United States Patent

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[54] **OUTBOARD MOTOR SUPPORT**
15 Claims, 6 Drawing Figs.

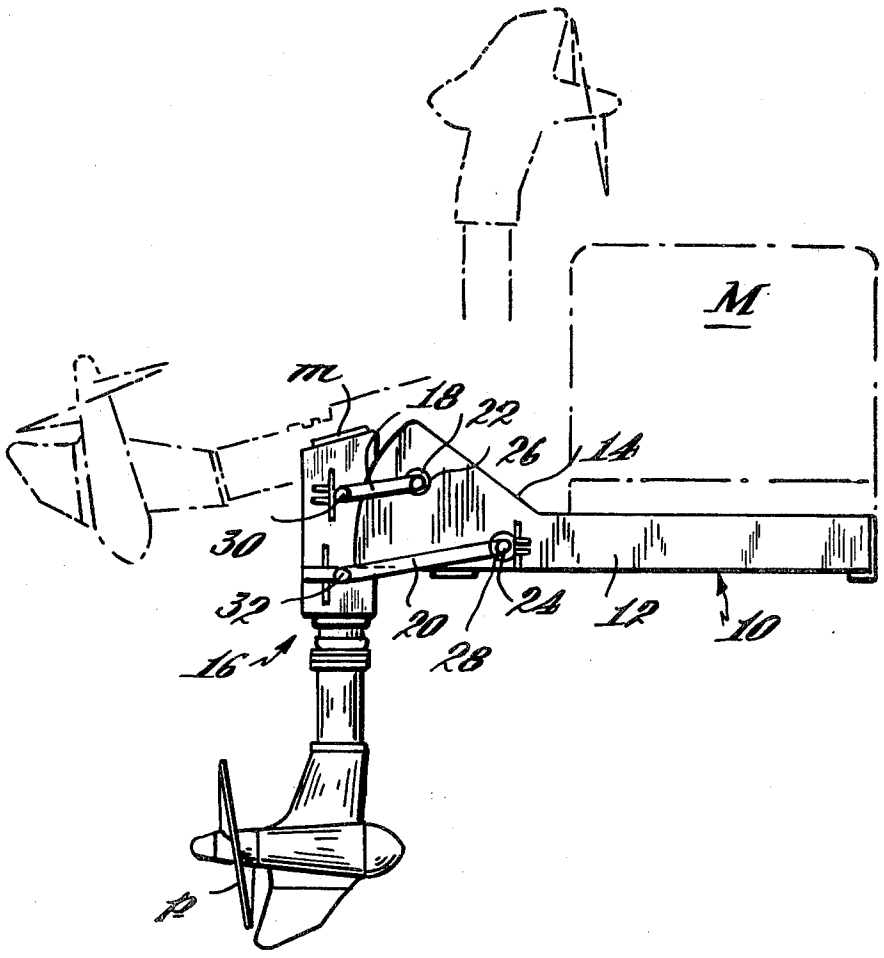
[52] **U.S. Cl.** **115/41**
[51] **Int. Cl.** **B63h 5/12**
[50] **Field of Search** 115/40, 41

[56] **References Cited**
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ABSTRACT: An outboard marine propulsion unit embodying a console adapted to be fastened to a vessel at the stern having spaced parallel arms extending therefrom over the transom for supporting a drive assembly, comprising a propeller and means for effecting rotation thereof, with the propeller submerged in water for rotation about a horizontal axis, and linkage mounting the assembly between the arms for linear and arcuate movement to raise the propeller substantially vertically upward a distance corresponding substantially to its radius and thereafter to swing it along an arc to an inverted position in which it extends substantially vertically upward from the vessel.



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2 Sheets-Sheet 1

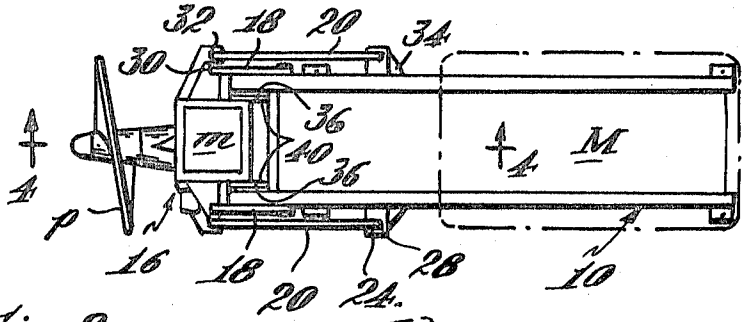


Fig. 2

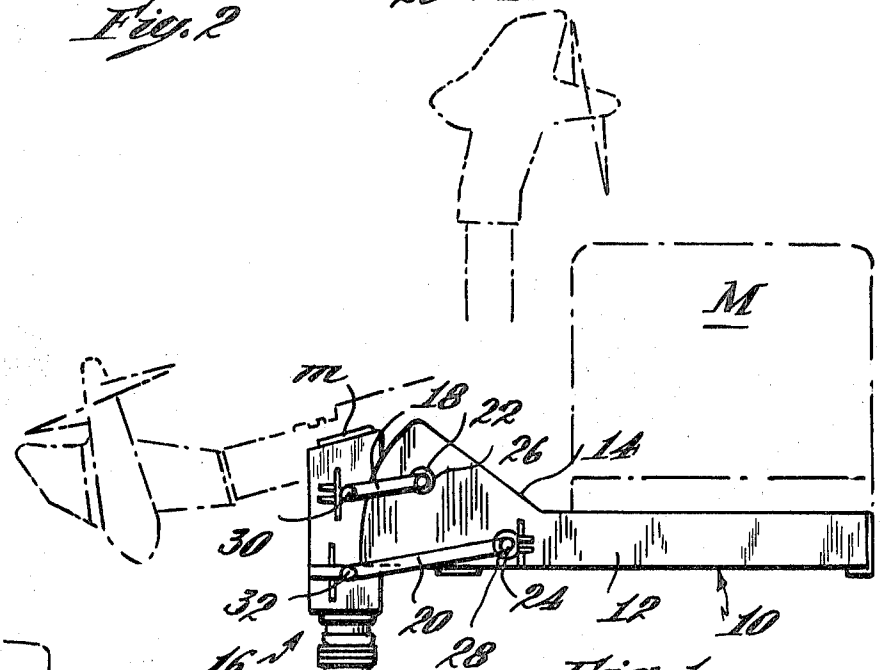


Fig. 1

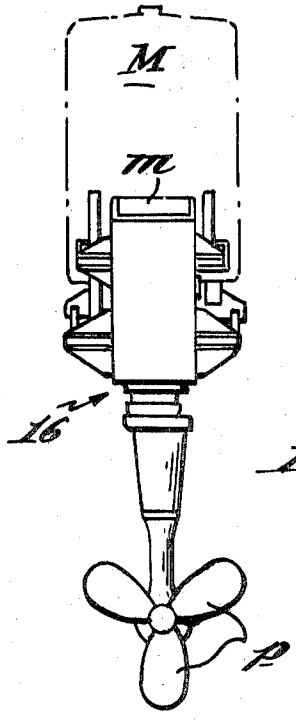


Fig. 3

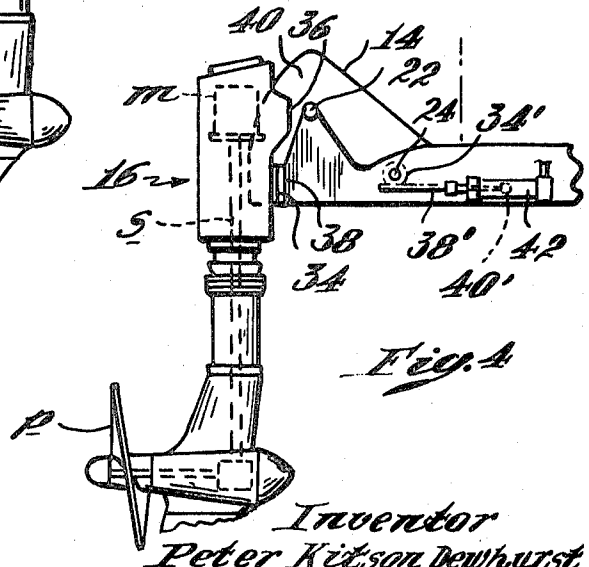


Fig. 4

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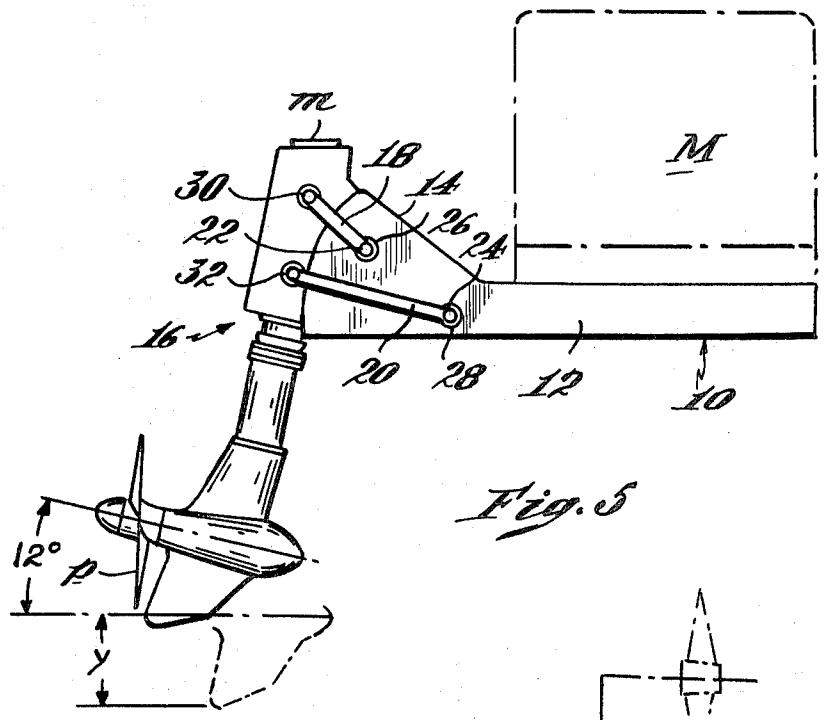

m
18
14
30
22
26
24
32
16
M
20
28
12
10
12°
p
y

Fig. 5

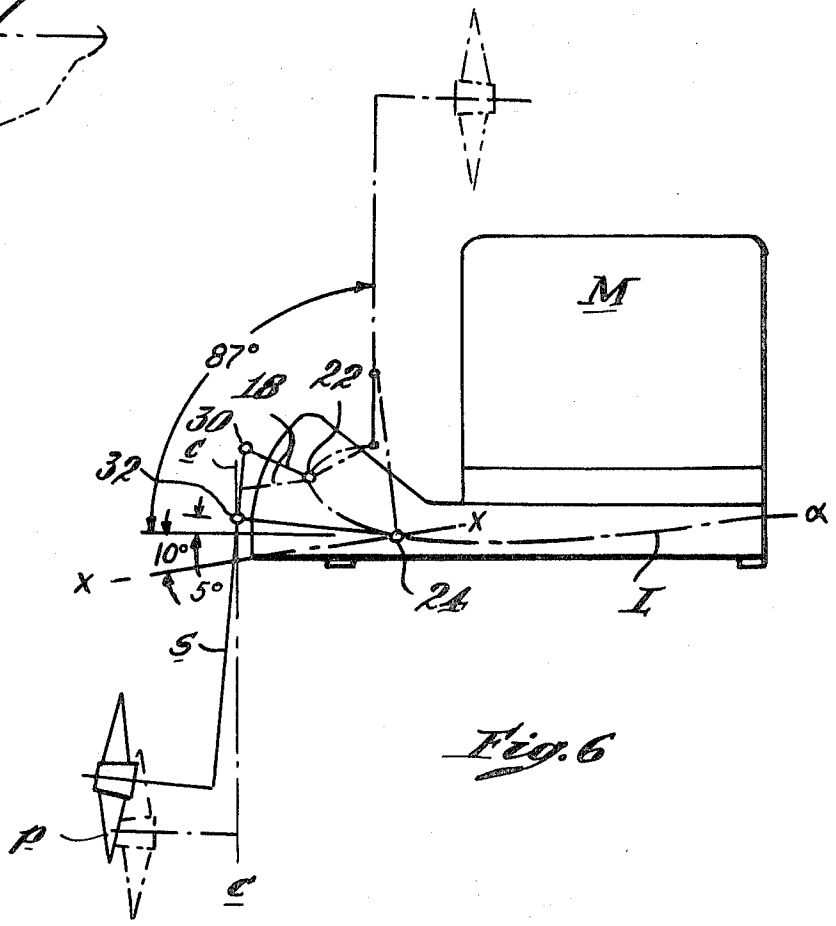

M
87°
18
22
30
c
32
x
α
10°
5°
x
24
I
s
p
c

Fig. 6

OUTBOARD MOTOR SUPPORT

BACKGROUND OF THE INVENTION

Various expedients have been provided for mounting outboard-type marine propulsion units or parts thereof to enable raising the propeller when travelling in shallow water to prevent damage thereto, or where the tide is expected to leave the vessel grounded so that the propeller will not have contact with the bottom. Additionally, provision has been made to allow the propeller shaft to be deflected rearwardly in the event that the propeller strikes an object in the water during forward movement of the vessel and for lifting the propeller completely out of the water for inspection and/or raising it to a position to enable storage or transportation of the vessel. Fixed vertical guideways which enable maintaining the propeller shaft horizontal during vertical movement provide for efficient operation but are not adequate since they prevent displacement of the propeller rearwardly to clear submerged objects; pivotal supports provide for clearing submerged objects, but since the upward movement is accompanied by angular movement efficient operation is reduced; and such combinations of vertical and pivotal supporting means as are known are complex and do not provide the versatility desired. The purpose of this invention is to provide an improved support for the propeller, propeller shaft, drive shaft and optionally the drive motor which will enable raising the propeller substantially vertically while in the water to clear a shallow bottom without reducing its efficiency of operation, or to raise it above the bottom of the vessel in the event of grounding; to permit it to swing rearwardly when colliding with submerged objects; and to permit it to be swung completely out of the water to an inverted position for storage or transportation.

SUMMARY

As herein illustrated, the drive assembly includes a nacelle mounting a motor, a drive shaft and propeller, and means supporting the nacelle outboard of the vessel with the propeller submerged for rotation about a horizontal axis; characterized in that the aforesaid means supports the nacelle for movement from said submerged position of the propeller substantially vertically upwards through a distance corresponding substantially to the radius of the propeller and thereafter arcuately to an elevated inverted, substantially perpendicular position standing upwardly from the vessel. The supporting means comprises a pair of spaced parallel arms connected to and extending outboard of the vessel and pair of links pivotally connected at their rear ends to the nacelle in longitudinally spaced relation and at their forward ends to spaced parallel shafts mounted between said arms in vertically and horizontally offset relation to each other. The aforesaid links are of different length, the pair of links of greater length being situated below the pair of links of shorter length and being so proportioned that when the longitudinal centerlines of the pair of links of greater length incline rearwardly and downwardly at approximately 10° below a horizontal passing through the forward ends of the links, the pair of links are parallel and the nacelle is substantially vertical. Upward movement of the links of greater length from below the horizontal to approximately 5 to 8° above the horizontal takes place about an instantaneous axis of indefinite length such that the assembly remains substantially vertical during such movement and continued upward movement of the assembly, as the pairs of links of greater length rise above substantially 5 to 8° takes place about an instantaneous axis of constantly changing radius which decreases from a length corresponding substantially to the length of the pair of links of greater length to the length of the pair of links of shorter length within approximately 75° to said substantially vertical position.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is an elevation of the marine propulsion unit showing the propeller in its normal downwardly extending, substantially vertical position and in dotted lines partially elevated and completely elevated;

FIG. 2 is a plan view of FIG. 1;

FIG. 3 is a front elevation of FIG. 1 as seen from the left side thereof;

FIG. 4 is an elevation, partly in section, taken on the line 4—4 of FIG. 2;

FIG. 5 is an elevation similar to FIG. 1, showing the propeller raised by an amount corresponding to the radius of the propeller while still submerged; and

FIG. 6 is a diagrammatic view of the movement of the propeller from its downwardly extending vertical position to its upwardly extending vertical position and showing the locus of the constantly changing axis of angular movement of the propeller as it moves from its depressed position to its elevated position.

Referring to the drawings, FIGS. 1 and 4 show an outboard marine propulsion unit of the kind adapted to be mounted on the stern of a vessel, for example a barge, with a drive assembly comprising a drive motor *m*, drive shaft *s*, propeller *p* and suitable gearing supported by a nacelle **16** which, in turn, is suspended substantially vertically between a pair of spaced parallel arms **12** extending outboard from the vessel so that the propeller is submerged in the water. The arms are integral extensions of a console **10** fabricated of metal plates which is adapted to be bolted or otherwise secured to the deck of the vessel and in turn provides support for a motor M by means of which the nacelle supporting drive assembly is elevated and depressed as will appear hereinafter.

The rear ends of the arms **12–12** have vertically disposed fan-shaped bearing plates **14–14** and the nacelle is supported between the bearing plates by pairs of links **18–18**, and **20–20**. The pairs of links **18–18** and **20–20** are mounted at the outer sides of the bearing plates and are connected at their forward ends to vertically and horizontally offset parallel shafts **22, 24**, the latter being journaled in bearings **26, 28** carried by the bearing plates. The rear ends of the links are connected to vertically spaced trunnions **30, 32** fixed to and extending laterally from opposite sides of the nacelle.

The nacelle has at its forward side thrust plates **34** adapted by engagement with bearing blocks **38** provided on the inner sides of the bearing plates, to hold the assembly with the drive shaft substantially vertical as illustrated in FIG. 4, in which position the axis of the propeller shaft is substantially horizontal and the pairs of links **18** and **20** are substantially parallel; and bearing surfaces **36** adapted by engagement with bearing surfaces **40** on the inside of the bearing plates **14** to provide lateral support during its swinging movement. In this position the rear ends of the links **20** are below the forward ends and the longitudinal center lines X–X of the links **20** slope downwardly from their forward ends approximately 10° to the horizontal (FIG. **6**). This is the normal position of the assembly for efficient operation when underway provided there is sufficient draft.

The aforesaid links enable raising the propeller from its lowermost position to a position above the bottom of the vessel by an amount corresponding to the radius of the propeller without appreciable angular displacement of the drive shaft to the vertical or the propeller shaft to the horizontal. This vertical movement enables raising the propeller for shallow draft navigation without substantial loss of efficiency and enables raising the propeller to a position above the level of the bottom of the vessel so that grounding of the vessel will not damage the propeller. The vertical movement in combination with a arcuate movement permits the propeller to rise upwardly over a submerged object without destructive impact since there is just enough arcuate movement embodied in the linkage so that a rearwardly directed force will be largely absorbed by vertical displacement. Arcuate movement of the unit is minimal until the propeller has been raised to its inoperative post position along a flat arc subtending at an angle of approximately 15 to 18° from 10° below the horizontal to 5 to 8° above the horizontal and inversion takes place along an arc of much shorter radius which subtends an angle of approximately 75 to 80° starting at about 5 to 8 ° above the horizontal. FIG. 5 shows the propeller raised through a vertical

distance Y corresponding substantially to the radius in which the axis of the propeller shaft inclines upwardly to the horizontal about 12°. In this position the plane of the propeller is tilted so little that it operates substantially at the maximum efficiency.

FIG. 6 diagrammatically illustrates the links 18 and 20 and the centerline c–c of the nacelle as it is moved thereby from the position extending substantially vertically downward from the vessel to an inverted position extending substantially vertically upward from the vessel. Initially, the pair of links incline downwardly and rearwardly and are parallel to each other. At this position, the drive shaft is substantially vertical. During the first approximately 10° of angular movement of the lower links 20 upwardly to a horizontal position and from the horizontal position upwardly to approximately 5 to 8° above the horizontal, the drive shaft and propeller move along a flat arc, the radius of which is at infinity. From approximately 5 to 8° above the horizontal, upwardly, the shaft and propeller move through an acute arc, the radius of which diminishes from a length corresponding to that of the longer links 20 to the shorter links 18. The initial 15 to 18° of arcuate movement about an instantaneous axis, the radius of which changes from an infinite length to a length corresponding to the length of the longer links affords a sufficient, substantially vertical movement without angular deflection to provide for raising the propeller substantially vertically from its normal position in which its axis of rotation is substantially at the level of the bottom of the protruding to a position in which the axis is above the level of the bottom by an amount corresponding substantially to the radius of the propeller and thus without sacrificing the efficiency of its operation. Movement beyond about 5 to 8° above the horizontal takes place along an acute arc, the instantaneous axis of which diminishes in radius from a length corresponding to the length of the longer links to a length corresponding to the shorter links and guides the shaft and propeller in a tight circle to said inverted upstanding position. The locus of the instantaneous axis of arcuate movement afforded by the linkage is diagrammatically shown in FIG. 6 by the line L which originates at infinity and passes successively through the axes of the shafts 24 and 22.

To effect elevation of the assembly the rear ends of the links 20 are made fast to the shaft 24 and the latter has fixed to it a pinion 34'. A rack 36' is held in engagement with the pinion and connected at one end to the protruding end of a piston rod 38', the other end of which is connected to a piston 40' in a hydraulic cylinder 42. The hydraulic cylinder is supplied with pressure fluid from a compressor which, in turn, is driven by the motor M. The means for effecting elevation of the linkage, however, is not considered to be significant since other means may be employed for this purpose.

The linkage herein shown provides an inexpensive and reliable means for mounting the assembly; however, it is within the scope of the invention to employ any known equivalent for the aforesaid linkage and to provide for electric, hydraulic or manual operation of the same.

I claim:

1. An outboard drive assembly for a vessel comprising a nacelle mounting a propeller and propeller shaft, and means supporting the nacelle outboard of the vessel with the propeller submerged and with the shaft substantially horizontal, said means supporting the nacelle for compound rectilinear and arcuate movement from a substantially vertical, downwardly extending position in which the propeller is submerged to an elevated, substantially inverted perpendicular position standing upwardly from the vessel; characterized in that said means is operative to initiate movement from the one position to the other which is predominantly rectilinear for a distance corresponding substantially to the radius of the propeller and thereafter is predominantly arcuate until the propeller reaches said upstanding inverted position.

2. An outboard drive assembly according to claim 1, wherein the nacelle supports a drive motor, a drive shaft connected at one end to the motor, and gearing connecting the drive shaft and propeller shaft.

3. An outboard drive assembly according to claim 1, wherein the nacelle is free to move along said substantially vertical and arcuate paths in response to a thrust applied thereto in a rearward direction below the water line.

4. An outboard drive assembly according to claim 1, comprising power-operable means for effecting movement of the nacelle along said substantially vertical and arcuate paths.

5. An outboard drive assembly according to claim 1, wherein the vertical distance the nacelle travels is at least sufficient to raise the center of rotation of the propeller to a level above the bottom of the vessel which corresponds to the radius of the propeller.

6. An outboard drive assembly according to claim 1, wherein said means supports the nacelle for movement along a substantially flat arc subtending an angle of approximately 15 to 18° from approximately 10° below the horizontal to 5 to 8° above the horizontal on a radius which is of substantially infinite length so that the nacelle travels substantially vertically through said initial movement and thereafter along an acute arc subtending an angle of approximately 75° from approximately 5 to 8° above the horizontal to substantially 80° above the horizontal on a radius which is relatively short, to said inverted, substantially perpendicular position standing up from the vessel.

7. An outboard drive assembly for a vessel comprising a nacelle mounting a propeller and shaft, and means supporting the nacelle outboard of the vessel with the propeller submerged and with its shaft substantially horizontal, said means supporting the nacelle comprising long and short links pivotally connected at their rear ends to the nacelle in vertically spaced relation to each other and at their forward ends to the vessel in vertically and horizontally offset relation to each other; characterized in that in the normally operative position of the nacelle, in which the propeller is submerged and the shaft is substantially horizontal, the links are substantially parallel so that the initial upward movement of the nacelle takes place along an arc of infinite radius and hence is substantially vertical and thereafter the nacelle travels upwardly along an arc, the radius of which varies from the length corresponding to that of the longer link to a radius corresponding to that of the shorter link, to said inverted position standing upwardly from the vessel.

8. An outboard drive assembly according to claim 7, comprising pairs of links supporting said nacelle.

9. An outboard drive assembly according to claim 7, wherein the initial position of the longer link is substantially 10° below the horizontal, and wherein at this position the links are parallel.

10. An outboard drive assembly according to claim 7, wherein the nacelle travels along said arc of infinite radius through a substantially perpendicular distance at least equal to the radius of the propeller.

11. An outboard drive assembly according to claim 7, wherein the nacelle travels along said arc of substantially infinite radius through a substantially perpendicular distance sufficient to raise the axis of rotation of the propeller above the bottom of the vessel a distance corresponding at least to the radius of the propeller.

12. An outboard drive assembly for a vessel comprising a console adapted to be fastened to the vessel, spaced parallel arms extending therefrom outboard of the vessel, a nacelle mounting a propeller and shaft, and means supporting the nacelle between the arms with the propeller submerged in the water and with its shaft substantially horizontal, said means comprising long and short links, vertically spaced trunnions on the nacelle to which the rear ends of the links are pivotally connected, vertically and transversely offset shaft mounted between the arms to which the forward ends of the links are pivotally connected, means on the nacelle and arms abutting when the nacelle is so disposed that the propeller shaft is horizontal, said means preventing forward angular movement of the nacelle from said vertical position, said links in said position being parallel and said nacelle being free to move initially, substantially vertically along a flat arc, the radius of

which is substantially infinitely long, a perpendicular distance corresponding substantially to the radius of the propeller and thereafter along a short arc, the radius of which diminishes from a length corresponding to the length of the longer link to the length of the shorter link to raise the nacelle and propeller to an inverted, substantially perpendicular position standing upwardly from the vessel.

13. An outboard drive assembly according to claim 12, wherein the shaft to which the forward end of the longer link is connected is rotatable and there is power-operable means connected thereto for effecting rotation thereof.

14. An outboard drive assembly according to claim 12, comprising a gear on the shaft to which the forward end of the longer link is connected, a rack meshing with said gear and power-operable means for effecting reciprocation of the rack.

15. An outboard drive assembly according to claim 12, comprising a fluid-operable motor operably connected to the shaft to which the forward end of the longer link is connected to effect oscillatory rotation thereof, and a compressor on the console for supplying fluid pressure to the fluid-operable motor.