Feb. 21, 1961 J. E. HODGSON 2,972,328

TILTING MECHANISM FOR OUTBOARD MOTORS

Filed July 25, 1957 4 Sheets-Sheet 1

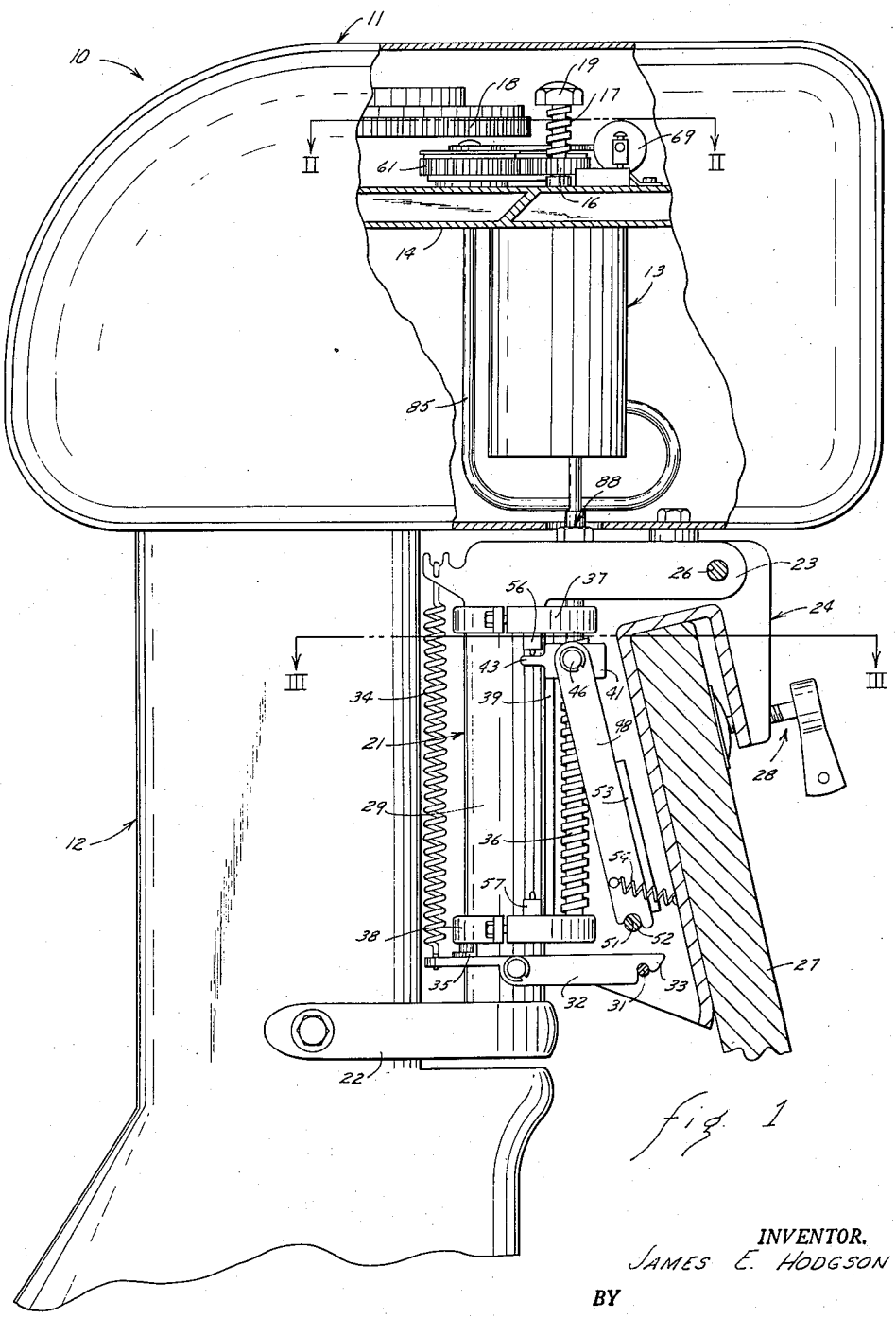


fig. 1

INVENTOR.
JAMES E. HODGSON

BY

Woodhams Blanchard & Flynn
ATTORNEYS

Feb. 21, 1961 J. E. HODGSON 2,972,328

TILTING MECHANISM FOR OUTBOARD MOTORS

Filed July 25, 1957 4 Sheets-Sheet 2

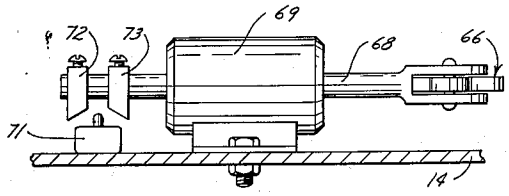


fig. 5

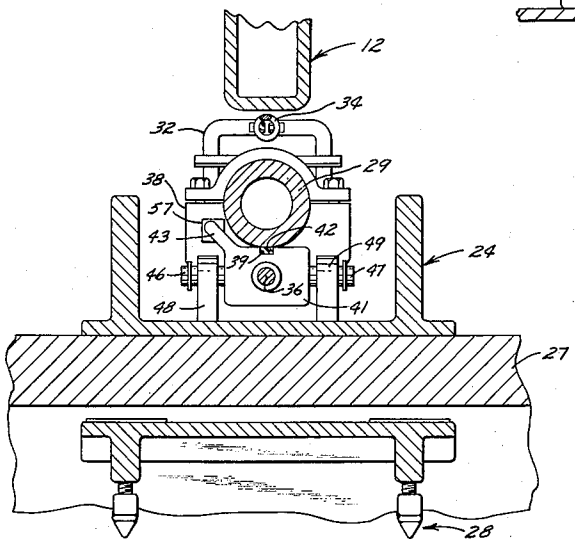


fig. 3

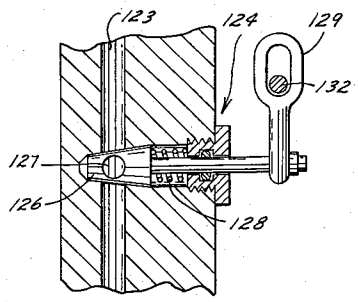


fig. 9

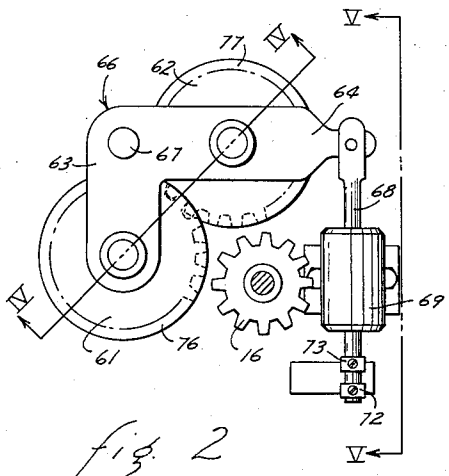


fig. 2

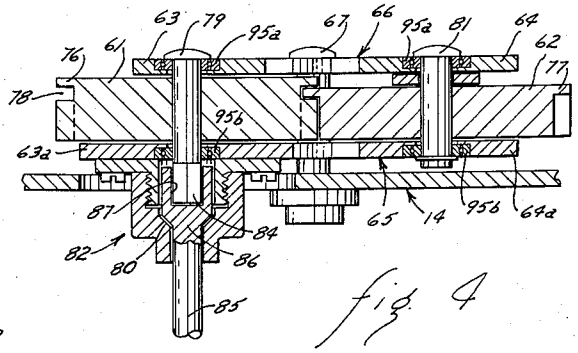


fig. 4

INVENTOR.
JAMES E. HODGSON

BY

Woodhams Blanchard & Flynn
ATTORNEYS

Feb. 21, 1961 J. E. HODGSON 2,972,328

TILTING MECHANISM FOR OUTBOARD MOTORS

Filed July 25, 1957 4 Sheets-Sheet 3

fig. 6

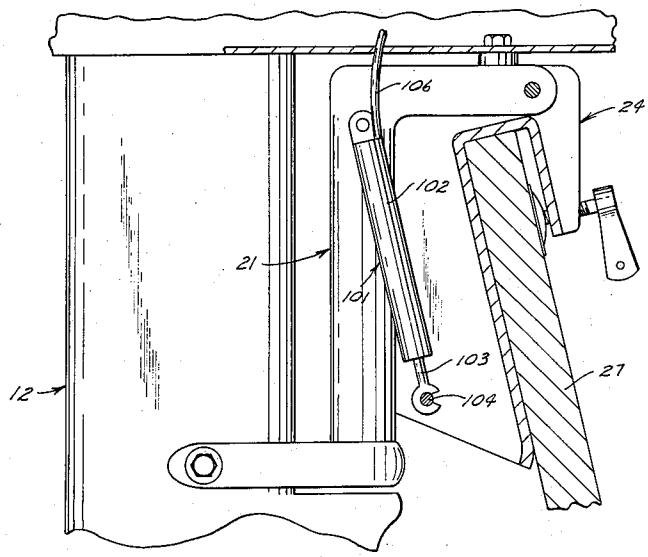
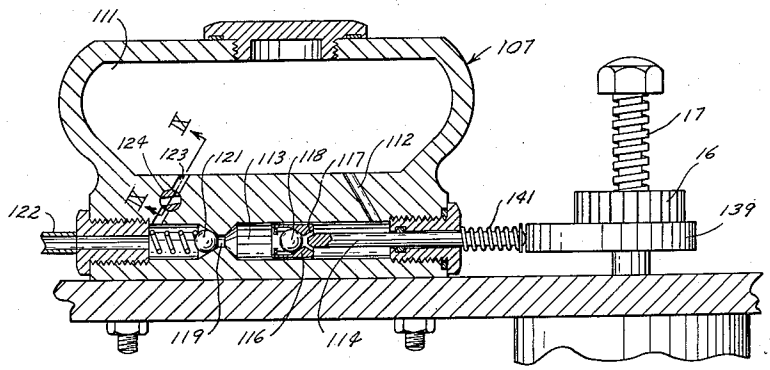


fig. 8



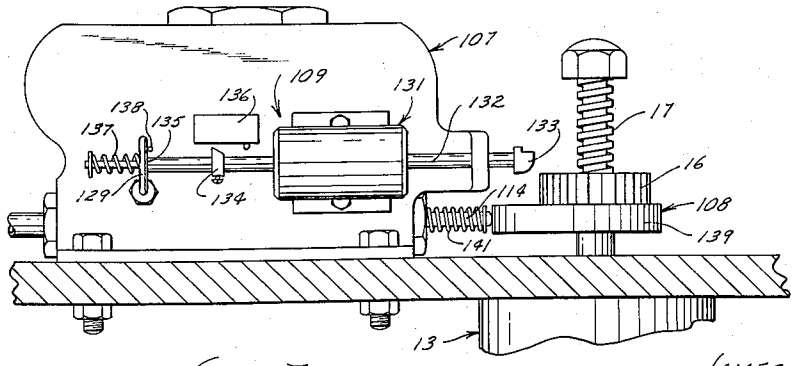


fig. 7

INVENTOR.
JAMES E. HODGSON

BY

Woodhams Blanchard & Flynn
ATTORNEYS

Feb. 21, 1961 J. E. HODGSON 2,972,328

TILTING MECHANISM FOR OUTBOARD MOTORS

Filed July 25, 1957 4 Sheets-Sheet 4

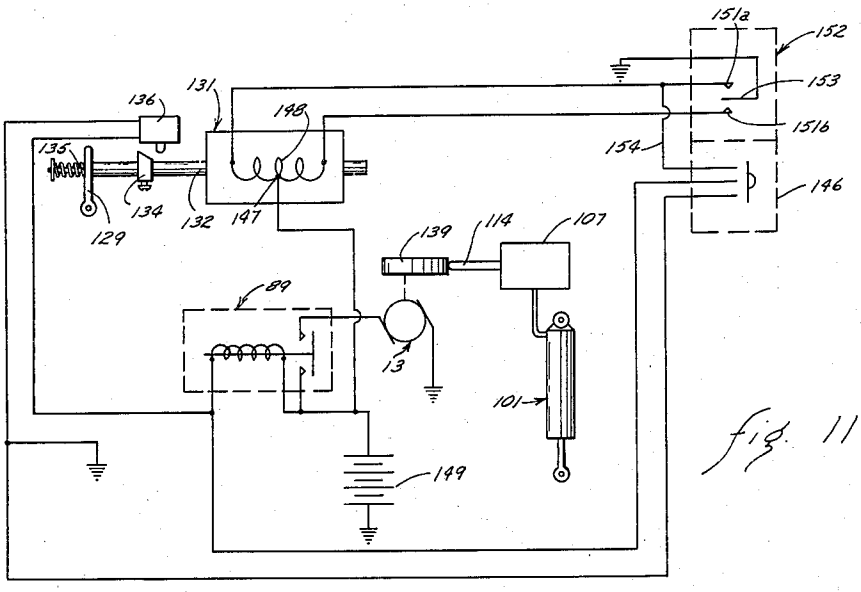


fig. 11

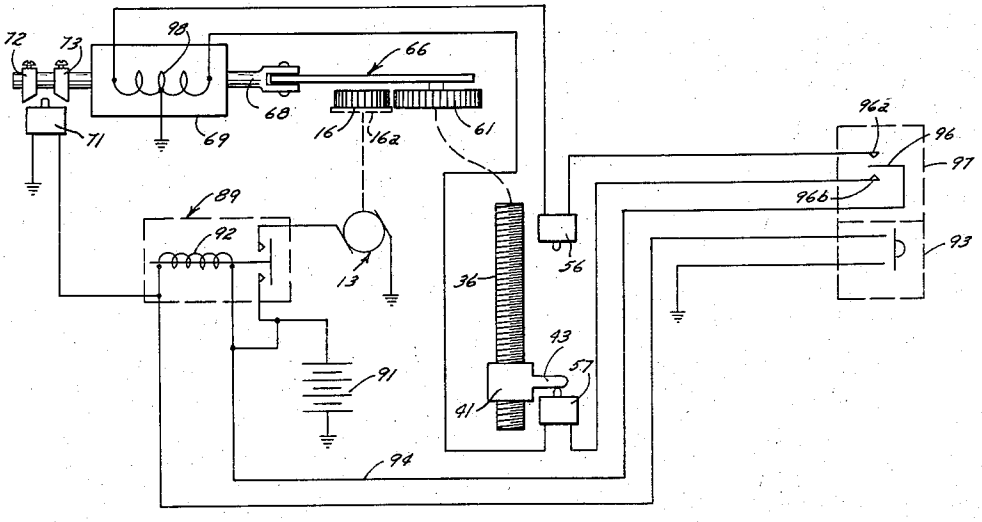


fig. 10

INVENTOR.
JAMES E. HODGSON
BY
Woodhams Blanchard & Flynn
ATTORNEYS

United States Patent Office 2,972,328 Patented Feb. 21, 1961

2,972,328

TILTING MECHANISM FOR OUTBOARD MOTORS

James E. Hodgson, 2337 Benton, Kalamazoo, Mich.

Filed July 25, 1957, Ser. No. 674,195

9 Claims. (Cl. 115—41)

This invention relates to a power operated device for tilting an outboard motor with respect to the transom of a boat on which said motor is mounted. In particular, this invention relates to an outboard motor tilting device, wherein movement of the outboard motor is brought about by remote control and wherein the tilting mechanism employs as its power source the starting motor for the outboard motor, or a pressure fluid operated device.

In the operation of an outboard motor propelled boat, it is frequently necessary to raise the propeller and drive shaft housing in order to avoid contact thereof with underwater obstacles. Thus, for example, when beaching the boat it is necessary to raise the propeller and driveshaft housing so that they do not strike against the bottom. Further, it is sometimes desirable to raise the propeller and driveshaft housing when the boat is operating in shallow water. Insofar as I am aware, no completely satisfactory device for accomplishing this purpose has been devised. In particular, no remotely controlled power operated device for raising the propeller and driveshaft housing of an outboard motor is presently available.

Accordingly, it is an object of this invention to provide a device for tilting an outboard motor on and with respect to the transom of a boat in order to raise or lower the propeller and driveshaft housing thereof.

It is a further object of this invention to provide a device, as aforesaid, which may be remotely controlled.

It is a further object of the invention to provide a device, as aforesaid, in which operation of the tilting mechanism is brought about by energization of the starter motor conventionally provided on electrically started outboard motors.

It is a further object of this invention to provide a device, as aforesaid, in which operation of the starter motor is effective to cause actuation of mechanical or fluid pressure operated structure for causing tilting of the outboard motor.

It is a further object of this invention to provide a device, as aforesaid, in which the additional structure for effecting tilting of the outboard motor consists of a relatively few parts which can be easily incorporated within and on conventional outboard motor constructions.

It is a further object of this invention to provide a device, as aforesaid, which is inexpensive to manufacture, effective in operation and which will not detrimentally affect the operation of the outboard motor in any respect.

Other objects and advantages of this invention will become apparent to those acquainted with equipment of this type upon reading the following description and inspecting the accompanying drawings.

In the drawings:

Figure 1 is a side elevational view, partially broken away, of an outboard motor construction embodying one form of the invention, mounted upon the transom of a boat.

Figure 2 is a sectional view taken along the line II—II of Figure 1.

Figure 3 is a sectional view taken along the line III—III of Figure 1.

Figure 4 is a sectional view taken along the line IV—IV of Figure 2.

Figure 5 is a view taken along the line V—V of Figure 2.

Figure 6 is a fragmentary view similar to Figure 1, and showing a modification of the invention wherein the tilting mechanism is fluid-pressure operated.

Figure 7 is a side elevational view of the starter motor structure of the engine associated with the pump structure for operating the device shown in Figure 6.

Figure 8 is a view similar to Figure 7, but showing the pump in central section.

Figure 9 is a sectional view taken along the line IX—IX of Figure 8.

Figure 10 is a schematic, diagram illustrating the electrical and mechanical connections for the tilting mechanism disclosed through Figures 1 through 5.

Figure 11 is a schematic, diagram illustrating the electrical and mechanical connections for the modified tilting mechanism as disclosed in Figures 6 through 9.

General description

In general, the invention provides structure driven by the starter motor of the outboard motor and adapted to cause tilting of the outboard motor with respect to the boat transom. In the mechanical form of the tilting apparatus, the output shaft of the starter motor is drivingly connected to a rotatable, but axially non-movable screw of a screw-type jack. A screw follower is adapted to move axially along the screw and is connected to arms which are pivotally mounted on the transom clamp. As the screw follower moves axially along the screw, the arms will pivot with respect to the transom clamp to cause tilting of the motor with respect to the transom.

In the fluid pressure operated device, the output shaft of the starter motor is connected for operating a pump. The pump supplies fluid to a piston and cylinder arrangement which is pivotally connected to the transom clamp and to the outboard motor structure. Fluid pressure supplied to the piston and cylinder arrangement is adapted to cause tilting movement of the outboard motor with respect to the transom.

Detailed description

The invention is adapted to be used with any conventional type of outboard motor. For the purpose of completeness of disclosure, a brief description of one suitable outboard motor structure will be given herein. However, it is to be understood that the invention can be utilized with outboard motor structures which differ materially in construction from that disclosed herein. Therefore, the following description of a particular outboard motor structure is given for illustrative purposes only.

Referring to Figure 1, there is shown an outboard motor structure **10** which includes an engine housing **11** and a driveshaft housing **12** extending downwardly from the engine housing. An electric starter motor **13** is positioned within the engine housing **11** and is supported therewithin by a suitable frame structure **14**. A pinion gear **16** is mounted upon a threaded portion **17** of the output shaft of the motor. Unless restrained by the structure of the invention, as pointed out in greater detail hereinbelow, the pinion gear **16** is adapted to move upwardly along the threaded portion of the output shaft when the motor is energized and is adapted to mesh with a ring gear **18** on the crankshaft of the engine. A stop nut **19** is provided for limiting axial movement of

the pinion gear. Engagement of the pinion gear with the ring gear 18 will crank the engine in conventional fashion.

The outboard motor structure also includes a swivel bracket structure 21. The swivel bracket structure includes a lower yoke 22 which is secured to the driveshaft housing 12. An upper arm 23 extends from the swivel bracket and is pivotally mounted on a conventional transom clamp 24 by a pivot pin 26. The transom clamp is secured to the transom 27 of the boat in conventional fashion, as by operation of the securing structures 28.

A lock pin 31 is secured to the transom clamp 24 adjacent the lower end thereof. A lock lever 32, which is U-shaped in plan view (Figure 3), is pivotally mounted upon the intermediate section 29 of the swivel bracket structure and is provided with hook portions 33 for releasably securing the outboard motor structure in position with respect to the transom clamp 24. The web of the lock lever 32 is connected by a spring 34 to the upper arm 23 of the swivel bracket structure 21. The spring 34 urges the lock lever 32 into hooking engagement with the lock pin 31. However, should the driveshaft housing 12 engage an underwater obstacle, the spring 34 will yield to enable the lock lever 32 to disengage from the lock pin 31 and thereby permit the outboard motor structure to pivot upwardly about the pivot pin 26.

Having now described a suitable, conventional outboard motor structure, reference will now be made to the novel structure to which the invention relates.

An elongated, threaded rod 36 (Figures 1 and 3) is secured to, and extends parallel with, the intermediate section 29 of the swivel bracket structure 21. The threaded rod 36 is supported at its respective axial ends by brackets 37 and 38. The brackets 37 and 38 are provided with bearings in which the rod is rotatably mounted. A key 39 is fixed to the intermediate section 29 and extends axially therealong adjacent the threaded rod 36. An internally threaded screw follower 41 is mounted upon the threaded rod 36 for axial movement therealong. The key 39 fits within a keyway 42 (Figure 3) in the screw follower 41 and limits movement of the screw follower to axial movement along the threaded rod 36. A switch operating finger 43 extends from the screw follower for actuation of the limit switches as will be described hereinafter.

A pair of limit-switches 56 and 57 (Figures 1 and 3) are mounted upon the lower surface of the upper bracket 37 and upon the upper surface of the lower bracket 38, respectively. The limit-switches 56 and 57 are adapted to be actuated by the switch operating finger 43 on the screw-follower 41 when said screw follower reaches its terminal positions. A stop 35 mounted on the bracket 38 limits the movement of lock lever 32 effected by the spring 34 in a locking direction. It will be noted that, should an obstruction be hit, the lock lever 32 will pivot counterclockwise, as appearing in Figure 1, to release from the lock pin 31.

The screw follower 41 has stub shafts 46 and 47 extending therefrom on opposite sides thereof. A pair of actuating arms 48 and 49 are pivotally supported on the shafts 46 and 47, respectively. The lower ends of each of the arms 48 and 49 are provided with notches, of which one appears at 51 (Figure 1). The notches are adapted to releasably embrace a support pin 52 (Figure 1) which is mounted on and extends horizontally from both sides of the transom clamp 24. During the tilting of the motor, the pin 52 supports the arms 48 and 49 and acts as a fixed center for the pivotal movement of said arms as the screw follower 41 moves axially along the threaded rod 36.

A pair of guide bars, one of which is shown at 53 in Figure 1, are mounted upon the side of the transom clamp 24 so that they extend along and are snugly adjacent to the arms 48 and 49 when said arms are engaging the pin 52 and the screw follower 41 is at the upper end of its travel along the screw 36. A pair of spiral springs, one of which is shown at 54 in Figure 1, are secured to and extend between the lower ends of said arms 48 and 49 and the transom clamp 24. Said springs 54 continuously urge the lower ends of the arms 48 and 49 against the bars 53. Thus, if said arms are disengaged from the pin 52 by an unplanned, upward tilting of the outboard motor, the bars 53 and springs 54 will cooperate to reengage automatically the notches 51 with the pin 52 when the motor pivots downwardly again.

A pair of gears 61 and 62 (Figures 1, 2 and 4) are rotatably mounted by means of the shafts 79 and 81, respectively, upon and between the legs 63, 63*a*, 64 and 64*a* of the bell crank levers 65 and 66. The bell crank levers 65 and 66 are in turn supported upon a stub shaft 67 which is rotatably mounted on the frame 14. The gears 61 and 62 are positioned adjacent to the pinion gear 16 and are radially aligned with said pinion gear when it is in its normal, lowermost position, as appearing in Figure 1. The end of leg 64 of the bell crank lever 66 is connected to the operating arm 68 of the double acting solenoid 69 (Figures 1, 2 and 5). The solenoid operating arm 68 is biased to an intermediate position wherein both of the gears 61 and 62 are out of meshing engagement with the pinion gear 16. Energization of the solenoid and movement of the operating arm 68 thereof in one direction will bring gear 61 into meshing engagement with pinion gear 16 while movement of the operating arm in the opposite direction will bring gear 62 into meshing engagement with said pinion gear.

A micro-switch 71 (Figure 5) is mounted upon the frame structure 14. A pair of switch operators 72 and 73 (Figures 2 and 5) are mounted upon the operating arm 68 of the solenoid 69 and are adapted to actuate the micro-switch 71, when the solenoid is energized.

As pointed out above, when the starter motor 13 is energized, the normal tendency of the pinion gear 16 is to move upwardly into engagement with the ring gear 18. In order to utilize the starter motor for controlling the operation of the tilting device, it is necessary to prevent such upward movement of the pinion gear and, accordingly, the gears 61 and 62 are provided with flanges 76 and 77 (Figures 2 and 4), respectively, which flanges are adapted to overlie a portion of the pinion gear 16 when one of the gears is in meshing engagement therewith. Gears 61 and 62 are in constant meshing engagement with each other and gear 61 is provided with a circumferential groove 78 (Figure 4) into which the flange 77 of gear 62 is slidably received. Thus, either of the gears 61 and 62 may be moved into meshing engagement with the pinion gear and the flange on such gear will prevent the upward movement of said pinion gear.

Referring to Figure 4, the gears 61 and 62 are drivingly connected to the shafts 79 and 81, respectively. A driving device is connected to one of the shafts, here the shaft 79, for driving the threaded rod 36 therefrom. The driving device disclosed herein includes a flanged adapter 82 secured to the lower surface of the bell crank 65 and having a central opening 80 through which the upper end of the flexible shaft or cable 85 extends and is rotatably supported. Said cable 85 has a polygonal recess 87 in the enlarged, upper end 86 thereof. The lower end 84 of the shaft 79 extends below the lower bell crank 65 and has a polygonal cross-section corresponding to and receivable into the recess 87 in the end of the flexible shaft. The flanged adapter 82 retains the enlarged head 86 in engagement with the shaft 79. The other end of the flexible shaft 85 is connected by a suitable fixture 88 (Figure 1), to the upper end of the threaded rod 36. Thus, upon rotation of the shaft 79, the flexible shaft 85 will rotate and will cause rotation of the screw or threaded rod 36. The shafts 79 and 81 are rotatably engaged by the bearing structures 95*a* and 95*b*, which are mounted on the bell cranks 65 and 66. Thus, the gears

61 and 62 and their shafts 79 and 81 are free to rotate with respect to said bell cranks and also to move arcuately with respect to the frame structure 14 into or out of meshing engagement with pinion gear 16.

Referring to Figure 10, there is illustrated a diagram of the electrical and mechanical connections provided for the desired operation of the outboard motor and of the tilting device. The starter motor 13 is connected to one of the fixed contacts of the starter relay 89. The boat battery 91 is connected to the other fixed contact of the starter relay. The winding 92 of the starter relay is connected to the boat battery 91 and to one contact of the push-button start switch 93. The other contact of the start switch is connected to ground. Thus, upon closing the start switch 93, the winding 92 of starter relay 89 will be energized to cause closing of the contacts thereof and thereby cause actuation of the starter motor 13 in conventional fashion. The battery is also connected by the conductor 94 to the movable contact 96 of the motor tilt switch 97. The movable contact 96 is normally biased as by springs, to a position intermediate the fixed contacts 96*a* and 96*b*. The fixed contact 96*a* of the motor tilt switch 97 is connected through the normally closed limit switch 56 to one end of the winding 98 of the solenoid 69. The other fixed contact 96*b* of the motor tilt switch 97 is connected through the normally closed limit switch 57 to the other end of the winding 98. A center tap on the winding 98 is connected to ground. Thus, upon closing of the movable contact 97 against one of the fixed contacts 96*a* or 96*b* of the motor switch, the solenoid 69 will be energized to move its operating arm in one direction or the other. The normally open micro-switch 71 is connected to one end of the start relay winding 92 and to ground. Upon movement of the operating arm 68 in one direction or another, either the switch operator 72 of the switch operator 73 will close the micro-switch and thereby connect one end of the starter relay winding 92 to ground. Thus, even though the start switch 93 is not closed, the relay 89 will be energized to cause energization of the motor 13. This, in turn, will cause rotation of the pinion gear 16 in conventional fashion.

Obviously both the start switch 93 and the motor tilt switch 97 may be mounted in any convenient location on the boat, such as on the dash board thereof, to permit remote control over the starting of the outboard motor and over the tilting thereof.

Operation

While the operation of the disclosed device has been referred to hereinabove, it will be briefly summarized for purposes of completeness. Starting of the outboard motor 13 may be accomplished in conventional fashion. Upon closing of the start switch 93 the boat battery 91 will be connected through the contacts of the relay to the start motor 13 which will cause starting of the outboard motor in conventional fashion.

Referring now to the operation involved in the tilting of the motor, assuming that the drive shaft housing of the outboard motor is in its normal downward condition, the tilting operation will be initiated by the boat operator closing the movable contact 96 against the fixed contact 96*a* of the motor tilt switch 97. This will complete a circuit from the battery 91 through the motor tilt switch 97, limit switch 56, to one end of the winding 98 of solenoid 69, and thence to ground through the center tap on the solenoid winding. This will cause the solenoid arm to move leftwardly which will move gear 62 into meshing engagement with the pinion gear 16. When gears 16 and 62 are in engagement, the switch operation will close micro-switch 71 and thereby energize motor 13. The motor 13 will rotate the pinion gear 16 which will, in turn, rotate the gear 62, gear 61 and the flexible shaft 85.

The flange 77 on gear 62 will prevent the pinion gear from moving upwardly on shaft 17. Rotation of the flexible shaft 85 will cause corresponding rotation of the rotatable, but axially non-movable, threaded rod 36. This will cause screw follower 41 to move axially along the rod due to the threaded engagement thereof with the rod. Such movement of the rod will continue until either the movable contact 96 is returned to its intermediate position or until the limit-switch 56 is opened by contact thereof with the switch operating finger 43 on the screw follower. Such contact between the switch operating finger 43 and the micro-switch will occur at the end of the desired axial movement of the screw follower 41. Axial movement of the screw follower 41 will cause pivoting movement of the actuating arms 48 and 49 about the pin 52. Such pivoting movement will be translated into pivotal movement of the outboard motor structure including the engine housing 11 and the driveshaft 12 upwardly about the pivot pin 26. As the screw follower 41 moves downwardly on the threaded rod 36 the lock lever 32 will be moved outwardly from the transom clamp 24 and thereby disengaged from the pin 31.

Assuming that the outboard motor is in its upper, tilted position, downward movement thereof is initiated by moving the movable contact 96 of the tilt action switch into engagement with the lower contact 96*b*. This will connect the battery 91 through the lower contact 96*b* and through the limit switch 57 to the rightward end of the winding of solenoid 69. Such energization of the solenoid winding will pull the operating arm 68 of the solenoid to the right. This will move the gear 61 into meshing engagement with the pinion gear 16. Thereupon, the micro-switch 71 will be closed by switch operator 72. The battery will then be connected through the winding of the relay 89 and through the closed contacts of the micro-switch 71 to ground. This will energize the winding of relay 89 and will close the contacts thereof, whereupon motor 13 will be energized to cause rotation of the pinion gear 16. This will cause rotation of the flexible shaft in the opposite direction which will, in turn, cause the screw follower 41 to move upwardly along the threaded rod 36. Thus, the outboard motor structure will tilt downwardly to return to its original position, so long as the movable contact 96 is held closed against the lower contact, until the switch operating finger 43 opens the normally closed micro-switch 57.

As pointed out above, the switch 96 is spring biased into a position between its two fixed contacts 96*a* and 96*b*. Therefore, the movable contact 96 must be held in engagement with the desired fixed contact in order to continue movement of the screw follower along the threaded rod 36. The motor 13 will be de-energized and the tilting movement of the outboard motor structure will stop upon release of the movable contact 96.

Modification

Referring to Figures 6 through 9 and 11, there is disclosed a mechanism whereby tilting of the outboard motor structure may be effected by fluid pressure. Such a structure is equally advantageous for the purposes of the invention as that previously discussed and, in fact, has certain advantages which make it a preferred manner of accomplishing the purposes of the invention.

Referring to Figure 6, there is disclosed an outboard motor structure generally similar to that discussed above with respect to Figure 1. In this embodiment of the invention, a hydraulic piston and cylinder 101 arrangement is provided to accomplish tilting of the outboard motor. As shown in Figure 6, the cylinder 102 is pivotally connected to the swivel bracket 21 adjacent the upper end thereof. The piston 103 is pivotally connected to a pivot pin 104 which is secured to the transom clamp assembly 24. A conduit 106 is provided for supplying fluid pressure to the piston and cylinder assembly 101.

The structure (Figure 7) for supplying fluid pressure to the piston and cylinder assembly 101 includes a pump

structure 107, mechanism 108 connected to the output shaft of the starter motor for operating the pump and control structure 109 for controlling the operation of the pump and movement of the pinion gear 16 on the starter motor shaft.

Referring to Figure 8, the pump structure 107 includes a reservoir 111 having a port 112 extending therefrom to the pump chamber 113. A pump piston 114 having an enlarged head 116 is slidably disposed within the pump chamber 113. Passages 117 extend through the enlarged head 116 whereby fluid may pass forwardly through the enlarged head. A check valve 118 is provided in the enlarged head for preventing flow of fluid backwardly therethrough. Thus, upon leftward movement of the pump rod 114, as appearing in Figure 8, fluid within the pump chamber will be moved outwardly therefrom through the passage 119 and the check valve 118 will prevent movement of fluid through passages 117. Upon rightward movement of the pump rod, fluid within the rightward portion of the pump chamber will pass the check valve 118 and move into the leftward portion of the chamber. A check valve 121 is provided in the passage 119 for preventing flow of fluid backwardly into the pump chamber 113. However, check valve 121 will permit flow of fluid from the pump chamber outwardly thereof through passage 119. The outlet conduit 122 of the pump structure 107 is connected to the conduit 106.

A by-pass conduit 123 extends from adjacent the outlet port of the pump structure and communicates with the reservoir 111. A by-pass valve structure 124 is disposed in the by-pass conduit 123. The by-pass valve structure 124 (Figure 9) includes a frusto conical valve element 126, having a port 127 therethrough. The valve element 126 is received within a corresponding recess in the pump housing and is urged into fluid tight engagement therewith by the spring 128. A valve operating member 129 is connected to the valve element 126 for controlling the position thereof.

A double acting solenoid 131 (Figure 7) is secured to the pump structure 107. The solenoid operating arm 132 has a retaining shoe 133 secured thereto at one end thereof. The retaining shoe 133 is adapted to overlie the pinion gear 16 to prevent vertical movement thereof upon energization of the starter motor. A switch operator 134 is secured to the solenoid operating arm 132 and is adapted to actuate a micro-switch 136. The solenoid operating arm 132 also extends through the valve operating element 129 and has a shoulder 135 which is adapted to bear against said element. The valve operating member 129 is urged by a spring 137 against the shoulder 135 so that upon movement of the solenoid operating arm the valve will open or close. A stop 138 is secured to the pump housing and is adapted to block movement of the valve operating member 129. When the member 129 bears against stop 138, the by-pass valve is closed.

A cam 139 is secured to the output shaft of the starter motor. A spring 141 urges the pump rod 114 into engagement with the cam 139. Thus, upon rotation of the starter motor shaft, the pump rod 114 will be moved rightwardly and leftwardly, as appearing in Figure 8, within the pump chamber 113, and thereby effect pumping of the fluid.

Referring to Figure 11, there is schematically disclosed a connection of the hydraulic and electrical connections for effecting the desired operation of the hydraulic form of the outboard motor tilting device. A push button switch 146 is provided for energizing the starting motor in conventional fashion as discussed above with respect to the Figure 10. In this embodiment of the invention, a center tap 147 on the solenoid coil 148 is connected to one side of the boat battery 149. The respective ends of the solenoid coil 148 are connected to the fixed contacts 151*a* and 151*b*, respectively, of the motor tilt switch 142. The movable contact 153 of the motor tilt switch 152 is connected to ground. A conductor 154 extends from the fixed contact 151*a* to a fixed contact of the push button switch 146. The normally open switch 136 upon closing thereof by switch operator 134 connects one end of the starter relay winding to ground to energize said winding and thereby energize the starter motor.

The operation of the hydraulic device embodiment of the invention is generally similar to that of the mechanical device previously discussed. Upon closing of the push button switch 146 the boat battery will be connected through the winding of the starter relay to ground and will energize the starter motor in conventional fashion. Simultaneously, one end, the leftward end, as appearing in Figure 11, of the solenoid coil, will be connected to ground through the conductor 154. This causes the solenoid operating member to move leftwardly as appearing in Figure 11 to open the by-pass valve 124. Thus, operation of the pump rod 114 by the cam 139 does not pressurize the cylinder 102 and the fluid merely recirculates through the pump and the reservoir. Any fluid pressure in the cylinder 102 will be relieved so that the motor will be moved to its lower position, as shown in Figure 6.

When it is desired to tilt the outboard motor structure upwardly, the movable contact 153 of the tilt switch is moved into contact with the fixed contact 151*b*. This provides a circuit through the center tap 147, the rightward half of the solenoid coil 148, the fixed contact 151*b*, and the movable contact 153 to ground. This causes the solenoid operating rod 132 to move rightwardly. This places the retaining shoe 133 above the pinion gear 16 and prevents vertical movement thereof. Such movement of the solenoid operating rod moves the valve operator 129 against stop 138 to close by-pass valve 124 and also closes the normally open switch 136 and connects one end of the starter relay coil to ground. This causes closing of the starter relay contacts and thereby causes energization of the starter motor. Rotation of the starter motor, through the cam 139 and the pump rod 114 effects the supply of fluid pressure to the cylinder 102. Such pressurizing of the cylinder causes said cylinder to move with respect to its piston rod and thereby causes tilting of the motor about the pivot pin 26.

If it is desired to tilt the motor downwardly, the movable contact 153 is moved into engagement with contact 151*a*. This energizes the solenoid 131 to move the operating rod thereof leftwardly as appearing in Figure 7. Such movement will open the by-pass valve 124. Fluid within the cylinder 102 will drain into the reservoir and the outboard motor will tilt downwardly due to the weight thereof.

The movable contact 153 of the tilt control switch is normally biased to its intermediate position. Also, the solenoid operator arm 132 is normally positioned so that the by-pass valve 124 is closed and the switch 136 in its normally open position. Thus, the motor will normally stay in whatever position it happens to be in since the fluid pressure within the cylinder 102 cannot drain backwardly into the reservoir, nor is the pump operating to supply any further fluid thereto.

While the foregoing discussion has related to a device wherein the pump is driven directly from the output shaft of the starter motor, it will be apparent that such pump could be driven through intermediate gearing, if such is desired. Further, while the foregoing disclosure has suggested the use of a piston type pump for effecting the desired supply of fluid pressure, it will be apparent that other types of pumps can be utilized, if such is desired, without departing from the scope of the invention.

With respect to the structure shown in Figure 2, it will be apparent that the function performed by the flanges 76 and 77 on the gears 61 and 62 can be performed by a similar flange on the lower side of the pinion 16, as indicated in broken lines at 16*a* in Figure 10. Thus, where a flange 16*a* is provided, the flanges 76 and 77 would be unnecessary.

Although particular, preferred embodiments of the invention have been described, it is to be understood that the invention includes such variations and modifications as lie within the scope of the appended claims.

I claim:

1. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, an engine tilting mechanism operatively intermediate said engine and support, an electrical motor normally useful for starting said engine, means selectively interconnecting said starter motor and said engine tilting mechanism to cause tilting of said engine, and means for energizing said starter motor.

2. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, an engine tilting mechanism operatively intermediate said engine and support, an electrical motor normally useful for starting said engine, a reciprocally movable pinion gear mounted on the shaft of said starting motor for selectively interconnecting said starting motor and engine when it is desired to start said engine, means selectively interconnecting said starter motor and said engine tilting mechanism to cause tilting of said engine, and means operable with said motor and tilting mechanism interconnecting means for preventing the engine connecting movement of said pinion gear.

3. A device according to claim 2 inclusive of a solenoid having a movable operative element for drivingly connecting the shaft of said starter motor to said tilting mechanism, and means responsive to further movement of said operating element to cause energization of said starter motor.

4. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means for securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, an arm pivotally connected to said mounting support below said pivot, a rotatable, vertically extending externally threaded rod secured to said outboard motor structure, an internally threaded screw follower on said rod and movable axially therealong, means pivotally interconnecting said arm and said screw follower, a gearing assembly, power transmitting means connected to said gearing assembly and to said rod whereby said rod is rotated upon rotation of said gearing assembly, an electrical motor normally useful for starting said engine, a pinion gear reciprocally movable on the shaft of said motor for interconnecting said starter motor and engine, means for bringing said gearing assembly into meshing engagement with said pinion gear in either of two conditions so that said rod may be rotated in one direction or another upon rotation of said pinion gear; means on said gearing assembly for preventing movement of said pinion gear when said gearing assembly is in meshing engagement therewith; and means for energizing said motor to rotate said pinion gear after said gearing assembly is in meshing engagement with said pinion gear.

5. A device according to claim 4 including a double-acting solenoid having a movable operating element; means for energizing said solenoid and thereby moving said operating element in one direction or another to bring said gearing assembly into meshing engagement with said pinion gear in one condition or another; a switch operable by movement of said operating element in one direction or another after said operating element has moved said gearing assembly into meshing engagement with said pinion gear, operation of said switch being effective to energize said starting motor; and a pair of limit switches operable by said screw follower to de-energize said starting motor whereby said starting motor will be de-energized upon a predetermined upward or downward movement of said screw follower.

6. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, a piston and cylinder arrangement operatively intermediate said engine and support, an electrical motor normally useful for starting said engine, pump means operated by said motor, means connecting said pump means and piston and cylinder arrangement for supplying fluid pressure thereto to cause tilting of said engine.

7. A device according to claim 6 inclusive of means on the shaft of said motor for operating said pump means, a pinion gear likewise on said shaft for normally interconnecting said starter motor and engine when it is desired to start the engine, and means for selectively preventing the engine connecting movement of said pinion gear when it is desired to operate said pump and piston and cylinder arrangement.

8. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, a fluid pressure operated expansion member operatively intermediate said engine and support, pump means for supplying fluid under pressure to said expansion member, an electrical motor normally useful for starting said engine, means selectively interconnecting said starter motor and said engine when it is desired to start the engine, means on said starter motor for driving said pump, and means for selectively preventing the interconnection of said starter motor and engine connecting means when it is desired to apply fluid under pressure to said expansion member for tilting said engine.

9. A tilting device for boat transom mounted outboard engines comprising an engine mounting support adapted for engagement to said boat transom, an outboard engine, pivotal means securing said engine to said support whereby the engine may be moved to alternate tilted positions with respect to said boat transom and support, a fluid pressure operated expansion member operatively intermediate said engine and support, pump means for supplying fluid under pressure to said expansion member, an electrical motor normally useful for starting said engine, means selectively interconnecting said starter motor and said engine when it is desired to start the engine, and means on said starter motor for driving said pump.

References Cited in the file of this patent

UNITED STATES PATENTS

1,845,712	Jacques	Feb. 16, 1932
2,755,766	Wanzer	July 24, 1956
2,822,999	Tromanhauser	Feb. 11, 1958
2,885,990	Hawthorne	May 12, 1959