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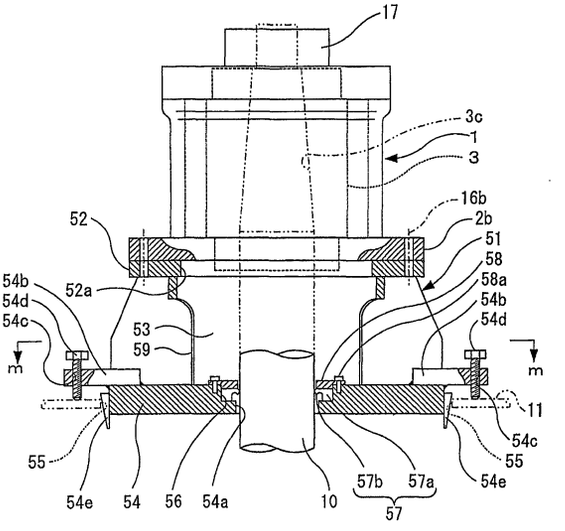
(54) STEERING ENGINE INSTALLATION METHOD AND ROTARY VANE STEERING ENGINE

(57) A base plate 54, a steering gear foundation 51 and a steering gear 1 are assembled so as to form a combined body; the combined body is supported on a steering gear deck through stay members 54b and adjusting screw bolts 54d of the base plate 54; a gathering body is formed, with a rudderstock 10 being connected to the steering gear 1; position adjustment of the base plate 54 within the horizontal plane is carried out, in the condition that the base plate 54 is loosely fitted into a penetrating hole 55 of the steering gear deck, with wedges 54e being inserted; inclination and position in the vertical direction at the part of the base plate 54 are adjusted by means of the adjusting screw bolts 54d; thus the gathering body is so maintained that its axis aligns and its position in the fore-and-aft and the port-and-starboard directions and in the upper-and-lower direction is proper; and the steering gear 1 is worn to the steering gear deck 11, with the outer peripheral portion of the base plate 54 being welded to the peripheral portion of the aforementioned penetrating hole 55.

Fig.1



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Description

Technical Field to Which the Invention Pertains

[0001] The present invention relates to technology of a steering gear for a ship, and is concerned with a rotary vane steering gear.

Background of the Invention

[0002] A conventional rotary vane steering gear 1, as shown in Fig. 9 ~ Fig. 10 for instance, is such that a housing 2 accommodates a rotor 3 interiorly, a lower neck 3a of the rotor 3 is inserted into a boss portion 2a provided on the internal bottom of the housing 2, an upper neck 3b of the rotor 3 is inserted into a hole boring through a top cover 4 of ring shape arranged at the upper opening of the housing 2, the lower neck 3a is supported free rotatably by a radial bearing 5a and a thrust bearing 5b, and the upper neck 3b is supported free rotatably by a radial bearing 5c. Accordingly, the rotor 3 is free rotatable in a condition that it is loaded radially and axially.

[0003] The housing 2 is provided with a mounting flange 2b of ring shape, which is so arranged as to be protruded at the bottom of the outer peripheral portion.

[0004] The rotor 3 is provided with vanes 6, which are so arranged as to be protruded on the outer periphery of the rotor 3 at the same intervals circumferentially, and the housing 2 is provided with segments 7, as many as the vanes 6, which are so arranged as to be protruded on the inner periphery of the housing 2 at the same intervals circumferentially. Respective edge ends of the vanes 6 and the segments 7 are provided with seals 8. By virtue of this constitution, oil chambers 9 oil-tight are formed between the respective vanes 6 and the respective segments 7, and the rotor 3 is rotated inside the housing 2 by oil fed to the oil chambers 9 by an oil pump.

[0005] The rotor 3 is provided with a rudderstock fitting hole 3c centrally, into which a top end 10a of a rudderstock 10 is inserted and fitted. As a deck hole 11a of a steering gear deck 11, through which the rudderstock 10 penetrates, is under draft line of a ship, a water seal 12 is provided directly on this portion of the steering gear deck 11 in order to keep the deck hole 11a water-tight. Furthermore, as shown in Fig. 12, a rudderstock penetrating hole 13a of a stern hull 13 is provided with a neck boss 15, in which a neck bearing 14 that bears radial load acting on the rudderstock 10 is contained.

[0006] In the aforementioned conventional constitution, it has been necessary that the rotary vane steering gear 1 and the rudderstock 10 are fitted to the hull on the spot in the following troublesome method as standard, though there is difference somewhat, since the steering gear 1, a steering gear foundation 16 and the water seal 12 are independent, respectively, and separately provided:

[0007] Namely, as shown in Fig. 12, prior to insertion of the rudderstock 10, the neck boss 15 containing the neck bearing 14 is fitted to the rudderstock penetrating hole 13a of the stern hull 13, and at the same time, the steering gear foundation 16 is fitted to the steering gear deck 11 at the prescribed position.

[0008] On this occasion, such boring machining, which is large-scaled work, is carried out in the hull block inclusive of the steering gear deck 11 containing the steering gear foundation 16, and the stern hull 13 containing the neck bearing 14 and the neck boss 15 in one body, as to make the axis of the steering gear foundation 16 and the axis of the neck bearing 14 align, and at the same time, the upper surface of the steering gear foundation 16 is so machined that it makes a right angle with the axis. Furthermore, centering work is applied to the water seal 12 in advance so that its axis aligns with the axis of the rudderstock 10, and it can be directly attached to the steering gear deck 11.

[0009] Next, the rotary vane steering gear 1 is placed on the steering gear foundation 16, the rudderstock 10 is raised up to the rotary vane steering gear 1 through the neck bearing 14 from its bottom, and a top end 10a of the rudderstock 10 is inserted into the rudderstock fitting hole 3c of the rotor 3. On this occasion, it is in such a condition that whole weight of the steering gear is supported under a condition that a tapered portion of the rudderstock top end 10a firm sticks to the rudderstock fitting hole 3c of the steering gear rotor. The rudderstock 10 is erected perpendicularly so that clearance between the rudderstock 10 and the top end or bottom end portion of the neck bearing 14 becomes uniform in the fore-and-aft and the port-and-starboard directions. Under this condition, a hydraulic nut 17 is attached to the top end of the rudderstock 10.

[0010] As shown in Fig. 11, the rudderstock top end 10a is provided with an oil port 10b for the purpose of spreading out the inside diameter of the rudderstock fitting hole 3c of the steering gear rotor 3 by oil, and hydraulic jacks 10c are installed inside the hydraulic nut 17 for the purpose of making the rudderstock top end 10a additionally insert into the rudderstock fitting hole 3c of the rotor 3 as much as its spread inside diameter. By this constitution, the rudderstock fitting hole 3c of the rotor 3 is spread out by oil, and at the same time, the rudderstock top end 10a is inserted into the rudderstock fitting hole 3c by the hydraulic jacks 10c. Under this condition, the oil pressure is released, and then the rudderstock fitting hole 3c of the rotor 3 is shrunk and the top end 10a is fastened to the rotor 3.

[0011] This combined body of the rudderstock 10 and the steering gear 1 is applied position adjustment in the upper-and-lower, the fore-and-aft, and the port-and-starboard directions, and axis adjustment, and its ultimate position is determined. Under this condition, adjusting liners are inserted between the mounting flange 2b of the steering gear housing 2 and the steering gear foundation 16.

[0012] Next, as shown in Fig. 9, plural reaming holes

16a are bored through the mounting flange 2b of the steering gear housing 2 and the steering gear foundation 16, and reamer bolts 16b are fitted through the reaming holes 16a, and thus the combined body of the steering gear 1 and the rudderstock 10 is fastened so as not to cause displacement in the fore-and-aft, the port-and-starboard, and the upper-and-lower directions and in the axis, and then remaining bolts are bound for completing foundation of the steering gear 1 and the rudderstock 10.

[0013] After that, the water seal 12 is directly worn on the steering gear deck 11 at the rudderstock penetrating portion, and at the same time, as shown in Fig. 12, a rudder blade 18 is fitted to the lower end of the rudderstock 10 for finalizing the outfitting.

[0014] These working strokes cause such problems that not only a great deal of man-hours is expensed in its outfitting design and outfitting work at a shipyard, outfitting cost is increased and an outfitting period becomes long, but also, if measurement in situ for such work at the outfitting site is inaccurate, an error can be caused in the adjusted mounting, and a serious trouble can be caused. Furthermore, simplification of outfitting work and shortening an outfitting period become a significant proposition to be aimed.

[0015] The present invention resolves the aforementioned problems and aims at offering such a steering gear mounting method and a rotary vane steering gear as to be able to achieve reduction of man-hours in outfitting design and outfitting work at a shipyard, reduction of outfitting cost, shortening of an outfitting period and improvement in degree of outfitting accuracy.

Disclosure of Invention

[0016] In order to resolve the aforementioned problems, the present invention of a steering gear mounting method in the claim 1 is constituted so that:

a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;

this combined body is hung in such a condition that the base plate is loosely fitted into a penetrating hole provided on a steering gear deck, and a rudderstock is so arranged as to be inserted into the center hole of the base plate, through a rudderstock penetrating portion of a stern hull, and the top end of the rudderstock is connected to the steering gear, and thus a gathering body composed of the steering gear, the steering gear foundation, the base plate, the deck seal and the rudderstock is formed;

this gathering body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, and under this condition, position of the gathering body at the part of the base plate is adjusted within the horizontal plane by making the axis of the gathering body align with the axis of a neck bearing provided on the stern hull at a rudderstock penetrating portion, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the gathering body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper; and

this gathering body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and then a rudder blade is fitted to the lower end of the rudderstock.

[0017] In the aforementioned constitution, when the penetrating hole of the steering gear deck is formed within about 10mm larger in diameter than diameter of the base plate, and that thickness of the base plate is made as 40 ~ 60mm against thickness of the steering gear deck, which is 12 ~ 15mm for instance, as the values derived from statistical and experiential analysis, position and axis adjustment of the gathering body composed of the steering gear, the steering gear foundation, the deck seal and the rudderstock are possible, and in spite of movement of the base plate for such position adjustment, the base plate can afford to be welded to the penetrating hole of the steering gear deck.

[0018] Furthermore, the aforementioned thickness of the base plate is sufficient in strength, makes it possible to accommodate the deck seal, and makes strain caused by welding localize so that no influence is exerted on the finalized position and axis of the gathering body composed of the steering gear, the steering gear foundation, the deck seal and the rudderstock.

[0019] Accordingly, thanks to the aforementioned constitution in accordance with the present invention, in which the steering gear, the steering gear foundation, the base plate and the deck seal are connected each other at a land-base factory in advance, with axis adjustment and mutual position adjustment having been already finished with high accuracy, and at a shipyard's outfitting site, fitting position adjustment and axis adjustment are carried out only for a gathering body composed of the steering gear, the steering gear foundation, the base plate, the deck seal and the rudderstock, and that

such position and axis adjustment can be done simply by means of inserting wedges and turning the adjusting screw bolts, man-hours and cost of the outfitting work, which used to be much due to need of position adjustment for every individual member in conventional outfitting work, can be reduced, and that simplification of outfitting work and shortening of an outfitting period can be attained.

[0020] The present invention of a steering gear mounting method in the claim 2 is constituted so that:

> a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
> this combined body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with wedges being inserted into a gap between the base plate and the penetrating hole of the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper; and
> this combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the rudderstock penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and a rudder blade is fitted to the lower end of the rudderstock.

[0021] Thanks to the aforementioned constitution in accordance with the present invention, in which axis adjustment and position adjustment are carried out with respect to the combined body composed of the steering gear, the steering gear foundation, the base plate and the deck seal, prior to wearing the rudderstock, equal effect can be exhibited to that mentioned in the present invention of a steering gear mounting method in the claim 1.

[0022] The present invention of a steering gear mounting method in the claim 3 is constituted so that:

> a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, a steering gear arranged on the steering gear foundation, a neck boss loosely fitted into a penetrating hole of a stern hull, with a neck bearing being interiorly packaged, and a trunk that links the under surface of the base plate with the neck boss are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
> this combined body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck and at the same time the neck boss is loosely fitted into the penetrating hole of the stern hull, and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with wedges being inserted into a gap between the base plate and the penetrating hole of the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper; and
> this combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and at the same time, it is worn to the stern hull, with the outer peripheral face of the neck boss being welded to the peripheral portion of the penetrating hole of the stern hull, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the neck bearing of the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and lastly a rudder blade is fitted to the lower end of the rudderstock.

[0023] Thanks to the aforementioned constitution in accordance with the present invention, in which the steering gear, the steering gear foundation, the base plate, the deck seal, the trunk and the neck boss inclusive of the neck bearing are connected each other at a

land-base factory in advance, with axis adjustment and mutual position adjustment having been already finished with high accuracy, and at a shipyard's outfitting site, fitting position adjustment and axis adjustment are carried out only for a combined body composed of the steering gear, the steering gear foundation, the base plate, the deck seal, the trunk and the neck boss inclusive of the neck bearing, and that such position and axis adjustment can be done simply by means of inserting wedges and turning the adjusting screw bolts, manhours and cost of the outfitting work, which used to be much due to need of position adjustment for every individual member in conventional outfitting work, can be reduced, and that simplification of outfitting work and shortening of an outfitting period can be attained.

[0024] The present invention of a steering gear mounting method in the claim 4 is constituted so that:

a base plate placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
this combined body is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided at nearly equal intervals on the peripheral portion of the deck hole;
or under this condition, a rudderstock is so arranged as to be inserted into the center hole of the base plate, through a rudderstock penetrating portion of a stern hull, and the top end of the rudderstock is connected to the steering gear, and thus a gathering body composed of the steering gear, the steering gear foundation, the base plate, the deck seal and the rudderstock is formed;
position of the combined body or the gathering body at the part of the base plate is adjusted within the horizontal plane, with cotters being inserted in the tangential direction into gaps between the outer peripheral face of the base plate and the projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body or the gathering body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper;
this combined body or gathering body is worn to the steering gear deck, with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and then, in the case of the combined body, a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the penetrating portion of the stern hull, and the top end of the rudderstock is connected to the steering gear; and
a rudder blade is then fitted to the lower end of the rudderstock.

[0025] Thanks to the aforementioned constitution in accordance with the present invention, in which fitting position adjustment and axis adjustment of the combined body composed of the steering gear, the steering gear foundation, the base plate and the deck seal, or the gathering body, in which this combined body wears the rudderstock, in the claim 1 and the claim 2 are carried out by means of inserting the cotters and adjusting the adjusting screw bolts, as a different method, equal effect is exhibited to that mentioned in the present invention of a steering gear mounting method in the claim 1 and the claim 2.

[0026] The present invention of a steering gear mounting method in the claim 5 is constituted so that:

a base plate placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, a steering gear arranged on the steering gear foundation, a neck boss loosely fitted into a penetrating hole of a stern hull, with a neck bearing being interiorly packaged, and a trunk that links the under surface of the base plate with the neck boss are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
this combined body is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided at nearly equal intervals on the peripheral portion of the deck hole and at the same time the neck bush is loosely fitted into the penetrating hole of the stern hull;
and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with cotters being inserted in the tangential direction into gaps between the outer peripheral face of the base plate and the projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction touch to the steering gear deck, and turning the adjusting screw

bolts, and the combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper;

this combined body is worn to the steering gear deck, with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and at the same time, it is worn to the stern hull, with the outer peripheral face of the neck boss being welded to the peripheral portion of the penetrating hole of the stern hull, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the neck bearing of the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear; and

a rudder blade is then fitted to the lower end of the rudderstock.

[0027] Thanks to the aforementioned constitution in accordance with the present invention, in which fitting position adjustment and axis adjustment of the combined body composed of the steering gear, the steering gear foundation, the base plate, the deck seal, the trunk and the neck boss inclusive of the neck bearing in the claim 3 are carried out by means of inserting the cotters and adjusting the adjusting screw bolts, as a different method, equal effect is exhibited to that mentioned in the present invention of a steering gear mounting method in the claim 3.

[0028] The present invention of a steering gear mounting method in the claim 6 is constituted so that:

a remaining combined body, in which a steering gear is temporarily removed from a combined body composed of a base plate, a steering gear foundation, a steering gear and a deck seal, or from a combined body composed of a base plate, a steering gear foundation, a steering gear, a neck boss, a trunk and a deck seal, is in such a condition that the base plate is loosely fitted into a penetrating hole provided on a steering gear deck, or the base plate is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided on a peripheral portion of a deck hole;

position of the remaining combined body at the part of the base plate is adjusted within the horizontal plane, by such a means that the base plate is supported on the steering gear deck through stay members and adjusting screw bolts and wedges are inserted into a gap between the base plate and the penetrating hole of the steering gear deck, or by such a means that the base plate is supported on the steering gear deck through adjusting screw bolts arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction and cotters are inserted in the tangential direction into gaps between the outer peripheral face of the base plate and projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate, or arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction, touch to the steering gear deck, and turning the adjusting screw bolts, and the remaining combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper;

this remaining combined body is worn to the steering gear deck, with the outer peripheral face of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and, in case of the combined body inclusive of the trunk, the remaining combined body is worn to the stem hull additionally, with the outer peripheral face of the neck boss being welded to the peripheral portion of a rudderstock penetrating hole of the stern hull; and

then, the steering gear is worn again onto the steering gear foundation, a rudderstock is so arranged as to be inserted into a center hole of the base plate, through the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and a rudder blade is fitted to the lower end of the rudderstock.

[0029] Thanks to the aforementioned constitution in accordance with the present invention, equal effect is exhibited to that mentioned in the present invention of a steering gear mounting method in the claims 2 ~ 5, and in addition, positioning of the combined body becomes further easy since, by virtue that the steering gear is temporarily removed from the combined body and a center hole of the steering gear foundation in the remaining combined body becomes open, measuring work for putting the axis of the combined body on a proper position against the reference line of the hull can be conducted through the center hole of the steering gear foundation.

[0030] The present invention of a rotary vane steering gear in the claim 7 is constituted so that:

a steering gear wearing a rudderstock, a steering gear foundation arranged under the steering gear so as to support the steering gear, a base plate arranged under the steering gear foundation so as to be loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, or placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, and a deck seal worn into a peripheral portion of a center hole formed in the base plate, which slid-

ingly contacts the rudderstock with water tightness, are assembled in one combined body;
the steering gear is composed of a rotor, to which the rudderstock is fitted, a housing, in which the rotor is accommodated and space for oil chambers is formed in the circumferences of the rotor, and a ring-shaped top cover arranged at an upper opening of the housing, and is so constituted that plural vanes are arranged at equal intervals along circumferential direction on the outer periphery of the rotor, plural segments are arranged at equal intervals along circumferential direction on the inner periphery of the housing, the aforementioned space for oil chambers is divided into plural oil chambers by the vanes and the segments, a lower neck of the rotor is free movably supported by a boss portion of the inner bottom portion of the housing through a radial bearing and a thrust bearing capable of holding whole load acting on the rudderstock in the direction of the axis, an upper neck of the rotor is free movably supported by the ring-shaped top cover through a radial bearing, and a mounting flange is protruded on the lower portion of the outer periphery of the housing;
the steering gear foundation is composed of a mounting plate that is connected to the mounting flange of the steering gear and forms a center hole for penetrating the rudderstock, and a support plate that is connected to the back of the mounting plate and extends downward, and the base plate is connected to the lower end of the support plate, and, in the base plate, stay members of more than three are provided on the peripheral edge of the upper surface of the base plate at nearly equal intervals so as to protrude outward from the peripheral portion, screw holes are penetrated in the upper and lower direction at the protruded end of the stay members, and adjusting screw bolts are screwed in the screw holes, or screw holes of more than three are provided at the peripheral portion of the base plate at nearly equal intervals so as to penetrate in the upper and lower direction, and adjusting screw bolts are screwed in the screw holes; and the combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck.

[0031] Thanks to the aforementioned constitution in accordance with the present invention, in which the steering gear, the steering gear foundation and the base plate are combined in one body at a manufacturing factory in advance, the axes of the steering gear and the steering gear foundation are already aligned each other completely and also their relative position is already settled to a proper position completely, and hence there is no need to provide adjusting liners that used to be conventionally necessitated when they are outfitted separately. Furthermore, at an outfitting site of a shipyard, the steering gear can be outfitted at a proper position on the steering gear deck only by such a single working stroke that this combined body of the steering gear and the steering gear foundation, or the gathering body, in which the rudderstock is worn to the combined body, is fitted to the steering gear deck, with the base plate being welded to the penetrating hole of the steering gear deck, or to the steering gear deck in the peripheral portion of the deck hole, after positioning of the base plate in the upper-and-lower, the fore-and-aft and the port-and-starboard directions and axis adjustment of the base plate against the neck bearing, which supports the rudderstock at the rudderstock penetrating hole of the stern hull, are carried out only by means of inserting wedges or cotters and adjusting the adjusting screw bolts at the base plate.

[0032] By virtue of this, design and manufacturing of a steering gear foundation conventionally carried out by a shipyard, and such work conventionally carried out at an outfitting site as fitting of a steering gear foundation, position adjustment in the upper-and-lower, the fore-and-aft and the port-and-starboard directions and axes adjustment between a steering gear and its foundation by means of adjusting liners, reaming after the position and axes adjustment, and machining of the upper surface of the steering gear foundation for creating a right angle with the axis become unnecessary. As the result, besides that the shipyard is dispensed from design, manufacturing and fitting of the steering gear foundation, the position adjustment and the axis adjustment for the combined body of the steering gear and the steering gear foundation, or the gathering body, in which the rudderstock is worn to the combined body, can be carried out simply by means of insertion of the wedges or cotters and adjustment of the adjusting screw bolts, and thus reduction of man-hours in the outfitting work, reduction of outfitting cost, shortening of an outfitting period and improvement in degree of outfitting accuracy become possible.

[0033] The present invention of a rotary vane steering gear in the claim 8 is constituted so that:

a steering gear wearing a rudderstock, a steering gear foundation arranged under the steering gear so as to support the steering gear, a base plate arranged under the steering gear foundation so as to be loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, or placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a deck seal worn into a peripheral portion of a center hole formed in the base plate, which slidingly contacts the rudderstock with water tightness, a trunk of cylindrical shape arranged under the lower surface of the base plate coaxially, and a neck

boss with a built-in neck bearing connected to the lower end of the trunk are assembled in one combined body;

the steering gear is composed of a rotor, to which the rudderstock is fitted, a housing, in which the rotor is accommodated and space for oil chambers is formed in the circumferences of the rotor, and a ring-shaped top cover arranged at an upper opening of the housing, and is so constituted that plural vanes are arranged at equal intervals along circumferential direction on the outer periphery of the rotor, plural segments are arranged at equal intervals along circumferential direction on the inner periphery of the housing, the aforementioned space for oil chambers is divided into plural oil chambers by the vanes and the segments, a lower neck of the rotor is free movably supported by a boss portion of the inner bottom portion of the housing through a radial bearing and a thrust bearing capable of holding whole load acting on the rudderstock in the direction of the axis, an upper neck of the rotor is free movably supported by the ring-shaped top cover through a radial bearing, and a mounting flange is protruded on the lower portion of the outer periphery of the housing;

the steering gear foundation is composed of a mounting plate that is connected to the mounting flange of the steering gear and forms a center hole for penetrating the rudderstock, and a support plate that is connected to the back of the mounting plate and extends downward, and the base plate is connected to the lower end of the support plate, and, in the base plate, stay members of more than three are provided on the peripheral edge of the upper surface of the base plate at nearly equal intervals so as to protrude outward from the peripheral portion, screw holes are penetrated in the upper and lower direction at the protruded end of the stay members, and adjusting screw bolts are screwed in the screw holes, or screw holes of more than three are provided at the peripheral portion of the base plate at nearly equal intervals so as to penetrate in the upper and lower direction, and adjusting screw bolts are screwed in the screw holes; and

the combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and at the same time, the combined body is worn to a stern hull, with the outer peripheral portion of the neck boss being welded to the peripheral portion of a rudderstock penetrating hole of the stern hull.

[0034] Thanks to the aforementioned constitution in accordance with the present invention, in which the steering gear, the steering gear foundation, the base plate, the trunk and the neck boss with the built-in neck bearing are combined in one body at a manufacturing factory in advance, the axes of these are already aligned each other completely and also their relative position is already settled to a proper position completely, and hence there is no need to provide adjusting liners that used to be conventionally necessitated when they are outfitted separately.

[0035] Furthermore, at an outfitting site of a shipyard, the steering gear and the neck bearing can be outfitted at a proper position, respectively, only by such a single working stroke that the aforementioned combined body or the gathering body, in which the rudderstock is worn to the combined body, is fitted to the steering gear deck and the stern hull, with the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or to the steering gear deck in the peripheral portion of the deck hole, and at the same time, with the outer peripheral face of the neck boss being welded to the peripheral portion of the rudderstock penetrating hole of the stern hull, after adjusting the axis and position of the base plate in the upper-and-lower direction and in the horizontal plane only by means of inserting wedges or cotters and adjusting the adjusting screw bolts at the base plate.

[0036] By virtue of this, design and manufacturing of a steering gear foundation conventionally carried out by a shipyard, and such work conventionally carried out at an outfitting site as fitting of a steering gear foundation, position adjustment in the upper-and-lower, the fore-and-aft and the port-and-starboard directions and axes adjustment between a steering gear and its foundation by means of adjusting liners, reaming after the position and axes adjustment, and machining of the upper surface of the steering gear foundation for creating a right angle with the axis become unnecessary. In addition, such boring machining for the neck bearing, which is incorporated in the neck boss fitted to the rudderstock penetrating hole of the stern hull, that used to be conventionally applied in advance, as to make the axis of the neck bearing align with the axis of the steering gear foundation also becomes unnecessary. As the result of these, besides that the shipyard is dispensed from design, manufacturing and fitting of the steering gear foundation, reduction of man-hours in the outfitting work, reduction of outfitting cost, shortening of an outfitting period and improvement in degree of outfitting accuracy become possible.

(Effect of the Invention)

[0037] In accordance with the present invention as aforementioned, by virtue of such constitution that the steering gear, the steering gear foundation and the base plate, and in addition, the trunk and the neck boss inclusive of the neck bearing, in case that the trunk is equipped, are constituted in one combined body, incor-

porated with the deck seal, in advance at a manufacturing factory, outfitting work at an outfitting site of a shipyard can be finished only with such work that the combined body of the steering gear, the steering gear foundation and the base plate, or the combined body inclusive of the trunk, the neck bearing and the neck boss in addition, or the gathering body, in which the rudderstock is worn to the combined body, is supported on the steering gear deck through the stay members and the adjusting screw bolts of the base plate, in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, or in the condition that the base plate is placed on the peripheral portion of the deck hole formed on the steering gear deck, and its position in the upper-and-lower, the fore-and-aft and the port-and-starboard directions and its axis are adjusted simply by means of inserting wedges at the part of the base plate and adjusting the adjusting screw bolts, or inserting cotters in the tangential direction of the outer peripheral face at the part of the base plate and adjusting the adjusting screw bolts arranged at the peripheral portion of the base plate, and then the base plate of the combined body is welded to the penetrating hole of the steering gear deck, or to the steering gear deck, and the neck boss of the combined body is welded to the penetrating hole of the stern hull. Accordingly, such work conventionally necessitated at a shipyard and its outfitting site as design, manufacturing and fitting of a steering gear foundation; machining of the upper surface of a steering gear foundation for creating a right angle with the axis; position adjustment, axis alignment and reaming between a steering gear and its foundation; and furthermore, fitting of a water seal to a steering gear deck after aligning; becomes unnecessary, and such excellent effect as reduction of man-hours in the outfitting design and outfitting work at a shipyard, reduction of outfitting cost, shortening of an outfitting period and remarkable improvement in degree of outfitting accuracy can be exhibited.

Brief Description of Drawings

[0038]

Fig. 1 shows a partially sectioned front view of a rotary vane steering gear in accordance with the mode for carrying out the present invention;
Fig. 2 shows a plane view of a section seen along the arrows m - m in Fig 1;
Fig. 3 shows an explanatory drawing showing process of fitting work of a combined body composed of a rotary vane steering gear, a steering gear foundation and a base plate, a rudderstock and a rudder blade, in accordance with the mode for carrying out the present invention;
Fig. 4 shows a partially sectioned front view of a rotary vane steering gear in accordance with other mode for carrying out the present invention;
Fig. 5 shows an explanatory drawing showing process of fitting work of a combined body composed of a rotary vane steering gear, a steering gear foundation, a base plate, a trunk and a neck boss, a rudderstock and a rudder blade, in accordance with the same other mode for carrying out the present invention;
Fig. 6 shows a partially sectioned front view of a rotary vane steering gear in accordance with further other mode for carrying out the present invention;
Fig. 7 shows a plane view of a section seen along the arrows n - n in Fig 6;
Fig. 8 shows a partially sectioned front view of a rotary vane steering gear in accordance with further other mode for carrying out the present invention;
Fig. 9 shows a partially sectioned front view of a conventional rotary vane steering gear and its foundation;
Fig. 10 shows a sectional plane view of the same conventional rotary vane steering gear;
Fig. 11 shows a sectional front view showing constitution of a hydraulic nut of the same conventional rotary vane steering gear; and
Fig. 12 shows an explanatory drawing showing process of conventional fitting work of a rotary vane steering gear, a foundation, a rudderstock and a rudder blade.

The Best Mode for Carrying out the Invention

[0039] The mode for carrying out the present invention is described and illustrated below with reference to the accompanying drawings. Regarding the members that basically act similar action to the arts explained in Fig. 9 ~ Fig. 10 and Fig. 12, explanation is omitted, with the same numbers being affixed.

[0040] In Fig. 1 ~ Fig. 2, a steering gear foundation 51 oppositely provided to the under surface of a mounting flange 2b of a rotary vane steering gear 1 consists of a mounting plate 52 forming a center hole 52a for penetrating a rudderstock 10, and a support plate 53 welded to the under surface of the mounting plate 52 so as to extend downward. A base plate 54 welded to a lower end of the support plate 53 is so constituted that a center hole 54 for penetrating the rudderstock 10 is provided, an outer periphery is formed in a circle having prescribed diameter, 4 stay members 54b are provided on the peripheral edge of the upper surface of the base plate 54 at nearly equal intervals so as to protrude outward from the peripheral portion, screw holes 54c are penetrated in the upper and lower direction at the protruded end of the respective stay members 54b, and adjusting screw bolts 54d are screwed in the respective screw holes 54c.

[0041] The steering gear 1 touches the mounting plate 52 of the steering gear foundation 51 at the mounting flange 2b, and the steering gear 1 and the steering gear foundation 51 are fixed each other by such a con-

necting means as, for instance, reamer bolts 16b. Any other connecting means serves the purpose if whole force acting on the steering gear 1 and the rudderstock 10 in the upper-and-lower, the fore-and-aft, the port-and-starboard directions and the turning direction can be transmitted to the steering gear foundation 51.

[0042] The base plate 54 of the steering gear foundation 51 is arranged so as to be loosely fitted into a penetrating hole 55 made on a steering gear deck 11, and that it is so arranged that a pitch circle of the aforementioned adjusting screw bolts 54d of the stay members 54b lies outside the penetrating hole 55, and the base plate 54 is fitted to the steering gear deck 11, with the peripheral edge end of the base plate 54 being welded to the peripheral portion of the penetrating hole 55.

[0043] A circular recess 56 is provided on the upper surface of the base plate 54 of the steering gear foundation 51 coaxially with the center hole 54a, a deck seal 57 of ring shape is worn into the circular recess 56, and the deck seal 57 made of elastic material seals a clearance between the center hole 54a and the rudderstock 10. This deck seal 57 is so constituted that the under surface and the outer side of an outer ring portion 57a touch the bottom surface and the side of the circular recess 56, respectively, and a circular lip portion 57b slidingly contacts the periphery of the rudderstock 10, in such form that the circular lip portion 57b protrudes from a top portion of the outer ring portion 57a in the radial direction inside, and then bends downward. The deck seal 57 is worn to the base plate 54 in such a manner that a ring plate 58 is fitted to the base plate 54 of the steering gear foundation 51 by bolts 58a so as to press down the top surface of the deck seal 57. Furthermore, a work opening 59 is provided at the support plate 53 of the steering gear foundation 51 so as to make it possible on the steering gear deck 11 to conduct inspection and maintenance work for the deck seal 57.

[0044] Function in the aforementioned constitution is described in the following: At a steering gear manufacturing factory, the steering gear 1, the steering gear foundation 51 and the base plate 54 are assembled in one combined body in advance by means of reamer bolts, etc. after their relative positions are determined, and the deck seal 57 is worn to the base plate 54.

[0045] Thanks to this, the axes of these members are completely aligned and their relative positions are made completely proper, and hence there is no need to provide adjusting liners that used to be conventionally necessitated when they are outfitted separately.

[0046] At an outfitting site of a shipyard, as shown in Fig. 3, the combined body of the steering gear 1, the steering gear foundation 51 and the base plate 54 is supported on the steering gear deck 11 through the stay members 54b and the adjusting screw bolts 54d of the base plate 54 in the condition that the base plate 54 is loosely fitted into the penetrating hole 55 of the steering gear deck 11.

[0047] Next, the rudderstock 10 is inserted from the lower part of a stern hull 13 into a neck bearing 14, the center hole 54a of the base plate 54 and the deck seal 57, and lifted until its top end 10a is inserted into a rudderstock fitting hole 3c of a rotor 3 of the steering gear 1.

[0048] A hydraulic nut 17 is worn to the rudderstock top end 10a, and the top end of the rudderstock 10 is united to the steering gear rotor 3 by hydraulic pressure, etc. similarly to the conventional technology. Position of this gathering body of the steering gear 1, the steering gear foundation 51, the base plate 54, the deck seal 57 and the rudderstock 10 is so adjusted that relative position of the rudderstock 10 in the upper and lower direction (perpendicular direction) at the penetrating portion of the neck bearing 14 becomes proper, and a gap between the inside of the neck bearing 14 and the rudderstock 10 becomes equal in the fore-and-aft and the port-and-starboard directions (horizontal direction).

[0049] For the sake of this, position of the gathering body is determined in such a manner that position of the base plate 54 within the horizontal plane is adjusted by means of inserting wedges 54e into a gap between the base plate 54 and the penetrating hole 55 of the steering gear deck 11, and at the same time, inclination and position of the base plate 54 in the perpendicular direction are adjusted by means of making the tips of the adjusting screw bolts 54d arranged at the stay members 54b of the base plate 54 touch the steering gear deck 11, and turning the adjusting screw bolts 54d.

[0050] Under this condition, welding is applied between the outer periphery of the base plate 54 and the periphery of the penetrating hole 55 of the steering gear deck 11. Work at the outfitting site is finished, with a rudder blade 18 being fitted to the lower end of the rudderstock 10.

[0051] In the aforementioned constitution, when the penetrating hole 55 of the steering gear deck 11 is formed within about 10mm larger in diameter than diameter of the base plate 54, and that thickness of the base plate 54 is made as 40 ~ 60mm against thickness of the steering gear deck 11 of 12 ~ 15mm, according to statistical and experiential analysis, position and axis adjustment of the gathering body composed of the steering gear 1, the steering gear foundation 51, the base plate 54, the deck seal 57 and the rudderstock 10 are possible, and in spite of movement of the base plate 54 for such position adjustment, the outer periphery of the base plate 54 can afford to be welded to the periphery of the penetrating hole 55 of the steering gear deck 11.

[0052] Furthermore, the aforementioned thickness of the base plate 54 is sufficient in strength, makes it possible to accommodate the deck seal 57, and makes strain caused by welding localize so that no influence is exerted on the finalized position and axis of the gathering body composed of the steering gear 1, the steering gear foundation 51, the base plate 54, the deck seal 57 and the rudderstock 10.

[0053] Furthermore, instead of conducting the posi-

tion adjustment and the axis adjustment on the gathering body uniting the combined body, which is composed of the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57, with the rudderstock 10, as aforementioned, it is also possible that position adjustment and axis adjustment are conducted on the combined body composed of the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57, prior to connecting the rudderstock 10.

[0054] In this case, the combined body composed of the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57 is supported on the steering gear deck 11 through the stay members 54b and the adjusting screw bolts 54d of the base plate 54 in the condition that the base plate 54 is loosely fitted into the penetrating hole 55 of the steering gear deck 11, and under this condition, position of the combined body at the part of the base plate 54 is adjusted within the horizontal plane and in the perpendicular direction as well as for inclination, using the wedges 54e and the adjusting screw bolts 54d in the same manner as aforementioned, so that the axis of the rudderstock fitting hole 3c of the rotor 3 of the steering gear 1 aligns with the axis of the neck bearing 14, and position in the upper and lower direction becomes proper, and at the thus determined position, the outer periphery of the base plate 54 is welded to the periphery of the penetrating hole 55 of the steering gear deck 11.

[0055] After this, the rudderstock 10 is lifted from the lower part of the stem hull 13 through the neck bearing 14, the top end of the rudderstock 10 is connected to the steering gear rotor 3, and the rudder blade 18 is fitted to the lower end of the rudderstock 10 with the same procedure as aforementioned.

[0056] Fig. 4 ~ Fig. 5 show another mode for carrying out the present invention, in which additional constitution is given to the constitution of the aforementioned mode for carrying out the present invention, and, regarding the members that basically act similar action to the arts explained in the aforementioned mode for carrying out the present invention, explanation is omitted, with the same numbers being affixed.

[0057] In Fig. 4, a trunk 60 of cylindrical shape is arranged under a base plate 54 co-axially, and a neck boss 15 that interiorly packages a neck bearing 14, which radially supports a rudderstock 10 at a part of a rudderstock penetrating hole 13a provided on a stern hull, is arranged at a lower end of the trunk 60. The trunk 60 is fitted, with its upper end portion being linked with the under surface of the base plate 54, and with its lower end portion being linked with the upper end of the neck boss 15, and with the outer periphery of the neck boss 15 being welded to the periphery of the rudderstock penetrating hole 13a of the stern hull.

[0058] Function in the aforementioned constitution is described in the following: At a steering gear manufacturing factory, the steering gear 1, the steering gear foundation 51, the base plate 54, the trunk 60 and the neck boss 15 interiorly packaging the neck bearing are assembled in one combined body in advance by means of welding and reamer bolts, etc. after their relative positions are determined in the upper-and-lower direction, and in the fore-and-aft and the port-and-starboard directions, and their axes are aligned, and then the deck seal 57 is worn to the base plate 54. Thanks to this, there is no need to provide adjusting liners that used to be conventionally necessitated when they are outfitted separately.

[0059] At an outfitting site of a shipyard, as shown in Fig. 5, the combined body of the steering gear 1, the steering gear foundation 51, the base plate 54, the trunk 60 and the neck boss 15 interiorly packaging the neck bearing 14 is supported on a steering gear deck 11 through stay members 54b and adjusting screw bolts 54d of the base plate 54 in the condition that the base plate 54 is loosely fitted into the penetrating hole 55 of the steering gear deck 11, and the neck boss 15 is loosely fitted into the rudderstock penetrating hole 13a of the stem hull 13.

[0060] Under this condition, position adjustment at the part of the base plate 54 within the horizontal plane, and in the perpendicular direction, and inclination adjustment are conducted by means of wedges 54e and the adjusting screw bolts 54d with the same procedure as aforementioned, so that relative position of the combined body to the hull in the upper-and-lower direction, and in the fore-and-aft and the port-and-starboard directions and axis become proper, and then, at the thus determined position, welding is applied between the outer periphery of the base plate 54 and the periphery of the penetrating hole 55 of the steering gear deck 11, and between the outer periphery of the neck boss 15 and the periphery of the rudderstock penetrating hole 13a of the stern hull 13.

[0061] Next, the rudderstock 10 is lifted from the lower part of the neck bearing 14 provided at the rudderstock penetrating hole of the stern hull 13 through a center hole 54a of the base plate 54 and the deck seal 57 until its top end 10a is inserted into the rudderstock fitting hole 3c of the rotor 3 of the steering gear 1. After that, the top end of the rudderstock 10 is connected to the rotor 3 of the steering gear by means of a hydraulic nut 17 with the same procedure as aforementioned. Finally with a rudder blade 18 being fitted to the lower end of the rudderstock 10, work at the outfitting site is finished.

[0062] In this context, it is also possible to comply with such procedure that, under a condition that the aforementioned combined body is supported on the steering gear deck 11 through the stay members 54b and the adjusting screw bolts 54d of the base plate 54, with the base plate 54 being loosely fitted into the penetrating hole 55 of the steering gear deck 11, and the neck boss 15 being loosely fitted into the rudderstock penetrating hole 13a of the stern hull 13, the rudderstock 10 is first connected to the combined body, and position adjustment is conducted for a gathering body, in which this

combined body wears the rudderstock 10, and then the gathering body is welded to the hull at the parts of the base plate 54 and the neck boss 15.

[0063] Furthermore, it is also possible to comply with such procedure that, after the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57 are assembled in advance in one combined body, or in one combined body, in which the neck boss 15 interiorly packaging the neck bearing 14 and the trunk 60 linking the base plate 54 with the neck boss 15 are added to this combined body, the steering gear 1 is temporarily removed at the shipyard's outfitting site; the remaining combined body is supported on the steering gear deck 11 through the stay members 54b and the adjusting screw bolts 54d of the base plate 54; under this condition, positioning of the remaining combined body is conducted, using the stay members 54b and the adjusting screw bolts 54d of the base plate, with the same procedure as aforementioned; the remaining combined body is welded to the hull at the part of the base plate 54, or at both parts of the base plate 54 and the neck boss 15; after that, the steering gear 1 is worn again; and the rudderstock 10 is connected to the steering gear 1.

[0064] In this case, positioning work becomes further easy, since, with the steering gear 1 being temporarily removed from the combined body, the center hole 52a of the mounting plate in the remaining combined body becomes open, and measuring work for making the axis of the remaining combined body align with the axis of the neck bearing 14 provided on the rudderstock penetrating hole 13a of the stern hull 13, or for placing it on a proper position against the reference line of the hull can be conducted through the center hole 52a. In this context, it is not necessitated, on the occasion that the steering gear is removed and worn again at the outfitting site of the shipyard, to conduct re-positioning for the steering gear 1, since it has already been accurately positioned by means of reamer bolts, etc. against the combined body in advance at the factory.

[0065] Fig. 6 ~ Fig. 8 show further other mode for carrying out the present invention, in which a different means is offered, from the mode for carrying out the present invention afore-explained based on Fig. 1 ~ Fig. 5, for conducting position adjustment and axis adjustment of the combined body of the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57, or the gathering body, in which the rudderstock 10 is worn to this, or the combined body of the steering gear 1, the steering gear foundation 51, the base plate 54, the deck seal 57, the trunk 60 and the neck boss 15 inclusive of the neck bearing 14, at the part of the base plate 54, respectively. Regarding the members that act similar action to the arts explained in the aforementioned mode for carrying out the present invention, explanation is omitted, with the same numbers being affixed.

[0066] In Fig. 6 ~ Fig. 7, 4 screw holes 54f are provided at a peripheral portion of the base plate 54 so as to be nearly at equal intervals on their pitch circle and penetrate in the upper and lower direction, and adjusting screw bolts 54g are screwed into the screw holes 54f, respectively. A deck hole 61 having smaller diameter than that of the pitch circle of the respective screw holes 54f of the base plate 54 is provided on the steering gear deck 11, and the base plate 54 is placed on the deck at the peripheral portion of the deck hole 61. 4 projections 62 are fixedly provided on the steering gear deck 11 at locations around the outer periphery of the base plate 54, so as to create some loose gaps against the outer periphery of the base plate 54, at nearly equal intervals in the peripheral direction, and cotters 63 are inserted into the gaps between the respective projections 62 and the outer periphery of the base plate 54.

[0067] Function in the aforementioned constitution is described in the following: The combined body unified with the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57, which has already been finished with respective position adjustment and axis adjustment in advance at the steering gear manufacturing factory, is placed on the deck at the peripheral portion of the deck hole 61 at the outfitting site of the shipyard, under a condition that the base plate 54 is loosely fitted inside the projections 62 on the steering gear deck 11.

[0068] Position of this combined body is settled in such a manner that, in order to make its axis align with the axis of the neck bearing 14 shown in Fig. 3, and make its relative position in the upper and lower direction proper, position adjustment at the part of the base plate 54 within the horizontal plane is conducted by means of inserting the cotters 63 into the gaps between the projections 62 provided on the steering gear deck 11 and the outer periphery of the base plate 54, and at the same time, inclination and position in the vertical direction at the part of the base plate 54 are adjusted by means of making the tips of the adjusting screw bolts 54g touch to the steering gear deck 11 and turning the adjusting screw bolts 54g.

[0069] Under this condition, the combined body is worn to the steering gear deck 11, with the lower edge end of the outer periphery of the base plate 54 being welded to the steering gear deck 11.

[0070] Fig. 8 shows constitution of the case where the means of the position adjustment and the axis adjustment as well as wearing to the steering gear deck 11 shown in Fig. 6 ~ Fig. 7 is applied to the combined body, in which the combined body of the steering gear 1, the steering gear foundation 51, the base plate 54 and the deck seal 57 is unified with the trunk 60 and the neck boss 15 inclusive of the neck bearing 14. As it exhibits similar function and effect, explanation is omitted, with the same numbers being affixed to the members.

Claims

1. A steering gear mounting method **characterized in that**:

   a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
   this combined body is hung in such a condition that the base plate is loosely fitted into a penetrating hole provided on a steering gear deck, and a rudderstock is so arranged as to be inserted into the center hole of the base plate, through a rudderstock penetrating portion of a stern hull, and the top end of the rudderstock is connected to the steering gear, and thus a gathering body composed of the steering gear, the steering gear foundation, the base plate, the deck seal and the rudderstock is formed;
   this gathering body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, and under this condition, position of the gathering body at the part of the base plate is adjusted within the horizontal plane by making the axis of the gathering body align with the axis of a neck bearing provided on the stern hull at a rudderstock penetrating portion, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the gathering body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper; and
   this gathering body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and then a rudder blade is fitted to the lower end of the rudderstock.

2. A steering gear mounting method **characterized in that**:

   a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
   this combined body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with wedges being inserted into a gap between the base plate and the penetrating hole of the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper; and
   this combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the rudderstock penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and a rudder blade is fitted to the lower end of the rudderstock.

3. A steering gear mounting method **characterized in that**:

   a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
   this combined body is supported on the steer-

ing gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck, and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with wedges being inserted into a gap between the base plate and the penetrating hole of the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper; and

this combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the rudderstock penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and a rudder blade is fitted to the lower end of the rudderstock.

4. A steering gear mounting method **characterized in that**:

a base plate loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, a steering gear arranged on the steering gear foundation, a neck boss loosely fitted into a penetrating hole of a stern hull, with a neck bearing being interiorly packaged, and a trunk that links the under surface of the base plate with the neck boss are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;

this combined body is supported on the steering gear deck through stay members and adjusting screw bolts of the base plate in the condition that the base plate is loosely fitted into the penetrating hole of the steering gear deck and at the same time the neck boss is loosely fitted into the penetrating hole of the stern hull, and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with wedges being inserted into a gap between the base plate and the penetrating hole of the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper; and

this combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, and at the same time, it is worn to the stern hull, with the outer peripheral face of the neck boss being welded to the peripheral portion of the penetrating hole of the stern hull, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the neck bearing of the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and lastly a rudder blade is fitted to the lower end of the rudderstock.

5. A steering gear mounting method **characterized in that**:

a base plate placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, and a steering gear arranged on the steering gear foundation are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;

this combined body is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided at nearly equal intervals on the peripheral portion of the deck hole;

or under this condition, a rudderstock is so arranged as to be inserted into the center hole of the base plate, through a rudderstock penetrating portion of a stern hull, and the top end of the rudderstock is connected to the steering gear, and thus a gathering body composed of the steering gear, the steering gear foundation, the base plate, the deck seal and the rudderstock is formed;

position of the combined body or the gathering

body at the part of the base plate is adjusted within the horizontal plane, with cotters being inserted in the tangential direction into gaps between the outer peripheral face of the base plate and the projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body or the gathering body is so maintained that its axis aligns with the axis of the neck bearing arranged at the rudderstock penetrating portion of the stern hull, and its position in the upper and lower direction becomes proper;
this combined body or gathering body is worn to the steering gear deck, with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and then, in the case of the combined body, a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the penetrating portion of the stern hull, and the top end of the rudderstock is connected to the steering gear; and
a rudder blade is then fitted to the lower end of the rudderstock.

6. A steering gear mounting method **characterized in that**:

a base plate placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a steering gear foundation arranged on the base plate, a steering gear arranged on the steering gear foundation, a neck boss loosely fitted into a penetrating hole of a stern hull, with a neck bearing being interiorly packaged, and a trunk that links the under surface of the base plate with the neck boss are assembled in one combined body in advance, and at the same time, a deck seal, which will slidingly contact a rudderstock with water tightness, is worn into a peripheral portion of a center hole formed in the base plate;
this combined body is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided at nearly equal intervals on the peripheral portion of the deck hole and at the same time the neck bush is loosely fitted into the penetrating hole of the stern hull;
and under this condition, position of the combined body at the part of the base plate is adjusted within the horizontal plane, with cotters being inserted in the tangential direction into gaps between the outer peripheral face of the base plate and the projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted-by making the tips of the adjusting screw bolts arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction touch to the steering gear deck, and turning the adjusting screw bolts, and the combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper;
this combined body is worn to the steering gear deck, with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and at the same time, it is worn to the stern hull, with the outer peripheral face of the neck boss being welded to the peripheral portion of the penetrating hole of the stern hull, and then a rudderstock is so arranged as to be inserted into the center hole of the base plate, through the neck bearing of the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear; and
a rudder blade is then fitted to the lower end of the rudderstock.

7. A steering gear mounting method **characterized in that**:

a remaining combined body, in which a steering gear is temporarily removed from a combined body composed of a base plate, a steering gear foundation, a steering gear and a deck seal, or from a combined body composed of a base plate, a steering gear foundation, a steering gear, a neck boss, a trunk and a deck seal, is in such a condition that the base plate is loosely fitted into a penetrating hole provided on a steering gear deck, or the base plate is placed on the steering gear deck in the condition that the base plate is loosely fitted into inner peripheral faces of projections provided on a peripheral portion of a deck hole;
position of the remaining combined body at the part of the base plate is adjusted within the horizontal plane, by such a means that the base plate is supported on the steering gear deck through stay members and adjusting screw bolts and wedges are inserted into a gap between the base plate and the penetrating hole of the steering gear deck, or by such a means that the base plate is supported on the steering gear deck through adjusting screw bolts arranged at the peripheral portion of the base

plate so as to penetrate in the upper and lower direction and cotters are inserted in the tangential direction into gaps between the outer peripheral face of the base plate and projections provided on the steering gear deck, and at the same time, inclination and position in the vertical direction at the part of the base plate are adjusted by making the tips of the adjusting screw bolts arranged on the stay members of the base plate, or arranged at the peripheral portion of the base plate so as to penetrate in the upper and lower direction, touch to the steering gear deck, and turning the adjusting screw bolts, and the remaining combined body is so maintained that its position in the direction of the axis and in the upper and lower direction becomes proper;

this remaining combined body is worn to the steering gear deck, with the outer peripheral face of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and, in case of the combined body inclusive of the trunk, the remaining combined body is worn to the stern hull additionally, with the outer peripheral face of the neck boss being welded to the peripheral portion of a rudderstock penetrating hole of the stern hull; and

then, the steering gear is worn again onto the steering gear foundation, a rudderstock is so arranged as to be inserted into a center hole of the base plate, through the penetrating portion of the stern hull, the top end of the rudderstock is connected to the steering gear, and a rudder blade is fitted to the lower end of the rudderstock.

8. A rotary vane steering gear **characterized in that**:

a steering gear wearing a rudderstock, a steering gear foundation arranged under the steering gear so as to support the steering gear, a base plate arranged under the steering gear foundation so as to be loosely fitted into a penetrating hole having prescribed diameter formed on a steering gear deck, or placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, and a deck seal worn into a peripheral portion of a center hole formed in the base plate, which slidingly contacts the rudderstock with water tightness, are assembled in one combined body;

the steering gear is composed of a rotor, to which the rudderstock is fitted, a housing, in which the rotor is accommodated and space for oil chambers is formed in the circumferences of the rotor, and a ring-shaped top cover arranged at an upper opening of the housing, and is so constituted that plural vanes are arranged at equal intervals along circumferential direction on the outer periphery of the rotor, plural segments are arranged at equal intervals along circumferential direction on the inner periphery of the housing, the aforementioned space for oil chambers is divided into plural oil chambers by the vanes and the segments, a lower neck of the rotor is free movably supported by a boss portion of the inner bottom portion of the housing through a radial bearing and a thrust bearing capable of holding whole load acting on the rudderstock in the direction of the axis, an upper neck of the rotor is free movably supported by the ring-shaped top cover through a radial bearing, and a mounting flange is protruded on the lower portion of the outer periphery of the housing;

the steering gear foundation is composed of a mounting plate that is connected to the mounting flange of the steering gear and forms a center hole for penetrating the rudderstock, and a support plate that is connected to the back of the mounting plate and extends downward, and the base plate is connected to the lower end of the support plate, and, in the base plate, stay members of more than three are provided on the peripheral edge of the upper surface of the base plate at nearly equal intervals so as to protrude outward from the peripheral portion, screw holes are penetrated in the upper and lower direction at the protruded end of the stay members, and adjusting screw bolts are screwed in the screw holes, or screw holes of more than three are provided at the peripheral portion of the base plate at nearly equal intervals so as to penetrate in the upper and lower direction, and adjusting screw bolts are screwed in the screw holes; and

the combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck.

9. A rotary vane steering gear **characterized in that**:

a steering gear wearing a rudderstock, a steering gear foundation arranged under the steering gear so as to support the steering gear, a base plate arranged under the steering gear foundation so as to be loosely fitted into a penetrating hole having prescribed diameter

formed on a steering gear deck, or placed on a peripheral portion of a deck hole having prescribed diameter formed on a steering gear deck, a deck seal worn into a peripheral portion of a center hole formed in the base plate, which slidingly contacts the rudderstock with water tightness, a trunk of cylindrical shape arranged under the lower surface of the base plate coaxially, and a neck boss with a built-in neck bearing connected to the lower end of the trunk are assembled in one combined body;

the steering gear is composed of a rotor, to which the rudderstock is fitted, a housing, in which the rotor is accommodated and space for oil chambers is formed in the circumferences of the rotor, and a ring-shaped top cover arranged at an upper opening of the housing, and is so constituted that plural vanes are arranged at equal intervals along circumferential direction on the outer periphery of the rotor, plural segments are arranged at equal intervals along circumferential direction on the inner periphery of the housing, the aforementioned space for oil chambers is divided into plural oil chambers by the vanes and the segments, a lower neck of the rotor is free movably supported by a boss portion of the inner bottom portion of the housing through a radial bearing and a thrust bearing capable of holding whole load acting on the rudderstock in the direction of the axis, an upper neck of the rotor is free movably supported by the ring-shaped top cover through a radial bearing, and a mounting flange is protruded on the lower portion of the outer-periphery of the housing;

the steering gear foundation is composed of a mounting plate that is connected to the mounting flange of the steering gear and forms a center hole for penetrating the rudderstock, and a support plate that is connected to the back of the mounting plate and extends downward, and the base plate is connected to the lower end of the support plate, and, in the base plate, stay members of more than three are provided on the peripheral edge of the upper surface of the base plate at nearly equal intervals so as to protrude outward from the peripheral portion, screw holes are penetrated in the upper and lower direction at the protruded end of the stay members, and adjusting screw bolts are screwed in the screw holes, or screw holes of more than three are provided at the peripheral portion of the base plate at nearly equal intervals so as to penetrate in the upper and lower direction, and adjusting screw bolts are screwed in the screw holes; and

the combined body is worn to the steering gear deck, with the outer peripheral portion of the base plate being welded to the peripheral portion of the penetrating hole of the steering gear deck, or with the lower edge end of the outer periphery of the base plate being welded to the steering gear deck, and at the same time, the combined body is worn to a stern hull, with the outer peripheral portion of the neck boss being welded to the peripheral portion of a rudderstock penetrating hole of the stern hull.

FIG.1

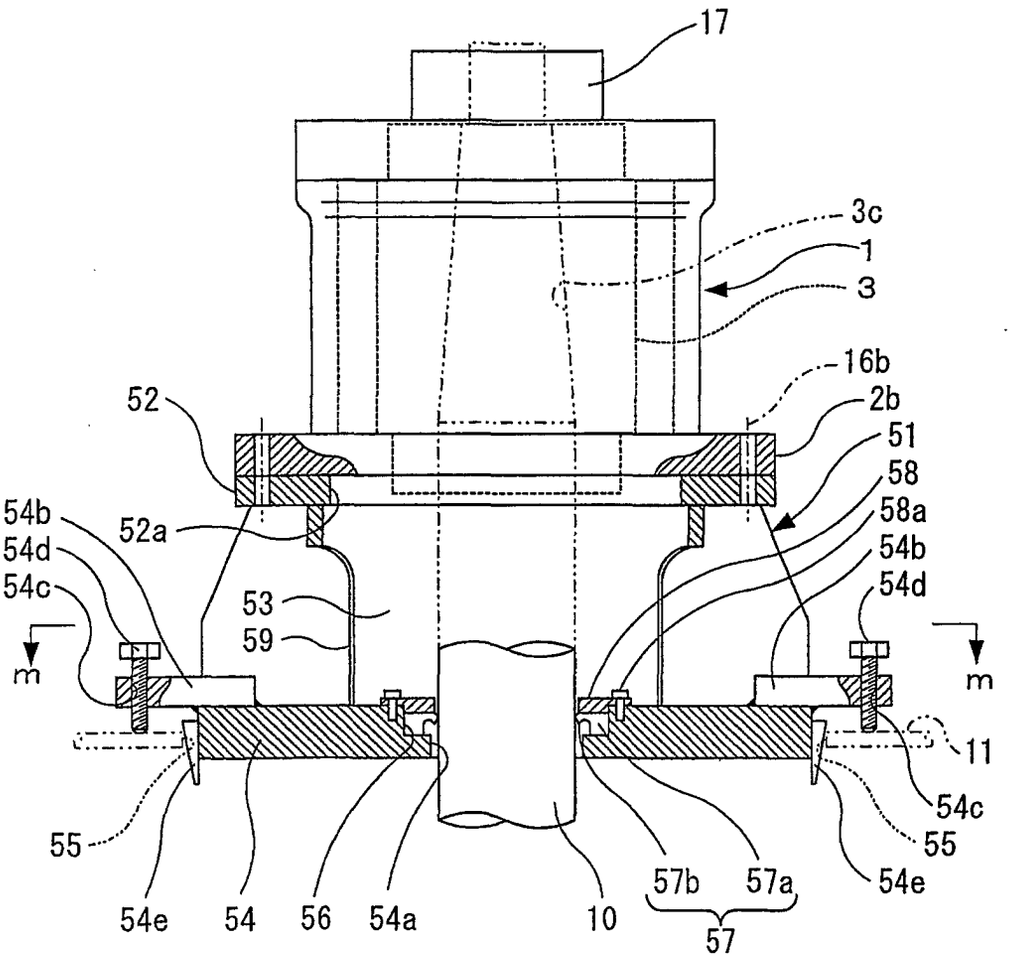
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FIG. 2

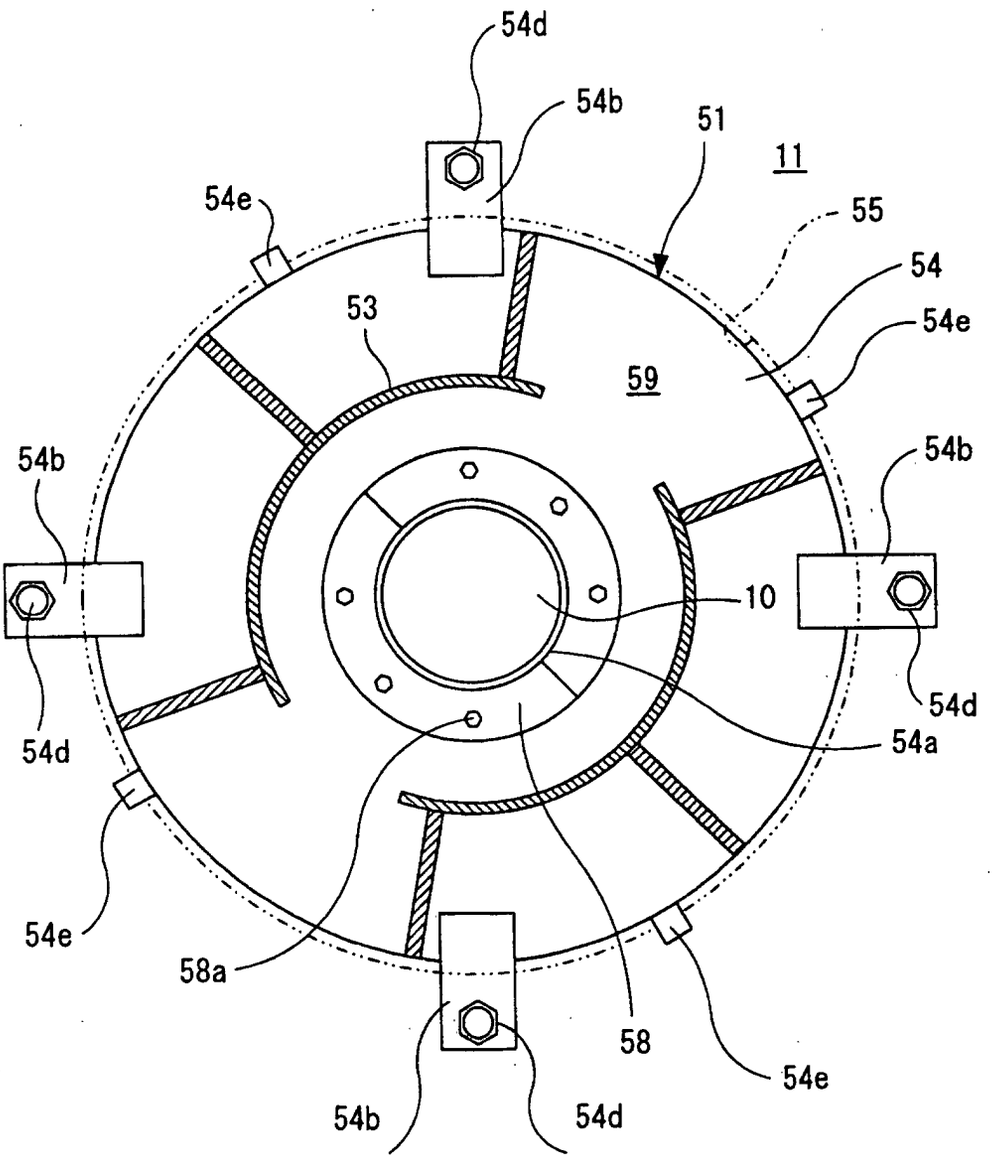
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FIG. 3

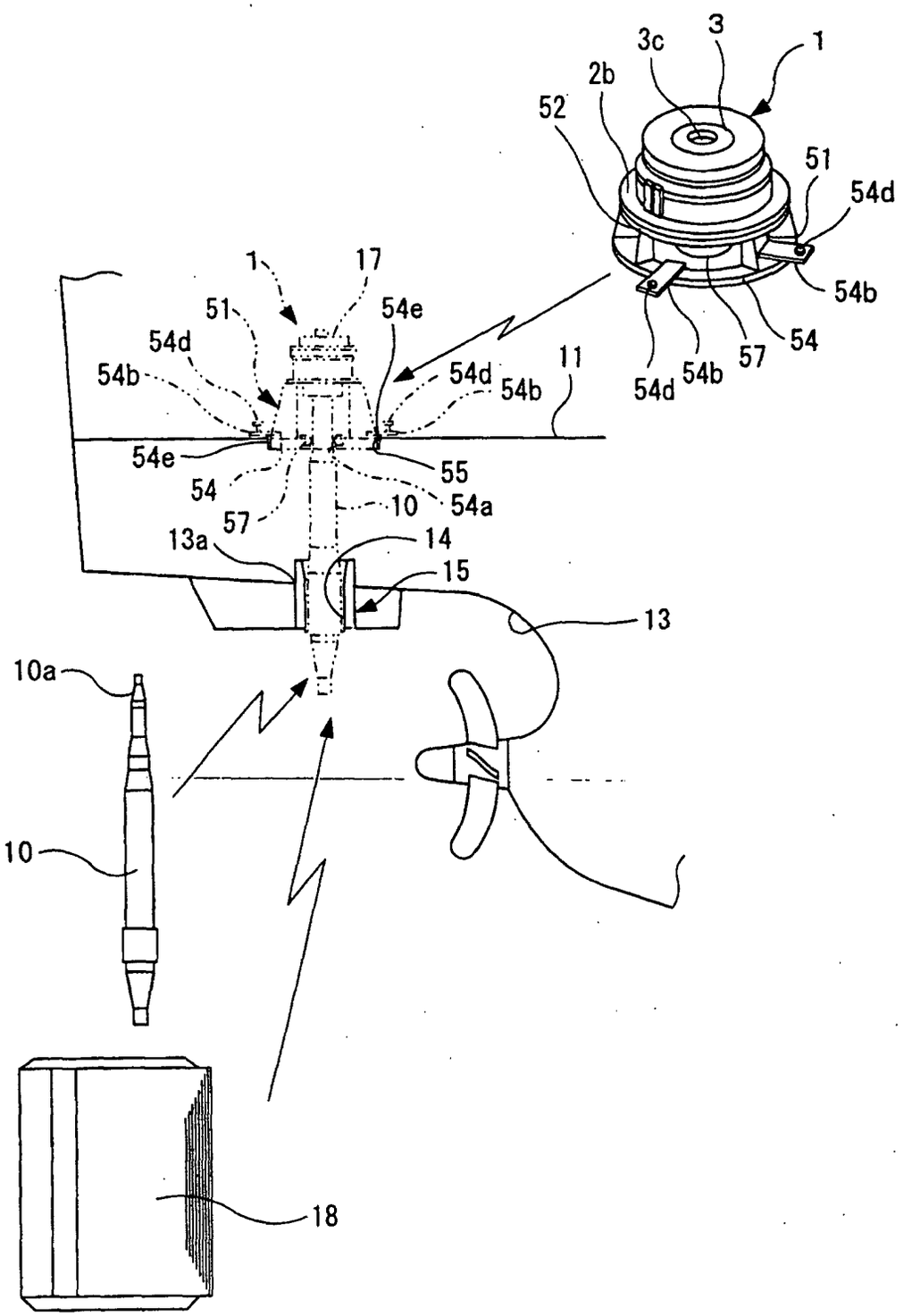
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FIG. 4

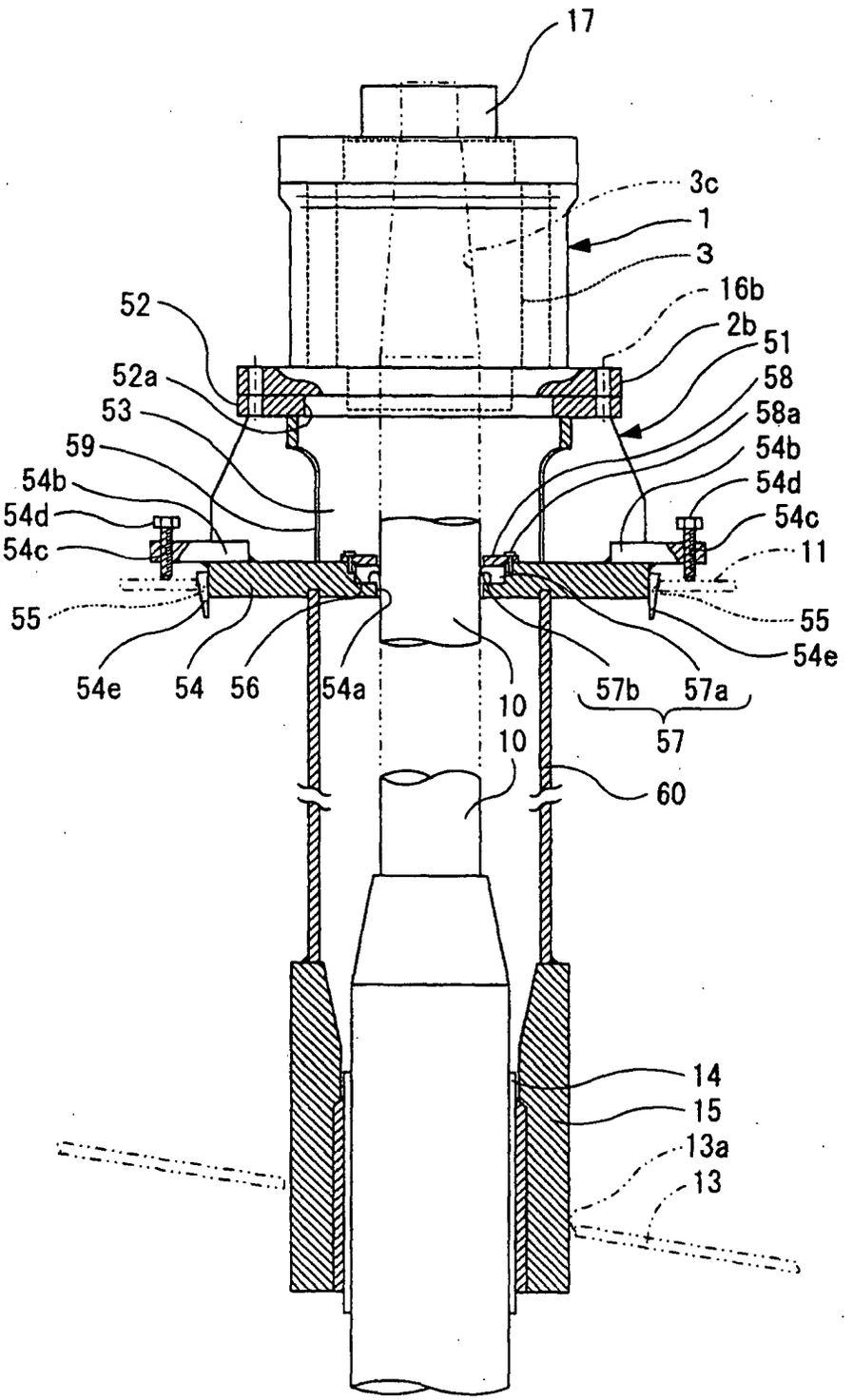
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FIG. 5

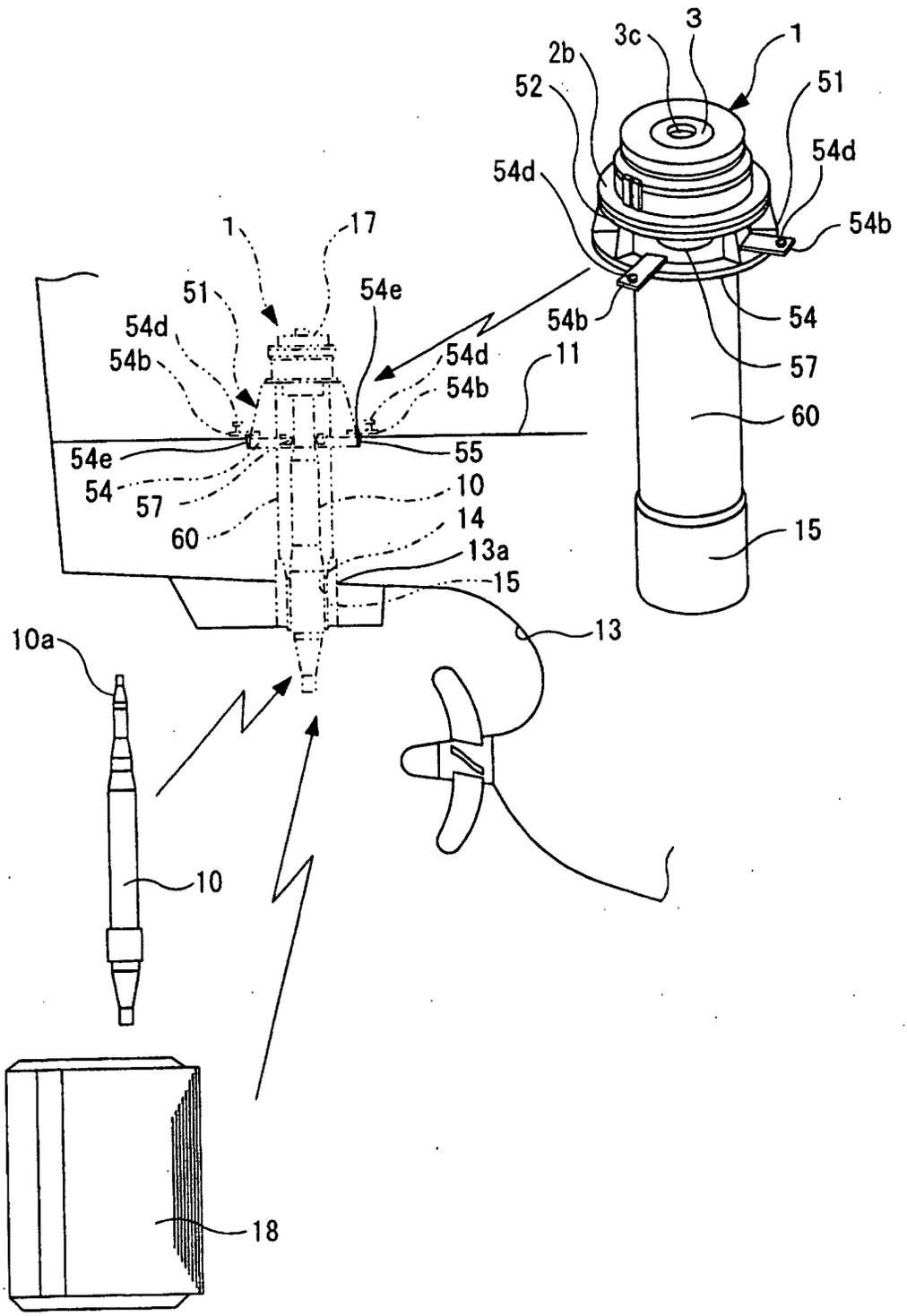
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FIG. 6

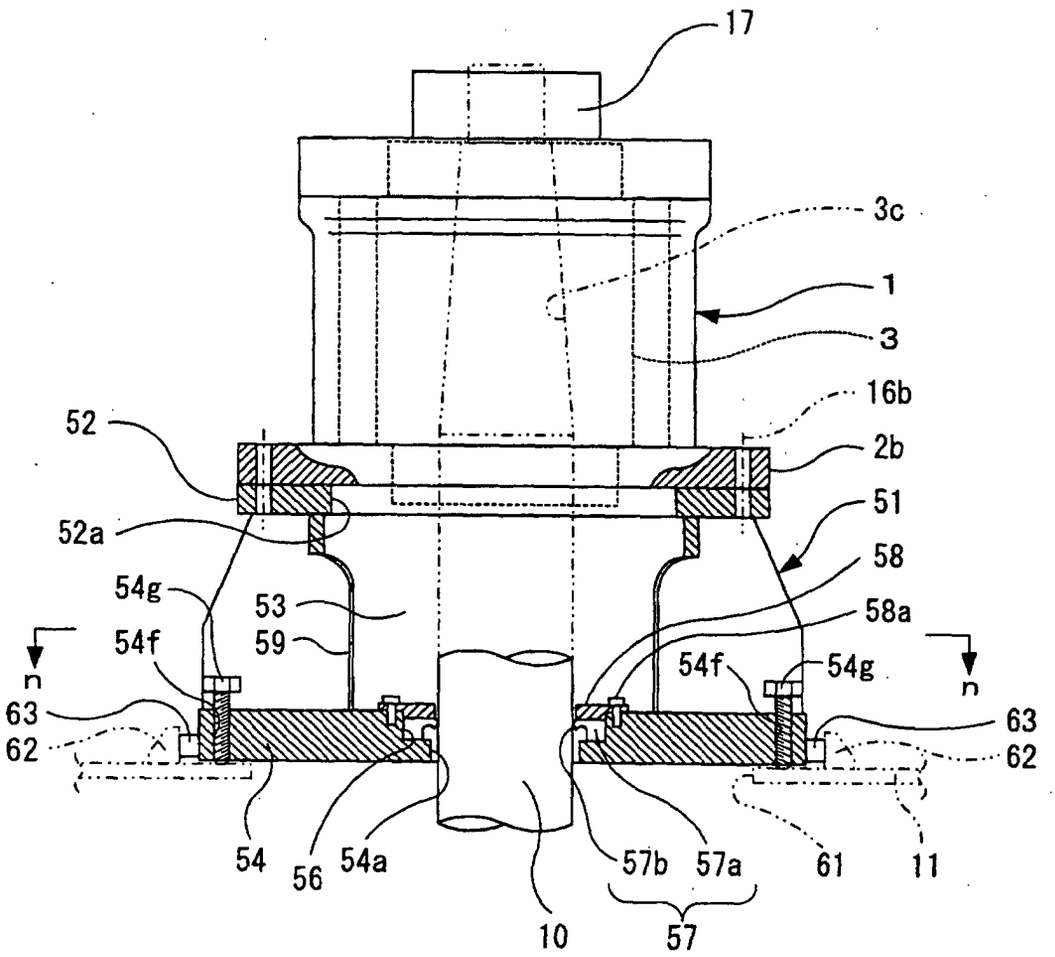
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FIG. 7

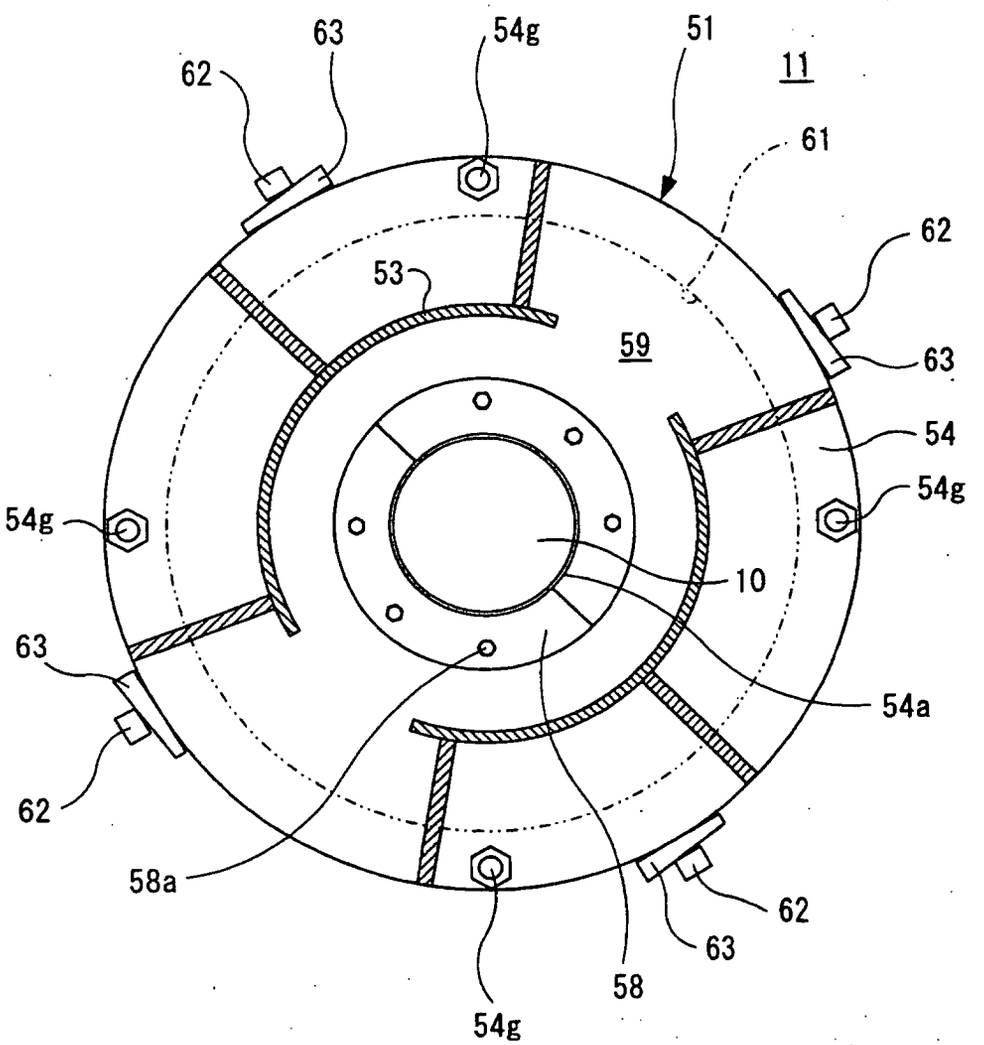
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FIG. 8

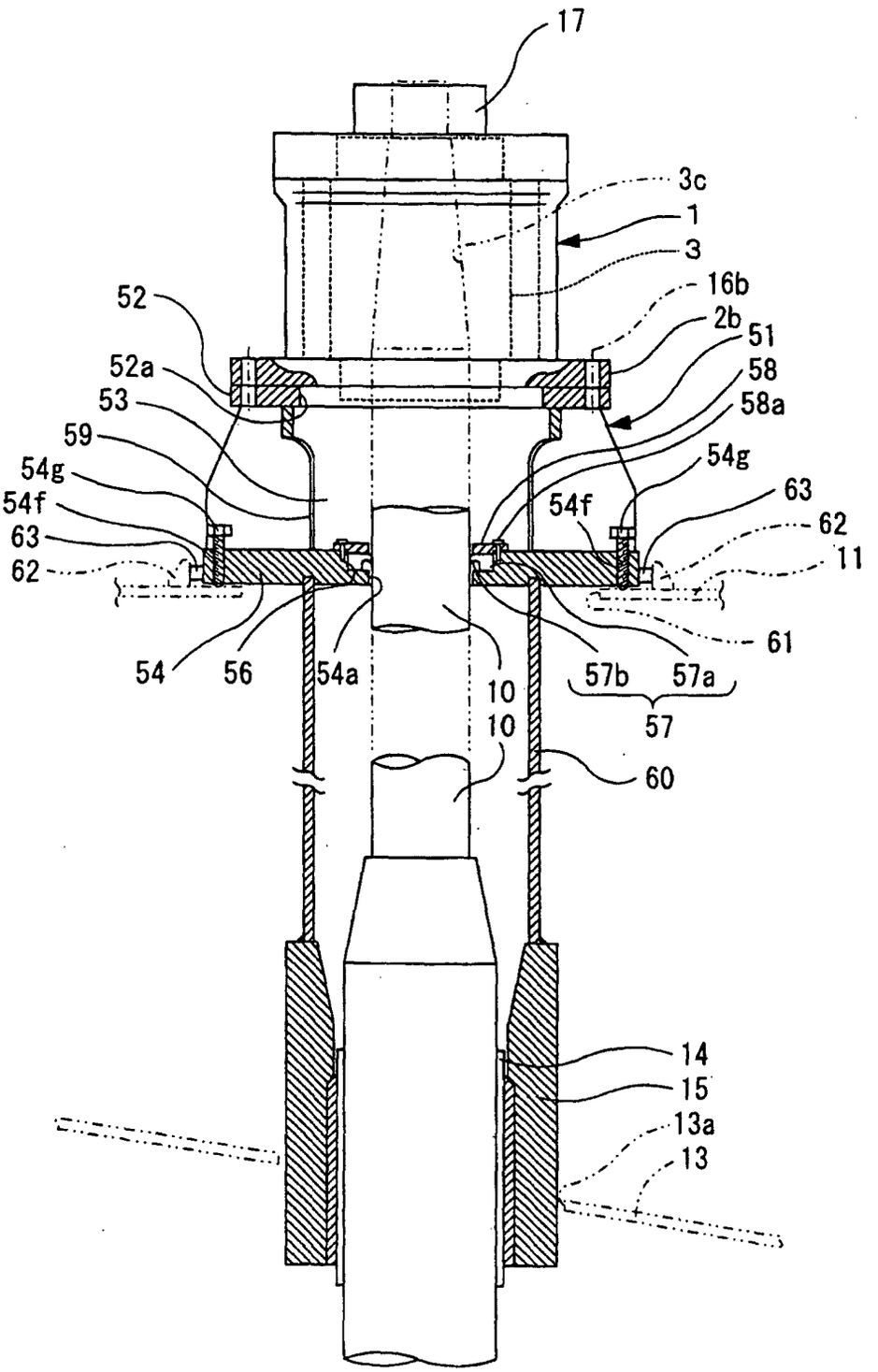
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FIG. 9

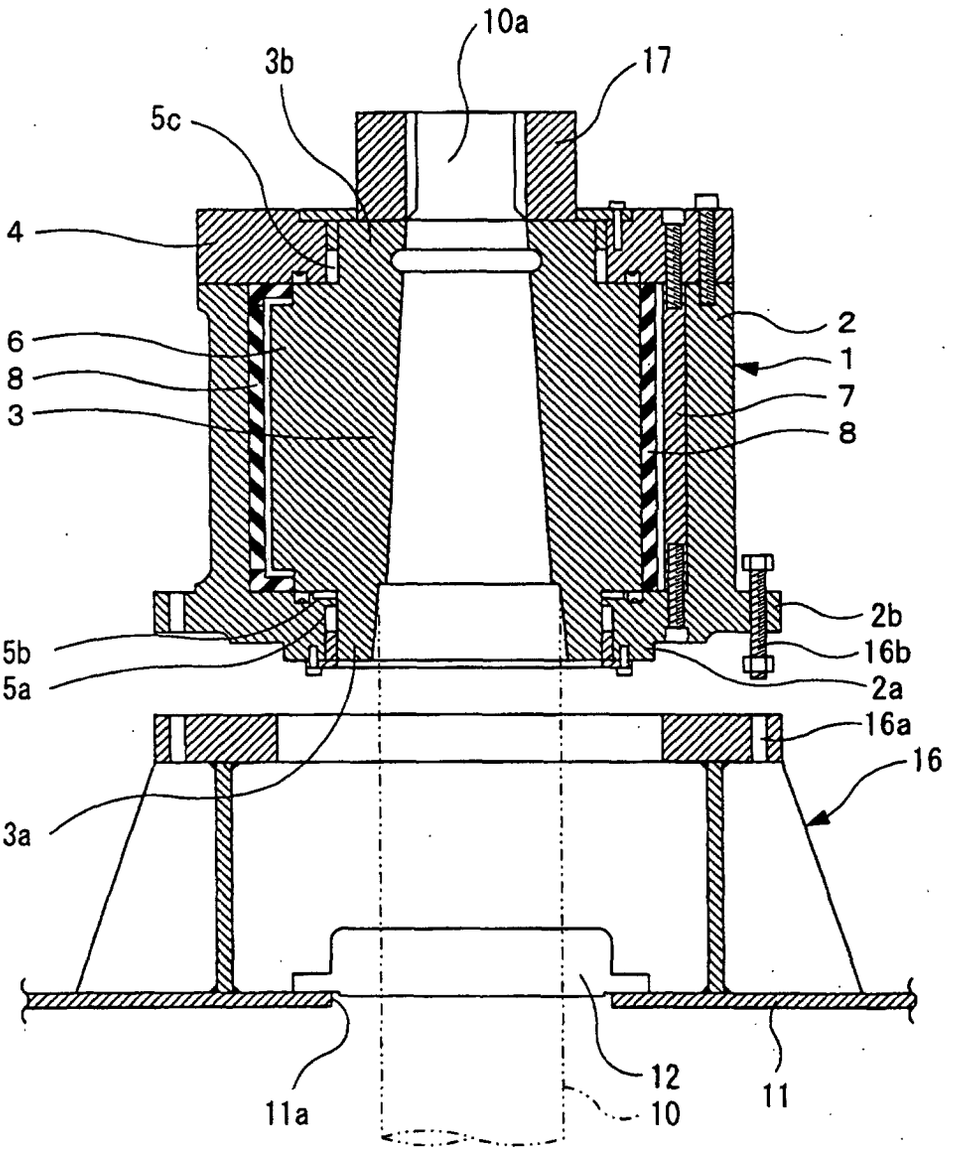


FIG. 10

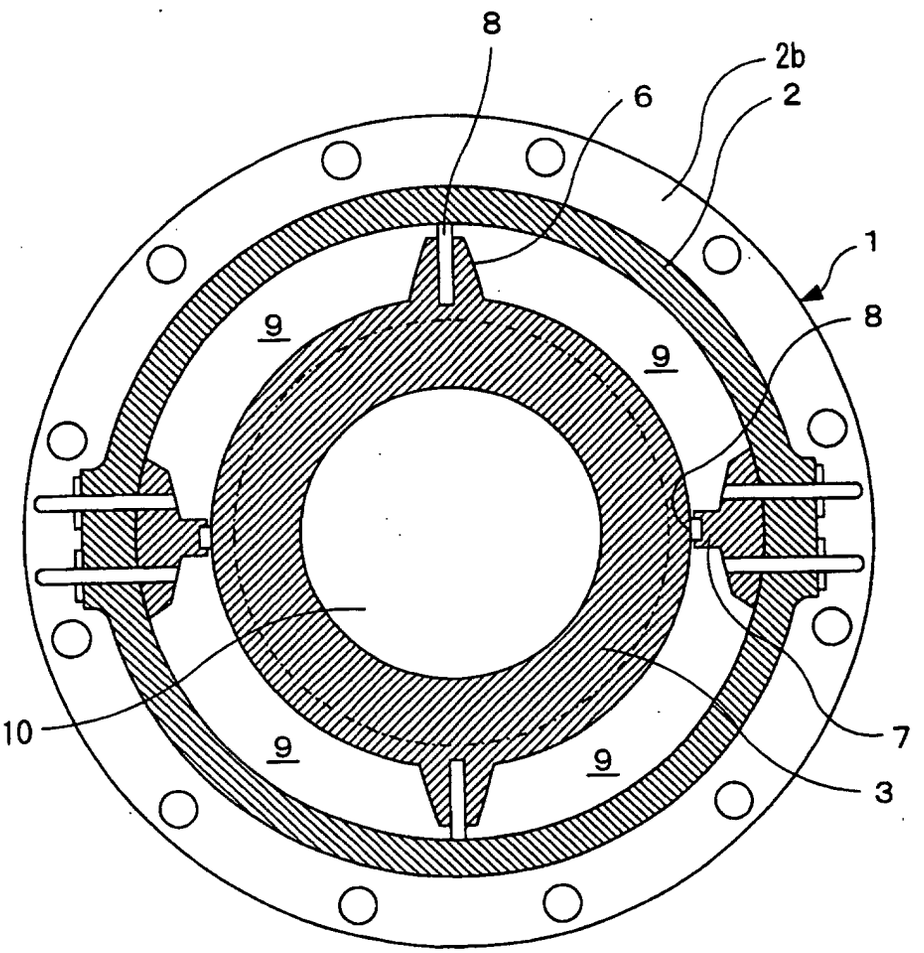


FIG. 11

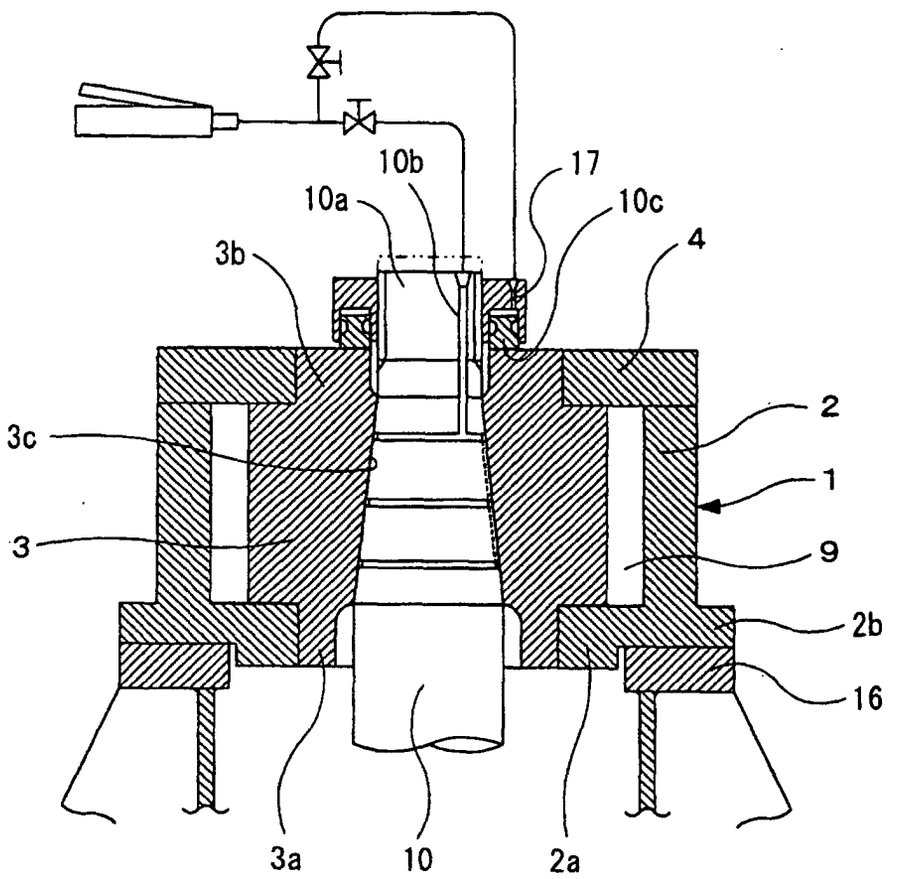
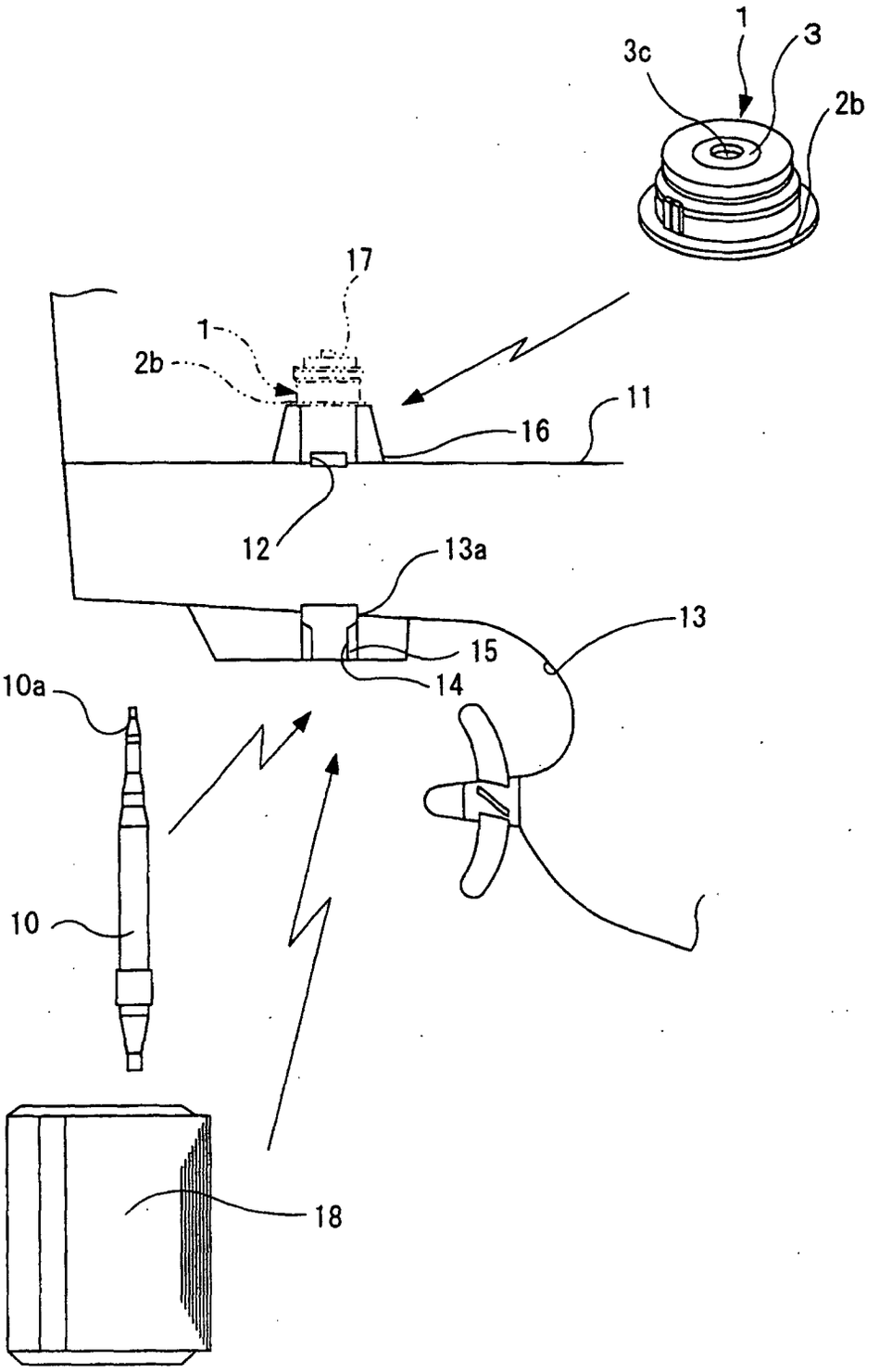


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/10896

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B65H25/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B63H25/26, 25/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Jitsuyo Shinan Toroku Koho	1996-2003

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 8-244688 A (Nippon Soju System Kabushiki Kaisha), 24 September, 1996 (24.09.96), (Family: none)	8,9
P,Y	JP 2002-46691 A (Japan Hamworthy Kabushiki Kaisha), 12 February, 2002 (12.02.02), (Family: none)	1-9
A	JP 7-96895 A (Nippon Soju System Kabushiki Kaisha), 11 April, 1995 (11.04.95), (Family: none)	1-9

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 January, 2003 (21.01.03)	04 February, 2003 (04.02.03)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/10896

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 50-21494 A (Ishikawajima-Harima Heavy Industries Co., Ltd.), 07 March, 1975 (07.03.75), (Family: none)	1-9
A	JP 59-25888 B2 (Kabushiki Kaisha Niigata Tekkosho), 22 June, 1984 (22.06.84), (Family: none)	1-9
A	JP 2-12160 Y2 (Kabushiki Kaisha Niigata Tekkosho), 05 April, 1990 (05.04.90), (Family: none)	1-9
A	JP 2968265 B1 (Japan Hamworthy Kabushiki Kaisha), 20 August, 1999 (20.08.99), (Family: none)	8,9

Form PCT/ISA/210 (continuation of second sheet) (July 1998)