Oct. 10, 1961 E. C. KIEKHAEFER 3,003,724

DAMPING AND LIFT DEVICE FOR OUTBOARD MOTORS

Filed Aug. 5, 1960 2 Sheets-Sheet 1

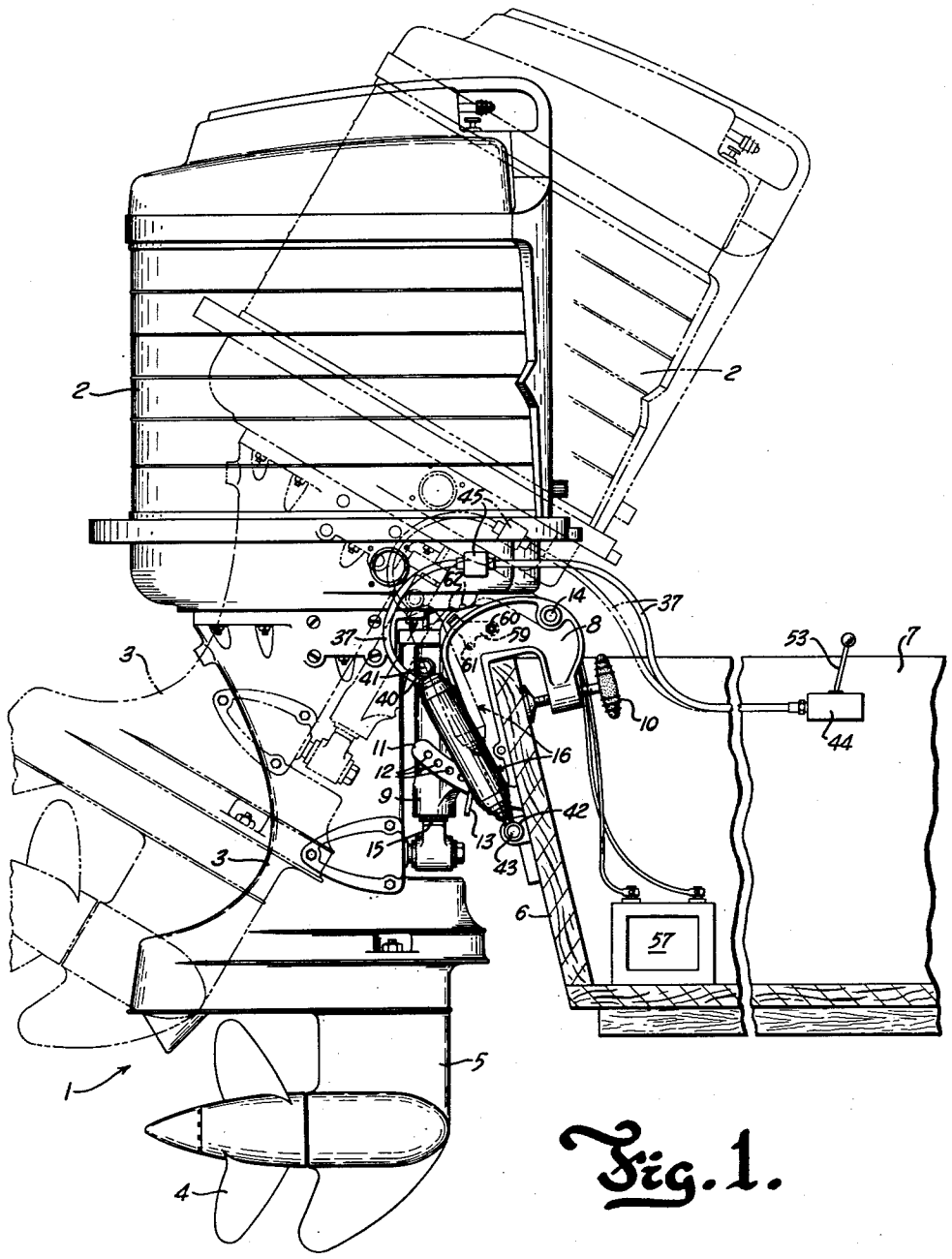


Fig. 1.

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Filed Aug. 5, 1960 2 Sheets-Sheet 2

Fig. 3.

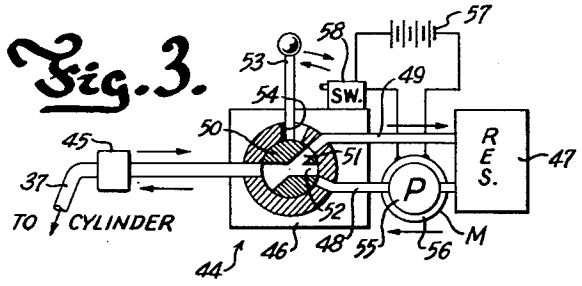
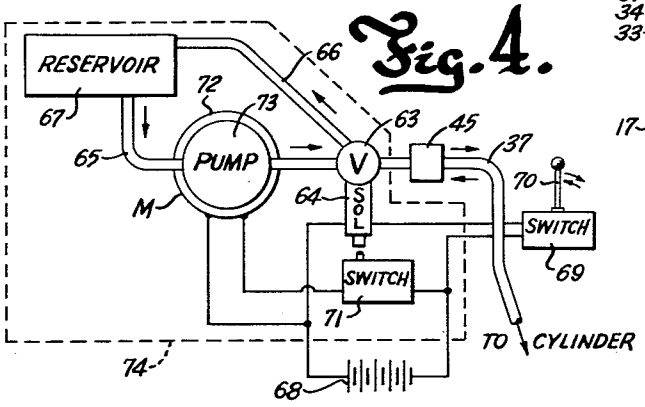


Fig. 4.



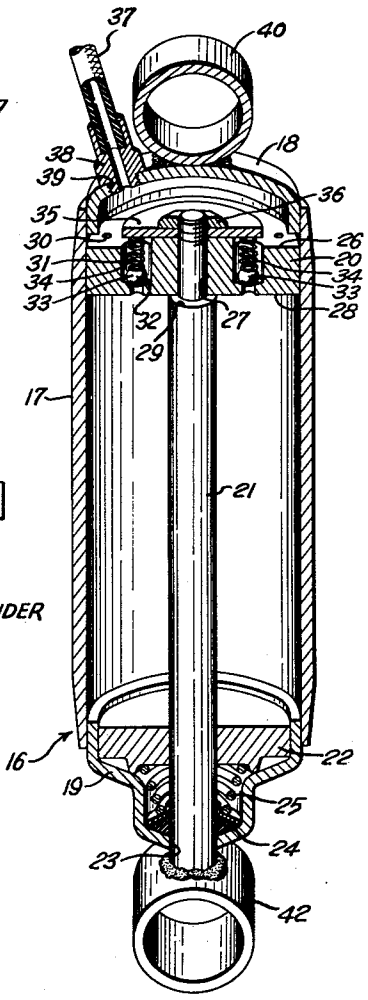
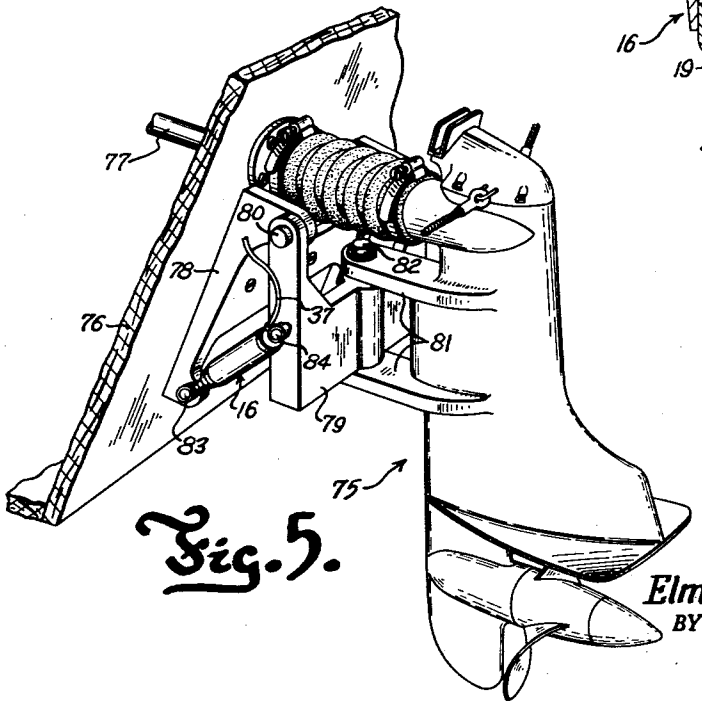


Fig. 2.

Fig. 5.



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DAMPING AND LIFT DEVICE FOR OUTBOARD MOTORS

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9 Claims. (Cl. 248—4)

This invention relates to an outboard propulsion unit supported to tilt about a horizontal transverse pivotal axis and more particularly to such a unit provided with damping means adapted for damping the angular momentum of the tilting unit about the pivotal axis and selectively raising and lowering the propulsion unit.

The support bracket means for relatively large high powered outboard propulsion units such as outboard motors, are frequently equipped with damping means, such as shock absorbers. The damping means serve to damp the angular momentum of the propulsion unit as when the unit strikes a submerged or floating object and thus prevent possible damage to the unit and/or boat transom to which the unit is secured by the impacts of the swinging propulsion unit against its mounting bracket.

The support bracket means for such propulsion units are also frequently equipped with power means for selectively tilting the unit on its transverse axis to a raised inoperative position with the lower portion of the unit out of the water and for returning the same to its running position in the water. When the propulsion unit is not equipped with power means for tilting the unit, it is necessary to manually raise the unit when desired. For propulsion units weighing as much as several hundred pounds, this is difficult and especially for one person.

In accordance with this invention an hydraulic damping means is interposed and connected between the pivotal outboard propulsion unit and its mounting bracket for damping the angular momentum of the tilting unit in either or both the upward or downward directions of pivot as when striking a submerged or floating object. A source of hydraulic pressure communicates with the damping means through a pressure line and is adapted to pressurize the damping means when desired to pivot the propulsion unit to a raised inoperative position. Means in the pressure line provide for relieving the pressure in the damping means and thereby provide for the return of the propulsion unit to its operative position in the water.

The accompanying drawings illustrate the best mode for carrying out the invention as presently contemplated and set forth hereinafter.

In the drawings:

FIG. 1 is a side elevation of an outboard motor mounted on the transom of a boat, partially shown, and shows the hydraulic dual function damping means of this invention and in broken lines shows the motor in a partially raised position;

FIG. 2 is an enlarged perspective sectionad view of a damping means adapted to serve a dual function in accordance with this invention;

FIG. 3 is an enlarged diagrammatic view of the control mechanism for the damping means whereby to effect raising and lowering of the motor unit as desired;

FIG. 4 is a diagrammatic view showing another embodiment of a control mechanism for the dual function damping means; and

FIG. 5 is a perspective view and shows how the invention might be utilized for an outboard propulsion unit having an inboard drive source, not shown.

Referring to the drawings, the motor unit 1 of the outboard motor includes an engine, not shown, enclosed within a cowl 2 supported on the hollow drive shaft housing 3. The housing 3 encloses a drive shaft, not shown, which drivingly connects the engine and the

propeller 4 carried by the lower unit 5. The motor unit 1 is fastened pendently and dirigibly to the transom 6 of a boat 7, only partially shown, by suspension means including a clamp bracket 8 and a swivel bracket 9.

The clamp bracket 8 is an inverted C-clamp structure which is adapted to engage over the edge of transom 6 to place the spaced legs thereof on opposed sides of the transom. The inner leg of bracket 8 carries one or more clamp screws 10 adapted to engage the inside of the transom and thereby securely clamp the bracket 8 to the transom. The outer leg of bracket 8 is provided with a rearwardly projecting portion 11 having spaced openings 12 adapted to selectively receive a tilt adjustment pin 13 normally engaged by the motor unit in service for positioning the motor unit at a desired operating position with respect to the vertical.

The swivel bracket 9 of the attachment means is pivotally connected to the clamp bracket 8 by means of the transverse horizontal tilt pin 14 to provide for tilting of the motor unit on a horizontal axis. The swivel bracket 9 carries the motor unit by means of the generally vertical swivel pin 15 which extends through the bracket 9 and is pivotal therein to provide for steering control of the motor unit.

According to this invention, damping means are interposed and connected between the clamp bracket 8 and swivel bracket 9 and serve the dual function of damping the angular momentum of the tilting or swinging motor as when the lower unit strikes an obstruction and of hydraulically raising the lower unit when desired.

As shown in the drawings, the damping means comprise one or more shock absorber units 16 as shown most clearly in FIG. 2. The shock absorber unit 16 includes the pressure cylinder 17 closed by end members 18 and 19, respectively, and filled with an hydraulic fluid such as oil. A piston 20 is slidably disposed within the cylinder 17 and is secured to one end of the rod 21 which extends coaxially of the cylinder and through guide plug 22 and outwardly through an opening 23 in the end member 19. A sealing member 24 surrounds the rod 21 and is maintained in sealing engagement with the rod and end member by the coil spring 25 abutting on guide plug 22.

The piston 20 of shock absorber unit 16 is provided with a stepped leading surface 26 with the inner portion of increased thickness being provided with an opening 27 coaxially thereof. The piston is carried by the rod 21 with the reduced diameter end portion thereof extending through opening 27 and with the trailing surface 28 of the piston resting on shoulder 29 of the rod. A plurality of circumferentially spaced orifices 30 extend through the piston and provide for restricted flow through the piston to provide damping as the piston moves within the cylinder when the shock absorber is extended or contracted. A plurality of circumferentially spaced stepped valve orifices 31 also extend through the piston with the larger bore openings being in the leading surface 26. The shoulders 32 within the stepped orifices 30 form seats for the ball valves 33. A relief spring 34 exerts a given force on each ball 33 and is retained within orifice 31 by means of the spring retaining washer 35 disposed on rod 21 adjacent the leading surface 26 of the piston. The nut 36 threaded on the end of rod 21 secures the piston on the rod between shoulder 29 and the retaining washer 35. The spring-loaded ball valves 33 serve as relief valves at a given pressure to produce a desired amount of damping for the stroke of the piston upon extension of the shock absorber.

A pressure line which is further described hereinafter communicates with the shock absorber unit 16 ahead of piston 20. The pressure line comprises a flexible conduit 37 having a fitting 38 on the end thereof which is adapted

to be threaded into opening 39 in end member 18 of the shock absorber and serves as a reservoir for the hydraulic fluid displaced by the piston rod. Upon contraction of the shock absorber, the amount of damping resulting from the piston stroke is dependent upon the resistance encountered by the piston as the fluid escapes ahead thereof into the conduit 37 and through the orifices 30 to the rear of the piston.

The shock absorber 16 further includes means for mounting the unit between the clamp bracket 8 and swivel bracket 9 of the motor suspension. An end ring 40 is provided on end member 18 of the shock absorber and is adapted to be pivotally secured on the transverse pin member 41 on swivel bracket 9. At the opposed end of the shock absorber 16, the ring member 42 provided on the outer end of piston rod 21 is adapted to be pivotally secured on the transverse pin member 43 which is disposed beneath pin member 41 on the outer leg of clamp bracket 8. So disposed and connected within the motor suspension, shock absorber 16 is extended and contracted with swinging or tilting movement of the motor unit about the transverse tilt pin 14 to damp the angular momentum of the unit and thereby greatly reduce the severity of the impacts at the top and bottom of the motor swing.

When connected to a suitable hydraulic system, the shock absorber 16 is also adapted to serve as means for raising the motor unit to a tilted position when desired.

According to FIG. 1, the flexible conduit 37 opposite from the shock absorber is connected to a remote control unit 44. The pressure conduit 37 may be interrupted by an adaptor fitting 45 mounted on the cowl 2 of the motor unit, as shown, to support the conduit and thereby prevent fouling of the pressure line when the motor unit is tilted. The adaptor fitting 45 further provides a disconnect means whereby the control unit 44 may be removed from the motor unit if and when desired.

The control unit 44, shown diagrammatically in FIG. 3, comprises a pressure supply mechanism and includes the selector valve 46 which communicates with the shock absorber 16 through conduit 37. The valve 46 also communicates with a reservoir 47 of hydraulic fluid through a supply line 48 and a return line 49. The rotatable member 50 of valve 46 is provided with intersecting passages 51 and 52 which are adapted to selectively place either the supply line 48 or return line 49 from the reservoir 47 in communication with pressure line 37 in accordance with operation of the control handle 53 which extends outwardly of valve 46 from member 50 through the opening 54.

A pump 55 operated by motor 56 is disposed in the supply line 48 and is adapted to develop the pressures needed to extend the shock absorber 16. The pump motor 56 is run off of battery 57 and is controlled by switch 58 which is engageable by the control handle 53 to start and operate the motor 56 when the valve member 50 is rotated to place the reservoir supply line 48 in communication with the line 37.

The control handle 53 for operating the rotatable valve member 50 has but two positions and is normally disposed to place the reservoir return line 49 in communication with line 37 to the shock absorber and out of engagement with motor switch 58 as shown in FIG. 3. In this position of the handle 53 and valve member 50, the shock absorber 16 can damp the angular momentum of the tilting motor unit as caused when the motor unit hits a floating or submerged obstruction in service.

When it is desired to raise or tilt the motor unit to an inoperative position, the handle member 53 is actuated to rotate the valve member 50 to place the reservoir supply line 48 in communication with line 37 to the shock absorber. At the end of the stroke of the handle member 53, the motor switch 58 is closed by engagement with handle member 53 placing pump 55 in operation to produce the necessary pressure in the shock absorber through line 37 ahead of the piston to effect an extension of the absorber and thereby tilt or pivot the motor unit to a raised, inoperative position. When it is desired to return the motor unit to its operative position, the handle member 53 and valve member 50 are simply returned to their initial position. The return of handle member 53 to its initial position permits the motor switch 58 to open and thereby shuts off the pump 55 and places the reservoir return line 49 in communication with the line 37 to the shock absorber to relieve the pressure therein. With the pressure ahead of the piston 20 in the shock absorber 16 relieved, the motor unit is adapted to return to its operative position.

If it is desired to maintain the motor unit in its inoperative position for a longer period of time, a mechanical holding means is also provided for the motor unit and comprises a pivotal member 59 mounted on the transverse pin member 60 carried by the clamp bracket 8 rearwardly of tilt pin 14. The pivotal member 59 carries a support bar 61 which is adapted to selectively engage within one or more transverse grooves 62 provided at the base of cowl 2 of the motor unit when the member 59 is pivoted upwardly in a vertical plane. To effect disengagement from the mechanical holding means the motor unit is raised slightly as required, either manually or hydraulically, to release the support bar 61 from the groove 62.

FIG. 4 shows another embodiment of a pressure supply and control arrangement whereby the motor may be raised hydraulically. According to FIG. 4 a two-position valve 63 actuated by solenoid 64 is adapted to selectively place the supply line 65 or return line 66 for reservoir 67 in communication with conduit 37 to the shock absorber 16. The solenoid valve 63 is operated by the battery 68 and is controlled by the on-and-off switch 69 actuated by handle means 70. When the switch 69 is open the solenoid valve 63 is in its normal position placing the reservoir return line 66 in communication with line 37 to the shock absorber and the shock absorber may then serve to damp any angular momentum imparted to the motor unit.

Upon closing the control switch 69 to tilt the motor unit to a raised inoperative position when desired, the solenoid 64 is energized and the valve 63 is actuated to place the reservoir supply line 65 in communication with line 37 to the shock absorber. The solenoid 64 simultaneously closes the switch 71 to complete the circuit of pump motor 72 which is run off of battery 68 to drive the pump 73 disposed in supply line 65 to thereby develop the pressure needed for extending the shock absorber.

In the embodiment of FIG. 4, it is contemplated that the hydraulic system remote from the shock absorber 16 and including reservoir 67, the pump 73, and the solenoid valve 63 together with the pump motor 72 and motor switch 71 may be mounted within the cowl 2 of the motor unit as represented by the dashed line 74. With this arrangement only the on-and-off control switch 69 is disposed remotely of the motor unit at the convenience of the operator. The arrangement offers the advantage that the hydraulic system for the shock absorber 16 remains intact and undisturbed when the outboard motor is removed from the boat for any reason.

In FIG. 5, a dirigible outboard propulsion or drive unit 75 is supported from the boat transom 76 and driven from an inboard power source, not shown, through the drive shaft 77 which extends through the transom. The suspension for the propulsion unit 75 includes the mounting bracket 78 rigidly secured to the transom 76. The swivel bracket 79 is pivotally supported from the mounting bracket 78 by means of transversely spaced horizontal tilt pins 80 providing for pivotal movement of the propulsion unit in a vertical plane. Forwardly extending and vertically spaced arms 81 on the propulsion unit are adapted to receive the swivel bracket 79 therebetween and a swivel pin 82 is disposed generally vertically through aligned holes in the arms 81 and swivel bracket to pro-

vide for pivotal movement of the propulsion unit on a generally vertical axis for steering.

The suspension for the propulsion unit **75** includes one or more shock absorbers **16** each mounted between brackets **78** and **79** on pins **83** and **84** provided on the respective brackets. The hydraulic systems of either FIG. 3 or FIG. 4 may be connected to the line **37** in FIG. 5 to adapt the shock absorber for damping any angular momentum imparted to the propulsion unit and for selectively raising and lowering the propulsion unit.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In an outboard propulsion unit for boats, the combination of: a mounting bracket adapted to be secured to the transom of a boat, a propulsion unit, a swivel bracket carrying said propulsion unit and pivotally connected to said mounting bracket on a horizontal transverse axis to provide for tilt of the propulsion unit in a vertical plane between an operative position and an inoperative position, fluid pressure damping means interposed and connected between the mounting bracket and swivel bracket and adapted to dissipate a substantial portion of the energy due to sudden pivotal movement of the propulsion unit upon said axis, a source of fluid pressure, and conduit means connecting the damping means and the pressure source, said pressure source being adapted to pressurize the damping means when desired to tilt the propulsion unit upon said axis from the operative position to an inoperative position.

2. The combination of claim 1 wherein the fluid pressure damping means is an hydraulic shock absorber adapted to tilt the propulsion unit upon being pressurized when desired.

3. The combination of claim 1 wherein the fluid pressure damping means comprises an hydraulic cylinder-piston means and the conduit means is connected to the cylinder means ahead of the piston means.

4. In an outboard motor, the combination of: a clamp bracket adapted to be secured to the transom of a boat, a motor unit, a swivel bracket carrying said motor unit and pivotally connected to the clamp bracket on a horizontal transverse axis to provide for tilt of the motor unit between an opeartive upright position and an inoperative position, hydraulic damping means interposed between and connecting the clamp bracket and swivel bracket to damp a substantial portion of the energy due to sudden pivotal movement of the motor unit upon said axis, a source of fluid pressure, conduit means connecting the damping means and the pressure source, valve means disposed in said conduit means and adapted to selectively control the pressure to the damping means, and means to actuate said valve means and thereby pressurize the damping means when desired to tilt the motor unit upon said axis from the operative position to an inoperative position.

5. The combination of claim 4 wherein the pressure source and valve means are carried on the motor unit providing for an hydraulic system for pressurizing the damping means which remains intact and undisturbed when the outboard motor is removed from the boat.

6. In an outboard motor, the combination of: a clamp bracket adapted to be secured to the transom of a boat, a motor unit, a swivel bracket carrying said motor unit and pivotally connected to the clamp bracket on a horizontal transverse axis to provide for tilt of the motor unit between an operative upright position and an inoperative position, an hydraulic cylinder-piston means, means pivotally connecting one member of said first named means to the clamp bracket, means pivotally connecting the other member of said first named means to the swivel bracket, said first named means being adapted to extend and thereby damp a substantial portion of the energy due to sudden pivotal movement of the motor unit upon said axis, a source of fluid pressure, conduit means connecting the pressure source and the cylinder means ahead of the piston means, valve means disposed in said conduit means and adapted to selectively control the pressure to the cylinder means, and means to actuate said valve means and thereby pressurize and extend said first named means when desired to tilt the motor unit upon said axis from the operative position to an inoperative position.

7. In an outboard motor, the combination of: a clamp bracket adapted to be secured to the transon of a boat, a motor unit, a swivel bracket carrying said motor unit and pivotally connected to the clamp bracket on a horizontal transverse axis to provide for tilt of the motor unit between an operative upright position and an inoperative position, hydraulic damping means interposed between and connecting the clamp bracket and swivel bracket to damp a substantial portion of the energy due to sudden pivotal movement of the motor unit upon said axis, a source of fluid pressure, conduit means connecting the damping means and the pressure source, valve means disposed in said conduit means and adapted to selectively control the pressure to the damping means, a solenoid for operating the valve means, a source of electrical energy for said solenoid, and switch means to control operation of the solenoid to selectively actuate the valve means and thereby pressurize the damping means to tilt the motor unit upon said axis from the operative position to an inoperative position.

8. The combination of claim 7 wherein the pressure source and the solenoid operated valve means are carried on the motor unit and remotely from the switch means for controlling the solenoid.

9. In a marine propulsion mechanism, the combination with mounting bracket means adapted to be secured to a boat and a propulsion unit pivotally connected to the mounting bracket means on a horizontal transverse axis to provide for tilt movement of the unit in a generally vertical plane between an operative position and an inoperative position, fluid pressure damping means interposed and connected between the mounting bracket means and propulsion unit and adapted to dissipate a substantial portion of the energy due to sudden pivotal movement of the propulsion unit upon said axis, a source of fluid pressure, and conduit means connecting the damping means and the pressure source, said pressure source being adapted to pressurize the damping means when desired to tilt the propulsion unit upon said axis from the operative position to an inoperative position.

No references cited.