April 13, 1937. R. T. SVENDSEN 2,076,603

BOAT PROPELLING MECHANISM

Filed Dec. 18, 1933 2 Sheets-Sheet 1

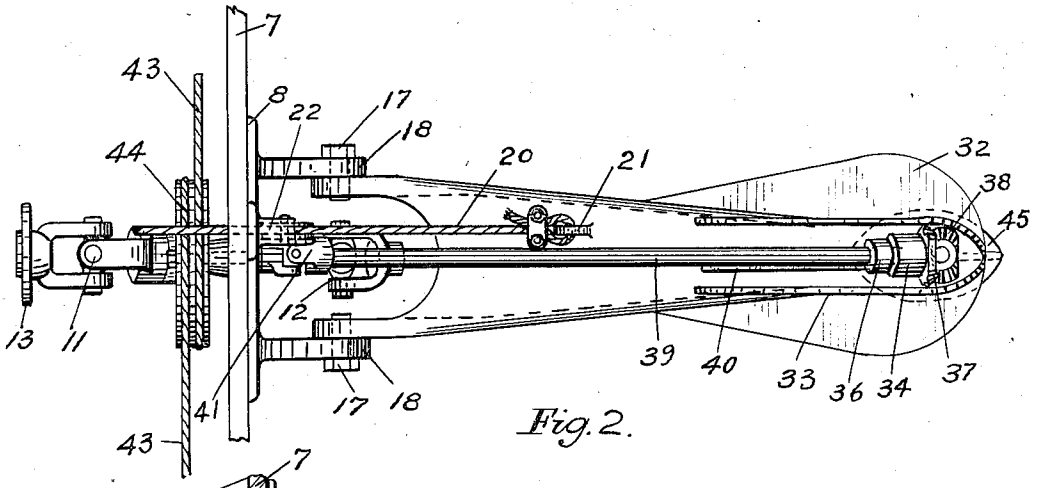


Fig. 2.

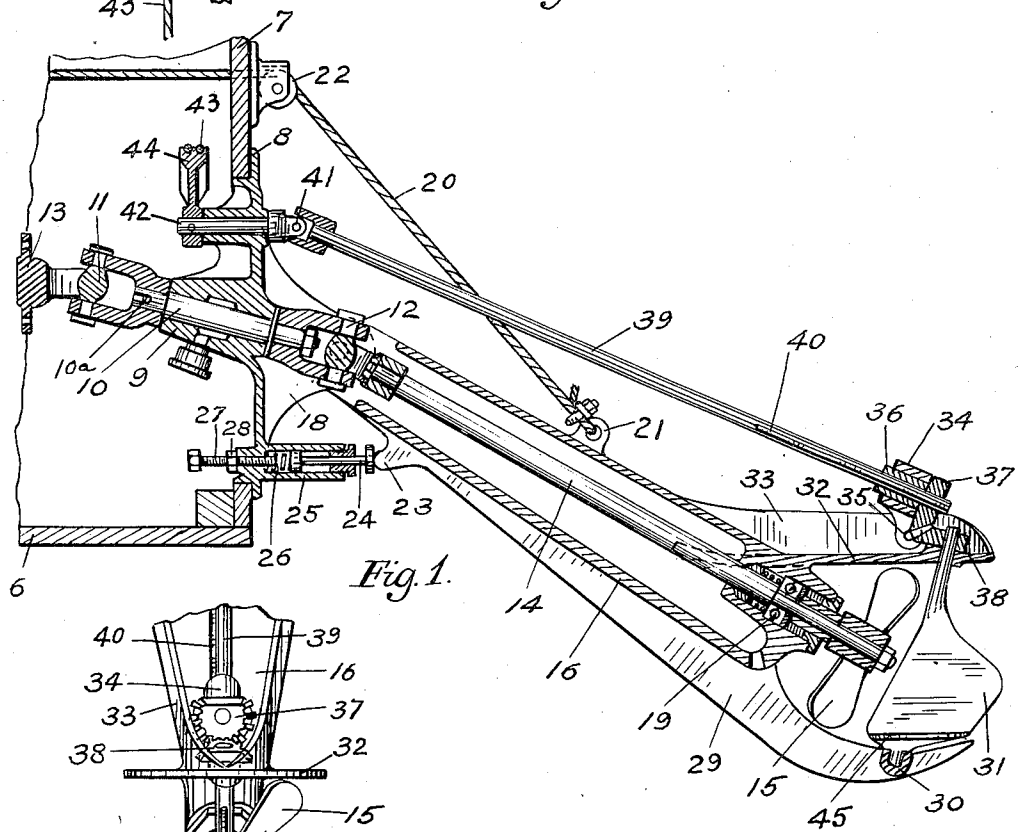


Fig. 1.

Fig. 3.

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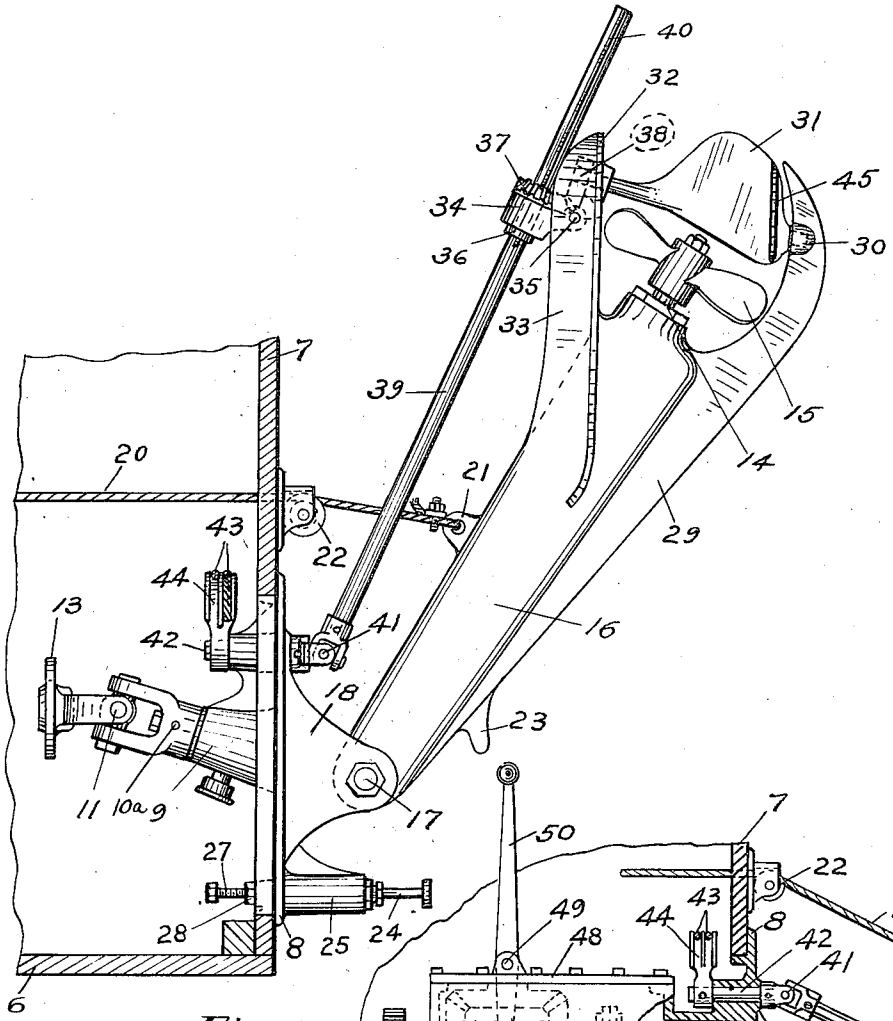


Fig. 4.

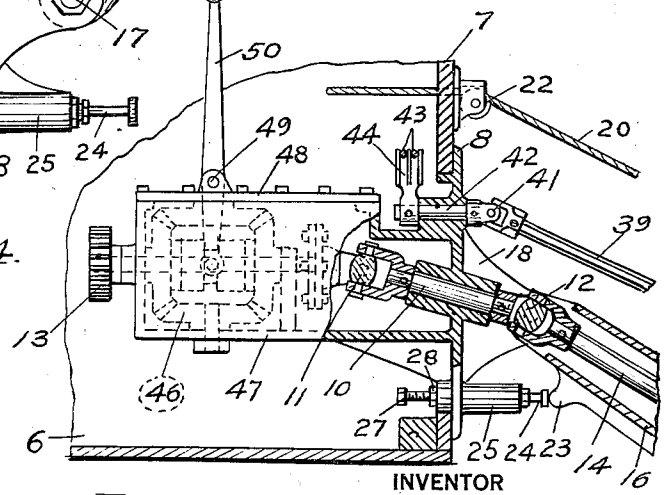


Fig. 5.

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BOAT PROPELLING MECHANISM

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Application December 18, 1933, Serial No. 702,920

17 Claims. (Cl. 115—41)

This invention relates to boat propulsion apparatus and the primary object is to provide an outboard drive unit, adapted to be power driven from an inboard motor, and which is not only efficient and practical in design but contains various novel features which give to the structure many decided advantages over other devices which within my knowledge compose the prior art. More particularly it is one of my objects to so design an outboard drive unit that it will incorporate the advantages of several existing types of drives without also including the disadvantages thereof. Thus, I contemplate the use of a drive unit or frame that normally extends rearwardly and downwardly from a point in the transom of the boat that is above the water line, while its lower, rear, or propeller end is vertically movable either manually, or automatically under the action of an obstruction in the water. This arrangement is desirable because it eliminates the necessity of a stuffing box, reduces breakage resulting from contact with obstructions, permits of the unit being lifted clear of the water when not in use, thus preventing corrosion and permitting inspection and repair, and results in a greatly simplified mechanical arrangement over the drive types employing outboard vertical drive shafts and housings. On the other hand, I eliminate the objections heretofore present in inclined types of drives by so designing the structure that the effective propeller thrust will be converted from an inclined to a horizontal direction, thus eliminating the otherwise normal tendency of the propeller to create a lift action to the rear end of the boat. The arrangement used will also automatically maintain the propeller at a predetermined operating depth without in any way interfering with its ability to move upwardly in response to moving contact with a submerged log, stone or other obstruction, which is a vital consideration, especially under high speed travel conditions. A further object is to provide a propeller drive mounting of this trailing or rearwardly extending type wherein a thrust bearing is arranged in the frame or housing so that the forward thrust action will be absorbed entirely by the frame or housing and not transmitted with the torque stresses through the power transmitting elements. A further object is to provide a novel arrangement of plate or deflector members, including an automatic depth adjusting plate which serves the additional purpose to decrease the normal cavitation action of the propeller, thereby correspondingly increasing the propeller efficiency, and this arrangement also insures a maximum forward or horizontal driving thrust of the propeller with respect to the boat. A further object is to provide a highly efficient, practical, comparatively simple and unique steering device in combination with the propeller mounting, this device being cooperatively associated with the propeller and the automatic depth adjusting and anti-cavitation means, and includes a rudder swingably carried by the propeller frame and controlled by a mechanism that not only eliminates the use of flexible cables attached to the rudder proper, but which mechanism is automatically self adjusting so as to not in any way interfere with the previously referred to vertical movements of the drive unit housing or propeller frame. A further object is to so construct the outboard drive unit that it can be readily and easily attached to and detached from the boat transom. These and still other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, wherein:

Fig. 1 is a longitudinal, sectional elevation through the drive mechanism and through the rear end of the boat to which said mechanism is applied, this structure illustrating a preferred form of the invention.

Fig. 2 is a top or plan view of the structure shown in Fig. 1.

Fig. 3 is a rear elevation of the lower end of the drive mechanism, or as seen from the right in Fig. 1.

Fig. 4 is a side elevation of the drive mechanism showing the vertically swingable drive frame as raised to an elevated position.

Fig. 5 is a sectional, detail elevation somewhat similar to a portion of Fig. 1, but illustrating a modified form of the invention.

Referring to the drawings more particularly and by reference characters, 6 designates generally a boat, the rear end wall or transom 7 of which has a central opening wherein is rigidly secured and sealed a mounting plate 8 preferably formed of cast metal. This plate 8 has an integral hub portion 9 serving as a bearing for a slightly inclined stub shaft 10, the opposite ends of which are respectively provided with universal joints 11 and 12, the opposed end sections of which universal joints preferably abut against the ends of the bearing hub 9. The universal joint 11 is connected by a coupling member 13 to the drive shaft of the engine (not shown) mounted within the hull proper of the boat. The universal joint 12 establishes a driv-

ing connection between the shaft 10 and the upper end of a shaft 14 upon the lower end of which is mounted a propeller 15. This shaft 14 extends through a cast frame or housing 16, the upper end of which frame is pivotally secured as at 17 to two transversely spaced lugs 18 extending integrally and rearwardly from the plate member 8.

The lower end of the frame 16 has a thrust bearing 19 through which the propeller shaft 14 extends, and this thrust bearing is so designed that it will convert the axial thrust of the propeller directly to the frame 16 so that such thrust action will not be carried through the shaft 14 and through the other driving elements. The center of the universal joint 12 is in alignment with the pivot centers 17 so that the frame 16 and shaft 14 will swing on a common center when the driving unit is raised to its elevated position, as shown in Fig. 4.

The frame 16 and associated parts are manually raised by pulling on a cable or rope 20, one end of which is fixed to the frame 16 as at 21, while the other end extends into the boat to within reach of the operator after first passing over a pulley 22 mounted on the transom wall 7. Thus it is a simple matter for the operator to lift the propeller out of the water, and he may lift the frame 16 even beyond the position shown in Fig. 4 and to or forward of a vertical position should there be occasion to do so. When the frame 16 is lowered for use it is maintained in proper operative position by an integral stop lug 23 which contacts with a plunger 24 operating in an integral cylinder portion 25 of the plate 8. The plunger 24 operates against a spring 26 and also against the fluid contents of the cylinder, thereby serving to impart a cushioning action to the plunger and frame, and the cylinder 25 is further provided with a stop bolt 27 which positively limits the inward movement of the plunger and thereby also positively limits the downward movement of the frame 16.

The bolt 27 screws into one end of the cylinder 25 and is provided with a suitable lock nut 28. It will thus be seen that provision is made not only for resiliently supporting the propeller frame in its operative position, but also that means are provided for adjusting this operative position of the propeller in the water when it is so desired.

It may here be noted that the frame 16 is provided on its under side with a long integral fin 29 which extends from the lug 23 and downwardly to a position under and rearwardly of the propeller 15. This fin serves not only to reinforce the frame, but also serves as a propeller guard so that the propeller will not become damaged by striking against obstructions in the water; and also serves, as a bearing support 30 and guard for the lower end of the rudder 31. The fin 29 also serves the useful and important purpose of a contact shoe so that it will be the first to engage submerged obstructions such as rocks and logs; and due to its particular form and position in the water it will of course readily ride over such obstructions, and when doing so will carry the propeller and rudder up out of destructive contact with such obstructions.

The upper end of the rudder 31 is journaled in a rearwardly extending, integral portion of the frame 16, which portion includes a horizontally disposed plate 32 extending laterally and rearwardly from the frame, and a pair of reinforcing, vertically disposed connecting rib members. The plate member 32 serves the double purpose of automatically determining the operative depth of the propeller, depending upon the speed of the boat, and also operates in the customary manner to decrease the cavitation action of the propeller. Thus it will be seen that as the propeller drops below its normal operating level in the water the plate 32 will assume an angular or inclined position and the water action or resistance will then tend to restore the plate to its horizontal position. To increase this tendency the forward end of the plate may be slightly curved upwardly, as shown in Figs. 1 and 4, although this curvature may be eliminated, as indicated in Fig. 3, or even reversed under circumstances where a deeper travel depth of the propeller in the water is desired.

The frame extension 32—33, in which the upper end of the rudder 31 is journaled, has a small bracket 34 pivotally secured as at 35, and this bracket has journaled in it a sleeve 36, one end of which is provided with a gear segment 37 that meshes with a similar gear segment 38 on the upper end of the rudder shaft. Consequently when the sleeve 36 is rotated in either direction it will correspondingly change the direction of the rudder 31 with respect to the longitudinal axis of the boat. The sleeve 36 is turned by a shaft 39 which extends therethrough and is keyed with respect to the sleeve by a key 40 which is sufficiently long so that the shaft 39 may slide freely within the sleeve 36 while still maintaining its actuating or operative relationship with respect thereto. The purpose of slidably associating the shaft 39 with the sleeve 36 is to permit such sliding action to take place when vertical adjustments are made to the frame 16, and particularly when it is raised out of the water and to the elevated position as shown in Fig. 4, wherein it will be seen that the shaft 39 has been required to move a considerable distance within the sleeve 36 of the segment 37.

The forward end of the shaft 39 has a universal joint connection 41 with a stub shaft 42 which is journaled in the plate 8, and is manually controlled from within the boat in any suitable manner, as for instance by cables 43 operating over a pulley segment 44 mounted on the inner end of the shaft 42.

The rudder 31 is provided, near its lower end, with a pair of laterally projecting integral flanges forming a deflector or baffle plate 45, the purpose of which is to assist in converting the effective propeller thrust from an inclined to a horizontal direction and also to assist in automatically maintaining the desired propeller depth in the water. It will thus be seen that as the boat moves forwardly there will be a stream or current of water moved directly rearwardly through the space defined by the plate members 32 and 45, and consequently the reaction to the propeller 15 and frame 16 will be in a perfectly horizontal direction. This in turn obviously results in a more efficient propelling action, and, also, because of the cooperative relationship of the propeller and baffle 45 entirely eliminates the otherwise normal tendency of the propeller to lift the rear end of the boat.

In the modification of the invention as shown in Fig. 5, I have illustrated a convenient and unique method of incorporating a power control or reversing unit in the drive mechanism, and this unit, which I have designated generally by the numeral 46, is contained within a housing

47, the major portion of which is cast integrally with the plate 8 so as to form a rigid part thereof. This housing 47 may have a detachable cover plate 48 through which extends and to which may be pivoted, as at 49, a shipper lever 50, which lever is employed to control the reversing device 46. It will thus be seen that by manually actuating the lever 50 the propeller shaft may be driven in either direction while the member 13 rotates in only one direction, and this control unit may of course also be employed to connect the propeller shaft in a neutral or inactive position so that the engine can be run without necessarily actuating the propeller.

It is admittedly not new to employ a reversing mechanism in a propeller drive structure of a motor boat. To my knowledge, however, it appears to be entirely new and novel to arrange the reversing or power control unit in the particular manner herein set forth, and to form the housing 47 rigid with respect to the transom plate 8.

In either of my constructions it will be noted as one of the outstanding and important features, that the outboard drive structure can be entirely removed from the boat with a minimum of effort and in a very short space of time. It is only necessary to temporarily remove the pivot bolts 17, and to disconnect the power shaft 10 from the universal joint 11; and when this is done the frame unit 16 can be entirely removed, the shaft 10 slipping from the bearing 9 and even without first removing the steering shaft 39, as the unit 36—37 will of course easily slip off and away from this shaft. 10*a* designates a shear pin which may also be employed to effect the releasable connection between parts 10 and 11.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. An outboard drive unit for a boat comprising a frame pivotally secured to and extending rearwardly from the boat for vertical adjustment with respect thereto, a propeller shaft mounted in the frame and having a propeller secured upon the rear end thereof with its axis inclined to create a downward and rearward propeller thrust, the axis of said shaft and propeller being operatively disposed at an acute angle with respect to the horizontal, and a pair of spaced, substantially horizontal plate members carried by the rear end of the frame, for vertical adjustment therewith with respect to the boat and with one of such plates disposed to receive and rearwardly deflect the propeller thrust in the water.

2. An outboard drive unit for a boat comprising a frame pivotally secured to and extending rearwardly from the boat, a propeller shaft mounted in the frame and having a propeller secured upon the rear end thereof, the axis of said shaft and propeller being normally, operatively disposed at an acute angle with respect to the horizontal, and a plate member carried by the frame and cooperatively associated with the propeller to convert the normally inclined thrust action thereof as applied to the rear end of the boat into a substantially horizontal direction.

3. A boat drive comprising a frame element extending from and vertically adjustable with respect to the boat, a propeller shaft mounted in the frame for operation in an inclined position, a propeller mounted on the shaft, a plate over the propeller and a thrust direction converting baffle member spaced below the plate, said plate and baffle member both being carried by said adjustable frame element.

4. A boat drive comprising a frame element pivotally secured to and extending from the boat, a propeller shaft mounted in the frame for operation in an inclined position, a propeller mounted on the shaft, and a pair of vertically spaced, horizontally disposed plate members associated with the propeller and carried by said frame to maintain desired propeller depth and decrease cavitational action of the propeller.

5. A boat drive device comprising a frame extending rearwardly from and pivotally attached to the boat so that its lower end may be automatically elevated when contacting with obstructions in the water, said frame having a power driven propeller and propeller shaft with a common axis extending in an inclined direction, and means for effectively converting a part of the normally inclined propeller thrust action into a horizontal direction to eliminate the boat lifting tendency of the propeller and thereby also increase the boat propelling action of the propeller.

6. An outboard drive unit for a boat having an inboard power plant, comprising a frame member pivotally and detachably connected at one end to the stern end of the boat, a propeller at the other end of the frame member, and power transmitting mechanism for transmitting power from the power plant to the propeller including a sectionally formed shaft, two sections of which are detachably connected at a point in substantial alignment with the axis of the pivot connection between the frame and boat, a rudder carried by the frame and a device disconnectible independently of the frame member and power transmitting mechanism for actuating the rudder.

7. An outboard drive unit for a boat having an inboard power plant, comprising a frame member pivotally attached at its forward end to the stern of the boat so that its other end may be moved vertically in a plane parallel with the direction of travel, a power driven propeller and a rudder carried entirely and independently of other support by said other frame end, and a control mechanism including a shaft extending forwardly from the rudder to a fixed part of the boat in substantial parallelism with the frame member, said mechanism being self adjusting whereby rudder control will be maintained irrespective of vertical adjustments to the frame.

8. A drive structure for a boat having an inboard motor, comprising a plate member forming part of the transom wall of the boat, a frame pivotally attached to the plate member for movement in a vertical plane, a propeller and propeller shaft journaled in the frame, a stub shaft journaled in a bearing portion of the plate member, and universal joints for connecting opposite ends of said stub shaft with said propeller shaft and with the motor shaft respectively, the universal joint between the stub and propeller shafts being in substantial axial alignment with the pivot connection between the frame and plate member.

9. A drive structure for a boat having an inboard motor, comprising a plate member forming part of the transom wall of the boat, a housing attached to said plate member, a normally in-

clined frame pivoted at its forward end to the plate member for movement in a vertical plane extending parallel with respect to the direction of travel, a propeller at the rear end of the frame, and a power transmitting mechanism, including a power reversing device located in said housing, for operatively connecting and disconnecting the propeller to the motor.

10. An outboard drive unit for a boat having an inboard motor comprising a frame secured to and extending rearwardly from the boat, a motor connected propeller shaft mounted in the frame and having a propeller secured upon the rear end thereof, the axis of said shaft and propeller being operatively disposed at an acute angle with respect to the horizontal, and a horizontally disposed anti-cavitation and propeller depth controlling plate rigidly secured to the rear end of the frame, said plate having a forward portion angularly inclined with respect to the plane of the remaining horizontal portion thereof.

11. A boat drive comprising a frame pivoted to and extending rearwardly from the boat with a propeller at its rear end movable vertically therewith, said propeller having its axis normally disposed for operation in an inclined position, a plate carried by the rear end of the frame for movement below the level of the water to receive downward pressure from the water passing rearwardly thereover as the boat is moved forwardly under propeller action, to thereby counteract upward propeller thrust and hold the propeller and adjacent frame end down in operative position.

12. A propulsion apparatus for a boat having a fixed inboard motor, comprising an automatically tiltable frame normally disposed in an inclined position in a vertical plane parallel with the direction of travel, a drive shaft in said frame carrying a propeller operatively connected to the motor, and a substantially horizontal plate member carried by said frame for minimizing the cavitating action of the propeller, said plate having a forward portion angularly disposed with respect to the plane of the remaining portion.

13. An outboard drive unit for a boat having an inboard motor comprising a frame secured to and extending rearwardly from the boat, a motor connected propeller shaft mounted in the frame and having a propeller secured upon the rear end thereof, the axis of said shaft and propeller being operatively disposed at an acute angle with respect to the horizontal, a plate having a substantially horizontal portion carried by the rear end of the frame above the propeller, and means, other than said plate portion, carried by the frame, and responsive to the action of water pressure thereon when traveling through the water for holding the propeller down to a predetermined operative depth in the water when moving at various speeds.

14. An outboard drive unit for a boat comprising a frame pivotally secured to and extending rearwardly from the boat for vertical adjustment with respect thereto, a propeller shaft mounted in the frame and having a propeller secured upon the rear end thereof, the axis of said shaft and propeller being operatively disposed at an acute angle with respect to the horizontal, and a forwardly and upwardly curved plate carried by the frame and for engagement with the water at a level above the operative position of the propeller.

15. A boat drive comprising a frame pivoted to and extending rearwardly from the boat with a propeller at its rear end movable vertically therewith, said propeller having its axis normally disposed for operation in an inclined position, and a forwardly and upwardly curved plate carried by the rear end of the frame for contact with the water as the boat is moved forwardly under propeller action, to hold the propeller and adjacent frame end in operative position, said plate being disposed in a position to decrease the cavitation action of the propeller.

16. An outboard drive unit for a boat, comprising an inclined frame member pivotally attached at its forward upper end to the stern end of the boat and having a propeller at its rear end for operation at a relatively lower level in the water back of the boat, said frame having a guard fin for protecting said propeller and for automatically raising the frame when contacting with an obstruction in the water, and a substantially horizontal anti-cavitation plate attached to the frame for travel engagement with the water when the boat moves forwardly under propeller action, the leading edge of said plate being upwardly curved.

17. A propulsion apparatus for a boat having an inboard motor, comprising an outboard frame normally disposed in an inclined position rearwardly of the boat and pivotally attached thereto so as to be swingable in a vertical plane parallel with the direction of travel, a propeller carried by the rear end of the frame, drive connections extending from the propeller to the motor, a substantially horizontal anti-cavitation plate member carried by the rear end of the frame for travel engagement with the water as the boat moves forwardly under propeller action, the leading edge of said plate being inclined forwardly and upwardly, and a rudder carried by and angularly adjustable with respect to the frame.

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