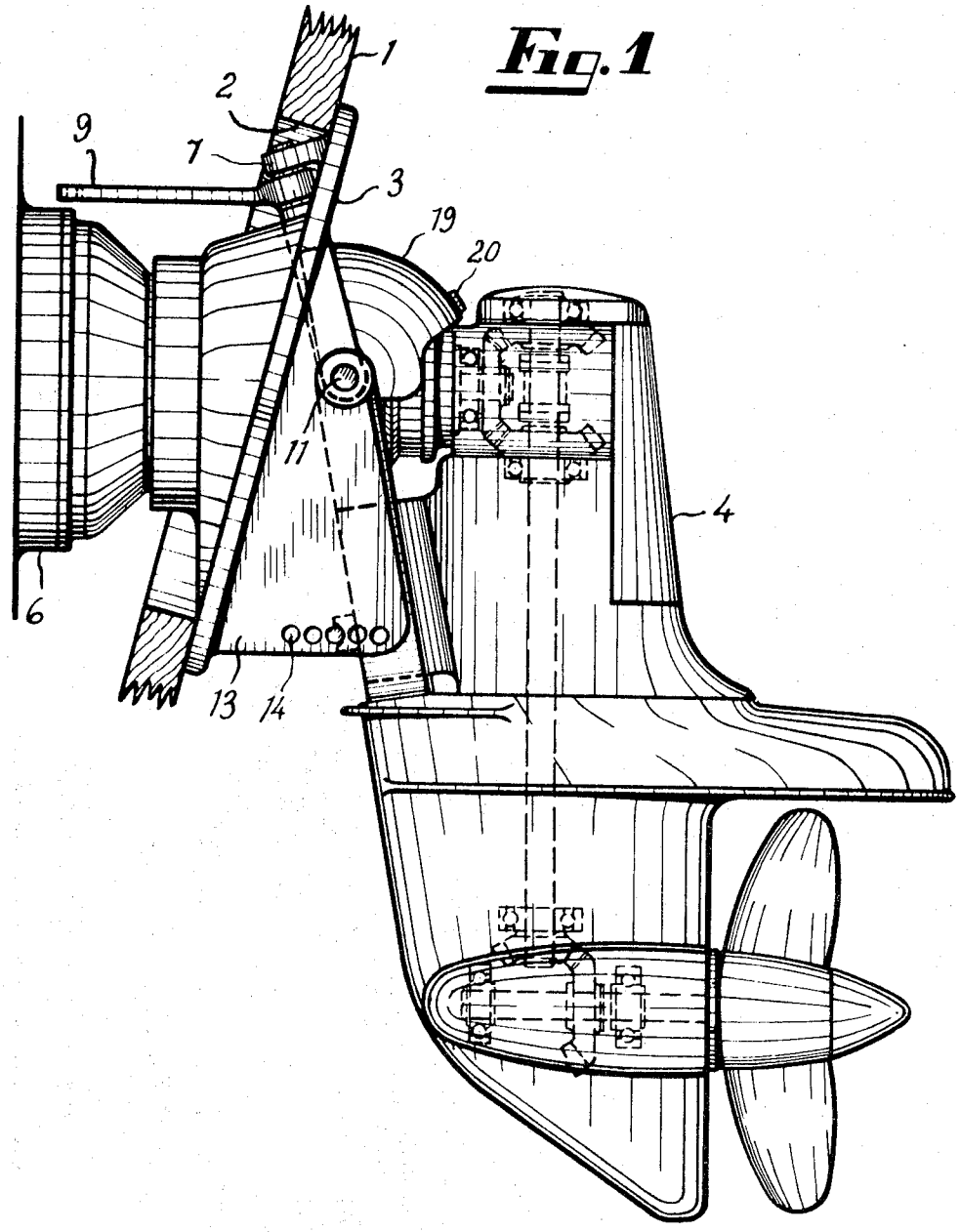
Sept. 5, 1967 K. A. BERGSTEDT 3,339,517

STEERING MECHANISM FOR INBOARD-OUTBOARD UNIT

Filed March 2, 1965 3 Sheets-Sheet 1

Fig. 1



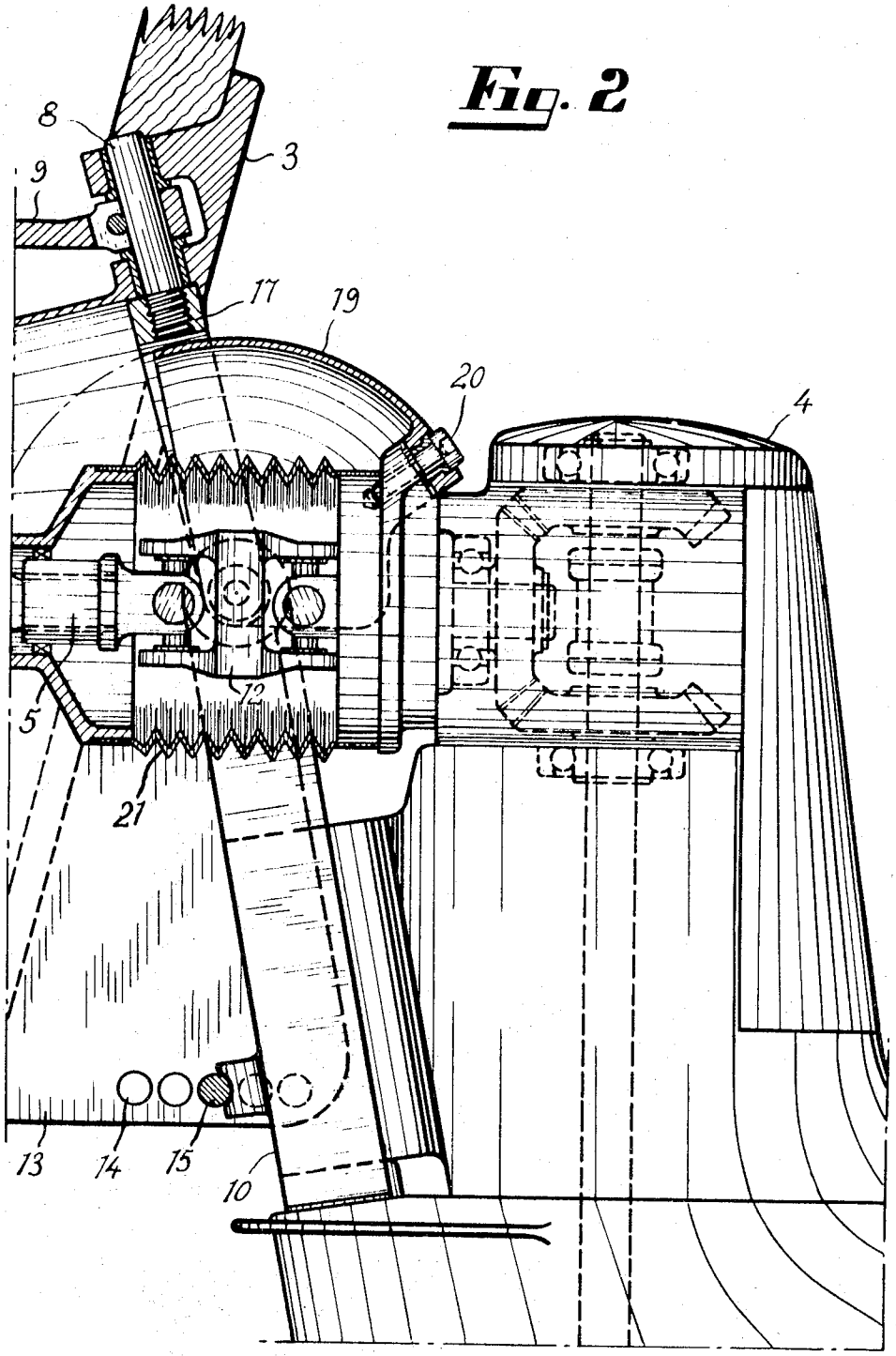
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STEERING MECHANISM FOR INBOARD-OUTBOARD UNIT

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Fig. 2



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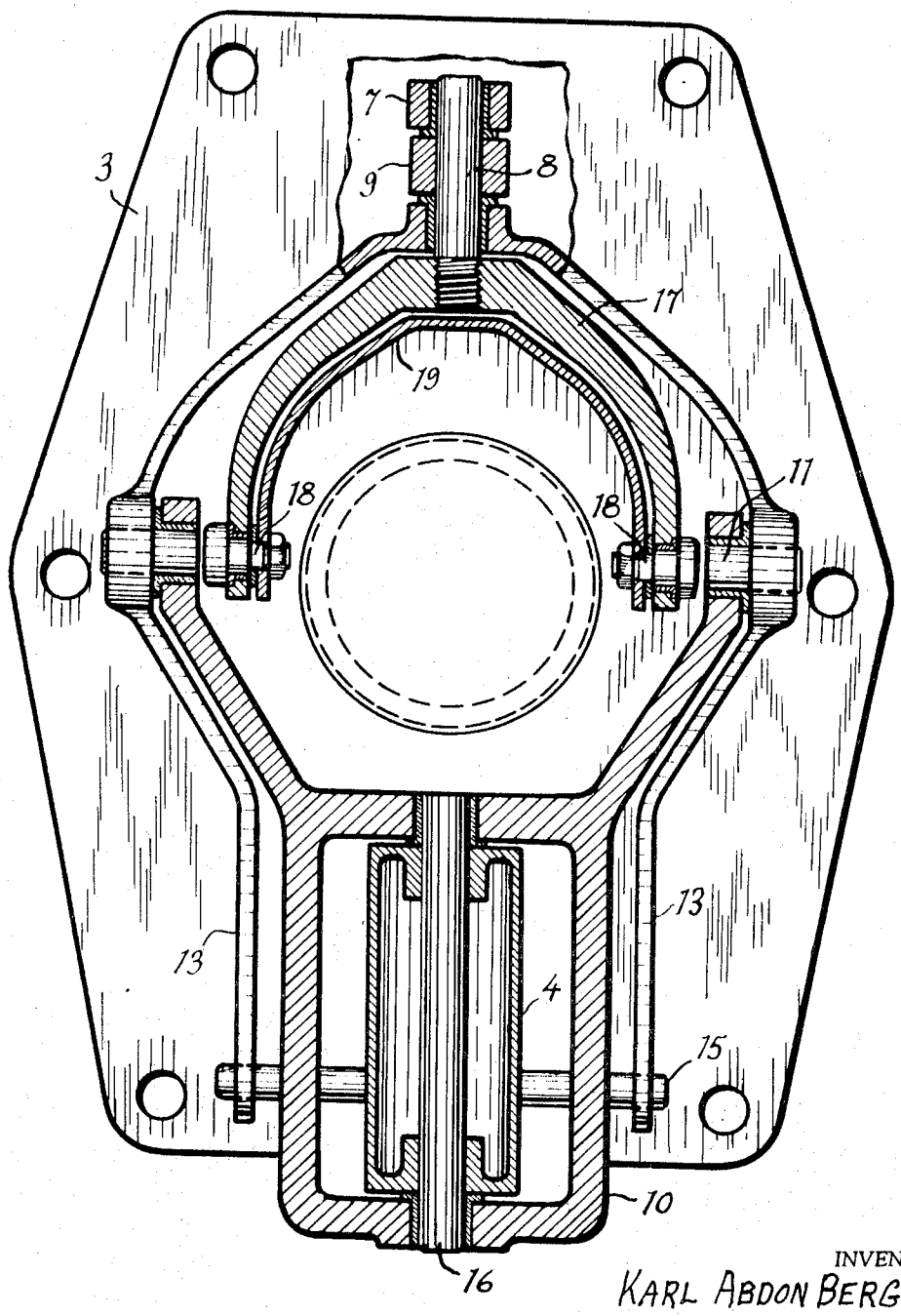
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STEERING MECHANISM FOR INBOARD-OUTBOARD UNIT

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Fig. 3



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STEERING MECHANISM FOR INBOARD-OUTBOARD UNIT

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12 Claims. (Cl. 115—41)

This invention relates to a marine propulsion unit of the inboard-outboard type which generally comprises an engine, preferably located in the after part of a boat, and a propeller shaft housing mounted on the boat for movement about a generally vertical steering axis and for tilting movement about a generally horizontal axis, and with drive shaft means extending from the engine through an opening in the stern of the boat for connection to a propeller shaft within the propeller shaft housing. In such a unit, means are provided for selectively moving the propeller shaft housing about the steering axis under the control of the operator of the vessel. In view of the universal pivotal mounting of the propeller shaft housing, problems have been encountered in providing an entirely satisfactory mechanism for connecting a steering wheel or the like to the propeller housing.

Accordingly, it is the primary object of this invention to provide a novel and improved steering mechanism for an inboard-outboard unit of the type generally described.

It is a further object of the present invention to provide a novel and improved steering mechanism for an inboard-outboard unit of the type generally described in which the steering mechanism comprises a rudder post or the like having a rotational axis fixed relative to the boat, whereby the angular movement of the rudder post may be controlled by conventional steering mechanism within the boat, while at the same time movement of the rudder post will effect movement of the propeller shaft housing about its steering axis, and further when the propeller shaft housing is tilted upwardly when the propeller shaft housing is in a position other than centered relative to the boat, the propeller shaft housing will tend to be moved about its steering axis toward a centered position, without any corresponding movement of the rudder post.

It is a further object of this invention to provide a novel and improved steering mechanism of the type described in which movement of the rudder post when the propeller shaft housing is in a fully tilted position will not effect any movement of the propeller shaft housing about its steering axis.

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a side view of an inboard-outboard unit of a type with which this invention is concerned with the outboard portion of the unit being mounted on a boat transom and with the unit incorporating the steering mechanism of the present invention;

FIG. 2 is an enlarged view, partly in section, of a portion of the device as shown in FIG. 1; and

FIG. 3 is a cross-sectional view taken substantially in a plane through the steering axis of the unit.

With reference to the drawings there is shown at **1** a portion of the stern or transom of a boat with the transom having an opening **2** extending therethrough. A plate **3** is mounted on the transom on the outboard side thereof in fixed relation by means such as bolts. The plate **3** extends outwardly beyond the circumference of the opening **2** and in cooperation with other structure associated with the propulsion unit fully closes the opening **2** in the transom to prevent entrance of water. Means are provided for suspending an outboard propeller shaft housing **4** on the plate **3** for universal pivotal movement about a horizontal axis and about an upwardly extending generally vertical steering axis extending mutually perpendicularly to said horizontal axis. The plate **3** is also connected by suitable means to an inboard motor **6** mounted within the hull of the vessel. The drive shaft **5** of the motor extends toward an opening in the plate **3** and means including a double universal connection **12** are provided to provide a flexible drive between the drive shaft **5** and gearing within the propeller shaft housing connected to a generally vertical shaft which is drivingly connected to the propeller disposed at the lower after part of the propeller shaft housing.

The plate **3** is also provided as at **7** with bearing means for journalling a rudder post **8**. Accordingly, it will be appreciated that the axis of the rudder post is fixed relative to the plate **3** and thus the vessel. A tiller or the like **9** is mounted on the rudder post **8** for rotational movement with the post. The tiller is adapted to be connected by suitable conventional means to a remote control station, such as a steering wheel, at the forward portion of the boat.

As most clearly shown in FIG. 3, the outboard housing **4** is pivotally supported for movement about its steering axis on an intermediate member which in the specific embodiment shown is a yoke **10** which is pivotally supported on the plate **3** by means of pins **11** carried by the plate **3** and extending into the upper end of the yoke **10**. The pins **11** are disposed on opposite sides of the opening in the plate **3** through which the flexible drive shaft means extends, and the pins are axially aligned to provide a horizontal pivot axis for the intermediate member **10**. The horizontal axis of the member **10** passes close to the center line of the flexible drive connection formed in part by the universal **12** when the unit is in its lowered position as shown in FIGS. 1 and 2. The pins **11** are mounted in flanges **13** integral with and projecting rearwardly from the plate **3**. At their lower ends the flanges **13** are provided with a series of openings **14** adapted to receive a bolt **15** against which the forward portion of the intermediate member or yoke **10** abuts. By insertion of the bolt **15** in a suitable one of the holes **14**, the trim of the outboard housing **4** can be regulated in a known manner to vary the inclination of the propeller axis of rotation. The bolt **15** also transmits some of the thrust of the propeller to the vessel, while at the same time the outboard housing may swing upwardly about the axis of the bearings **14** in the event that the outboard housing should encounter an object in the water or when it is desired to tilt the housing upwardly.

The outboard housing **4** is pivotally mounted on the intermediate member **10** by means of a shaft **16** fixed relative to the outboard housing and supported at its ends in bearings carried by the intermediate member **10**. The axis

of the shaft **16**, and thus the steering axis of the outboard housing, lies in a vertical plane with, and extending through, the axis of the rudder post **8**, and the steering axis extends at right angles through the horizontal pivotal axis of the intermediate member **10**. Thus, it will be seen that the outboard housing is universally pivotally supported on the plate **3** and thus the vessel **1** whereby the outboard housing may be tilted upwardly about a horizontal axis with the yoke **10** and may be moved about a generally vertical axis extending perpendicularly to the tilt axis and relative to the yoke **10**.

In accordance with one aspect of this invention, the rudder post **8** is connected to the outboard housing **4** by means of a second universal pivotal connection, the center of which is coincident with the center of the universal mounting the housing **4** for tilting and steering movement. The second universal comprises a fork member **17** mounted for movement with the lower end of the rudder post **8**. The prongs of the fork extend downwardly on opposite sides of the opening in the plate **3** through which the flexible drive extends and terminates below the pivot pins **11**. The fork prongs are provided at their lower ends with bearings for a pair of pivot pins **18** having axes extending in alignment with each other and located in the same horizontal plane as the axes of the pins **11**. The axis of the pivots **18** is coincident with the axis of the pins **11** when the outboard housing is aligned with the center line of the vessel for straight ahead steering, or in other words when the rudder post **8** is centered relative to the boat. The center of rotation of the pivots **18**, or the point about which the pivots **18** move when the rudder post **8** is angularly moved, lies in the axis of the horizontal pivot pins **11**.

Pivotally mounted on the pivot pins **18** is a generally cup shaped member **19**. As most clearly shown in FIGS. 1 and 2, the cup **19** has a bearing receiving a screw **20** which is threadably engaged in a flange or the like on the outboard housing **4**. Thus, the screw **20** forms a pivot pin pivotally and drivingly connecting the cup **19** and housing **4**. The axis of the pivot **20** extends at right angles through the axis of the horizontal pivots **18** and is inclined upwardly and rearwardly of the form **17**. Accordingly, it will be seen that the outboard housing **4**, by reason of the pivots **20** and **18**, is connected to the steering post by a universally pivotal connection providing relative movement between the outboard housing and steering post about a horizontal axis lying in a common horizontal plane with the horizontal axis of the pins **11** and about a second axis lying with the steering axis in a vertical plane extending perpendicularly to the horizontal axis of the pins **11**. The pin **20** is located aft or rearwardly of the horizontal axis of the pins **11** and **18** and above the same. Thus, for a reason which will be hereinafter apparent, the axis of the pivot **20** is normally angularly displaced from the axis of the rudder shaft **8** about the horizontal axis of the pins **20** by an angular amount corresponding to the angular distance between the then lowered position of the outboard housing and the fully tilted position thereof.

The cup member **19** is disposed within the confines of the prongs of the fork **17** and is disposed over and extends partly downwardly of and on opposite sides of the universal **12**. A water tight flexible housing **21** of rubber or the like, in a known manner, is connected between a bell or the like fixed relative to the engine and a similar portion on the outboard housing to seal the universal connection **12** and associated elements from water. In this manner the cup member **19** not only provides a link in a universal pivotal connection but also provides a protective shell or cover for the elements beneath.

When the outboard housing is in a lowered position as shown in FIGS. 1 and 2 and the outboard housing is centered for straight line steering, movement of the rudder post **8** angularly about its axis in either direction will result in corresponding movement of the cup member **19**, which by its pivotal connection to the outboard housing **4** will cause the outboard housing to be moved about the generally vertical steering axis defined by the axis of the shaft **16**. Inasmuch as the rudder post **8** is journalled on the plate **3** fixed to the transom of the boat, and thus the axis of the rudder post is fixed relative to the boat, the angular movement of the rudder post may be effected by conventional mechanisms such as the tiller **9** and no special through hull linkages or the like are required to control the steering position of the outboard housing **4**. When the outboard housing is centered as shown in FIG. 3, any upward tilting of the housing **4** will result in the pivot pin **20** being moved upwardly toward the rudder post **8**. In accordance with one aspect of the invention the axis of the pin **20** will be aligned with the axis of the rudder post **8** when the outboard housing is in its fully upwardly tilted position. Accordingly, any angular movement of the rudder post, when the outboard unit is fully tilted, will not result in any corresponding movement of the outboard housing **4** about its steering axis inasmuch as the rudder post axis and the axis of the pin **20** will be aligned and therefore the cup member **19** will merely pivot about the axis of the pin **20** without moving the outboard housing **4**.

In the specific embodiment shown, inasmuch as the housing **4** is constrained to move about a fixed horizontal pivotal axis, and the axis of the rudder post **8** is fixed relative to and extends perpendicularly to this fixed horizontal tilt axis, the axis of the pivot pin **20** will become aligned with the axis of the rudder post **8** even though the outboard housing **4** is tilted upwardly from a steering position other than a straight ahead position. Therefore, if the outboard housing is displaced angularly about the axis of the shaft **16** from the straight ahead position of the housing at the time the outboard housing is tilted upwardly the housing will automatically move about the steering axis toward a centered position regardless of the angular position of the rudder post **8**. Thus, no matter the steering position of the outboard housing unit when it is tilted upwardly to its fully tilted position, it will be centered relative to the boat, and any subsequent movement of the central steering control so as to move the rudder post **8** will not effect any corresponding movement of the outboard housing.

Thus, there will be seen that there has been provided a novel and improved steering mechanism for an inboard outboard unit which fulfills all the stated objects of the invention. While the invention has been described in terms of the specific embodiment shown in the drawings, it will be apparent to those skilled in the art that the invention may be adapted to other different propulsion units. Accordingly, the foregoing description is to be taken as illustrative of, and not as limiting the scope of, the invention, and the invention shall be deemed to be limited only by the appended claims which shall include within their scope all structure which logically falls within the language of these claims.

I claim:

1. In a marine propulsion unit including a propeller shaft housing adapted to be located outboard of the hull of a vessel and to be drivingly connected to an engine mounted on the vessel, means for supporting said housing on said vessel for tilting movement about a horizontal axis and for pivotal movement about a generally vertically extending steering axis, a rudder post, means rotatably mounting the rudder post with the axis of the rudder post fixed relative to said vessel, the axis of the rudder post and said steering axis lying in a common vertically extending plane, the axis of said rudder post extending at right angles to and intersecting said horizontal axis, a member mounted for movement with said rudder post about the axis of the post, a second member pivotally mounted on said first member for movement relative thereto about an axis lying with said horizontal axis in

a common horizontally extending plane, and pivot means connecting said second member to said housing, said pivot means having a pivot axis lying in said common vertical plane and extending through the intersection of said horizontal axis and the axis of said rudder post, the axis of said pivot means normally being angularly displaced about said horizontal axis from the axis of said rudder post and from said steering axis.

2. In a marine propulsion unit including a propeller shaft housing adapted to be located outboard of the hull of a vessel and to be drivingly connected to an engine mounted on the vessel, means for supporting said housing for tilting movement about a horizontal axis and for pivotal movement about a generally vertically extending steering axis, a rudder post, means rotatably mounting the rudder post with the axis of the rudder post being fixed relative to said vessel, the axis of the rudder post and said steering axis lying in a common vertically extending plane, the axis of said rudder post extending at right angles to and intersecting said horizontal axis, a member mounted for movement with said rudder post about the axis of the post, a second member pivotally mounted on said first member for movement relative thereto about an axis lying with said horizontal axis in a common horizontally extending plane, and pivot means connecting said second member to said housing, said pivot means having a pivot axis lying in said common vertical plane and extending through the intersection of said horizontal axis and the axis of said rudder post, said housing being movable between a first position wherein the axis of said pivot means is angularly spaced about said horizontal axis from the axis of the rudder post and said steering axis to a second position wherein the axes of the rudder post and pivot means are in alignment.

3. In a boat having a stern transom with an opening therethrough spaced below the upper edge of the transom, a propeller shaft housing located aft of said transom and mounting a propeller, an engine mounted on said boat forward of said transom, means drivingly connecting said engine and propeller and having a portion extending through said opening, mounting means mounted on said transom in water tight relation and extending about said opening and having an opening for the passage of said portion of said means drivingly connecting said engine and propeller, means mounting said propeller shaft housing for movement about a horizontal axis and about a generally vertically extending steering axis including an intermediate member, means mounting said intermediate member on said mounting means for movement about one of said one horizontal and steering axes, means mounting said propeller shaft housing and said intermediate member for movement about the other said horizontal and steering axes, a rudder post, means mounting the rudder post for movement about a generally vertical axis fixed relative to said vessel, the rudder post axis and said steering axis lying in a common vertical plane, said rudder post axis extending at right angles to said horizontal axis, a fork member connected for movement with said rudder post and having prongs extending on opposite sides of said portion of said means connecting said engine and propeller, a link member pivotally mounted on said prongs for movement relative thereto about an axis lying in a common horizontal plane with said horizontal axis, and pivot means drivingly connecting said link member and said propeller shaft housing and permitting relative movement therebetween about an axis lying in said common vertical plane and passing through the intersection of said rudder post and horizontal axes, the axis of said pivot means normally being angularly spaced about said horizontal axis from said rudder post and steering axes.

4. In the combination described in claim 3 said propeller shaft housing being movable between a first position wherein the axis of said pivot means is angularly spaced from said rudder post and steering axis to a second position in which the axis of said pivot means is in alignment with said rudder post axis.

5. In the combination described in claim 3, said link member being a hood-like member disposed within the prongs of said fork and disposed over and partially about a portion of said means drivingly connecting said engine and propeller.

6. In the combination described in claim 3, said mounting means including a plate mounted on said transom on the after side thereof and surrounding said opening in the transom, a portion of said rudder post being disposed forward of said plate and within said opening in the transom, and means for moving said rudder post about its axis including means connected to the rudder post forward of said mounting plate.

7. In the combination described in claim 6, said propeller shaft housing being movable between a first position wherein the axis of said pivot means is angularly spaced from said rudder post axis and a second position in which said axis of the pivot means is in alignment with said rudder post axis.

8. In the combination described in claim 3, said intermediate member being a yoke supported on said mounting means for movement about said horizontal axis, said horizontal axis being fixed relative to the boat, said propeller shaft housing being mounted on said intermediate member for movement relative thereto about said steering axis.

9. In the combination described in claim 4, said intermediate member being pivotally mounted on said mounting means for movement about said horizontal axis, said horizontal axis being fixed and said propeller shaft housing being mounted on said yoke for movement relative thereto about said steering axis, whereby if said propeller shaft housing is not centered relative to said boat as said propeller shaft housing is tilted upwardly about said horizontal axis it will move about said steering axis and relative to said rudder post toward centered position relative to said boat.

10. In the combination described in claim 6 said intermediate member being supported on said mounting plate for movement about said horizontal axis, said horizontal axis being fixed relative to the boat, and said propeller shaft housing being mounted on said yoke for movement about said vertical axis, whereby if said propeller shaft housing is not centered relative to said boat as said propeller shaft housing is tilted upwardly about said horizontal axis it will move about said steering axis and relative to said rudder post toward centered position relative to said boat.

11. In the combination described in claim 7, said intermediate member being pivotally mounted on said mounting plate for movement about said horizontal axis, said horizontal axis being fixed relative to the boat, and said propeller housing being mounted on said yoke for movement about said steering axis, whereby if said propeller shaft housing is not centered relative to said boat as said propeller shaft housing is tilted upwardly about said horizontal axis it will move about said steering axis and relative to said rudder post toward centered position relative to said boat.

12. In a marine propulsion unit including a propeller shaft housing located rearwardly of the transom of a vessel, a propeller shaft in said housing, said transom being provided with an opening, and means extending through said opening for drivingly connecting said propeller shaft to an engine mounted in said vessel, support means separate from said drivingly connecting means for supporting said housing on said vessel for tilting movement about a horizontally extending axis and for pivotal movement about a generally vertically extending steering axis, a rudder post, means for rotatably mounting the rudder post with its axis fixed relative to said vessel and with the axis of the rudder post and said steering axis lying in a common vertically extending plane,

and means for providing movement of said propeller shaft housing about said steering axis in response to angular movement of the rudder post about its fixed axis including a universal pivotal connection between said rudder post and said propeller shaft housing, said support means including plate means adapted to be mounted on said transom of said vessel and fixed thereto in watertight relation, said outboard housing being supported on said plate means, said means for mounting said rudder post being integrally carried by said plate means, said plate means extending outwardly beyond the periphery

of said transom opening entirely about the circumference of said opening, and said rudder post at least in part being disposed on the forward side of said plate opposite said propeller shaft housing.

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