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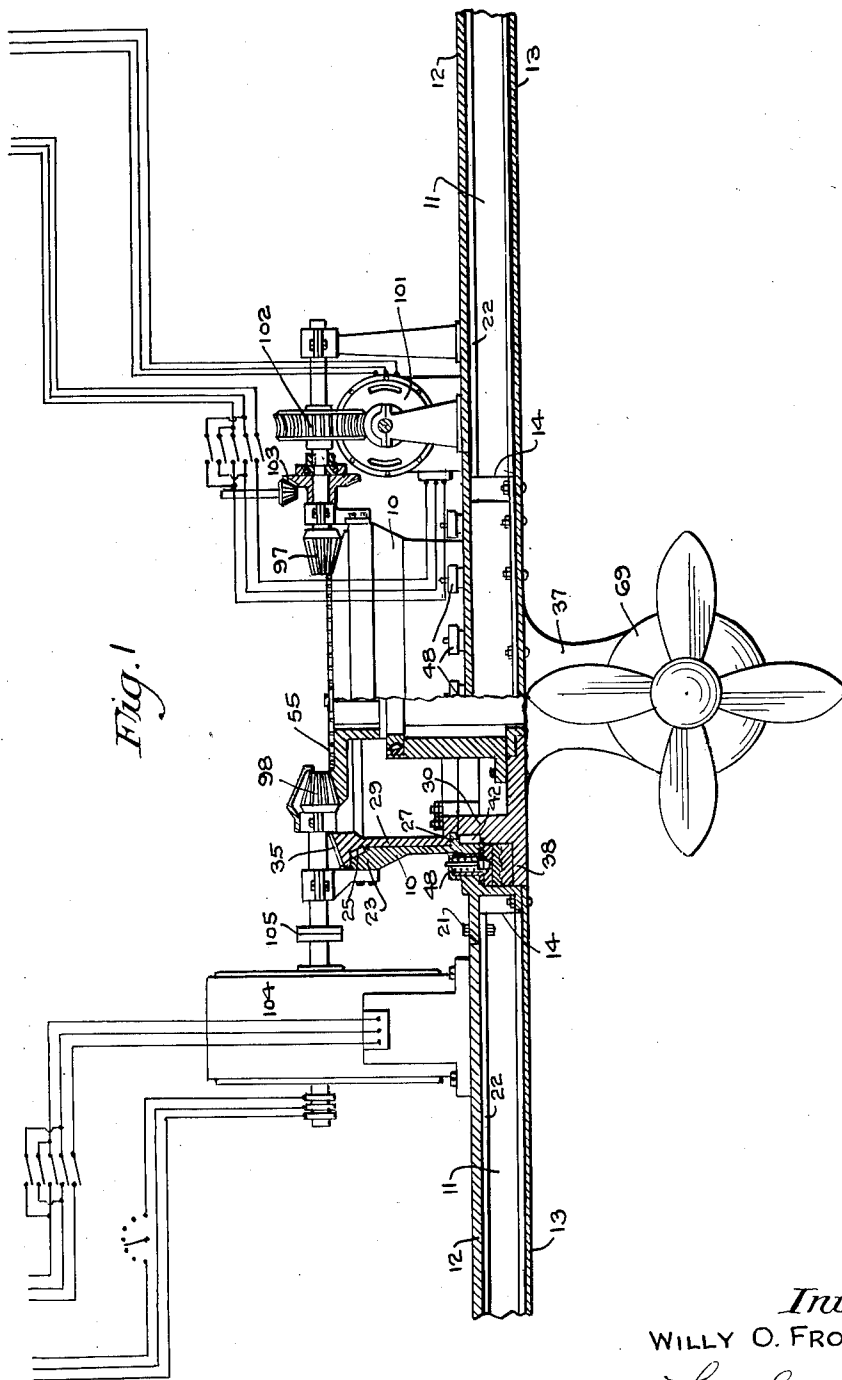
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2,586,019

MARINE PROPELLING AND STEERING MECHANISM

Filed Oct. 20, 1948

5 Sheets-Sheet 1



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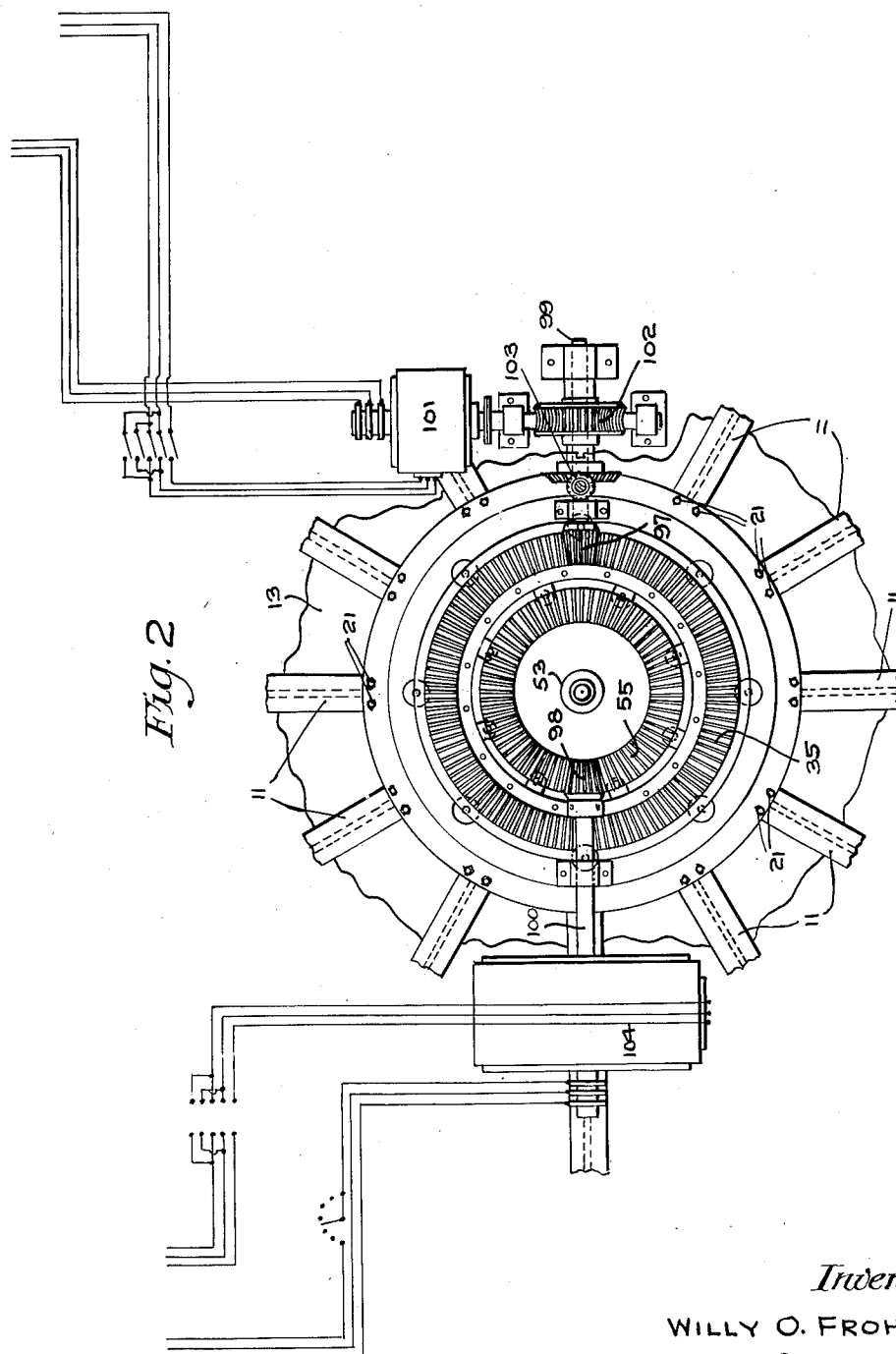
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MARINE PROPELLING AND STEERING MECHANISM

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5 Sheets-Sheet 2



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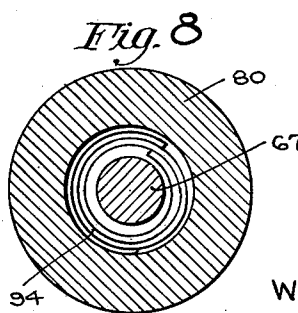
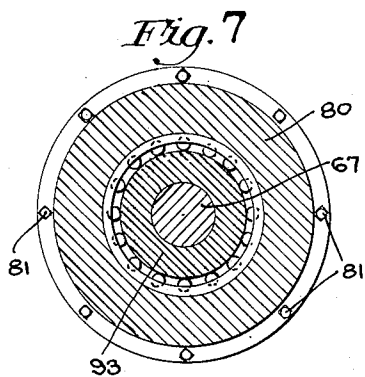
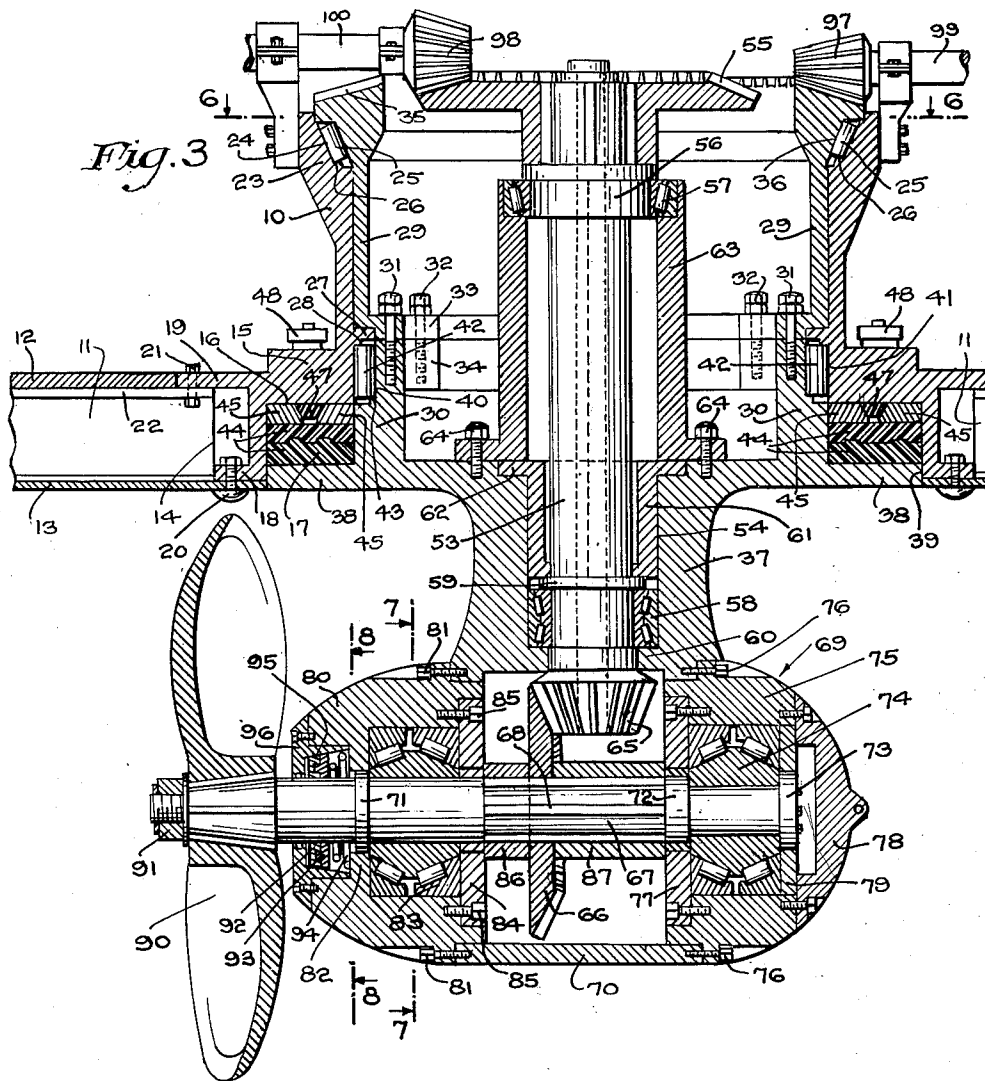
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MARINE PROPELLING AND STEERING MECHANISM

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5 Sheets-Sheet 3



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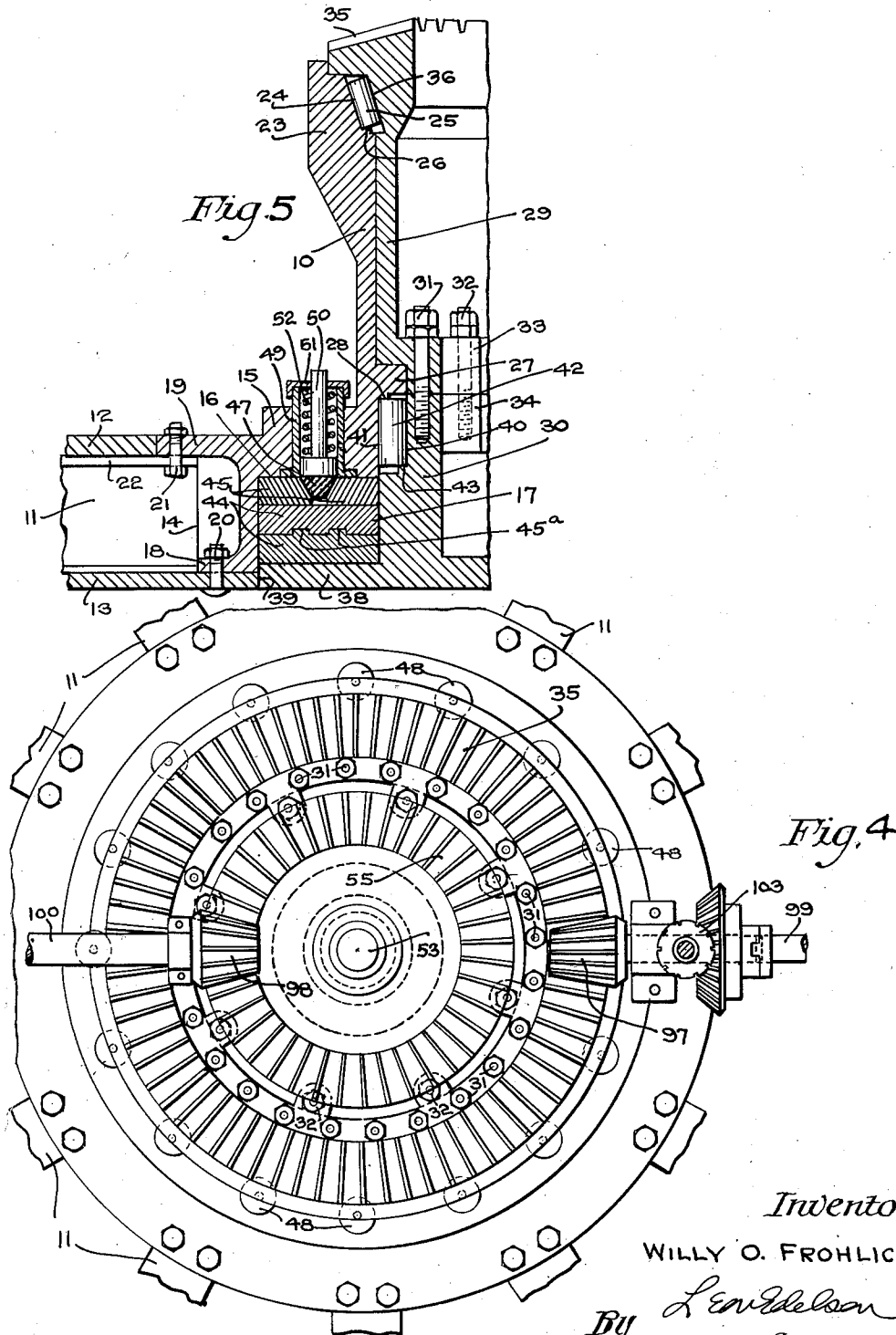
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MARINE PROPELLING AND STEERING MECHANISM

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MARINE PROPELLING AND STEERING MECHANISM

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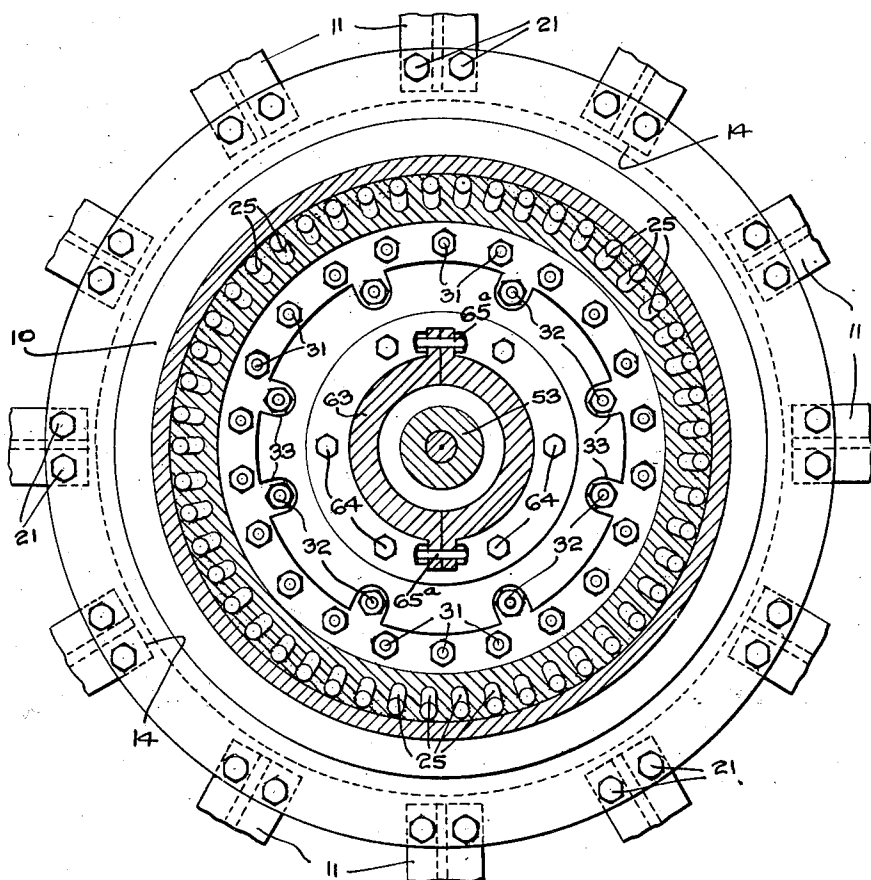


Fig. 6

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MARINE PROPELLING AND STEERING
MECHANISM

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5 Claims. (Cl. 115—35)

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This invention relates to improvements in marine propelling and steering mechanisms and has among its principal objects the provision of an improved construction and design of an in-board type of propelling mechanism in which the propeller, while rotatable about a horizontal axis for propelling the vessel, is additionally angularly adjustable about a vertical axis spaced from the propeller whereby the latter serves also to steer the vessel, the propeller being positionally adjustable for steering purposes through a full circle and being so operative as to dispense entirely with the necessity of a rudder.

A further and important object of the present invention is to provide a simple and effective inboard-mounted steering turret for the propeller in operative association with the drive shaft for the propeller, the steering turret and drive shaft mechanisms for the propeller being assembled in the form of a compact organization and having individual power driven means for selectively operating said mechanisms conjointly or separately as may be required.

Still another object of the present invention is to provide a so-called propulsion-steering turret of such compact organization and design that it may be readily incorporated in any double-hull type of marine vessel and which includes means for effectively preventing the entry of sea water into any of the rotary parts of the turret, all of the main rotary parts of the turret being suitably journaled within roller-bearings to insure free and easy rotation of the relatively movable parts of the turret.

A still further and important object of the present invention is to provide a propeller assembly of such design and construction as to enable it to be readily disassembled for purposes of service, maintenance and repair without necessitating removal or disturbance of the mounting for the turret steering mechanism or of the propeller main drive shaft which is operatively mounted within said turret steering mechanism.

Still another and important object of the invention is to provide a compact organization which is adapted for use in small as well as large vessels to serve both as a propelling and steering mechanism, and which is designed to supply driving power to the propeller by a vertically extending main power shaft geared to a horizontally disposed propeller shaft journaled in a housing which is revoluble, for purposes of steering, about the vertical axis of the main power shaft while the latter is rotating to supply driving power to the propeller, the arrangement being such that

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the propeller shaft may be quickly rotated through an arc of 180 degrees for reversing the direction of movement of the vessel and so eliminate the use of separate reversing gear.

A still further object of the invention is to provide a novel and efficient arrangement wherein the propelling and steering mechanisms are coaxially disposed and are respectively provided with substantially coplanar, concentrically arranged bevel gears each operatively geared to a separate motor drive shaft, the outer one of said bevel gears forming part of a revoluble steering turret which is journaled in a fixed support mounted in the hull of the vessel and the inner one of said bevel gears being keyed to the main propelling drive shaft revolubly journaled within the steering turret.

Other objects and advantages of the invention will appear more fully hereinafter, it being understood that the present invention consists substantially in the combination, construction, location and relative arrangement of parts, all as described in detail hereinafter, as shown in the accompanying drawings and as finally pointed out in the appended claims.

In the said accompanying drawings, which illustrate a preferred construction embodying the principles of the patent invention:

Figure 1 is a general view, partially in vertical cross-section, of a propulsion-steering turret mounted in the hull of a vessel in accordance with the present invention;

Figure 2 is a plan view of the turret installation shown in Figure 1;

Figure 3 is a vertical sectional view, on a somewhat enlarged scale, of the propulsion-steering turret assembly;

Figure 4 is a top plan view of the assembly shown in Figure 3;

Figure 5 is a vertical sectional view of the turret assembly as taken through one of the spring-pressed elements for pressure-sealing the interlocking annular water-seals interposed between the relatively rotatable members of the turret in the region where the latter is exposed to and in contact with the sea-water;

Figure 6 is a horizontal sectional view as taken along the line 6—6 of Figure 3;

Figure 7 is a vertical sectional view as taken along the line 7—7 of Figure 3; and

Figure 8 is a vertical sectional view as taken along the line 8—8 of Figure 3.

Referring now more particularly to the drawings, it will be observed that in the construction of the present invention a main support 10 of

generally circular, hollow form is suitably mounted in fixed position upon the hull of the vessel in the region of its stern. As most clearly appears in Figures 1, 2, 3 and 5, this stern region of the vessel is fitted with a plurality of radially extending I-beams 11 each of a height sufficient to fit snugly between the inner and outer hulls 12 and 13 of the vessel, the inner ends 14 of the radially extending beams each terminating approximately at the circumference of the circular opening provided in the hull bottom for mounting of the propelling and steering mechanism of the present invention.

The main support 10 is provided with a lower portion 15 of an enlarged diameter, the interior of said enlarged portion being undercut, as at 16, to provide an annular recess for accommodating therein a water-sealing assembly 17 to be described hereinafter. Extending radially outwardly from the enlarged portion 15 of the main support 10 are a pair of vertically spaced annular flanges 18 and 19, the flange 18 being secured, by the bolts 20, to the outer hull 13 of the vessel and the flange 19 being secured, by the bolts 21, to the upper flanges 22 of the radially disposed I beams 11. In installation of the main support 10 within the vessel, the preferred procedure would be to lay and suitably secure the radially extending I-beams 11 upon the floor of the vessel formed by its outer hull 13 and then mount the support 10 centrally within the hull opening located between the inner ends of the I-beams, the support 10 being then secured to the hull 13 by the bolts 20 and to the I-beams by the bolts 21 so that it is strongly and adequately supported by the hull and its reinforcing I-beams. Thereafter, the inner hull 12 may be laid to fully enclose the region immediately surrounding the mounted support 10.

The upper end of the vertically disposed support 10 is preferably provided with a thickened portion 23 which is internally formed with an inclined raceway 24 for a set of roller bearings 25, the raceway 24 being provided at its lower end with an annular seat 26 extending circumferentially about the internal surface of the raceway to limit downward axial displacement of the roller bearings, it being noted that the said annular seat 26 preferably extends short of the center line of the bearings so as to impose a minimum of frictional resistance to free rotation thereof. Formed internally of the member 10 at a point intermediate its opposite ends is an annular flange 27 the lower surface of which is stepped, as at 28, to provide a roller bearing thrust seat.

Rotatably supported within the stationary main supporting member 10 is a so-called turret assembly comprising an upper member 29 and a lower member 30 suitably secured together by a plurality of circumferentially spaced bolts preferably arranged in two sets 31 and 32 concentric with respect to each, the inner set 32 of these bolts being projected through registering lugs 33 and 34 respectively formed as integral internal elements of the turret members 29 and 30.

The circular upper edge of the member 29 of the turret assembly is cut or otherwise provided at its top end with a set of straight or spiral gear teeth to form an annular bevel gear 35 disposed for rotation in a substantially horizontal plane. The turret member 29 fits snugly within the upper portion of the stationary support 10 and is supported for rotation therein by the inclined

roller bearings 25, to which end the said turret member 29 is externally provided with an inclined raceway 36 which is complementary to and coacts with the raceway 24 to embrace therebetween the roller bearings 25.

The bottom member 30 of the turret assembly fits snugly in the lower portion of the stationary support 10 and is provided with a vertically depending centrally disposed, hollow throat portion 37 projecting below the outer hull of the vessel, said throat member 37 being in turn provided with a radially extending annular flange 38 adapted for disposition with its lower surface substantially flush with the exposed surface of the outer hull 13 of the vessel. It will be noted that the circumferential edge 39 of the flange 38 fits snugly into the undercut annular recess 16 formed in the lower portion of the stationary support 10. The upper portion of the turret member 30 is externally formed with a roller bearing raceway 40 which is complementary to and coacts with a raceway 41 formed internally of the support 10 immediately below its internal annular flange 27 to embrace therebetween a set of roller bearings 42, which latter serve conjointly with the upper set of roller bearings 25 to provide for easy rotation of the turret assembly with its stationary support 10. The lower end of the raceway 40 is provided with an annular seat 43 extending to a point short of the center line of the bearings 25, such seat operating in conjunction with the corresponding seat 28 formed on the internal flange 27 to limit axial displacement of the roller bearings 42 and to take the thrust imposed upon the bearings during rotation of the turret assembly within its support.

It will be apparent, of course, that in assembling the turret for rotation within its support, the upper member 29 thereof is inserted downwardly into the top portion of the support 10, while the lower member 30 of the turret assembly is projected upwardly into the bottom portion of the support, the two members 29 and 30 being then secured together by the bolts 31 and 32. The stepped internal flange 27 then functions in the nature of a key or spline to prevent axial movement of the turret assembly relatively to its stationary support while permitting free rotation of the turret within said support.

In order to insure against the entry of seawater into the vessel by passage between the relatively movable turret assembly and support and also to protect the roller bearings against seawater damage, an effective water-seal is interposed between these relatively movable parts as will now be described. As most clearly appears in Figures 3 and 5, the radial flange 38 of the rotatable turret assembly in effect constitutes a bottom closure member for the annular recess 16 of the stationary support. Disposed within the enclosed recess are a pair of annular gasket-type plates 44—44 formed of lignum vitae, fiber or any other material resistant to the deleterious effects of salt water, pressure and friction, these plates being superimposed upon one another with their flat surfaces in contact. Preferably, the plates are dovetailed, as at 45^a, to increase the area of their surface contact. Disposed above the plates 44—44 are a pair of laterally spaced split annular rings 45—45 the proximate edges of which are reversely tapered to provide therebetween an annular seat for a wedging ring 47. This latter ring is designed to press the split rings 45—45 outwardly of each other and downwardly against

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the plates 44—44 to thereby effect a water-tight seal between the stationary support 10 and the rotatable turret assembly. The necessary wedging pressure is imposed upon the ring 47 by a plurality of circumferentially spaced pressure-applying devices 48 suitably mounted in the support 10, each of these devices comprising, as shown in Figure 5, a cylinder 49 within which is disposed a spring-pressed plunger 50. The head of the plunger in each case bears directly upon the wedging ring and by adjusting the cylinder cap 51 the compressive force of the coil spring 52 may be varied to vary the force of the pressure exerted against the wedging ring and so transmitted to the sealing plates 44—44. By employing an adequate number of the pressure devices 48 uniformly spaced circumferentially about the wedging ring 47, effective water-tight sealing is obtained uniformly about the full circumference of the rotatable turret assembly and for all positions into which it may be rotated.

The depending throat portion 37 of the turret assembly is vertically bored, as at 54, for projection therethrough of the vertically extending main power drive shaft 53, this drive shaft being coaxial with and rotatable with respect to the revoluble turret. Keyed or otherwise suitably fixed to the upper end of the drive shaft 53 is a straight or spiral-toothed type of bevel gear 55 disposed for rotation in substantially the same horizontal plane as that of the bevel gear 35, the two gears being, of course, concentric as clearly appears in Figure 3. Press fitted upon an enlarged thrust collar 56 formed on the drive shaft just below the hub of the bevel gear 55 is roller bearing assembly 57, while similarly fitted upon the shaft adjacent its lower end is a second roller bearing assembly 58, the latter being in abutting engagement at one end thereof with a thrust flange 59 integrally formed on the drive shaft and at its opposite end with an inturned flange 60 formed on the lower extremity of the throat portion 37 of the turret assembly. A longitudinally split spacer and thrust sleeve 61 is interposed in the annular space between the drive shaft and the concentric wall of the vertical bore 54, the upper extremity of said spacer having an outwardly extending annular flange 62 which seats flush in a countersunk annular seat formed in the upper end of said throat portion 37.

Seated upon and extending vertically above the split spacer and thrust sleeve 61 is a longitudinally split tubular bearing mounting 63 for the upper roller bearing assembly 57, said bearing mounting being fixedly secured to the turret assembly for rotation therewith by the studs 64. It will be noted that upon securing the mounting 63 in position by its studs 64, the mounting serves to key the split spacer sleeve 61 in position as a fixed element of the turret assembly. Preferably, the two parts of the split bearing mounting 63 are each flanged at their opposite longitudinal edges to facilitate their securement together by bolts 65^a (see Figure 6).

For assembly of the main power drive shaft 53 within the turret assembly as shown in Figure 3, the shaft with its upper roller bearing assembly 57 and its lower roller bearing assembly 58 both press fitted thereon is first inserted into the vertical bore of the throat portion 37 of the turret assembly with the bottom end of lower roller bearing assembly resting on the flange 60 of the turret throat. Thereupon the split spacer and thrust sleeve 61 is inserted into position, and finally the two-part bearing mounting 63 is se-

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cured in position to embrace the shaft and support the upper roller bearing assembly. Thereafter, the lower protruding end of the shaft 53 has keyed or otherwise non-rotatably secured thereto a drive pinion 65 adapted for mesh engagement with a bevel drive gear 66 forming part of the propeller shaft driving mechanism now to be described.

As has been previously mentioned, the propeller drive shaft, designated 67, is disposed for rotation about a horizontally extending axis, the bevel drive gear 66 being splined thereto, as at 68. As most clearly appears in Figure 3, the propeller shaft 67, the meshed gears 65 and 66 for driving the same and the roller bearings associated with the propeller shaft are all enclosed with a housing 69 provided at the lower end of the throat portion 37 of the turret assembly, the general arrangement being such that the housing 69 forms a fixed part of the turret assembly and is rotatable therewith about the vertical axis of the main power drive shaft 53 so as to shift the propeller into any desired steering position.

The propeller shaft housing includes as a part thereof a cylindrical casing member 70 formed integrally with and as an element depending from the turret throat 37, the passage through said casing member 70 being of a diameter and axial length sufficient to readily accommodate therewithin the meshed gears 65 and 66 and a substantially intermediate length of the propeller shaft. The shaft itself is provided between its ends with a pair of axially spaced integral thrust collars 71 and 72. Removably secured to the rear end of the shaft is a rear thrust plate 73 which serves conjointly with the thrust collar 72 to embrace a roller bearing assembly 74 within which the rear end of the propeller shaft is rotatably journaled. An end ring 75 fitted within the rear end of the casing member 70 and secured thereto by studs 76 serves as the external support for the roller bearing assembly 74, said end ring 75 being removably fitted at its inner end with a thrust plate 77 disposed concentrically and in the plane of the thrust collar 72 of the propeller shaft. A cap member 78 is removably secured to the outer end of the end ring 75 to not only enclose the removable end thrust plate 73 but to also secure in position a supplemental thrust plate 79 concentric to and coplanar with the end thrust plate 73 on the propeller shaft.

Embracing the opposite or propeller end of the shaft 67 is an end member 80 which is removably secured, as by the studs 81, to the propeller end of the casing member 70. This end member 80 is internally flanged, as at 82, this flange being concentric to and substantially coplanar with the shaft thrust collar 71 to provide a fixed abutment for the outer end of a roller bearing assembly 83 within which the propeller end portion of the shaft is journaled. A thrust plate 84 for the inner end of the roller bearing assembly 83 is secured, as by studs 85, to the inner end of the end member 80. To maintain the bevel gear 66 in axially fixed position upon the propeller shaft spacer sleeves 86 and 87 are disposed upon opposite sides of the gear, the outer extremities of these spacer sleeves preferably terminating in shouldered portions of reduced diameter which respectively project into and abut against the inner thrust plates 77 and 84 of the two roller bearing assemblies.

The propeller 90 is fitted on the freely projecting end of the shaft 67 in any suitable manner, as by pressing it upon the tapered end of the

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shaft by means of a nut 91 removably secured to the threaded end of the shaft. To prevent entry of sea water into the propeller shaft housing and so possibly damage the collar bearing journals, a spring-pressed sealing ring assembly is fitted about the propeller end of the shaft just inside the corresponding end of the propeller shaft housing. This sealing assembly generally comprises a pair of superposed plates 92 and 93 of lignumvitae, fiber or other such material resistant to the deleterious effects of sea water, these plates being wedged into close contact with the shaft by the compressive force of a helical spring 94 operating in conjunction with a tapered seat 95 formed internally of a member 96 removably secured to the end of the propeller housing. As appears in Figure 3, the inner end of the coil spring 94 abuts against the internal flange 82 of the propeller housing end member 80 to exert an outward wedging thrust against the water-sealing plates 92 and 93, thereby sealing the shaft against seepage of water along its surface into the propeller shaft housing.

To effect disassembly of the propeller shaft organization for purposes of service, maintenance and repair it is merely necessary to remove the end cap member 78 and then the end thrust plate 73 following which, upon simple removal of the studs 81 which hold the end member 80 in position, the entire propeller shaft with its propeller and drive gear intact may be slipped out of the cylindrical casing member 70.

Rotation of the turret assembly and of the propeller assembly as a unitary organization for purposes of steering the vessel is effected by means of a power driven pinion gear 97 in mesh with the turret gear 35, while rotation of the main power drive shaft 53 for propelling the vessel in the direction determined by the position of the propeller about the vertical axis of the drive shaft is effected by means of a power driven pinion gear 98 in mesh with the upper bevel gear 55 of the main drive shaft.

The prime movers for the steering drive pinion 97 and for the propelling drive pinion 98 may be disposed at any conveniently spaced points about the outer circumference of the fixed main support 10 of the mechanism of the present invention. In the arrangement illustrated the pinions 97 and 98 are disposed in diametrically opposed relation with their drive shafts 99 and 100 extending outwardly of the support 10 toward their respective prime movers. In the case of the steering drive pinion 97 its drive shaft 99 is preferably driven by a reversible electric motor 101 through a suitable speed reduction unit 102 of the worm gear type. For emergency use, as upon failure of electric power to the motor 101, an auxiliary driving mechanism may be provided for manual operation of the steering turret, which auxiliary steering mechanism may include a hand-wheel-operated bevel gear set 103 operatively associated with the pinion drive shaft 99 and adapted to be thrown into and out of operation by any suitable clutch mechanism, the details of which form no part of the present invention and accordingly, are not shown or described in detail.

For driving the main power shaft 53 geared to the propeller shaft, the drive shaft 100 for propelling drive pinion 98 in mesh with the power shaft bevel gear 55 is preferably driven by a propulsion type electric motor 104 through the intervention of an electro-magnetic coupling unit 105 of conventional design and oper-

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ation, the electric motor employed being provided with suitable electric switching gear for controlling its speed of operation and for affecting reversal of operation should emergency so require.

It will be understood, of course, that the present invention is susceptible of various changes and modifications which may be made from time to time without departing from the general principles or real spirit of the invention, and it is accordingly intended to claim the same broadly, as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. In a marine propelling and steering mechanism, in combination, a hollow main support stationarily mounted above an opening in the hull of a vessel, said support being undercut at its lower end to provide an annular recess externally concentric to the interior of said support, a hollow turret revolubly nested within and fixed against axial displacement relatively to said support, said turret having an axially depending mounting for a propeller assembly arranged beneath said hull opening and revoluble with said turret about its axis of rotation, an annular flange on said turret extending radially into said annular recess to enclose the bottom end thereof, a water-impervious annular plate assembly fitted in said recess above said turret flange, and a plurality of circumferentially spaced pressure-applying devices carried by said support above said plate assembly to uniformly wedge the latter tightly in water-sealing condition against the confining wall surfaces of said annular recess.

2. In a marine propelling and steering mechanism as defined in claim 1 wherein said plate assembly includes an annular gasket element, a pair of laterally spaced split rings superimposed upon said element and having oppositely tapered proximate edges and an annular split wedging ring disposed between the tapered edges of said laterally spaced rings to wedge the latter downwardly against said gasket element and outwardly against the confining side walls of the recess in which said plate assembly is disposed.

3. In a marine propelling and steering mechanism as defined in claim 1 wherein said plate assembly includes an annular gasket element, a pair of laterally spaced split rings superimposed upon said element and having oppositely tapered proximate edges and an annular split wedging ring disposed between the tapered edges of said laterally spaced rings to wedge the latter downwardly against said gasket element and outwardly against the confining side walls of the recess in which said plate assembly is disposed, and wherein said pressure-applying devices each includes a spring-pressed plunger bearing against the upper surface of said wedging ring.

4. In a marine propelling and steering mechanism, in combination, a hollow main support stationarily mounted above an opening in the hull of a vessel, a hollow turret assembly revolubly nested within and fixed against axial displacement relatively to said support, said turret having an axially depending mounting for a propeller assembly arranged beneath said hull opening and which said mounting includes an axially bored throat portion for projection therethrough of a main drive shaft operatively geared to said propeller assembly, a roller bearing assembly fitted in the lower end of said bored throat portion, a longitudinally split spacer and thrust

sleeve locked in the bore of said throat portion immediately above said roller bearing assembly, and a drive shaft rotatably journaled within said roller bearing assembly and split sleeve, said drive shaft having an annular flange disposed between said bearing assembly and split sleeve whereby said shaft is axially fixed in said turret assembly while free to rotate relatively thereto.

5. In a marine propelling and steering mechanism as defined in claim 4 wherein is included a cylindrical, longitudinally split, bearing mounting extending vertically above said spacer and thrust sleeve, said bearing mounting being coaxial with said drive shaft and fixed to said turret assembly for rotation with the latter, and wherein is included a second roller bearing as-

sembly supported by the upper end of said bearing mounting to provide an upper roller bearing support for the drive shaft.

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