

March 15, 1966

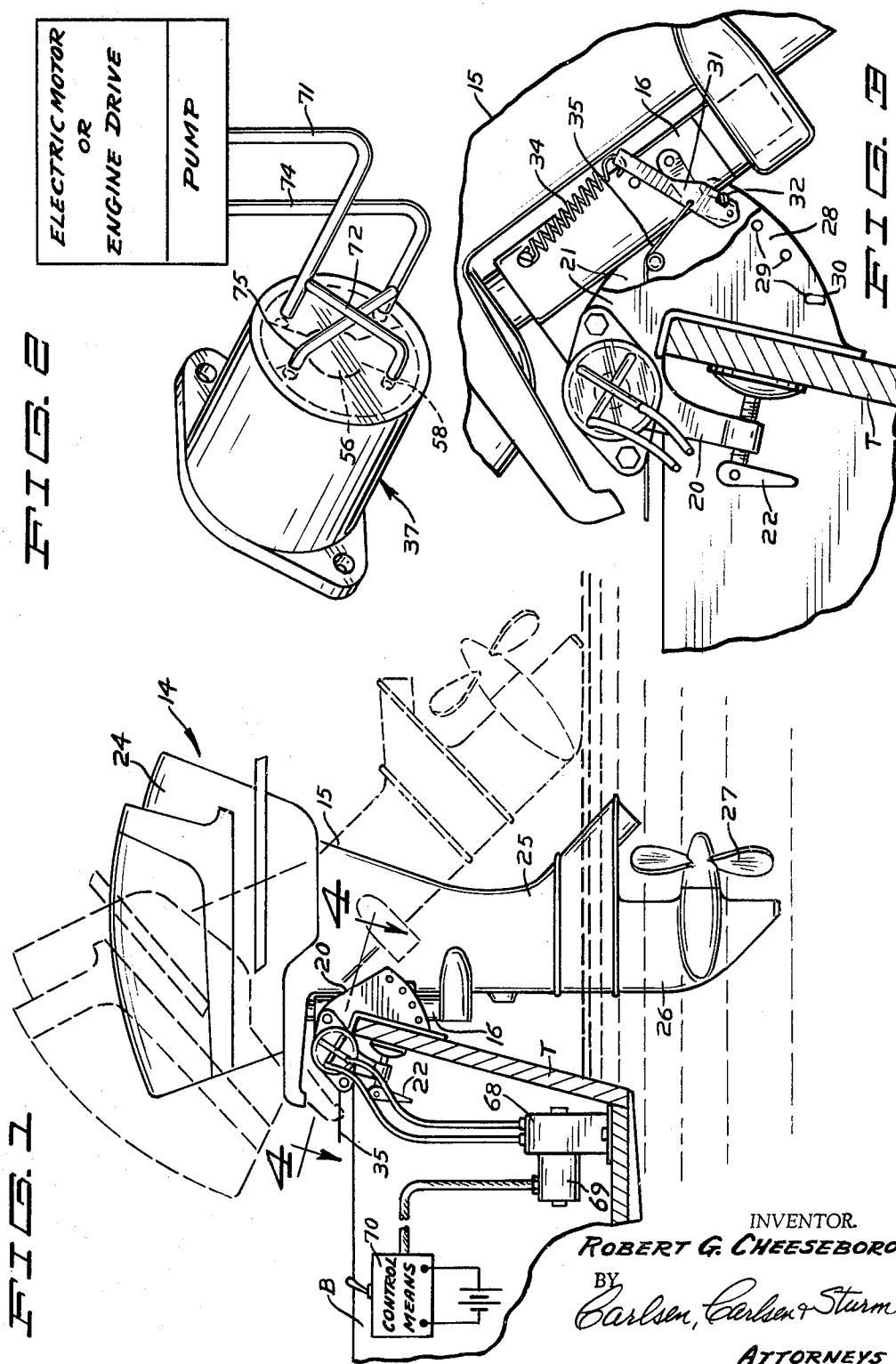
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3,240,452

TILT CONTROL DEVICE

Filed Jan. 22, 1964

4 Sheets-Sheet 1



March 15, 1966

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3,240,452

Filed Jan. 22, 1964

4 Sheets-Sheet 2

FIG. 4

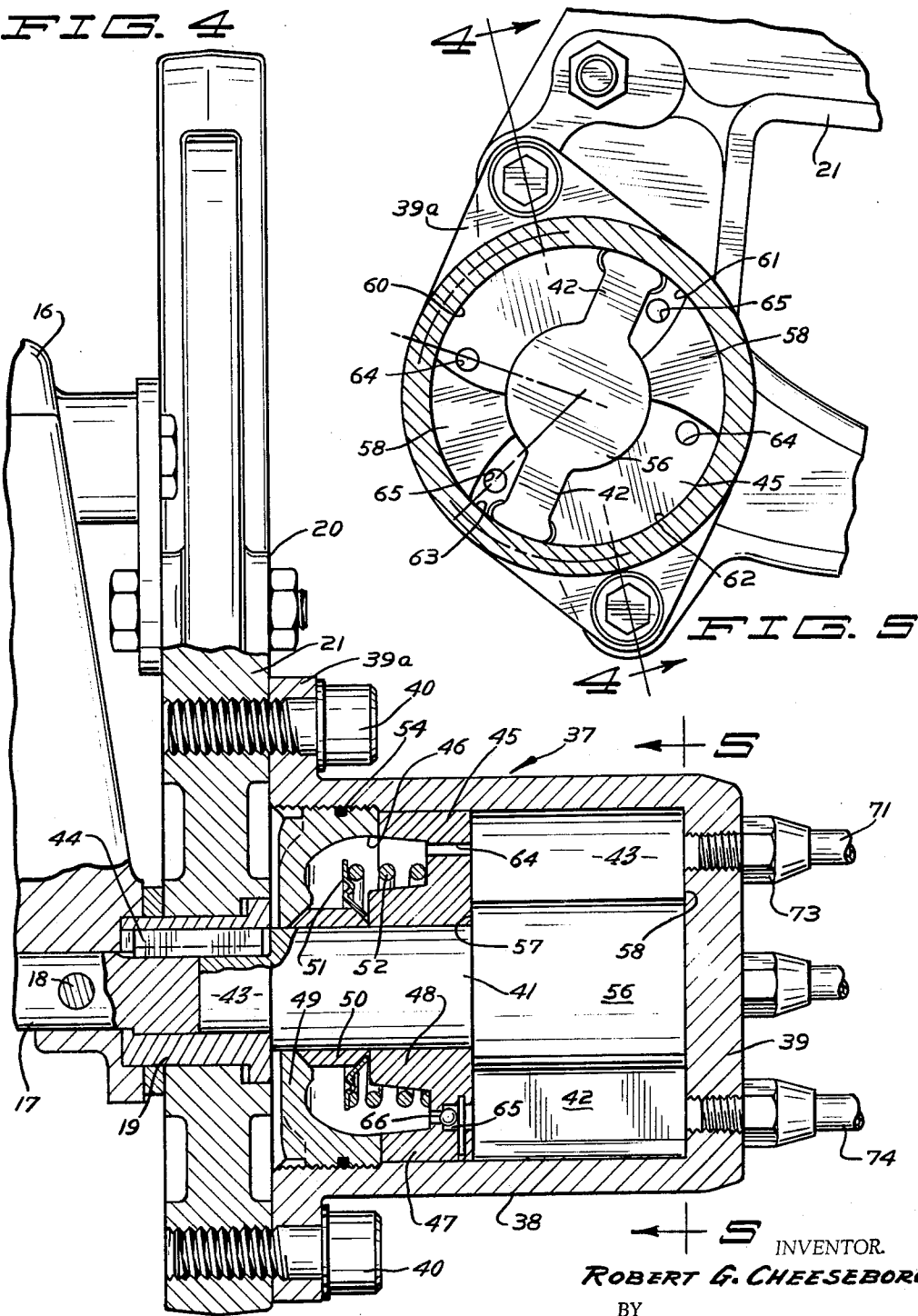


FIG. 5

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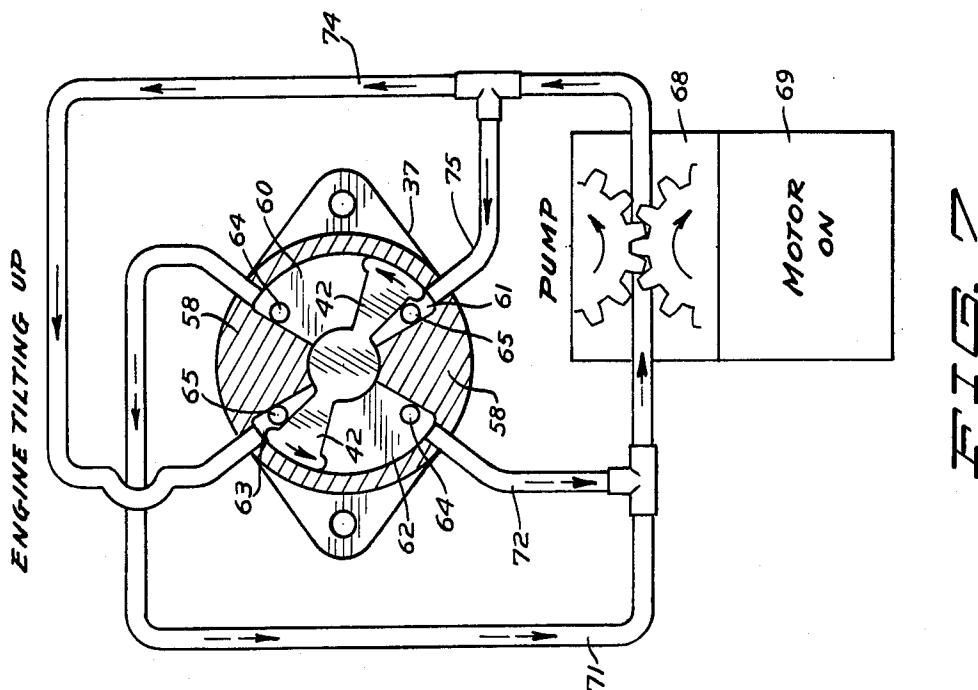
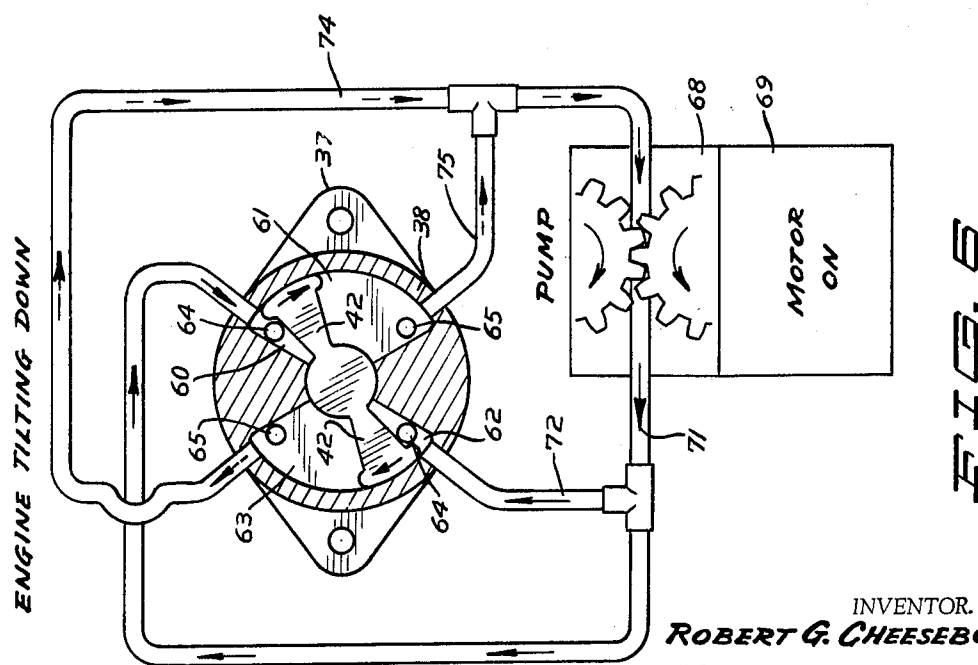
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4 Sheets-Sheet 3



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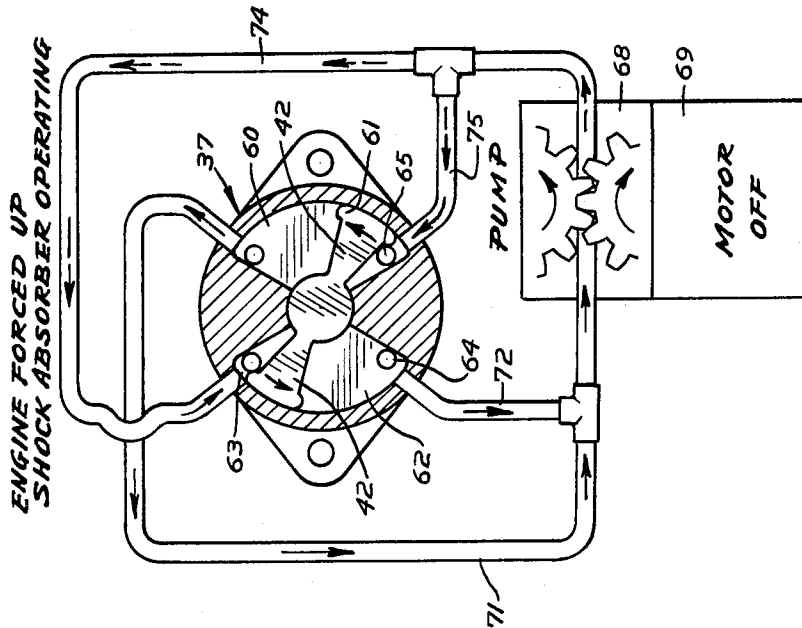
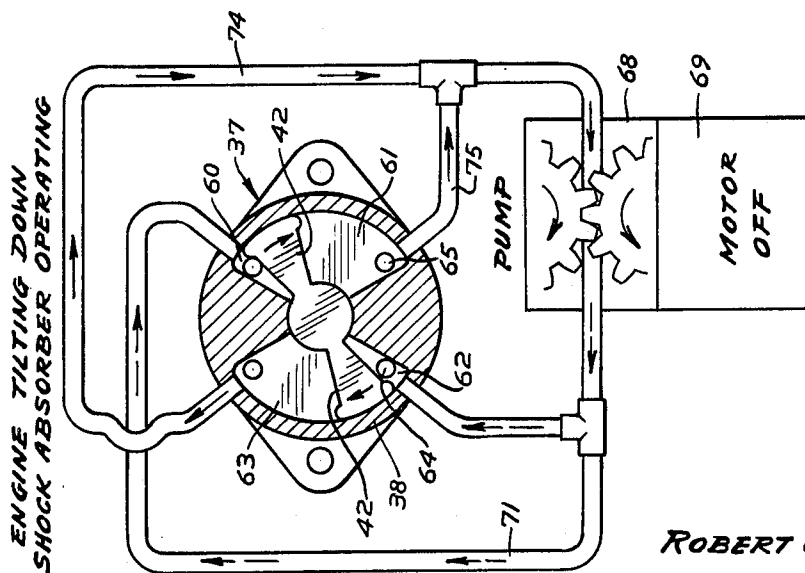
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TILT CONTROL DEVICE

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6 Claims. (Cl. 248-4)

This invention relates to tilt control devices for outboard motors and particularly concerns such a device which can serve as a shock absorber for absorbing the shock of rapid tilting of the motor or as a tilt actuating means for causing the motor to tilt as desired or which can serve both of such functions.

In outboard motor construction it is, of course, conventional to pivot the power unit on the mounting bracket on a horizontal axis so that the power unit may be tilted in fore and aft directions. This is to enable relative raising and lowering about the pivot or tilt axis of the lower prop carrying portion of the power unit which is normally submerged. With the relatively large high horsepower engines in use today, it is important that means be provided for controlling the tilt in two respects.

First, it is not uncommon during operation for the lower submerged portion of the motor to engage an underwater or floating obstacle such as a log causing the motor to flip forwardly about its tilt axis and then rearwardly again, as the obstacle is cleared, to its upright operating position. Such rapid movement of a heavy motor, and particularly its impact at the limits of its arc of movement, can cause dangerous and excessive strain on the transom of the boat on which the motor is mounted. Under such stresses motors have been known to fly off of the transom or break the motor mounting bracket or the transom itself. It is, accordingly, desirable to provide a shock absorbing device operative between the motor and its mounting bracket to damp such rapid tilting movement about the tilt axis in either a forward or rearward direction.

Ideal damping is effected by a device which increasingly dampens tilting movement to cushion shock as the motor moves toward its forward tilt limit. Return movement of the motor to its upright operating position should ideally be slow and smooth.

A second desirable function of a tilt control device for larger outboard motors is its use as a power means for effecting intentional forward and rearward tilting of the power unit about the tilt axis. The weight of such motors, sometimes exceeding 200 pounds, makes the desirability of such function obvious. Moreover, power tilt means should be capable of operation from a point on the boat which is remote from the motor itself, it being understood that the operator's station is generally located substantially forward of the outboard motor.

Others have heretofore provided shock absorbers and power tilting devices for outboard motors. A device designed for both purposes is disclosed in United States Patent No. 3,003,724 to Kiekhaefer. The present invention is an improvement on the device disclosed in that patent having certain advantages thereover in construction, operation and result.

The primary object of the present invention is to provide a new and improved rotary device adapted when in a static condition to dampen swinging movement of an outboard motor about its tilt axis and also adapted to be power actuated to positively effect tilting of the motor about said axis when desired.

Another object of the invention is to provide a rotary shock absorption device on the tilt axis of an outboard motor for cushioning swinging movement of the motor in either direction about said axis.

2

Still another object of the invention is to provide a new and improved power tilt device for an outboard motor in which the motor and its mounting bracket are rotationally interconnected by the device on the axis of tilt as distinguished from an extendible and contractible power tilt device such as a hydraulic jack.

Still another object of the invention is to provide a tilt control device for an outboard motor which is hydraulically operated and of such construction and design as to require a minimum of sealing means to effectively prevent leakage of hydraulic fluid.

With these and other objects in view the invention broadly comprises an outboard motor having in combination a power unit pivotally connected by a tilt pin to a boat bracket for fore and aft tilting movement of the power unit when the bracket is mounted on a boat, and a shock absorber having two parts which are rotationally related with two or more hydraulic fluid chambers formed circumferentially therebetween about the axis of rotation to yieldably resist said relative rotation, said parts being respectively connected to the power unit and bracket with said rotational axis coaxial with the tilt pin whereby said shock absorber will resist said tilting movement.

In a more advanced form the invention includes a source of hydraulic fluid and means for selectively conducting said fluid under pressure from the source to either of said fluid chambers in the shock absorber to force said relative rotation in either direction and thus cause fore or aft tilting movement of the power unit about the tilt pin.

The above mentioned and additional objects of the invention will be brought to light during the course of the following specification, reference being made to the accompanying drawings, in which—

FIG. 1 is a side elevation of an outboard motor, embodying the tilt control device, mounted in operating position on a boat transom, and shown in forwardly tilted position in broken lines.

FIG. 2 is a schematic view showing the tilt control device in perspective and connected to a source of fluid under pressure.

FIG. 3 is an enlarged fragmentary side elevation of the device and adjacent motor portions with the motor in forwardly tilted position.

FIG. 4 is a transverse section taken through the motor structure on line 4—4 of FIG. 1, and through the tilt control device on line 4—4 of FIG. 5.

FIG. 5 is a section taken along line 5—5 of FIG. 4.

FIG. 6 is a schematic view of the hydraulic circuit of the device showing fluid movement under pump pressure to tilt the motor downwardly from a forwardly tilted to an operating position.

FIG. 7 is similar to FIG. 6 with reverse fluid movement to tilt the motor upwardly.

FIG. 8 is similar to FIG. 6 with the pump idle and the motor tilting downwardly.

FIG. 9 is similar to FIG. 8 but shows the direction of fluid movement with the motor tilting upwardly due to external pressures.

Referring now more particularly to the drawings, reference characters will be used to denote like parts or structural features in the different views. An outboard motor of conventional construction and design is designated generally by the number 14. The motor includes a power unit, denoted generally at 15, suitably journaled for turning movement about an upright axis, in a motor bracket 16. The bracket 16 in turn is mounted on a horizontal tilt pin 17 (FIG. 4), and held against rotation thereon by cross pins 18. Pin 17 has its ends suitably connected to bearings 19 which are journaled one in each side of a conventional boat bracket 20. Bracket 20 generally comprises a pair

of transversely spaced integrally connected inverted C-clamps 21 which are secured to the top portion of the transom T of boat B by means of clamp screws 22. Accordingly, when boat bracket 20 is secured to the transom, the power unit 15 is tiltable in fore and aft directions about the axis of the tilt pin 17 in conventional manner.

The power unit 15 includes the usual powerhead 24, drive shaft housing 25 and lower unit 26, through which the powerhead is connected to the propeller 27. Each of the clamps 21 is provided with a rearwardly projecting extension 28 (FIG. 3) having a series of apertures 29 formed about the axis of tilt pin 17 for reception of a locking pin 30 between the portions 28. A latch hook device 31 is pivotally mounted on the motor bracket 16 for releasable locking engagement with pin 30 to hold the power unit in any selected operating position dependent upon the placement of pin 30. Near the rear end of extension 28 and on the arc of apertures 29, a short inwardly projecting pin 32 is mounted. This pin is engageable by latch device 31 to lock the power unit in a forwardly tilted position, as shown in FIG. 3. The latch 31 is yieldably held in locking position by a spring 34 but may be raised to an unlocked position by manual pull on a cable 35 which extends forwardly to the operator's position.

The latch device may be double, extending to both sides of the motor bracket 16 and engaging pins 32 on each side of the boat bracket. This structure is more fully explained in U.S. Patent No. 3,016,869, which issued January 16, 1962, on the application of Anderson et al. It should be sufficient here to explain that during normal operation the latch mechanism 31 is in locking engagement with pin 30. When it is desired to tilt the motor the latch mechanism is manually released through cable 35 and the motor is tilted until the latch engages pin 32 to be locked in the tilted position until again released by cable 35. It will also be understood that the mechanism 31 is so designed as to frictionally pull up and off of the pin 30 when excessive rearward pulling force is applied to the lower portion of the power unit such as when the lower unit 26 engages an underwater obstacle.

Turning now to FIGS. 4 and 5, the novel structure of the present invention will be described in detail. A cylindrical housing denoted generally at 37 has an annular wall 38, closed at one end by an end wall 39, and provided at its other end with a flange 39a. Diametrically opposed portions of the flange 39a are secured to the outer side of one of the clamps 21 as by screws 40 so that the wall 38 is coaxial with the tilt pin 17. A wing shaft 41 is disposed concentrically within the housing 37 and has a pair of diametrically opposing vanes or wings 42 extending radially from one end portion thereof into contact with the inner surface of the wall 38. The opposite or inner end portion of the shaft 41 is reduced as at 43 for insertion in bearing 19 in end to end engagement with tilt pin 17. Pin 17, shaft portion 43 and bearing 19 are provided with suitable aligned, axially extending keyways for the reception of key 44 to ensure rotation of the elements with one another.

A circular partition member 45 encircles shaft 41 within the housing 37 and divides the interior of the housing generally into an outer liquid chamber in which wings 42 are movable and an inner liquid chamber or reservoir 46. The partition member 45 has a marginal rim 47 extending inwardly along the wall 38 and an axially extending central hub portion 48. The open end of the housing 37 is internally threaded for reception of a cover member 49 which also encircles shaft 41 and which bears against the rim 47 to retain the member 45 in fixed position in the housing. A packing ring 50 encircles shaft 41 and is held securely against the cover 49 by means of the retainer ring 51 and coil spring which is compressed between ring 51 and member 45. Packing ring 50, accordingly, prevents axial leakage of fluid from reservoir 46 along shaft 41. An O-ring groove and seal 54 is provided around the

periphery of cover member 49 to prevent leakage around the cover.

The outer end portion of the wing shaft 41 which carries the vanes 42 is enlarged as at 56 to form a center hub for the vanes. The hub 56 and the vanes 42 are of equal axial length with the inner faces of each slidably engaging against the partition member 45 as at 57 and the outer end faces thereof engaging the housing end wall 39.

The housing chamber in which the vanes 42 are disposed may be generally referred to as the pressure chamber. This chamber is divided circumferentially of the shaft portion 56 into a plurality of expandable and contractible sub-chambers as will now be described. A pair of diametrically opposed abutments 58 are mounted in fixed position within the housing to extend between the partition 45 and end wall 39. Accordingly, as shaft 41 turns with pin 17, each vane or wing 42 is movable in the pressure chamber between the abutments and the vanes in conjunction with the abutments divide the chamber into four sub-chambers, as will be observed in FIG. 5. These chambers are designated by the numbers 60, 61, 62, and 63 and it will be subsequently understood that diametrically opposed chambers 60 and 62 perform identical functions as do the alternate diametrically opposed chambers 61 and 63.

Partition member 45 is provided with identical ports 64 which connect the reservoir 46 with chambers 60 and 62 adjacent to the abutments 58. It is also provided with a pair of ports 65 controlled by check valves 66 which connect the reservoir with chambers 61 and 63 adjacent abutments 58 and allowing unidirectional flow of liquid from the reservoir into those chambers.

The system for supplying fluid to and receiving it from the various chambers will now be described with particular reference to FIGS. 1 and 2. A reversible pump 68 is mounted at a suitable point on the boat, as shown in FIG. 1, or may be mounted on the powerhead 24. This pump, which might also be driven off of the engine itself, is here shown as connected to a reversible electric motor which is controlled from a switching means 70 adapted to be located at a forward operator's station in the boat. One side of the pump is connected through lines 71 and 72 and ports in the housing end wall 39 as by couplings 73 to the chambers 60 and 62. The other side of the pump is connected to chambers 61 and 63 through lines 74 and 75 and ports in end wall 39.

Operation of the device as a tilt mechanism will now be described. It will be understood that when the power unit 15 is in its normal upright operating position, as shown in full lines in FIG. 1, the wings 42 will be in substantially the position shown in FIG. 7. That is, chambers 60 and 62 will be expanded and chambers 61 and 63 contracted. To tilt the motor forwardly to bring the propeller out of the water, the latch 31 is released and the motor 69 turned on to drive the pump in the direction denoted by the arrows in FIG. 7. This will cause high pressure in lines 74 and 75 and chambers 61 and 63 expanding these chambers and moving wings 42 in a counterclockwise direction. The device in this condition functions as a fluid motor and the tilt pin 17 being keyed to the wing shaft 41 will tilt the power unit forwardly.

During this operation the valves 66 will remain closed and fluid from the contracting chambers 62 and 64 will return to the pump through lines 71 and 72. When the power unit has been fully tilted, the latching device 31 will engage pin 32 to lock the unit in this position. The vanes alone will not retain the motor in its tilted position when the pump is shut off as there is an escape of pressure from chambers 61 and 63 into the opposing chambers due to fluid leakage around the ends and side faces of the vanes, the tolerances being such as to allow such fluid passage.

When it is desired to return the motor to its upright operating position, the motor 69 is reversed, after unlatching mechanism 31, and the fluid flow takes the direction

5

shown in FIG. 6. Pressure is admitted to chambers 60 and 62 through lines 71 and 72 and fluid is bled from chambers 61 and 63 through lines 74 and 75 causing movement of vanes 42 in a clockwise direction. The outboard motor is then power tilted downwardly. While the motor would achieve this position through gravity alone due to the above mentioned leakage around the vanes 42, the power operation is faster and ensures re-latching with the catch pin 30.

The shock absorbing characteristics of the device will be understood by reference to FIGS. 8 and 9. In FIG. 9 the vanes are shown in normal position when the outboard motor is upright and the motor 69 inoperative. The system including chambers 60, 61, 62 and 63 are filled with fluid. Should the lower unit 26 engage an underwater obstacle, the motor will be unlocked from pin 30 and forced in an upwardly tilting direction by the impact. As this occurs the vanes 42 will be moved in a counter-clockwise direction (FIG. 9) and the fluid in chambers 60 and 62 will have a damping effect on such movement, cushioning the shock of the impact as it is transferred to the boat bracket 20. The chambers 60 and 62 are yieldably contractible to absorb the vane movement due to passage of fluid into reservoir 46 through ports 64 and from the reservoir into chambers 61 and 63 through ports 65. In addition there is leakage past the vanes 42 themselves from the contracting chamber as hereinbefore discussed.

Accordingly, there is a gradual absorption of the shock within the device reducing undesirable strain on bracket 16, tilt pin 17, bracket 20 and the boat transom T. The upward tilting movement of the motor is rapidly decelerated and stopped prior to engagement of the latching device with pins 32.

Where impact with an underwater obstacle occurs, as just described, it is equally important to damp the return movement of the motor to its upright position. This automatically occurs with the present device which serves as a two-way shock absorber. After the shock of impact has been fully absorbed, the vanes at maximum tilt of the motor would be substantially in the position shown in FIG. 8 with the motor gravitationally returning to its operating position. Return movement will be very slow and smooth as the vanes move clockwise. This is due to the fact that with pump 68 inoperative and ports 66 closed by check valves 66, the vanes will contract chambers 61 and 63 only as fast as fluid can leak past and around the vanes into the chambers 60 and 62.

Accordingly, the device assures rapid absorption of the impact and a slow return of the motor to its operating position.

The rotary character of the device not only provides for smooth operation but allows compact incorporation with conventional outboard motor construction and virtually eliminates the wear and sealing problems which are characteristically present in extendible hydraulic jacks. The device accordingly economically and effectively carries out the aforementioned objectives.

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. In an outboard motor having a clamp bracket adapted to be secured to the transom of a boat and a motor unit, means pivotally mounting the motor unit on the clamp bracket on a horizontal axis to provide for

6

tilting of the motor unit from an upright operative position, and a rotary hydraulic shock absorber having two parts arranged for relative rotation on said axis and circumferentially spaced thereabout with one of said parts connected to the motor unit and the other of said parts connected to the bracket, and said absorber having hydraulic fluid removably retained between said parts to resist relative oscillating movement therebetween about said axis.

2. A tilt control device for boat transom mounted outboard motors comprising a boat bracket adapted for mounting on said boat transom, a power unit, pivotal means securing the power unit to said bracket whereby the power unit may be moved to alternate tilted positions with respect to said transom and bracket, a cylindrical housing and rotary vane system arranged in the housing operatively interconnecting said power unit and bracket and disposed coaxially with the pivotal means, and power driven pump means connected to said arrangement for supplying fluid pressure thereto to cause rotation of the rotary vane system within the housing and resultant movement of the engine about said pivotal means.

3. The subject matter of claim 2 wherein said cylindrical housing is provided with a pair of diametrically opposed internal stops, and said rotary vane system is provided with diametrically opposed external vanes disposed circumferentially intermediate said stops to form four expandible and contractible fluid chambers around said pivot axis which are connected to said pump means.

4. The subject matter of claim 3 wherein said pump means is reversible and is provided with pump outlets connected to alternate chambers for selectively supplying liquid under pressure to said alternate fluid chambers.

5. In an outboard motor having a boat bracket adapted to be securely mounted on the transom of a boat and a power unit, a tilt pin on the power unit and journaled in the boat bracket on a horizontal axis for tilting movement of the power unit in a vertical plane, a cylindrical housing integrally mounted on the boat bracket and disposed coaxial to said pin, a wing shaft disposed within the housing in end to end alignment with the tilt pin, key means irrotatably interconnecting the wing shaft to the tilt pin, said housing having an internal pressure chamber, a pair of diametrically opposed abutments within the pressure chamber, a pair of diametrically opposed radially extending wings on the wing shaft disposed circumferentially intermediate the abutments to jointly with the abutments divide the chamber into two pairs of sub-chambers, means forming a fluid reservoir within the housing, port means connecting the reservoir with each sub-chamber, a reversible rotary pump, power means connected to the pump for driving the pump in either direction to eject fluid from either side thereof, and a hydraulic fluid circuit providing a first fluid carrying connection between one pair of sub-chambers and one side of the pump and a second fluid carrying connection between the other pair of sub-chambers and the other side of the pump.

6. The subject matter of claim 5 wherein the wings are spaced relative to the housing walls to allow minimal fluid leakage therebetween.

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