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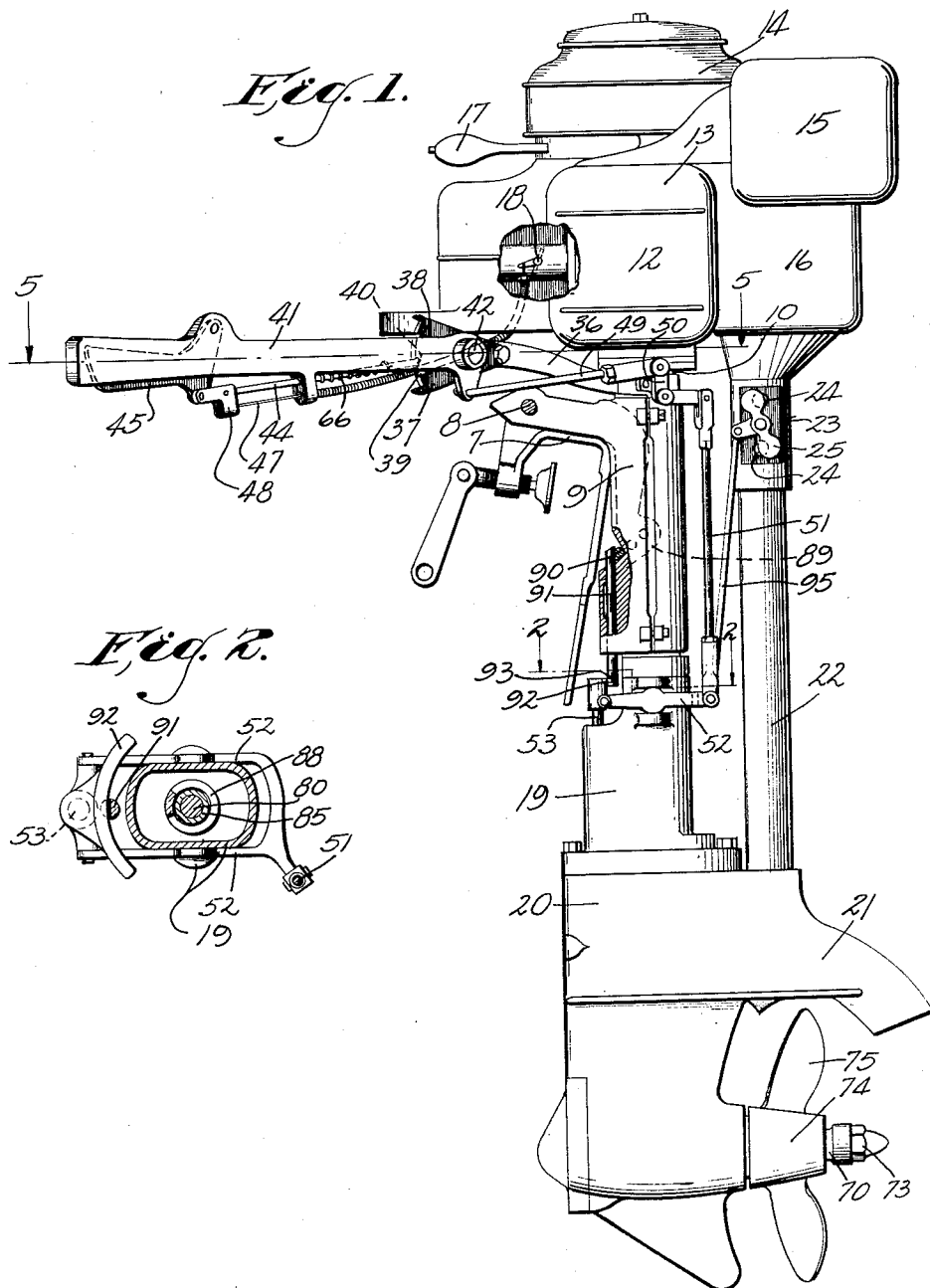
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2,071,634

CUSHION REVERSE DRIVE FOR OUTBOARD MOTORS

Filed April 5, 1935

2 Sheets-Sheet 1



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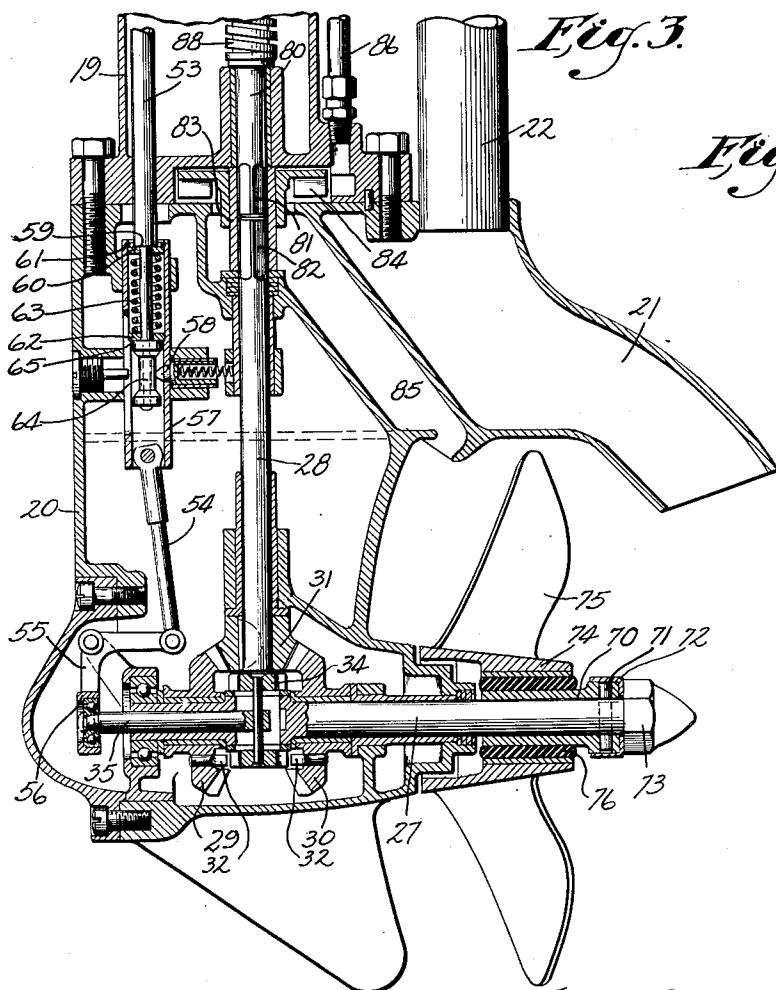


Fig. 4.

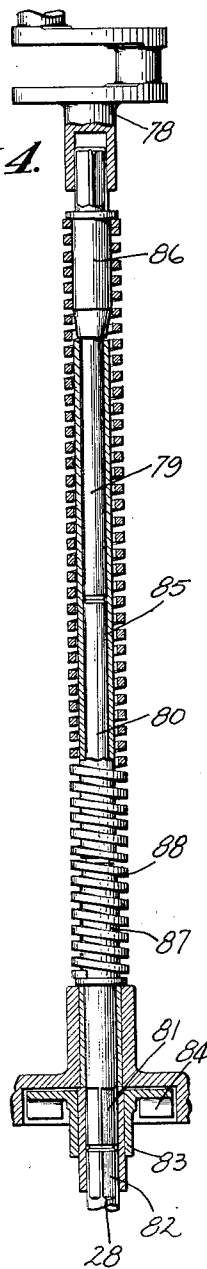


Fig. 6.

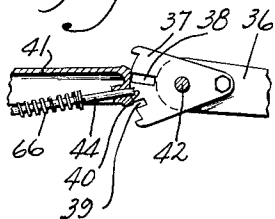
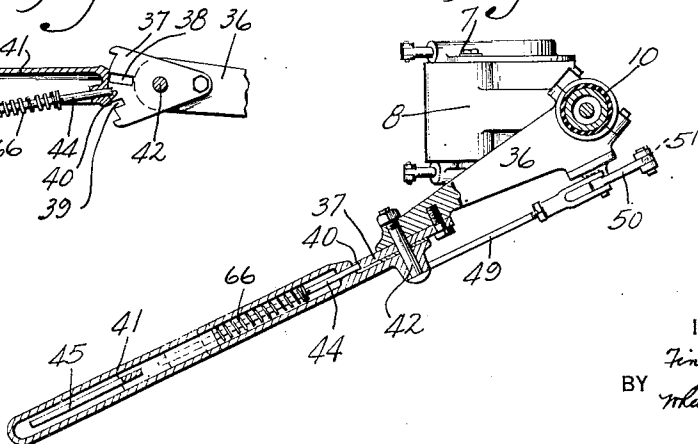


Fig. 5.



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CUSHION REVERSE DRIVE FOR OUTBOARD MOTORS

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This invention relates to improvements in a cushion reverse drive for outboard motors.

In reversible power drives it has been common to employ friction clutches in conjunction with reversing gearing to protect the driving mechanism from the shock occasioned by the reverser in its movement from one direction of drive to the other. In automobile practice it is common to bring the vehicle to a complete stop before reversing its direction of movement and then to disengage the friction clutch bearing connections before shifting the reverser. In marine practice, however, and particularly in outboard motor practice, greater simplification is desired and it is important to eliminate extraneous controls beyond those essential to the operation of the motor.

The present invention seeks to provide a reversible driving connection in which no interruption of power transmission is required as a prerequisite to reversal. I have found such an arrangement to be feasible provided the driving connections on both sides of the reversing gearing are fully cushioned. It is the major object of the present invention to devise a practical mechanism of this type.

The present case is a companion to my application for patent on a rubber cushion propeller, which is an element of the present device and is not specifically claimed herein.

It is a further object of the present invention to provide novel and improved means operated by the reverse control connections for interlocking the outboard motor against tilting upon reversal and for opening the exhaust cut-out valve upon reversal.

It is also an object of the present invention to provide improved means for regulating the speed of the outboard motor in such a way as to make the retarding of engine speed a prerequisite to the shifting of the gears, and also to limit the possible speed of the engine according to the different positions of the reverser clutch.

In the drawings:

Figure 1 is a side elevation of an outboard motor embodying the present invention, the portions of the structure being broken away to expose the operating connections.

Figure 2 is a detail view taken in section in the plane indicated at 2—2 in Figure 1.

Figure 3 is an enlarged detail view in vertical section through the lower unit of the outboard motor structure shown in Figure 1.

Figure 4 is an enlarged detail view partially in

section showing one form of spring drive shaft which may be employed in the present device.

Figure 5 is a detail view taken in section in the plane indicated at 5—5 in Figure 1.

Figure 6 is a detail view of the tiller handle interlock, partially in section and partially in side elevation.

Like parts are identified by the same reference characters throughout the several views.

There is the usual transom bracket 7 whereby the motor assembly may be mounted on the transom of a boat. Fulcrumed at 8 to the transom bracket is the swivel sleeve 9 which engages about the shaft housing 10 to permit the motor assembly to be oscillated for steering. Carried at the upper end of the shaft housing in the usual manner is the engine generically designated by reference character 12. Its cylinders appear at 13, its fly-wheel at 14, its fuel tank at 15, its muffler at 16, its timer control at 17, and its throttle control at 18.

Connected with the lower end of the shaft housing 10 is the casting 19 which couples the lower unit 20 to the shaft housing for oscillation therewith in steering. In accordance with common outboard motor practice the lower unit has an exhaust discharge conduit 21 communicating through exhaust pipe 22 with the muffler 16. At the upper end of pipe 22 is a cut-out valve casing 23 having ports 24 which may be opened and closed by an oscillatory valve plate 25 pivoted to the casing 23.

Suitably journaled in the lower unit 20 is the propeller shaft 27 and the lower section 28 of the drive shaft. The drive shaft section 28 and the propeller shaft 27 are connected by a reverser comprising gearing and reversing clutch now to be described.

Independently rotatable upon shaft 27 are the opposed bevel gears 29 and 30, each of which meshes continuously with a driving pinion 31 carried by drive shaft section 28. Each of the driven gears has hardened clutch teeth in the form of pins 32 driven into the gears and projecting axially therefrom as shown in Fig. 3. These pins are alternatively engaged by the corresponding complementary teeth of a clutch element 34 splined to the propeller shaft and operable axially thereof by means of the actuating control rod 35, which turns with the shaft. Accordingly, as the clutch is engaged with the one driven gear 29 or the other 30, the propeller shaft will be driven forwardly or in reverse.

The clutch operating means is so devised as to effect an abrupt throw of the clutch with a dis-

inct snap action to prevent any clashing between the clutch jaws and to ensure a prompt and effective clutch engaging movement. The mechanism for bringing about this result is as follows.

5 Clamped to the shaft housing 10 to project therefrom at a forward angle to the left is the tiller supporting arm 36 best shown in Figs. 1, 5 and 6. At its forward end this arm has a control segment 37 deeply notched at 38 and having a
10 shallower notch at 39 and a still shallower intermediate notch at 40. Adjacent to this segment the tiller 41 has pivotal movement about the bolt 42 which connects it to the tiller arm 36. Such
15 pivotal movement is controlled by the latch pin 44 reciprocable longitudinally of the tiller 41 under the control of the grip member 45 in the end of the tiller. This pin is engageable with the several notches 38, 39 and 40 to a depth deter-
20 mined by the depth of the notch, and its depth of engagement is made to control the engine speed by means of a Bowden wire 47 connected by link 48 with the pin 44 and the grip member 45. The opposite end of the Bowden wire is at-
25 tached to the throttle control lever 18 as shown in Fig. 1. When the pin engages a notch 38 the tiller lever 41 is necessarily oscillated in an out-
ward direction about its pivot bolt 42, thereby transmitting motion through link 49, bell crank
30 50, link 51, and lever 52, to rod 53. It may be observed in passing that the lever 52 is fulcrumed in channels in the casting 19, as best appears in Figs. 1 and 2.

The device which produces the delayed snap action is interposed between rod 53 and the link
35 54 from which motion passes through bell crank 55 and bearing coupling 56 to the propeller shaft control rod 35. A sleeve 57 connected with the actuated link 54 is guided for vertical reciproca-
40 tion and, in the neutral position of the parts, is restrained against movement by a spring pressed plunger 58 which engages in an aperture in its
side as shown in Fig. 3. In Figs. 1, 5 and 6 the parts are likewise illustrated as being in their
45 neutral position, the pin 44 of the tiller being engaged in the shallow notch 40 whereby the throttle 18 is almost closed to limit the engine to an idling speed.

The rod 53 is shouldered at 59 for engagement with a washer 60 held within the reciprocable tube
50 57 by a retaining ring at 61. A second washer at 62 upon rod 53 cooperates with washer 60 to confine a compression spring 63 for storing up energy in the initial movement of the parts from neutral
55 position. To the end of rod 53 is fastened a spool-shaped member 64 engageable with the tapered end of plunger 58 to force it from engagement in the aperture of the tube.

To continue the description of what happens when the tiller is moved to its forward propelling
60 position:

The rod 53 moves in a downward direction so that its shoulder 59 picks up washer 60 and in-
creases the compression of spring 63 upon washer 62 which, it will be noted, is engaged against an
65 interior shoulder 65 of tube 57. The spool 64 in the meantime, is moving away from washer 62 and will ultimately thrust the plunger 58 out-
wardly to a point where the engagement of the tube with the beveled end of the plunger will com-
70 plete its expulsion. At this point the tube is released and the energy stored in spring 63 will operate to impel the tube downwardly, thereby drawing the propeller shaft control rod 35 to the
75 left as viewed in Fig. 2 and engaging the clutch

finger 34 with the clutch teeth of the driven gear 29.

The tiller 41 will now be elevated to such a position that its control pin 44 will engage in the deep notch 38 under the compression of spring
5 66. This movement is transmitted through the Bowden wire 47 to the throttle 18 to oscillate the throttle in a clockwise direction as viewed in Fig. 1, thereby speeding the motor to any extent
10 to which the operator permits the grip 45 to expand from the tiller.

If the grip be fully retracted, the motor will be throttled as a prerequisite to the disengage-
ment of the reversal clutch 34. Thereupon the control pin 45 will be retracted from notch 38
15 of segment 37, and the tiller may be oscillated to transmit motion through the connections above described to the rod 53 in the lower unit which is now caused to move in an upward direction by the engagement of spool 64 with the washer 62 and
20 spring 63. As soon as the tiller reaches its neutral position the plunger 58 will snap into the aperture of the control tube 57 in the lower unit to again lock the parts against displacement.

If the tiller grip 45 be held in its retracted position and the downward movement of the tiller
25 be continued, the corresponding upward movement of the spool 64 will continue, thereby lifting washer 62 from its seat on shoulder 65 and causing compression of spring 63 in an upward
30 direction against washer 60 which is now fixed respecting the upper end of control tube 57 while the shoulder 59 moves upwardly therefrom. Ultimately the lower end of the spool will again
35 free the plunger 58, permitting the energy stored in compression spring 63 to throw the control tube 57 upwardly and thereby to move the propeller shaft control rod 35 to the right as viewed
40 in Fig. 3 to engage the clutch 34 with driven gear 30 and to operate the propeller shaft 27 in a reverse direction.

The pin 44 of the tiller is now in registry with notch 39 of segment 37 so that if the operator releases the grip 45 the motion thereof trans-
45 mitted to the throttle will speed up the engine above its idling speeds. The depth of notch 39, however, will not permit as great a speed in reverse as in the forward driving relation of the parts.

The snap action operation of the clutch in the lower unit has been found to be practicable inde-
50 pendently any other clutch or special mechanism to control the direction of motion of the outboard motor. It has been found, however, that there is a distinct shock in the engagement
55 of the clutch notwithstanding the prerequisite retarding of the engine speed, and accordingly it is preferred to protect the mechanism by shock absorbing means which, to be effective, must
60 preferably be disposed in the driving line at both sides of the clutch. Not only does the fly-wheel 14 have considerable momentum which, unless
65 cushioned, occasions shock in the reversing function but, in addition, the propeller is found to have considerable fly-wheel action.

The propeller mounting comprises the subject matter of the companion application above referred to. A sleeve 70 is mounted on the rear-
70 wardly projecting end of the propeller shaft 27 and is coupled thereto solely by means of the frangible shear pin 71, the ends of which are preferably enclosed by a cup-shaped retainer 72 held in place by the propeller nut 73 which is threaded to the shaft.

The hub 74 of propeller 75 is spaced from sleeve 70, and an annular cushion 76 of rubber or the like is inserted under compression in this space. This cushion not only absorbs shock in the direction of propeller rotation, but also permits the propeller to yield universally with respect to its shaft to absorb any shock, whatever its direction, to eliminate vibration, and to permit of the self-adjustment of the propeller to its best operating position. In the particular combination to which this invention is directed, the rubber cushion 76 permits of the slight degree of independent propeller rotation which is necessary to elastically cushion the shock which would otherwise be occasioned by the fly-wheel action of the propeller upon the engagement of clutch 34 with one of the driven gears 29 or 30.

At the other side of the clutch the reversing clutch is also cushioned.

As shown in Fig. 4, power is transmitted from the engine crank shaft 78 through a drive shaft made up of a number of sections 79, 80 and 28. A coupling socket is provided in the lower end of the crank shaft in which the squared end of the drive shaft section 79 is engaged. Each of drive shaft sections 80 and 28 have squared ends at 81 and 82 respectively, and these may conveniently be coupled by the hub portion 83 of a centrifugal pump runner 84 which delivers water from the intake passage 85 through pipe 86 to the cooling jackets of the engine.

The abutting ends of shaft sections 79 and 80 are not coupled directly to each other for power transmission, but are disposed within a guide sleeve 85 in which each shaft section is freely rotatable. Surrounding this sleeve and the enlarged terminal portions 86 and 87 of shaft sections 79 and 80 respectively, is a strong helical spring 88 which serves as a coupling between the two shaft sections encircled thereby. The operation of this spring offers a very substantial elastic cushioning effect between the engine and the reversing clutch.

It has been found that where the reversing clutch is operated with a snap action, and particularly where the driving connections of both sides of the clutch are cushioned as herein disclosed, there is little or no shock experienced upon engagement of the reversing clutch. It may be noted that the spring drive shaft represents only one of many designs of spring shafts which may be employed for this purpose. I have successfully used a light weight spring steel drive shaft employing the resilient torsional yielding of the shaft itself to effect this cushioning function in the combination disclosed.

The bracket 7 has segment arms rearwardly projecting at 89 and apertured to receive a thrust bolt 90 which is adjustable to various positions in said arms, so that when engaged by the notched portion of the swivel bearing sleeve 9, it may be turned to the upward position of the motor from which the motor is normally freely tiltable about the bracket fulcrum 8 during forward running. Such tilting movement is well known in the art as a means of protecting the motor against damage when a submerged obstacle or shoal is encountered.

In the present embodiment of the invention I provide means which locks the motor against tilting both when the gears of the reverser are in neutral and when the gears are adjusted for reverse or rearward propulsion. To accomplish this result I provide the swivel sleeve 9 with a

bearing in which the latch bolt 91 is vertically reciprocable, and I provide on the upper end of the reverse control rod 53 an arcuate shaped pusher 92 with which a notch 93 of the latch bolt 91 is connected. The arcuate form of the pusher 92 enables the connection between the parts to be maintained notwithstanding the steering movements of the casting 19 and lower unit 20 respecting the swivel bearing 9 in which the latch bolt 91 is guided. In the neutral position of the tiller and control parts the latch bolt 91 is engaged behind the thrust bolt 90, as clearly shown in Fig. 1. It will be obvious that if the tiller is elevated and control rod 53 depressed, the latch bolt 91 will be withdrawn from behind the aforesaid member 90 while a movement of the tiller to reversing position will further elevate the control rod 53 and the latch bolt 91 and increase the locking overlap between the parts.

When the outboard motor is being started with the controls in neutral so that no power is being transmitted to the propeller, there is no aspirating effect of the propeller slipstream upon the exhaust passage 21 such as might be in the exhaust passage of water. Accordingly it is desired to provide for the escape of exhaust gas from the relief ports 24 under these circumstances. Moreover, when the outboard motor is being operated in reverse the water actually accumulates under pressure in the exhaust passage 21 of the lower unit, and the higher speed of the engine under these circumstances necessitates an increase in the available capacity of the relief ports. Accordingly a connection is desirably provided by means of link 95 from link 51 to the valve plate 25, the relation of the parts being such that the relief ports 24 are fully closed in the forward operating position of the tiller, are partially open in the neutral operating position of the tiller, and are fully open in the reverse operating position of the tiller.

It will be apparent that the outboard motor structure described in the foregoing specification is a complete and comprehensive device for satisfying all requirements of a practical apparatus wherein the reverse gearing may be set in neutral position without transmission of power to the propeller and with a corresponding regulation of the engine speed, the bracket interlock, and the cut-out relief valve.

The control mechanism for the reversing clutch is self-locking in neutral position to store energy for movement with a snap action to either of its extreme positions wherein the gears are effective for power transmission to the propeller. The driving connections are cushioned on both sides of the clutch so that upon the occurrence of the snap action engagement of the clutch either in forward or direct propelling position, such engagement is cushioned throughout the driving connections and no damage or abrupt shock to the parts is permitted to result.

I claim:

1. An outboard motor comprising the combination with an engine, a propeller, and driving connections including a reverser, of a reverse lever adjustable between different positions in the operation of said reverser, a detent fixing at least one of said lever positions, and an engine speed control means connected with said detent to be adjusted in accordance with detent movement, whereby engine speed control is a prerequisite to the movement of said lever.

2. In an outboard motor, the combination with an engine, propeller, driving connections, and

propeller reversing means, of a reverse control lever operatively connected with said means and adjustable between positions corresponding to forward and reverse, a control sector associated with said lever, a detent means connected with said lever and variably engageable with said sector, engine speed control means connected with said detent, said sector and detent having parts interlockingly engaged at different lever positions to prevent movement of said lever, said speed control connection being such that the release of such interlocking engagement effects a retardation of engine speed, the degree of such interengagement being determinative of maximum engine speeds in the different positions of said lever.

3. In an outboard motor, the combination with an engine, propeller, driving connections, and reversing means, of a tiller lever operatively connected with the outboard motor to control the steering position thereof and pivotally adjustable respecting said outboard motor for the operative control of said reversing means, a grip movable in said tiller, a speed control device operatively connected with said grip, a tiller detent operatively connected with said grip whereby said detent and speed device are movable in unison in a direction such as to retard engine speed upon the retraction of said detent, and a detent sector having notches of differing depths with which said detent is selectively engageable in the different positions of said lever, the depth of each notch being determinative of maximum engine speeds in a given lever position.

4. In an outboard motor, the combination with an engine, drive shaft, propeller shaft, propeller, and means for reversing the direction of propeller thrust, of a bracket, a swivel bearing member pivoted to said bracket to permit of the tilting of the outboard motor, a shaft housing extending downwardly from said engine about said drive shaft and in swivel bearing relation to said swivel member, whereby said outboard motor is dirigible, a stop connected with said bracket and adapted to receive the thrust of said swivel member in the movement of said swivel member about its pivotal connection with said bracket, a locking bolt connected with said swivel member and reciprocally engageable with said stop, a reverse control lever, and motion transmitting connections from said lever to said bolt for the actuation of said bolt concurrently with the actuation of said means for reversing the direction of propeller thrust.

5. In an outboard motor structure, the combination with a bracket and a swivel bearing member fulcrumed thereto, of a stop member carried by said bracket and adapted to receive the thrust of said swivel bearing member, a latch bolt provided with a bearing in said swivel bearing member for the reciprocation of said latch bolt longitudinally of said member, and means for actuating said bolt.

6. In an outboard motor structure, the combination with a bracket and a swivel bearing member in fulcrumed connection, of a thrust rod adjustable forwardly and rearwardly in said bracket in a position to receive the thrust of said swivel bearing member, and a latch adjustably

mounted on said swivel bearing member and movable thereon to and from a position of engagement about said rod.

7. In an outboard motor structure, the combination with a bracket and a swivel bearing member in fulcrumed connection, of a thrust rod adjustable forwardly and rearwardly in said bracket in a position to receive the thrust of said swivel bearing member, and a latch adjustably mounted on said swivel bearing member and movable thereon to and from a position of engagement about said rod, said connections including relatively movable parts on said outboard motor and said swivel bearing member, one of said parts having sufficient angular extent to be effective upon the other in the various angular positions of said motor with respect to said driving member.

8. In an outboard motor, the combination with a unitary assembly comprising an engine, shaft housing, and lower unit, of a bracket, a swivel bearing pivotally connected with the bracket and embracing a portion of said shaft housing, a tiller connected with said shaft housing to control the dirigible position in said swivel bearing of said unitary assembly, said tiller including a pivotally movable element, a connection from said element to said unitary assembly above said bearing member, reversing gearing in said lower unit, a connection past said bearing member to said reversing gearing, a reverse interlock effective between said bearing member and bracket and provided with actuating means operatively engaged with said last mentioned connection to receive motion therefrom, an exhaust gas discharge passage associated with said lower unit, a pipe leading thereto from said engine provided with a relief port, and valve means controlling said port and operatively engaged with said last mentioned connections to be operated therefrom in accordance with the operation of said reversing gearing.

9. In an outboard motor structure, the combination with a shaft housing member provided in its sides with channels extending in a fore and aft direction, of a pair of control rods disposed respectively forwardly and rearwardly of said member, and a yoke lever connecting said rods and having fulcrum portions engageable in said channels for both pivotal and sliding movement therein.

10. An outboard motor comprising the combination with an engine having a speed control, a propeller, and means for reversing the direction of propeller thrust, of a control member for said thrust reversing means having positions corresponding to the forward thrust, rearward thrust, and neutral thrust, a lever operatively connected with said control member and having corresponding positions, a detent movable upon said lever, a detent bracket with which said detent is releasably engageable to define said several positions, and means connecting said detent with said speed control, said detent bracket having a conformation coacting with said detent to determine the maximum position of said speed control in each of the several lever positions.

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