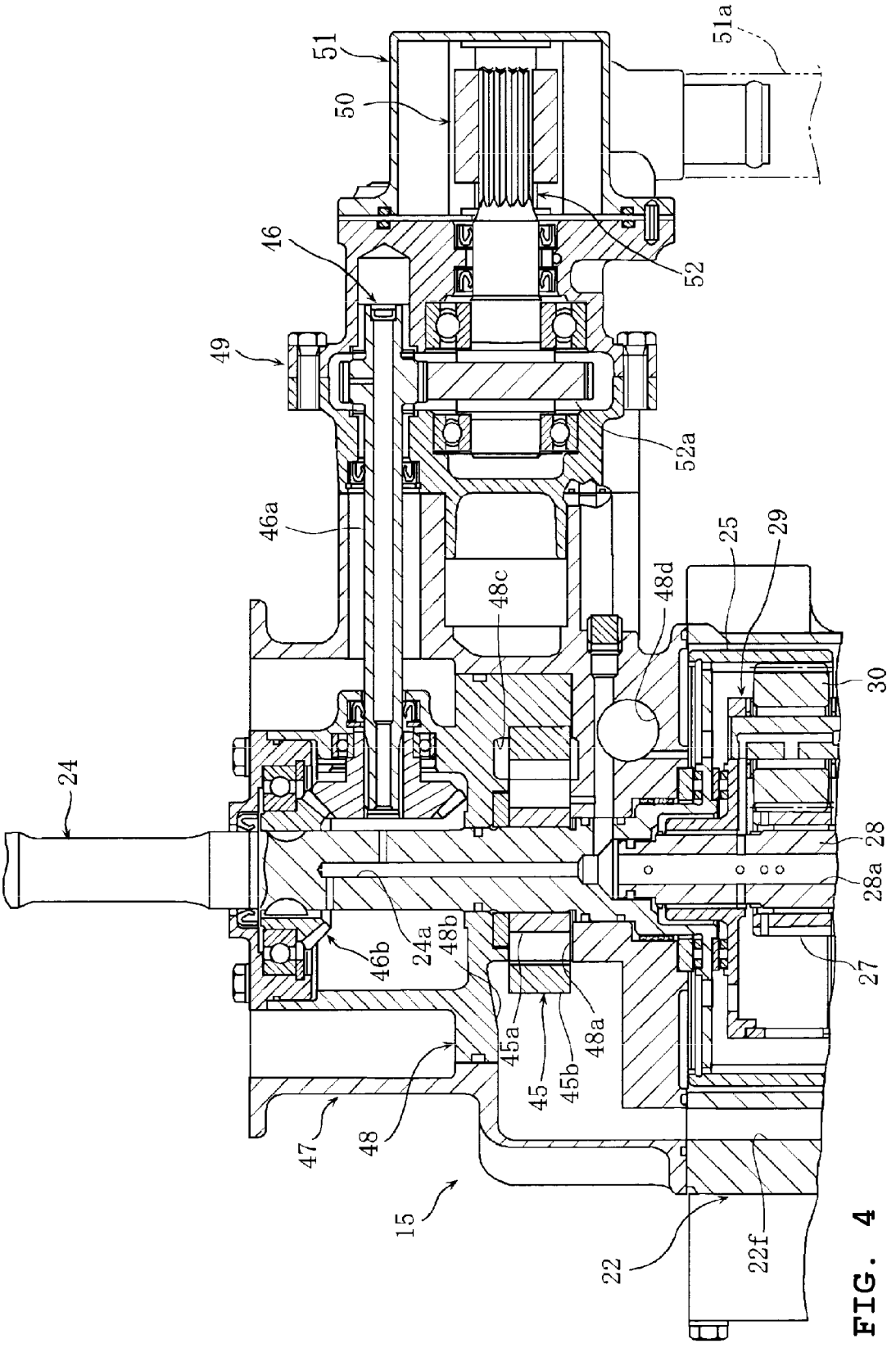

51a
51
50
16
52
49
52a
46a
25
29
48d
48c
30
24
28
28a
27
46b
24a
48b
45a
48a
45
45b
47
48
15
22
22f

FIG. 4

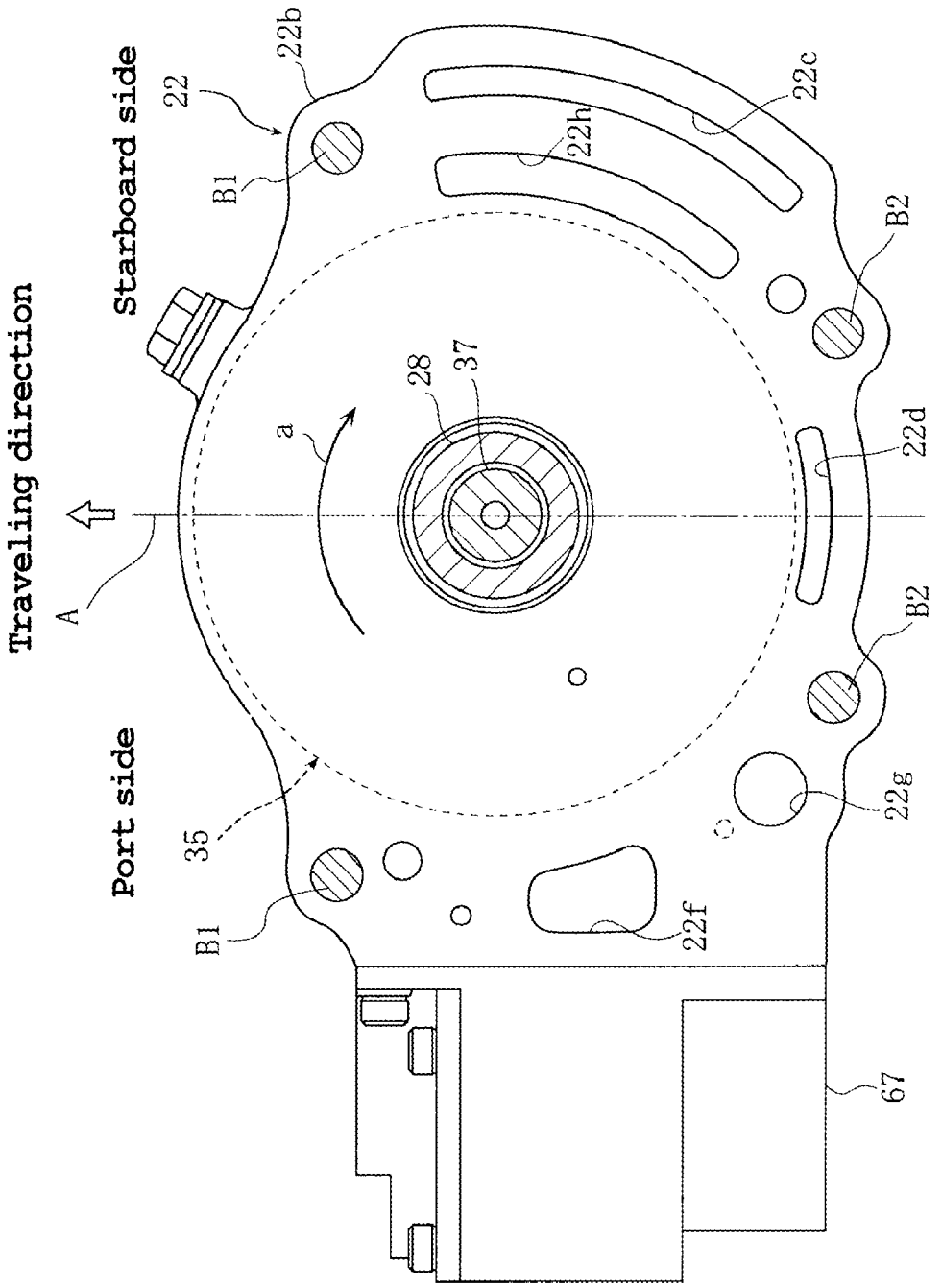

Traveling direction
A
Starboard side
Port side
22
22b
22c
22h
22d
22f
22g
B1
B2
B1
B2
28
37
a
35
67

FIG. 5

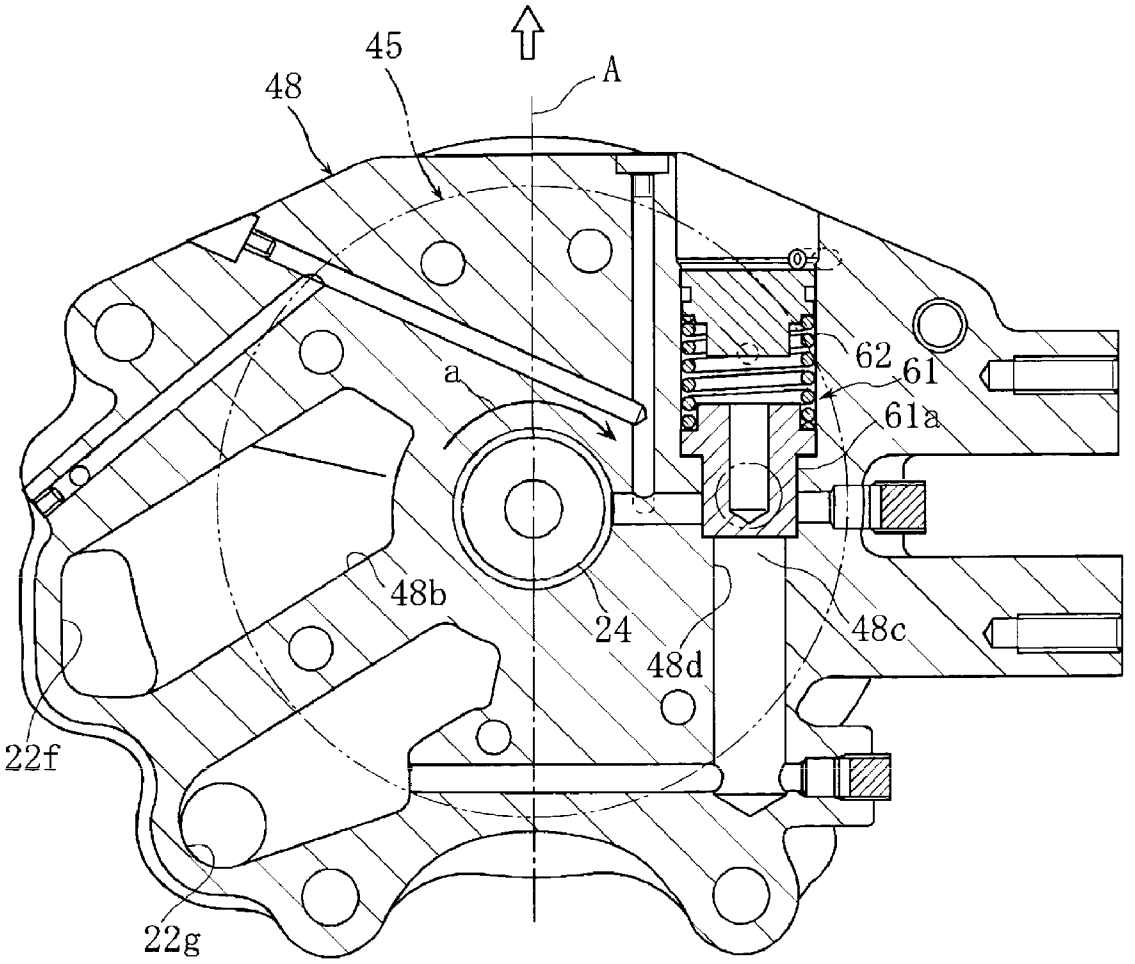



FIG. 6

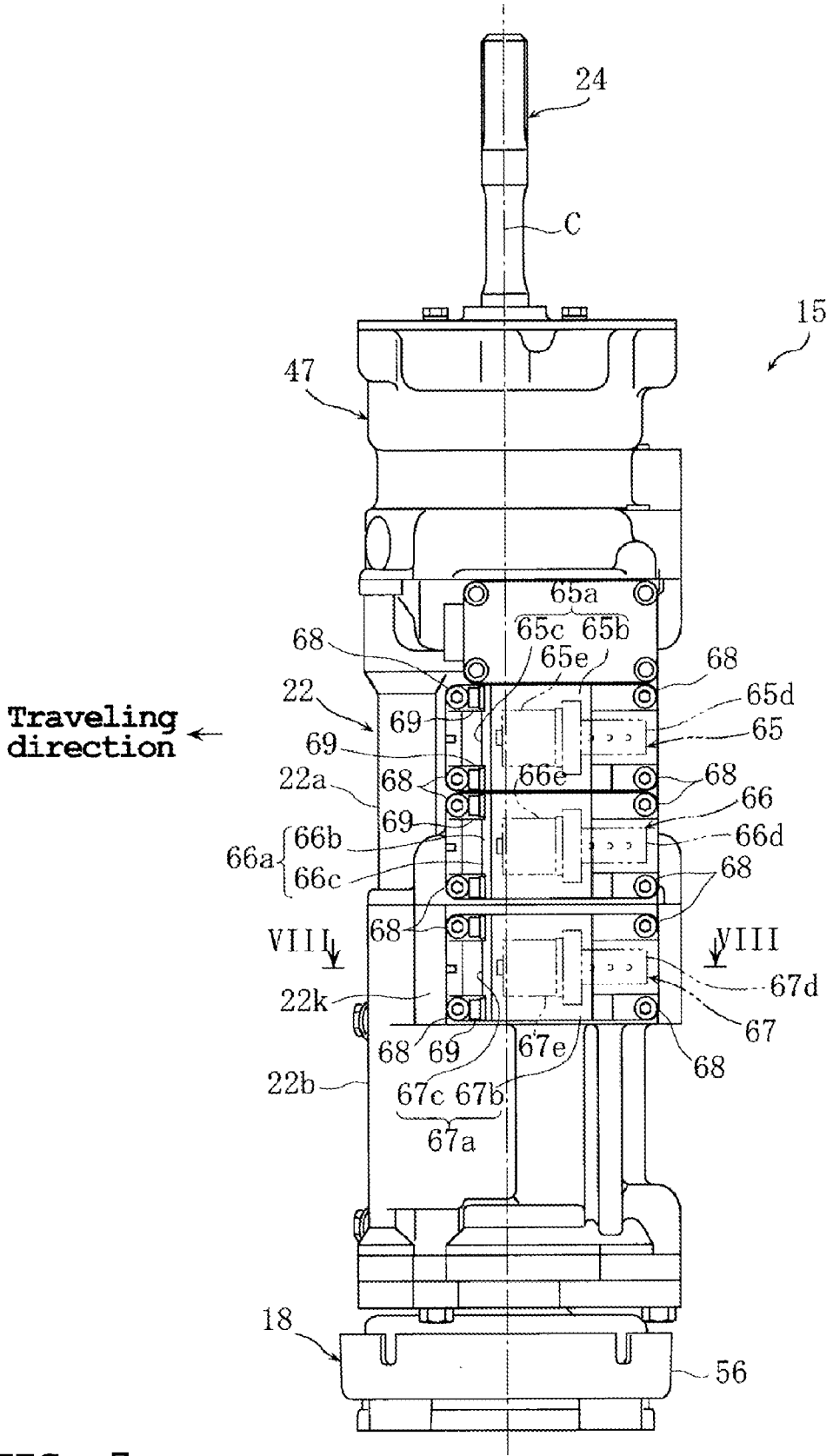

24
C
15
47
65a
65c 65b
65e
68
22
69
65d
65
Traveling direction
66e
22a
66
66b
66a
66d
66c
VIII
VIII
67d
22k
67
67e
22b
67c 67b
67a
18
56

FIG. 7

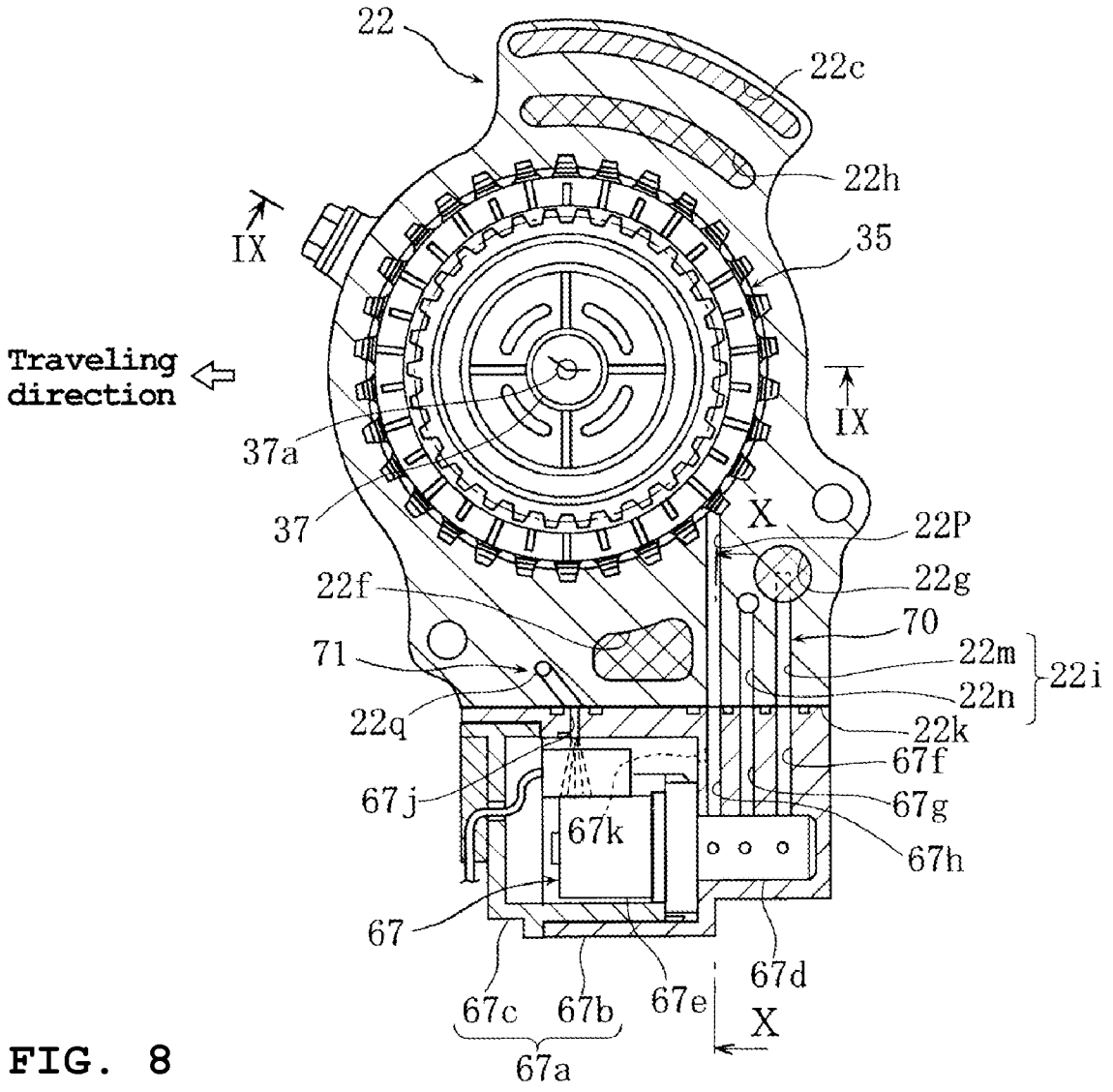

22
22c
22h
IX
35
Traveling direction
IX
37a
37
X
22P
22f
22g
70
71
22m
22n
22i
22q
22k
67f
67j
67g
67k
67h
67
67d
67c
67b
67e
X
67a

FIG. 8

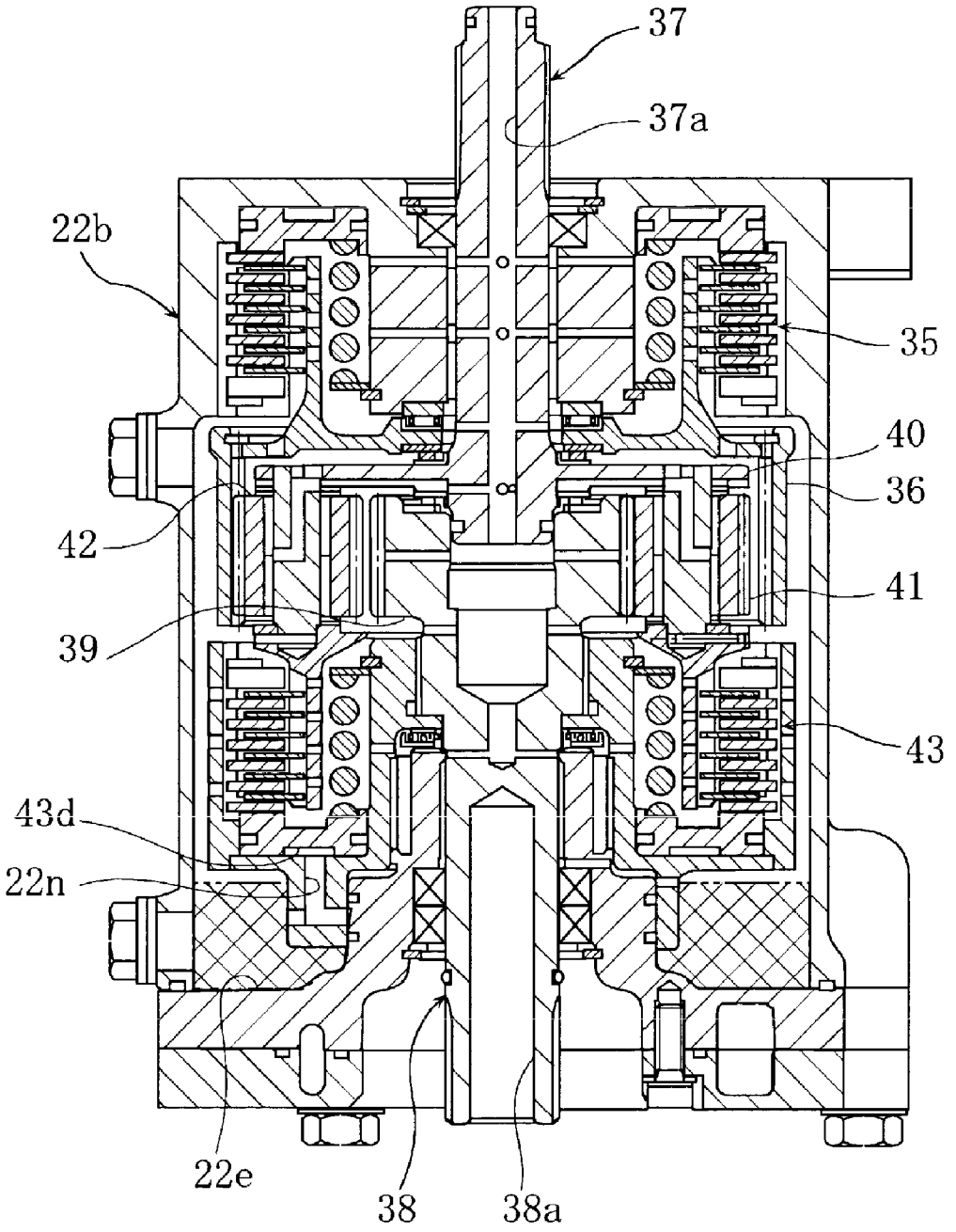



FIG. 9

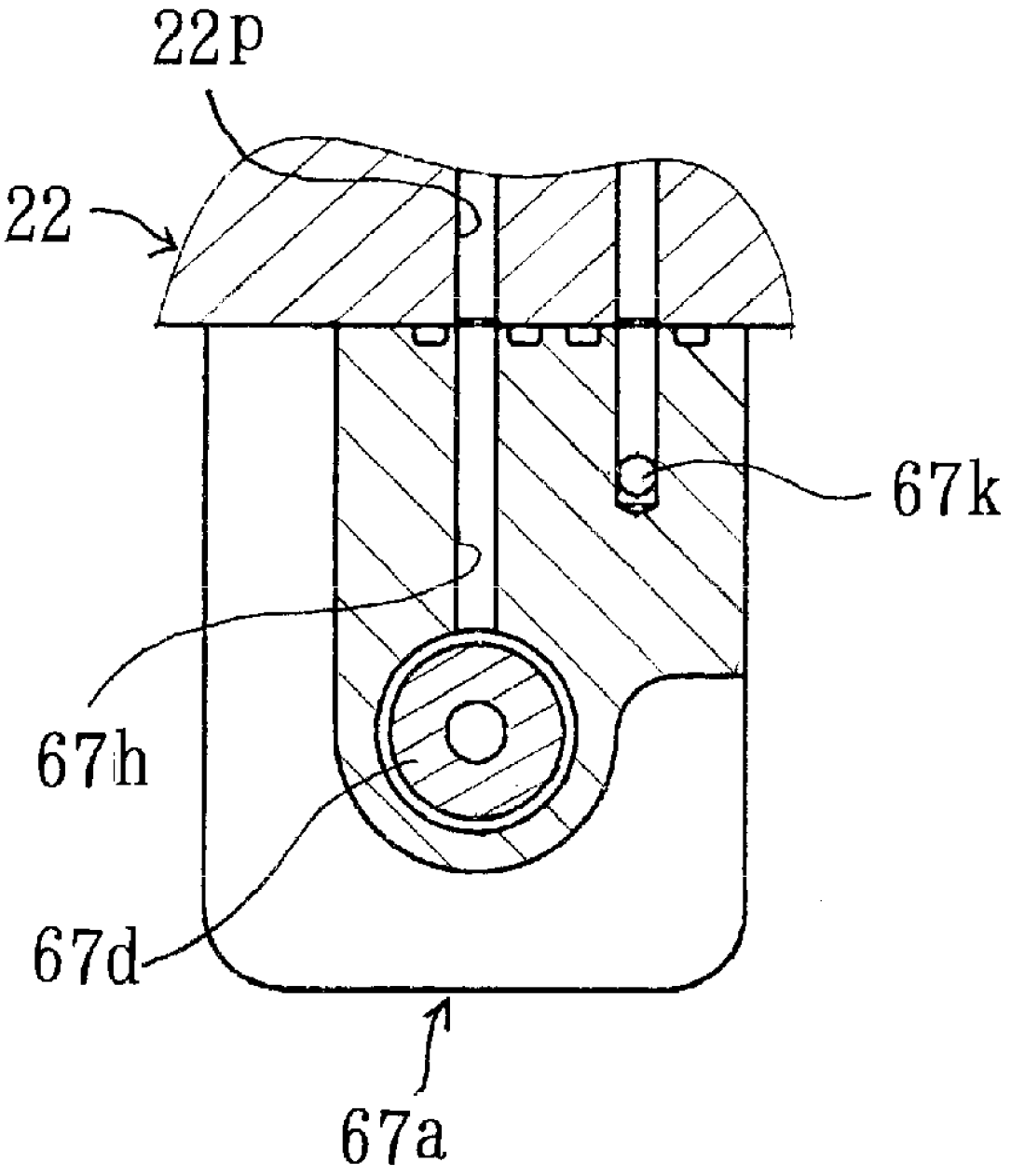



FIG. 10

# OUTBOARD MOTOR

## BACKGROUND OF THE INVENTION

**[0001]** 1. Field of the Invention

**[0002]** The present invention relates to an outboard motor including a transmission device arranged to change the speed of rotation of an engine and to transmit the rotation to a propeller.

**[0003]** 2. Description of the Related Art

**[0004]** An outboard motor including a hydraulic clutch type transmission mechanism which shifts the speed of rotation of an engine between high speed and low speed positions and transmits the rotation to a propeller, an oil pump supplying hydraulic pressure to the hydraulic clutch type transmission mechanism, and a hydraulic pressure control valve controlling hydraulic pressure supplied to the hydraulic clutch type transmission mechanism is known in the art. See, for example, WO 2007-007707 A1.

**[0005]** There are cases in which increasing the oil drawing rate of an oil pump is desired when the oil pump is disposed as close to an oil reservoir as possible in outboard motors including the hydraulic clutch type transmission mechanism, for example. However, if the oil pump is disposed adjacent to the oil reservoir, rotation of the engine that is reduced by the transmission mechanism is transmitted to the oil pump, thus causing a fluctuation of the rotational speed of the oil pump. Therefore, it is necessary to increase the size of the oil pump and the oil amount to an oil pan. This results in an undesirable increase in the cost and weight of the outboard motor.

## SUMMARY OF THE INVENTION

**[0006]** In order to overcome the problems described above, preferred embodiments of the present invention provide an outboard motor capable of ensuring a stable pump discharge amount without incurring increases in oil pump size and an oil amount.

**[0007]** A first preferred embodiment of the present invention provides an outboard motor including an engine arranged to generate power in which a crankshaft is vertically oriented, and a transmission device connected to the crankshaft and arranged to change the speed of rotation of the engine and transmit the rotation to a propeller, in which the transmission device includes a power transmitting portion connected to the crankshaft and a speed changing portion connected to the power transmitting portion, and the power transmitting portion includes a power transmitting shaft connected to an output shaft of the engine to rotate together therewith and an oil pump disposed on the power transmitting shaft.

**[0008]** A second preferred embodiment of the present invention provides the outboard motor in accordance with the first preferred embodiment, in which the power transmitting portion includes a driving force acquisition mechanism arranged to acquire driving force from the power transmitting shaft, a first housing, a second housing housed in the first housing to house the oil pump, and a third housing connected to the first housing to house the driving force acquisition mechanism.

**[0009]** A third preferred embodiment of the present invention provides the outboard motor in accordance with the second preferred embodiment, in which a relief passage arranged to fluidly connect a section for an oil discharge passage and a section for an oil drawing passage together is arranged in the second housing, and a relief valve which opens when pressure in the relief passage exceeds a predetermined value is interposed in the relief passage.

**[0010]** A fourth preferred embodiment of the present invention provides the outboard motor in accordance with the third preferred embodiment, in which the oil discharge passage and the oil drawing passage are provided on one side in the watercraft width direction of a straight line extending in a traveling direction through the power transmitting shaft.

**[0011]** In the outboard motor in accordance with the first preferred embodiment of the present invention, the oil pump is disposed on the power transmitting shaft rotating together with the engine thus preventing fluctuation of the ratio between the rotational speed of the oil pump and the engine speed. This facilitates setting of the oil amount corresponding to each engine speed and stable securing of a required pump discharge amount.

**[0012]** In the second preferred embodiment of the present invention, the driving force acquisition mechanism arranged to acquire driving force is provided on the power transmitting shaft. Therefore, engine power can be acquired from the power transmitting shaft separately from the oil pump, and a driving force proportional to the rotational speed of the engine can be acquired. As a result, an acquired driving force can be used for a wider range of purposes. For example, it is possible to secure a sufficient amount of coolant supply to the engine and so forth in the case that a coolant pump is connected to the driving force acquisition mechanism.

**[0013]** The second housing in which the oil pump is housed is connected to the first housing connected to the engine inside the first housing. The third housing in which the driving force acquisition mechanism is housed is connected to the first housing outside the first housing. Therefore, two mechanisms of the oil pump and the driving force acquisition mechanism can be compactly housed, thus facilitating assembly.

**[0014]** In the third preferred embodiment of the present invention, the relief passage is arranged in the second housing which houses the oil pump, and the relief valve is interposed in the relief passage. Therefore, the relief valve can be disposed in the second housing utilizing an open space, thus achieving a downsizing of the whole power transmitting portion.

**[0015]** In the fourth preferred embodiment of the present invention, the oil discharge passage and the oil drawing passage are provided on one side in the watercraft width direction of the straight line extending in the traveling direction through the power transmitting shaft. Therefore, the oil drawing passage and the oil discharge passage can be disposed on the front side and the rear side, respectively, in a rotational direction of the oil pump. Accordingly, an oil line configuration can be simplified. Oil is directly drawn from a section in which oil collects, thereby allowing for a reduction in the length of a drawing line to the oil pump. Consequently, this allows for a significant reduction in the total amount of oil and in the size of the oil pump, thus achieving a cost savings.

**[0016]** Other features, elements, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]** FIG. **1** is a side view of an outboard motor including a transmission device in accordance with a preferred embodiment of the present invention.

**[0018]** FIG. **2** is a cross-sectional rear view of a transmission device in accordance with a preferred embodiment of the present invention.

**[0019]** FIG. **3** is a cross-sectional front view of a transmission device in accordance with a preferred embodiment of the present invention.

**[0020]** FIG. **4** is a cross-sectional view of a power transmitting portion in which an oil pump of a transmission device is disposed in accordance with a preferred embodiment of the present invention.

**[0021]** FIG. **5** is a cross-sectional view taken along line V-V in FIG. **2**.

**[0022]** FIG. **6** is a cross-sectional view taken along line VI-VI in FIG. **2**.

**[0023]** FIG. **7** is a side view of a housing in which a transmission device is housed in accordance with a preferred embodiment of the present invention.

**[0024]** FIG. **8** is a cross-sectional view taken along line VIII-VIII in FIG. **7**.

**[0025]** FIG. **9** is a cross-sectional view taken along line IX-IX in FIG. **8**.

**[0026]** FIG. **10** is a cross-sectional view taken along line X-X in FIG. **8**.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0027]** Preferred embodiments of the present invention will be described hereinafter with reference to attached drawings.

**[0028]** FIGS. **1** through **10** are drawings for describing an outboard motor in accordance with preferred embodiments of the present invention. Front, rear, right, and left in descriptions of the preferred embodiments denote front, rear, right, and left in the view as seen from the rear of a watercraft unless otherwise specified.

**[0029]** In the figures, reference numeral **1** denotes an outboard motor installed in a stern **2***a* of a hull **2**. The outboard motor **1** is supported swingably in the vertical direction by a clamp bracket **3** fixed to the hull **2** via a swivel arm **4** and supported to be steerable to the right and left via a pivot portion **5**.

**[0030]** The outboard motor **1** has an engine **6** arranged to generate power, an exhaust guide **7**, a cowling **8**, an upper case **9**, and a lower case **10**.

**[0031]** The engine **6** includes a vertically oriented crankshaft **6***a* disposed in a generally vertical direction, and is mounted on the exhaust guide **7**. The cowling **8** is installed on an upper surface of the exhaust guide **7** to cover an outer periphery of the engine **6**. The upper case **9** is connected to a lower surface of the exhaust guide **7**. The lower case **10** is connected to a lower surface of the upper case **9**.

**[0032]** The outboard motor **1** is supported by the clamp bracket **3** via an upper mount member **11** mounted on the exhaust guide **7** and a lower mount member **12** mounted on a lower end of the upper case **9**.

**[0033]** The outboard motor **1** includes a transmission device **15** arranged to change a speed of rotation of the engine **6** and transmit the rotation to a propeller **13**. The propeller **13** is attached to a propeller shaft **13***a*. The propeller shaft **13***a* is disposed in the lower case **10** to be perpendicular to the crankshaft **6***a*. The propeller shaft **13***a* is connected to a drive shaft **14** coaxially disposed with the crankshaft **6***a* via a bevel gear mechanism **13***b*.

**[0034]** The transmission mechanism **15** includes a first input shaft (power transmitting shaft) **24** defining a portion of a power transmitting portion connected to the crankshaft (output shaft) **6***a* of the engine **6**, a planetary gear type transmission mechanism (speed changing portion) **20** connected to the first input shaft **24**, and a forward-reverse switching mechanism **21** connected to the transmission mechanism **20**.

**[0035]** The transmission mechanism **15** is housed in a generally cylindrical housing **22** that is oil-tight and the housing **22** is housed in the upper case **9** to be positioned in a front portion thereof in the traveling direction. An exhaust system **16** arranged to discharge exhaust gas from the lower case **10** into water is disposed in the rear of the transmission device **15** in the upper case **9**.

**[0036]** The housing **22** is divided into an upper housing **22***a* in which the transmission mechanism **20** is housed and a lower housing **22***b* in which the forward-reverse switching mechanism **21** is housed (as shown in FIG. **2**).

**[0037]** The planetary gear type transmission mechanism **20** has a first internal gear **25**, a first sun gear **27**, a first output shaft **28**, a first carrier **29**, first planetary gears **30**, and a second clutch **31**.

**[0038]** The first internal gear **25** is connected to the first input shaft **24** to rotate together therewith. The first sun gear **27** is connected toward the housing **22** via a first clutch **26**. The first output shaft **28** is coaxially disposed with the first input shaft **24**. The first carrier **29** is connected to the first output shaft **28** to rotate together therewith. The first planetary gears **30** are supported by the first carrier **29** to be capable of relative rotation and are meshed with the first sun gear **27** and the first internal gear **25**. The second clutch **31** is installed between the first sun gear **27** and the first carrier **29**.

**[0039]** The first input shaft **24** is coaxially disposed with the crankshaft **6***a* and combined with the crankshaft **6***a* to rotate together therewith.

**[0040]** The first sun gear **27** is housed in the housing **22**. The first sun gear **27** is connected to a support housing **33** rotatably supporting the first output shaft **28** or disconnected from the support housing **33** via the first clutch **26**.

**[0041]** The first clutch **26** is a one-way type clutch which only permits rotation of the first sun gear **27** in rotational direction (a) (clockwise) of the crankshaft **6***a* but prohibits rotation in the opposite direction (counterclockwise).

**[0042]** The second clutch **31** preferably is a wet type multi-plate clutch, for example, and has a clutch housing **31***a*, clutch plates **31***b*, a piston **31***e*, and a spring member **31***c*.

**[0043]** The clutch housing **31***a* is combined with the first sun gear **27** to rotate together therewith. The clutch plates **31***b* are disposed between the clutch housing **31***a* and the first carrier **29**. The piston **31***e* is disposed in a hydraulic chamber **31***d* formed in the clutch housing **31***a* and brings the clutch plates **31***b* into contact with each other with hydraulic pressure supplied to the hydraulic chamber **31***d* in a direction to transmit power. The spring member **31***c* urges the piston **31***e* in a direction to disconnect power transmission.

**[0044]** When an operator of a watercraft operates a shift lever (not shown) or a shift operation switch (not shown) to a low speed position, the first clutch **26** is engaged, the first sun gear **27** is locked, and the second clutch **31** is disengaged. When rotation of the engine **6** is transmitted from the first input shaft **24** to the first internal gear **25** in this state and the internal gear **25** rotates, each of the planetary gears **30** rotates itself, and rotates relatively to the first internal gear **25**, and revolves with respect to the first sun gear **27**. Thereby, the speed of the engine rotation is reduced and the rotation is transmitted to the first output shaft **28**.

**[0045]** On the other hand, when operation is switched to a high speed position, the first clutch **26** is disengaged, the first sun gear **27** enters a free state, and the second clutch **31** is engaged. When rotation of the engine **6** is transmitted from the first input shaft **24** to the first internal gear **25** in this state, the first internal gear **25**, each of the first planetary gears **30**, and the first sun gear **27** rotate unitarily. Thus, rotation of the first input shaft **24** is transmitted to the first output shaft **28** without speed reduction.

**[0046]** The forward-reverse switching mechanism **21** has a second internal gear **36**, a second input shaft **37**, a second output shaft **38**, a second sun gear **39**, a second carrier **40**, a second planetary gear **41**, a third planetary gear **42**, and a fourth clutch **43**.

**[0047]** The second internal gear **36** is connected to the housing **22** via a third clutch **35**. The second input shaft **37** is coaxially disposed with the first output shaft **28** and connected to the first output shaft **28** to rotate together therewith. The second output shaft **38** is coaxially disposed with the second input shaft **37**. The second sun gear **39** is unitary and integral with and connected to the second output shaft **38**. The second carrier **40** is connected to the second input shaft **37** to rotate together therewith. The second planetary gear **41** is rotatably supported by the second carrier **40** and meshed with the second sun gear **39**. The third planetary gear **42** is meshed with the second internal gear **36**. The fourth clutch **43** is installed between the second carrier **40** and the second output shaft **38**.

**[0048]** The fourth clutch **43** and the third clutch **35** preferably are, for example, wet type multi-plate clutches having constructions generally similar to the second clutch **31** described above.

**[0049]** When a forward-reverse switching lever (not shown) or a forward-reverse switching switch (not shown) is in a neutral position, the third and fourth clutches **35** and **43** are disengaged. The second input shaft **37** idles. Rotation of the second input shaft **37** is not transmitted to the second output shaft **38**.

**[0050]** When shifting from the neutral position to a forward position, the third clutch **35** is disengaged, and the fourth clutch **43** is engaged. The second internal gear **36**, the second and third planetary gears **41** and **42**, and the second sun gear **39** unitarily rotate. The second output shaft **38** rotates in the forward travel direction which is the same as rotational direction (a) (shown in FIG. **5**) of the engine **6**.

**[0051]** On the other hand, when shifting from the neutral position to a reverse position, the third clutch **35** is engaged, and the fourth clutch **43** is disengaged. The second internal gear **36** is fixed to the housing **22** to be unable to rotate. The second and third planetary gears **41** and **42** revolve while rotating in directions opposite to each other. The second sun gear **39** rotates in the opposite direction. Thereby, the second output shaft **38** rotates in the reverse travel direction which is the direction opposite to rotational direction (a) of the crankshaft **6***a*.

**[0052]** The transmission device **15** has a planetary gear type speed reducing mechanism **18** arranged to reduce the speed of rotation of the second output shaft **38** and transmitting the rotation to the drive shaft **14**.

**[0053]** The speed reducing mechanism **18** has an internal gear **55** connected to the second output shaft **38** to rotate together therewith, a planetary gear **57** meshed with the internal gear **55** and rolling on the internal gear **55**, and a sun gear **58** meshed with the planetary gear **57** and disposed to be unable to rotate.

**[0054]** The speed reducing mechanism **18** has a speed reducer housing **56** fixed to the lower case **10** and rotatably supporting a boss **55***a* of the internal gear **55** and a carrier **59** rotatably supporting the planetary gear **57**.

**[0055]** The sun gear **58** is fixed to the lower case **10** to be unable to rotate. The carrier **59** is rotatably supported by the sun gear **58**. The carrier **59** is combined with the drive shaft **14** to rotate together therewith.

**[0056]** The transmission device **15** includes the first input shaft **24** defining the power transmitting portion, an oil pump **45** disposed on the first input shaft **24**, and a driving force acquisition mechanism **46** arranged to acquire driving force from the first input shaft **24**, and preferably has the following specific construction.

**[0057]** The oil pump **45** supplies hydraulic pressure to the second through fourth clutches **31**, **35**, and **43** and supplies oil for lubricating and cooling each sliding portion of the transmission device **15**. The oil pump **45** is independent from an oil pump supplying lubricating oil to each sliding portion of the crankshaft **6***a* and so forth of the engine **6**.

**[0058]** The first input shaft **24** extends upward from the housing **22** and is housed in a first housing **47** connected to an upper surface of the housing **22**. A second housing **48** arranged to house the oil pump **45** is disposed in and fixed to the first housing **47**. The first input shaft **24** is rotatably supported by the second housing **48**.

**[0059]** The third housing **49** arranged to house the driving force acquisition mechanism **46** is connected to the outside of the first housing **47**. The third housing **49** is disposed to extend outward on the starboard side of the first housing **47** in the watercraft width direction.

**[0060]** The driving force acquisition mechanism **46** has a driving force acquisition shaft **46***a* extending in a direction toward the starboard side and perpendicular to the axis of the input shaft **24**. The driving force acquisition shaft **46***a* is connected to the first input shaft **24** to rotate together therewith via a bevel gear mechanism **46***b*.

**[0061]** A water pump **50** is connected to the driving force acquisition mechanism **46**. The water pump **50** is disposed in the third housing **49** in parallel, or substantially in parallel, with the driving force acquisition shaft **46***a* and has a pump shaft **52** on which a reduction gear **52***a* meshed with driving gear **46***c* of the driving force acquisition shaft **46***a* is arranged and a pump cover **51** housing the water pump **50**. The pump cover **51** is detachably connected to the third housing **49**.

**[0062]** Coolant drawn up by the water pump **50** and some of the coolant is supplied to the engine **6** side by a coolant hose **51***a* connected to the pump cover **51**. The remaining coolant is supplied to the transmission device **15** side by a branch hose **51***b* connected to the coolant hose **51***a*.

**[0063]** Coolant jackets **22***c* and **22***d* (shown in FIG. **5**) extending in the circumferential direction are arranged on the starboard and the rear sides of the housing **22**. The branch hose **51***b* is connected to the coolant jackets **22***c* and **22***d*.

**[0064]** The oil pump **45** is housed in a pump chamber **48***a* arranged in the second housing **48** and has an inner rotor **45***a* combined with the first input shaft **24** to rotate together therewith and an outer rotor **45***b* fixed to the second housing **48**. The oil pump **45** pressurizes and discharges oil drawn by rotation of the inner rotor **45***a*.

**[0065]** An oil inlet **48***b* fluidly connected to a suction port of the oil pump **45** and an oil outlet **48***c* fluidly connected to a discharge port are arranged in the second housing **48**.

**[0066]** An oil reservoir **22***e* is defined at a bottom of the housing **22**. The oil reservoir **22***e* and the oil inlet **48***b* are fluidly connected together by an oil drawing passage **22***f* arranged in the housing **22** and extending in the axial direction.

**[0067]** An oil discharge passage **22***g* extending in parallel, or substantially in parallel, with the oil drawing passage **22***f* is arranged in the housing **22**. An upstream end of the oil discharge passage **22***g* is fluidly connected to the oil outlet **48***c*. A downstream end thereof is fluidly connected to hydraulic chambers **31***d*, **35***d*, and **43***d* of the second through fourth clutches **31**, **35**, and **43** via respective clutch hydraulic passages **22***i*.

**[0068]** The oil drawing passage **22***f* and discharge passage **22***g* are disposed on the port side in the watercraft width direction with respect to a straight line "A" (shown in FIG. **5**) extending in the traveling direction through the center of the first input shaft **24**. In addition, the oil drawing passage **22***f* is disposed in a portion downstream of the oil discharge passage **22***g* in rotational direction (a) of the crankshaft **6***a*, that is, on a front side in the traveling direction.

**[0069]** An oil return passage **22***h* extending in the circumferential direction along the inside of the coolant jacket **22***c* is arranged on the side generally opposite to the oil drawing passage **22***f* across the second input shaft **37** in the lower housing **22***b*. The oil return passage **22***h* is fluidly connected to the oil reservoir **22***e*.

**[0070]** Oil passages **24***a*, **28***a*, **37***a*, and **38***a* are arranged to be fluidly connected to each other in the axes of the first input shaft **24**, the first output shaft **28**, the second input shaft **37**, and the second output shaft **38**, respectively. Oil supplied from the oil outlet **48***c* to the oil passages **24***a*, **28***a*, **37***a*, and **38***a* is supplied to each of bearings, sliding portions, and so forth.

**[0071]** In this case, oil supplied into the upper housing **22***a* returns to the oil reservoir **22***e* through the oil return passage **22***h* of the lower housing **22***b*. Oil supplied into the lower housing **22***b* drops and returns to the oil reservoir **22***e*.

**[0072]** A relief passage **48***d* fluidly connecting the oil discharge passage **22***g* and the oil drawing passage **22***f* together is arranged in the second housing **48**. A relief valve **61** is arranged in the relief passage **48***d*. The relief valve **61** is urged in the closing direction by a spring member **62** whose elastic force is set so that the relief valve **61** opens when pressure in the relief passage **48***d* exceeds a predetermined value (see FIG. **6**).

**[0073]** The transmission device **15** includes second through fourth hydraulic pressure control valves **65**, **66**, and **67** arranged to control hydraulic pressure supplied to the second through fourth clutches **31**, **35**, and **43**, respectively, of the planetary gear type transmission mechanism **20** and the forward-reverse switching mechanism **21** independently of each other.

**[0074]** Each of the second through fourth hydraulic pressure control valves **65** through **67** is controlled by a controller (not shown) to open or close based on a speed shifting signal, a forward-reverse switching signal, and so forth.

**[0075]** The hydraulic pressure control valves **65** through **67** are housed in respective hydraulic housing **65***a* through **67***a* defined independently of each other. The hydraulic housing **65***a* through **67***a* have respective housing main bodies **65***b* through **67***b* detachably mounted on a left side wall surface **22***k* of the housing **22** preferably by a plurality of bolts **68**, for example, inserted from the outside and respective lid members **65***c* through **67***c* detachably mounted on the housing main bodies **65***b* through **67***b* in a state that the hydraulic valves **65** through **67** are fixed preferably by a plurality of bolts **69**, for example, inserted from the front side.

**[0076]** Each of the hydraulic pressure control valves **65** through **67** is disposed in parallel, or substantially in parallel, in the vertical direction on the port side in the watercraft width direction of the housing **22** and is disposed to protrude outward from the housing in the watercraft width direction.

**[0077]** Each of the hydraulic pressure control valves **65** through **67** is disposed on the side opposite to the water pump **50** across the center line C of the transmission device and is positioned below the water pump **50** in a view from the rear of the watercraft (see FIG. **2**). This stabilizes the weight balance between the left and the right sides of the transmission device **15**.

**[0078]** Each of the hydraulic pressure control valves **65** through **67** is positioned above the lower mount member **12** in a view from a side of watercraft (see FIG. **7**). Thereby, each of the hydraulic pressure control valves **65** through **67** can be disposed without interfering with the lower mount member **12**. This allows prevention of an increase in the size of the upper case **9** in the watercraft width direction and downsizing of the whole outboard motor **1**.

**[0079]** The hydraulic pressure control valves **65** through **67** have respective valve shafts **65***d* through **67***d* whose axes are disposed in the fore-and-aft direction that is the watercraft traveling direction and respective electric drivers **65***e* through **67***e* connected to front sides of the respective valve shafts **65***d* through **67***d* and reciprocally driving the valve shafts **65***d* through **67***d* in the axial directions.

**[0080]** A hydraulic circuit **70** and a coolant circuit **71** are defined in a mating surface between the left side wall surface **22***k* of the housing **22** and each of the hydraulic housings **65***a* through **67***a*. Here, since the hydraulic circuits **70** and the coolant circuits **71** of the second through fourth hydraulic pressure control valves **65** through **67** have similar constructions, descriptions will be made only about the hydraulic circuit **70** and the coolant circuit **71** of the fourth hydraulic pressure control valve **67** arranged to control hydraulic pressure supplied to the fourth clutch **43**, that are shown in FIG. **8**.

**[0081]** The coolant circuit **71** is arranged to cool the hydraulic valve **67** by injecting oil. Specifically, hydraulic cooling passages **22***q* and **67***j* fluidly connected to the oil discharge passage **22***g* are arranged to extend in the watercraft width direction in the housing **22** and a hydraulic housing **67***a*. The hydraulic cooling passage **67***j* opens toward the driver **67***e* in the hydraulic housing **67***a*.

**[0082]** Oil pressurized by the oil pump **45** passes through the oil discharge passage **22***g* and the hydraulic cooling passages **22***q* and **67***j* and is injected to the driver **67***e*, thereby cooling the driver **67***e*. The oil injected to the driver **67***e* returns into the housing **22** via a return passage **67***k* formed in the hydraulic housing **67***a*.

**[0083]** The hydraulic circuit **70** is constructed to disconnect or connect hydraulic pressure to the fourth clutch **43** and specifically has the following construction.

**[0084]** As shown in FIG. **8**, the clutch hydraulic passage **22***i* defined in the housing **22** is bifurcated into a hydraulic pressure input passage **22***m* fluidly connected to the oil discharge passage **22***g* and a hydraulic pressure output passage **22***n* fluidly connected to the hydraulic chamber **43***d* of the fourth clutch **43**.

**[0085]** A hydraulic pressure input passage **67***f* fluidly connecting the valve shaft **67***d* of the hydraulic pressure control valve **67** and the hydraulic pressure input passage **22***m* together and a hydraulic pressure output passage **67***g* fluidly connecting the valve shaft **67***d* and the hydraulic pressure output passage **22***n* together are defined in the hydraulic housing **67***a*.

**[0086]** Hydraulic pressure releasing passages **22***p* and **67***h* arranged to release hydraulic pressure supplied to the hydraulic chamber **43***d* are arranged in the housing **22** and the

hydraulic housing **67***a*. Hydraulic pressure passes through the hydraulic pressure releasing passage **67***h* and **22***p* and returns into the housing **22**.

**[0087]** The hydraulic pressure input passages **22***m* and **67***f*, the hydraulic pressure output passages **22***n* and **67***g*, and the hydraulic pressure releasing passages **22***p* and **67***h* are arranged to extend in directions perpendicular or substantially perpendicular to the axis of the valve shaft **67***d*.

**[0088]** Hydraulic pressure pressurized by the oil pump **45** is supplied to the hydraulic pressure input passages **22***m* and **67***f* through the oil discharge passage **22***g*. The hydraulic pressure input passage **67***f* is blocked by the valve shaft **67***d*. Thereby, the fourth clutch **43** is disengaged.

**[0089]** When the valve shaft **67***d* of the hydraulic pressure control valve **67** operates and the hydraulic pressure input passage **67***f* opens, hydraulic pressure is supplied to the hydraulic chamber **43***d* of the fourth clutch **43** through the hydraulic pressure output passage **67***g*. Thereby, the fourth clutch **43** is engaged. The hydraulic pressure input passage **67***f* is blocked when the valve shaft **67***d* returns to the original position. Hydraulic pressure in the hydraulic chamber **43***d* is released into the hydraulic housing **67***a* through the hydraulic pressure releasing passages **67***h* and **22***p*.

**[0090]** In accordance with the present preferred embodiment, the oil pump **45** is disposed on the first input shaft **24** connected to the crankshaft **6***a* of the engine **6** to rotate together therewith. Therefore, the rotational speed of the oil pump **45** is the same as the rotational speed of the crankshaft **6***a*, thus securing a required pump discharge amount without incurring increase in the pump size and the oil amount.

**[0091]** In this preferred embodiment, the driving force acquisition mechanism **46** arranged to acquire driving force from the engine **6** is connected to the first input shaft **24**. Therefore, engine power can be directly acquired from the first input shaft **24** separately from the oil pump **45**. The engine power is a driving force proportional to the rotational speed of the engine **6** and with small fluctuation. Accordingly, the driving force can be used for a wider range of purposes. In this preferred embodiment, the water pump **50** is connected to such a driving force acquisition mechanism **46**, thus securing a sufficient amount of coolant supply to the engine **6** and so forth.

**[0092]** In this preferred embodiment, the first housing **47** housing the first input shaft **24** is connected to the housing **22**. The second housing **48** housing the oil pump **45** is connected to the first housing **47** inside of the first housing **47**. The third housing **49** housing the driving force acquisition mechanism **46** is connected to the starboard side of the first housing **47** in the watercraft width direction to protrude outward. Therefore, two mechanisms of the oil pump **45** and the driving force acquisition mechanism **46** can be housed compactly. Further, this facilitates assembling of the first through third housings **47** through **49**.

**[0093]** In this preferred embodiment, the relief passage **48***d* fluidly connecting the oil discharge passage **22***g* and the oil drawing passage **22***f* together is defined in the second housing **48** housing the oil pump **45**. The relief valve **61** is interposed in the relief passage **48***d*. Therefore, the relief valve **61** is disposed in the second housing **48** housing the oil pump **45** by effectively utilizing on open space, thus allowing downsizing of the whole transmission device **15**.

**[0094]** In this preferred embodiment, the oil discharge passage **22***g* and the oil drawing passage **22***f* are disposed on the port side of the straight line "A" extending in the traveling direction through the center of the first input shaft **24**. Therefore, the oil drawing passage **22***f* and the oil discharge passage **22***g* are disposed on the front side and the rear side, respectively, in rotational direction (a) of the oil pump **45**, thereby achieving a simple configuration of the oil line. Oil is directly drawn up from the oil reservoir **22***e*, thereby allowing reduction in the length of the drawing line to the oil pump **45**. As a result, this allows for reduction in the total amount of oil and in the size of the oil pump **45**, thus achieving cost saving.

**[0095]** While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

What is claimed is:

**1**. An outboard motor comprising:

an engine arranged to generate power including a vertically oriented crankshaft; and

a transmission device connected to the crankshaft and arranged to change a speed of rotation of the engine and transmit the rotation to a propeller; wherein

the transmission device includes a power transmitting portion connected to the crankshaft and a speed changing portion connected to the power transmitting portion; and

the power transmitting portion includes a power transmitting shaft connected to an output shaft of the engine to rotate together therewith, and an oil pump disposed on the power transmitting shaft.

**2**. The outboard motor according to claim **1**, wherein the power transmitting portion includes:

a driving force acquisition mechanism arranged to acquire driving force from the power transmitting shaft;

a first housing;

a second housing housed arranged in the first housing and arranged to house the oil pump; and

a third housing connected to the first housing and arranged to house the driving force acquisition mechanism.

**3**. The outboard motor according to claim **2**, wherein a relief passage arranged to fluidly connect an oil discharge passage and an oil drawing passage together is defined in the second housing, and a relief valve which opens when pressure in the relief passage exceeds a predetermined value is interposed in the relief passage.

**4**. The outboard motor according to claim **3**, wherein the oil discharge passage and the oil drawing passage are provided on one side in a watercraft width direction of a straight line extending in a traveling direction through the power transmitting shaft.

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