Feb. 28, 1950 A. W. WANZER 2,499,339

OUTBOARD PROPELLER MECHANISM FOR BOATS

Filed Nov. 20, 1944 4 Sheets-Sheet 1

Fig. 1.

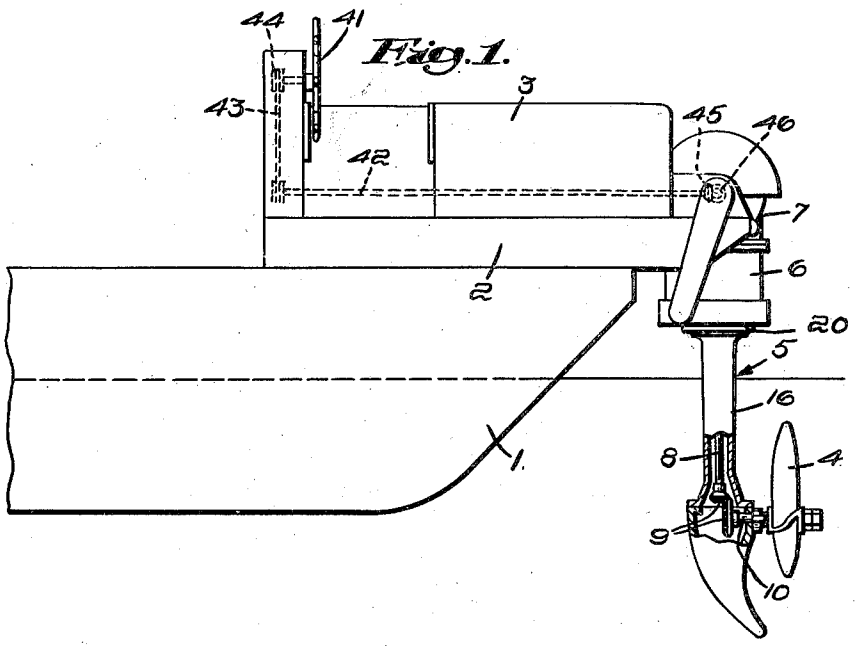
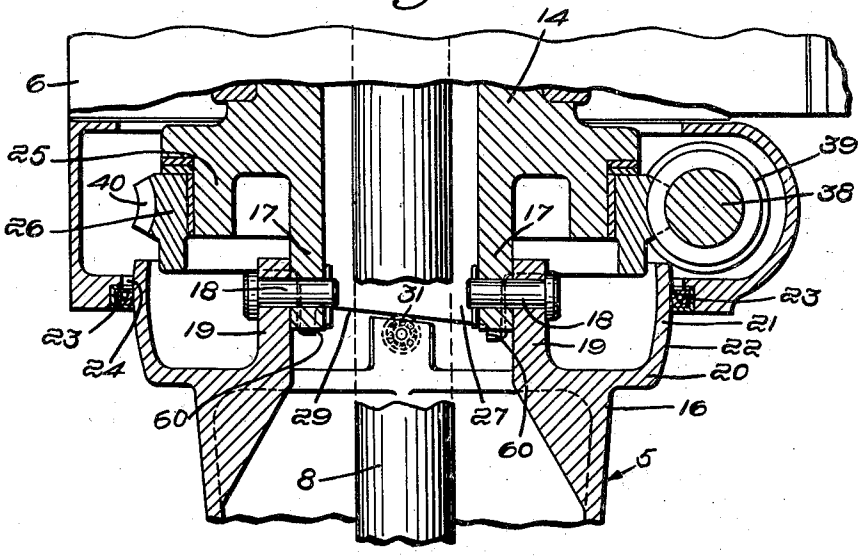


Fig. 4.



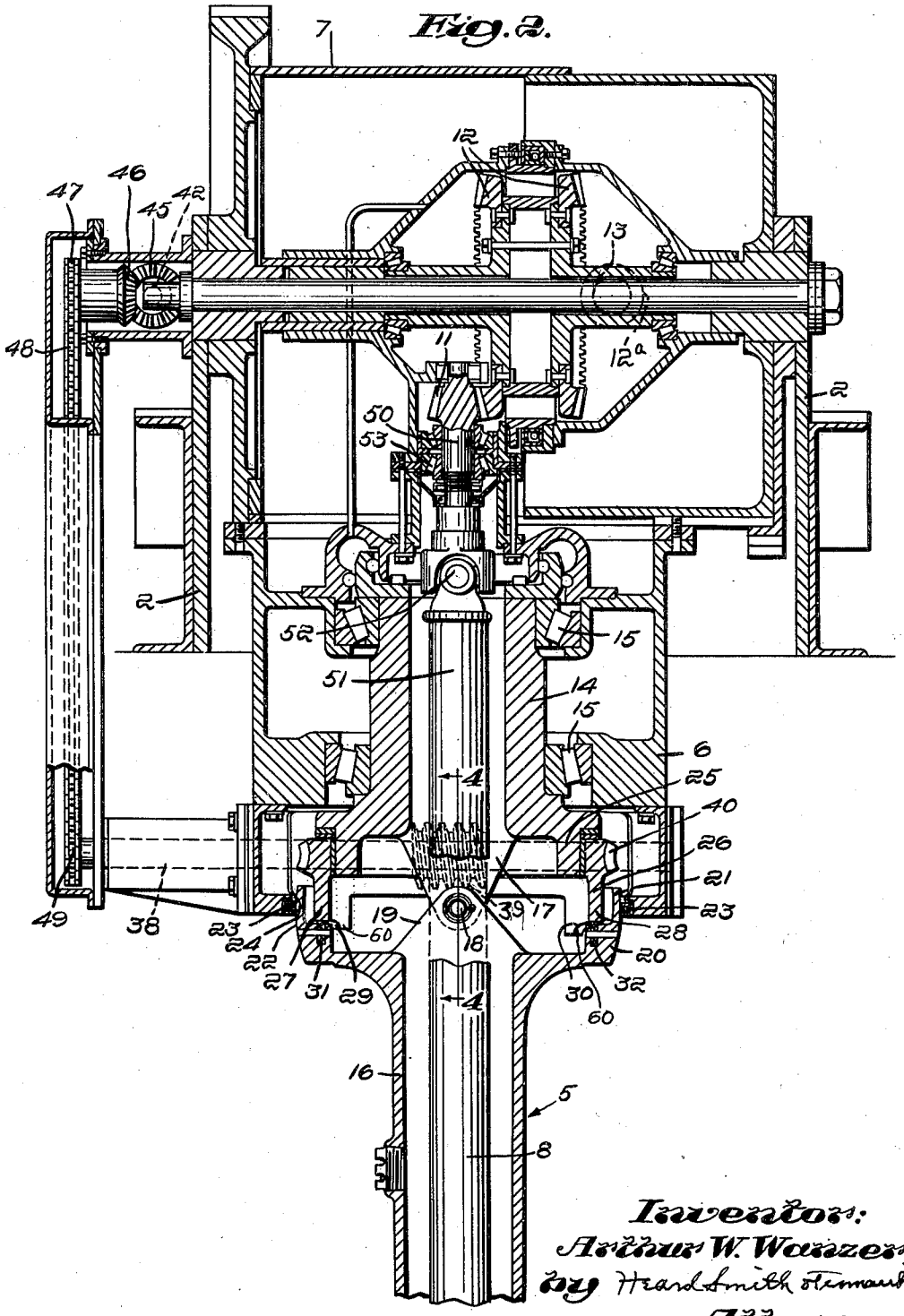
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Fig. 2.



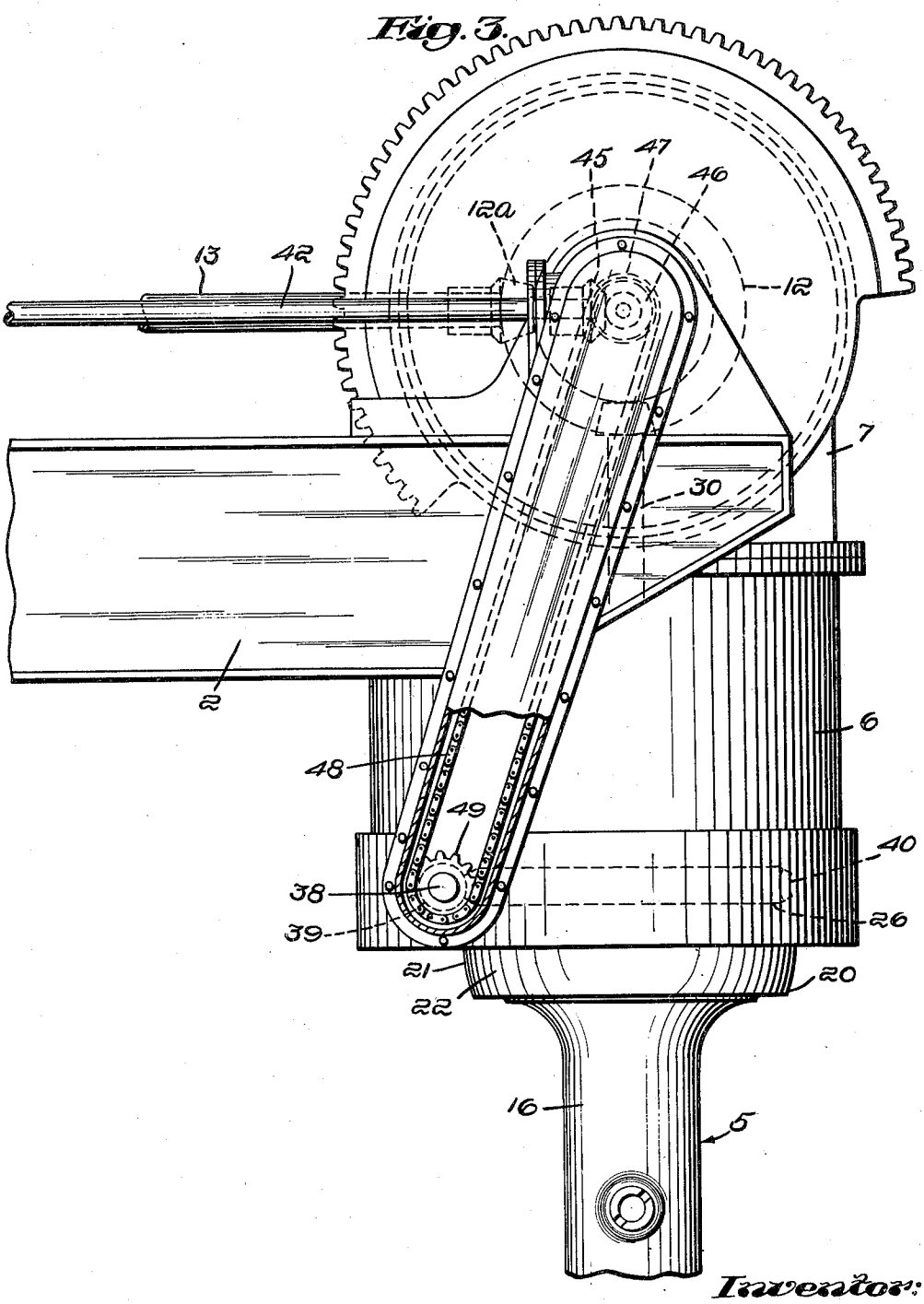
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OUTBOARD PROPELLER MECHANISM FOR BOATS

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Fig. 3.



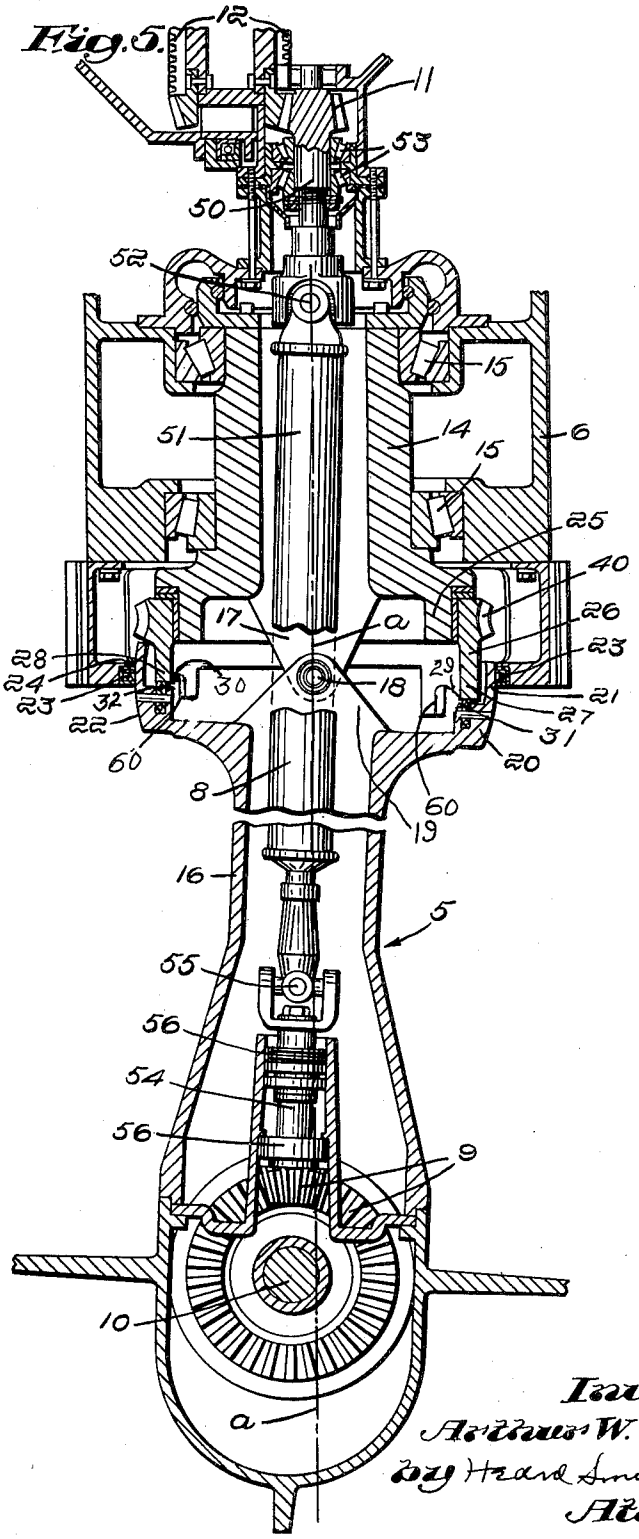
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OUTBOARD PROPELLER MECHANISM FOR BOATS

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Fig. 5.



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OUTBOARD PROPELLER MECHANISM FOR BOATS

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Application November 20, 1944, Serial No. 564,213

4 Claims. (Cl. 115—35)

1

This invention relates to propeller mechanism for boats of the type in which the propeller is carried on a horizontal propeller shaft situated at the lower end of a vertically extending propeller-supporting housing and is driven by a driving shaft extending vertically through the housing, and in which said housing is mounted to turn about a vertical axis for steering the boat.

In propeller mechanism of this type the transmission of power through the vertical driving shaft produces a turning moment on the vertically extending housing tending to turn it about its vertical axis in the same direction as that in which the driving shaft is rotating, and if this turning moment is unbalanced it places an extra load on the steering mechanism when the latter is actuated to turn the housing in a direction opposite to such turning moment and assists the steering operation when the housing is turned in the opposite direction, thus making it much harder to steer the boat in one direction than in the other.

In order to overcome and balance this turning moment on the housing, it has been proposed to offset the propeller shaft from the vertical shaft of the housing so that when the propeller is operating, the thrust on the propeller shaft subjects the housing to another turning moment that is in a direction opposite to that in which the housing is subjected by the rotation of the vertical driving shaft. A propeller mechanism having this construction is illustrated in the Mathewson Patent No. 2,335,597, November 30, 1943.

The turning moment to which the housing is subjected when power is being transmitted through the driving shaft may for convenience be referred to as the "primary turning moment," and the opposing turning moment to which the housing is subjected by the offset relation between the axis of the propeller and the vertical axis about which the housing turns may be referred to as the "secondary turning moment."

In propeller mechanism of this type, the primary turning moment on the housing varies with the power being transmitted through the driving shaft. In the device of said Patent No. 2,335,597, however, the propeller shaft has a fixed offset position with respect to the vertical axis of the housing, and hence the thrust on the propeller shaft is always acting to turn the housing in opposition to said primary turning moment through a fixed leverage regardless of the amount of power being transmitted through the driving shaft.

It is one of the objects of my present invention to provide a novel propeller mechanism of the above type in which the offset relation between the propeller shaft and the vertical axis of the propeller supporting housing will be varied automatically as the power transmitted through the driving shaft varies, so that the primary turning moment on the housing resulting from such transmission of power will at all times be balanced by the secondary turning moment thereon due to the thrust on the propeller shaft, said secondary turning moment increasing as the primary turning moment increases and decreasing as said primary turning moment decreases.

Another feature of the invention relates to a novel construction by which this automatic balancing of the primary turning moment on the propeller-supporting housing may be utilized to assist the operation of steering the boat by turning said housing about its vertical axis.

Other objects of the invention are to improve generally propeller mechanism in the particulars hereinafter set forth.

In the drawings:

Fig. 1 is a fragmentary view of a boat having my improved propeller mechanism mounted thereon.

Fig. 2 is an enlarged vertical section through the supporting housing and illustrating the driving connections between the engine shaft and the vertical driving shaft.

Fig. 3 is a side view of Fig. 2 looking toward the right with parts broken out.

Fig. 4 is an enlarged section on the line 4—4, Fig. 2.

Fig. 5 is a vertical sectional view through the propeller housing taken at right angles to the propeller shaft and looking toward the rear, Fig. 1 and showing the manner in which the offset relation between the propeller shaft and the axis of the propeller housing is established.

A propeller mechanism embodying my invention may be of the type adapted to be mounted on the deck of a boat with the propeller-supporting housing in outboard relation, or it may be of the type in which the motor is located within the vessel below the deck.

In the drawings, I have illustrated an embodiment in which the motor and operative connections between the latter and the propeller are mounted on the deck of the boat.

In the drawings 1 indicates the boat, barge or other vessel which is equipped with my improved propeller mechanism, the latter comprising a power generator, a propeller and operative connections between the power generator and pro-

peller, all of which parts are mounted on a suitable base or support 2 adapted to be mounted on the deck of the vessel 1.

The power generator may be of any suitable type such, for instance, as an internal combustion engine, and it is indicated generally at 3. The propeller is shown at 4 and it is carried at the lower end of a vertically extending propeller-supporting housing 5 which depends from and is supported by an extension 6 formed on a suitable supporting housing 7 that is mounted on the base 2. The operative connections between the power generator 2 and the propeller 4 include a vertically extending driving shaft 8 enclosed in the housing 5, the lower end of said shaft 8 being connected by bevel gears 9 to a horizontal propeller shaft 10 that is journaled in the housing and on which the propeller 4 is mounted. The upper end of the driving shaft 8 is connected by suitable bevel gears 11, 12 and 12a to an engine shaft 13 that is actuated by the engine or other power generator 3.

The vertically extending housing 5 is mounted for turning movement about its vertical ax's and for this purpose the upper end 14 of said housing is supported in suitable bearings 15 carried by the extension 6 of the housing 7. The means for turning the housing 5 for steering the boat will be presently described.

As stated above the transmission of power through the driving shaft 8 for operating the propeller produces a turning moment (herein referred to as the pirmary turning moment) on the housing 5 which tends to turn it about its vertical axis in the same direction as that in which the shaft 8 is rotating and one purpose of the present invention is to provide novel means for automatically balancing this primary turning moment by maintaining the propeller shaft 10 in such an offset relation to the vertical axis about which the housing turns that the turning moment on the housing due to the thrust on the propeller shaft (herein referred to as the secondary turning moment) will balance the primary turning moment on the housing due to transmission of power through the driving shaft 8 under all operating conditions.

The housing 5 is made in two sections which are pivotally connected together, an upper section 14 which is mounted in the bearings 15 and a lower section 16 which carries the propeller shaft 10. The upper housing section 14 is provided with two depending ears 17 which are pivotally connected at 18 to upstanding ears 19 with which the lower housing section 16 is provided. The axis of the pivotal connections 18 is parallel to the axis of the propeller shaft 10. The lower housing section 16 is provided at its upper end with an enlarged portion 20 having an upstanding annular flange 21, the outer surface 22 of which is a section of a sphere having as its center a point in the axial line 18 midway between the ears 17. This flange 21 extends into an opening 24 in the lower end of the extension 6 of the supporting housing 7 and there is provided a suitable sealing ring 23 between the surface 22 and the wall of the opening 24 to make a tight joint at this point. The curved exterior surface 22 of the upstanding flange and the sealing ring 23 maintain a tight joint between the housing 5 and the extension 6 of the housing 7 as the pivoted housing section 16 swings about its pivot 18 and as the housing 5 turns about its vertical axis.

Rotatively mounted on the lower end 25 of the upper housing section 14 is a gear member 26 forming part of the steering mechanism presently

to be described and which is provided with two depending portions 27, 28 that are situated inside of the flange 21 of the lower housing section 16 and each of which portions is formed on its underside with an inclined cam surface, said surfaces being indicated at 29 and 30 respectively. The large portion 20 of the pivoted housing section 16 carries two antifriction rolls 31, 32 which bear against said cam surfaces 29, and 30. These two cam surfaces 29, 30 are located on opposite sides of the axis of the pivotal connection 18 and therefore any relative rotating movement between the gear 26 and the housing section 14 will operate through the cam surfaces 29, 30 and the rolls 31, 32 to turn the pivoted housing section 16 about its pivot 18.

When power is being transmitted through the driving shaft 8 for operating the propeller, the primary turning moment on the housing 5 due to the resistance of the turning of the propeller shaft 10 will, as stated above, tend to turn the housing about its vertical axis a (see Fig. 5) in the same direction as that in which the driving shaft 8 is rotating. As stated above the gear 26 which carries the cam surfaces 29, 30 forms part of the steering mechanism and is, therefore, stationary except when it is operated for steering the boat. Assuming that the said gear 26 is stationary, and that no power is being transmitted through the drive shaft 8, the housing section 16 will assume a vertical position with the roll 31 at the low point of the cam surface 29, and the roll 32 at the high point of the cam surface 30.

If, now, the drive shaft 8 is turned toward the left, Fig. 5, or clockwise looking down on Fig. 5, the primary turning moment imparted to the housing 5, due to the transmission of power through the shaft 8, will tend to turn the housing toward the left or clockwise looking down on Fig. 5, and this will result in the roll 31 moving over the cam face 29 from the low point of said cam face toward the high point, and the roll 30 moving along the cam surface 30 from the high point thereof toward the low point, thereby causing the lower section 16 of the housing to have a swinging movement about the axis 18 into a position such as shown in Fig. 5. Such swinging motion moves the propeller shaft 10 laterally to one side of or offset from the axial line a of the propeller housing as seen in Fig. 5 and when the propeller shaft is in such offset position the thrust thereon will produce a secondary turning moment on the propeller-supporting housing 5 which will tend to turn it in an opposite direction to that in which it is turned by the primary turning moment. Because of these opposing forces, the housing 5 will come to rest with the pivoted section 16 thereof in such a position that the secondary turning moment thereon due to the offset position of the propeller shaft will just balance the primary turning moment resulting from transmission of power through the driving shaft 8. The turning movement of the housing will, of course, cause a shift in the direction of the propeller shaft, which, however, can be corrected by turning the gear 26 by the steering mechanism as will be presently described.

If at any time the primary turning moment on the housing 5 increases or decreases due to an increase or decrease of the power transmitted through the driving shaft 8, thus momentarily unbalancing the opposing forces acting on the housing 5 (i. e. the primary and secondary turning moments) said housing will be automatically

turned by the unbalanced forces in one direction or the other about its vertical axis and such turning movement will operate through the cam surfaces 29, 30 and the rolls 31, 32 to swing the pivoted housing section 16 about its pivot 18, thereby varying the offset relation sufficiently to bring said opposing turning moments back into balance. A balance between the primary and secondary turning moments on the housing will thus be automatically maintained, and the pivoted section 16 of the housing will be automatically held in such a position that the secondary turning moment thereon due to the offset position of the propeller shaft will just balance the primary turning moment due to transmission of power through the driving shaft 8.

In order to provide for this swinging movement of the housing section 16 without cramping the vertical driving shaft 8, the latter is made in three sections connected by universal joints. These comprise an upper section 50, an intermediate section 51, and a lower section 54. The upper section 50 is mounted in bearings 53 carried by the housing 7 and thus always maintains a vertical position. This upper shaft section is connected to the intermediate shaft section 51 by the universal joint 52. The lower shaft section 54 carries the bevel gear 9 by which the propeller shaft 10 is rotated and it is mounted in bearings 56 carried by the swinging housing section 16 and it is connected to the lower end of the intermediate shaft section by the universal joint 55.

The steering mechanism for steering the boat includes a transverse shaft 38 carried by the housing extension 6 and provided with a worm 39 meshing with the worm teeth 40 on the gear 26, and suitable mechanism connecting said shaft 38 with the steering wheel 41. This mechanism is similar to that illustrated in my co-pending application Ser. No. 475,744 and which matured into patent 2,458,813 on January 11, 1949, and it comprises a shaft 42 carried by the base 2 and connected by sprocket chain 43 with a sprocket wheel 44 rigid with the steering wheel 41, said shaft 42 having at its rear end a bevel gear 45 which meshes with and drives another bevel gear 46 that has rigid therewith a sprocket wheel 47 meshing with a sprocket chain 48 that engages another sprocket wheel 49 on the shaft 38.

The turning of the steering wheel 41 operates through the above connections to rotate the gear 26 about the lower end 25 of the upper housing section 14 and such turning movement of the gear 26 will operate through the cam surfaces 29, 30 to swing the pivoted section 16 of the housing about its pivot 18 thereby to either increase or decrease the offset relation of the propeller shaft to the vertical axis *a* of the housing 5.

As stated above, so long as power is being transmitted through the driving shaft 8 the propeller shaft will be automatically maintained in an offset relation which subjects the housing 5 to a secondary turning moment that just balances the primary turning moment to which said housing is subjected by transmission of power through the driving shaft 8. Whenever the steering mechanism is operated to turn the gear 26 this balance will be upset either by increasing or decreasing the amount of offset between the propeller shaft and the axis of the housing, thereby increasing or decreasing the secondary turning moment on the housing 5 relative to the primary turning moment thereon. Whenever the balance between the forces tending to turn the propeller housing in either direction is thus upset, said

housing will turn automatically into a position to bring the forces back into balance again.

If it be assumed that the boat is operating with the housing 5 occupying a position in which the propeller shaft 10 is in a position parallel to the forward movement of the boat and it is desired to give the boat a turning movement toward the right, which would involve turning the housing 5 counterclockwise looking down in Fig. 1, the steering wheel 41 will be operated to turn the gear 26 in a counterclockwise direction looking down in Figs. 1 and 4. This turning movement of the gear 26 will operate through the cam surfaces 29, 30 to swing the pivoted section 16 of the propeller-supporting housing laterally, thereby varying the turning moment on the housing due to the offset relation of the propeller shaft relative to the vertical axis *a* with the result that the opposing forces above referred to will be unbalanced. This unbalanced condition will produce an automatic turning movement of the housing 5 about its vertical axis which will bring the opposing forces back into balance and such turning movement of the housing swings the propeller shaft 10 into an angular position relative to the direction of movement of the boat which will result in causing the boat to turn.

The steering of the boat, therefore, is accomplished by turning the gear 26 in one direction or the other and such turning movement operates as above described to give the housing 5 an angular position about its vertical axis which causes the boat to turn in one direction or the other.

It will be noted that the depending portions 27 and 28 of the gear 26 are provided with stop shoulders 60 at each end of the cam surfaces 29, 30, such stop shoulders limiting the extent of the turning movement of the gear 26 on the housing section 14 and preventing the rolls 30, 31 from being carried off from the cam surfaces 29, 30.

I claim:

1. A propeller mechanism for boats comprising a vertically extending propeller-supporting housing, a propeller carried by said housing at its lower end, means for rotating the propeller including a vertically extending driving shaft enclosed in said housing and a horizontal propeller shaft on which the propeller is mounted, means supporting said housing for turning movement about a vertical axis for steering the boat, said housing being made with an upper section and with a lower section which carries the propeller shaft, means pivoting the lower section to the upper section to swing relative thereto about an axis parallel to the propeller shaft, and means responsive to the turning moment on the housing resulting from transmission of power through the driving shaft to swing the lower housing section about its pivotal axis into a position in which the axis of the horizontal propeller shaft is at one side of the vertical axis of the housing.

2. A propeller mechanism for boats comprising a vertically extending propeller-supporting housing presenting an upper section and a lower section pivotally connected thereto, a propeller carried at the lower end of said lower housing section, means for rotating said propeller including a vertically extending driving shaft enclosed in said housing and a horizontal propeller shaft on which the propeller is mounted, means supporting the upper section of said housing for turning movement about a vertical axis for steering the boat, whereby the torque to which the vertical driving shaft is subjected when the propeller is operated produces a turning moment on the hous-

ing tending to turn it about its axis in the same direction as that in which the driving shaft is rotating, steering mechanism for turning the housing to steer the boat, said steering mechanism including an annular member coaxial with the upper housing section and mounted for turning movement thereon, said annular member having a cam surface cooperating with the pivoted housing section to turn it about its pivot as said annular member is turned, said turning moment on the housing member producing a turning motion thereof about its vertical axis which operates through said cam surface to swing the pivoted housing section about its pivot thereby to move the propeller shaft into an offset position relative to said vertical axis.

3. A propeller mechanism for boats comprising a vertically extending propeller supporting housing, a propeller carried by said housing at its lower end, means for rotating the propeller including a vertically extending driving shaft enclosed in said housing and a horizontal propeller shaft on which the propeller is mounted, means supporting said housing for turning movement about a vertical axis for steering the boat, said housing comprising an upper section and a lower section, means mounting the lower section on the upper section for lateral swinging movement relative thereto in a direction at right angles to the propeller shaft, said mounting means holding the two housing sections from relative turning movement about said vertical axis, and cam means responsive to the turning moment on the housing resulting from transmission of power through the driving shaft to swing said lower section into a position in which the axis of the horizontal propeller shaft is at one side of the vertical axis of the housing.

4. A propeller mechanism for boats comprising a vertically extending propeller supporting housing, a propeller carried by said housing at its

lower end, means for rotating the propeller including a vertically extending driving shaft enclosed in said housing and a horizontal propeller shaft on which the propeller is mounted, means supporting said housing for turning movement about a vertical axis, said housing comprising an upper section and a lower section, means mounting the lower section on the upper section for lateral swinging movement relative thereto in a direction at right angles to the propeller shaft, steering mechanism for turning the housing about its vertical axis for steering the boat, said steering mechanism including an annular member turnable about said vertical axis and operatively engaging the lower housing member, one of the two last named parts having a cam surface which engages the other part, whereby the turning moment on the housing resulting from transmission of power through the driving shaft turns the housing relative to said annular member and thereby swings the lower housing section laterally and maintains it in a position in which the propeller shaft is sufficiently offset from said vertical axis so that the turning moment on the housing resulting from said offset relation substantially balances the turning moment to which the housing is subjected due to the transmission of power through the driving shaft.

ARTHUR W. WANZER.

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