SHIFT MECHANISM FOR OUTBOARD PROPULSION UNITS

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3,136,172

June 9, 1964

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Filed March 23, 1962

2 Sheets-Sheet 1
This invention relates to the shift mechanism for outboard propulsion units for watercraft and more particularly to the actuating means for a movable clutch element. If the speed of rotation of the propeller of an outboard propulsion unit for boats is suddenly slowed down with throttling down of the engine, the boat is subject to a torque roll as it settles further into the water and slows down at a somewhat lesser rate. As a result the propeller unit will trail out from the boat transom and when the boat has slowed down sufficiently, the propeller will again bite into the water and return the unit to its operating position with an undesirable hammer-like blow. It is generally an object of this invention to provide an improved actuating means for the clutch element including means to prevent or substantially lessen torque roll of the boat and propeller unit trail out when throttling down the engine.

Dog type clutch elements have been commonly employed in reversible outboard propulsion units. The clutch element is keyed on a shaft member intermediate spaced forward and reverse gears which are freely rotatable on the shaft member and driven in opposed directions. The clutch element is slidable axially on the shaft to selectively engage the gears and thereby impart rotation of the corresponding gear to the shaft member and propeller. Intermediate the spaced gears, the clutch element has a neutral position wherein the shaft member and propeller remain inoperative. The forward gear and the corresponding end of the clutch element are provided with ratchet teeth which in normal forward drive position, engage and prevent free rotation with engine speed. When the engine is throttled down suddenly and the forward gear slows down correspondingly, the clutch element is capable of ratcheting on the forward gear as the propeller windmills and slows down at a lesser rate and more commensurate with the slowdown in boat speed. Since the slowdown in propeller rotation is substantially commensurate to the slowdown in boat speed, there is little or no torque roll of the boat and trail out of the propeller unit. When the propeller and the boat have slowed down commensurate to the throttled down engine speed, the propeller will again bite into water and drive the boat at the lower speed.

According to this invention, means are provided for moving the clutch element axially and includes an improved linkage arrangement which permits ratcheting between the clutch element and the forward gear. The linkage arrangement includes a rigid link element and a yielding element disposed in parallel relation for actuating the clutch element slide member. During operation of the clutch actuating means to effect clutch engagement with the reverse gear to provide for reverse operation of the propulsion unit, the clutch element slide member is actuated by the rigid link element and is held firmly in place thereby. For forward operation of the propulsion unit, the slide member is actuated by the yielding element disposed in parallel with the rigid link to carry the clutch element into engagement with the forward gear. The structure further contemplates a relief means between the clutch element slide member and the rigid link element to provide for relative movement therebetween so that the clutch element can ratchet on the forward gear when the gear is suddenly slowed down by throttled down engine speed and the clutch element slows down at a somewhat lesser rate as the propeller windmills to prevent or substantially lessen trail out of the propeller unit.

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

In the drawings:

FIGURE 1 is a perspective view of the propulsion unit of an inboard-outboard drive shown mounted on the transom of a boat;

FIG. 2 is a partial side elevation of an inboard-outboard drive with parts broken away and sectioned to show the clutch actuating means of this invention;

FIG. 3 is an enlarged partial sectional view in elevation of the propulsion unit drive shaft housing showing the clutch actuating means of this invention and employed with a propeller which is rotatably driven to the right as one faces rearwardly to provide forward propulsion; and

FIG. 4 is a view similar to that of FIG. 3 and shows the clutch actuating means as employed with a propeller which is rotatably driven to the left as one facing rearwardly of propel the drive unit.

Referring to the drawings, the inboard-outboard drive includes a propulsion unit 1 which is pendently and dirigibly suspended outboard from the transom 2 of a partially shown boat or other watercraft 3. The propulsion unit 1 includes a propeller 4 which is driven by the engine 5 mounted inboard of the boat to be propelled.

The propeller 4 of propulsion unit 1 is carried by the generally horizontal propeller shaft 6 which is driven through beveled gears 7 and 8 by the generally vertical shaft 9 rotatably supported within housing 10 of the propulsion unit. A pair of vertically spaced beveled gears 11 and 12, one of which is a forward gear and the other a reverse gear, are mounted in suitable bearings and are freely rotatable on the upper end of shaft 9. The drive gear 13, the axis of which is disposed generally horizontally, drivingly engages the beveled gears 11 and 12 and causes the latter to rotate in opposite directions. A clutch element 14 disposed between beveled gears 11 and 12 is carried by shaft 9 and is slidable axially thereon by slide member 15 to selectively engage gears 11 and 12 to complete the drive connection between the drive gear 13 and vertical shaft 9. The clutch element 14 also has an intermediate neutral position between gears 11 and 12 in which case the propeller 4 is inoperative.

The drive gear 13 is driven by engine 5 through the generally horizontal drive connection including axially spaced and aligned shaft members 16 and 17 which are connected by the double universal joint 18. Universal joint 18 is disposed generally with the center thereof at the intersection of the generally transverse vertical and horizontal planes respectively containing the swivel and tilt axes of the propulsion unit 1 so that the drive connection from engine 5 will remain intact during steering and tilt movements of the propulsion unit.

Referring to FIG. 3, the upper gear 11 of the vertically spaced beveled gears is the forward gear and has a clutch engaging face provided with a plurality of angularly spaced ratchet teeth 19. The face of clutch element 14 corresponding to forward gear 11 is provided with complementary ratchet teeth 20 when engaged with teeth 19 on gear 11, provides forward propulsion with a right-hand propeller 4. In accordance with FIG. 3 reverse operation of the propulsion unit 1 is obtained when clutch element 14 is moved axially downwardly to provide engagement between the jaw 31 on the lower reverse gear 12 and the jaw 22 on the corresponding face of the clutch element.

Clutch element 14 is actuated by the slide member 15 through actuating means including a push-pull cable 23.
3. which is operated by a suitable control, not shown, from a remote location in the watercraft. The push-pull cable 23 enters the propulsion unit housing 10 and is adapted to actuate the rack 24 slidably disposed within rack guide 25 fixedly supported within housing 10. Rack 24 is disposed in meshing engagement with the sector gear 26 which is pivotally mounted on a generally transverse horizontal axis within an upwardly projecting portion of rack guide 25 at 27. In accordance with rack movements, the sector gear 26 is selectively pivotably in opposed directions from a central neutral position to effect corresponding movement of slide member 15. 

According to this invention, the actuating mechanism for clutch element 14 includes means providing for ratcheting between the clutch element and the forward gear 11 when the gear is suddenly slowed down by throttled down engine speed and the clutch element slows down at a somewhat lesser rate as the propeller 4 windmills to prevent or substantially lessen trail out of the propulsion unit relative to the transom. 

The means providing for ratcheting between clutch element 14 and forward gear 11 comprises linkage means 28 extending between sector gear 26 and slide member 15. In accordance with FIG. 3, the linkage means 28 includes a coil compression spring 29 and a rigid link member 30 disposed in parallel relation. Spring 29 and link member 30 have their lower ends pivotally mounted on horizontal pin means 31 carried by sector gear 26. Pin means 32 is disposed generally rearwardly with respect to the gear sector axis at 27 when the sector is disposed in its central neutral position and on the side opposite from the actuating means on the gear sector for locking the tilt lock mechanism 32 forming part of this invention. The opposed ends of spring 29 and link member 30 are pivotally mounted on a horizontal pin means 33 provided on the clutch actuating slide member 15. Relief means in the form of a longitudinal slot 34 is provided in the link member 30 providing for relative movement between the slide member 15 and the link member so that clutch element 14 can ratchet on forward gear 11 against the bias of spring 29. 

In the normal relation of linkage means 28, the spring 29 biases the slide member 15 upwardly so that pin means 33 carried by the slide member engages the upper end of slot 34. So disposed the rigid link member 30 is effective for moving slide member 15 downwardly to shift clutch element 14 into engagement with reverse gear 12 with corresponding pivotal movement of the sector gear 26. The spring 29 is utilized for shifting the clutch element 14 into engagement with forward gear 11 with corresponding movement of the sector gear.

forward gear 11 and reverse gear 12 of FIG. 3 are shown in inverted or reversed position in FIG. 4 and the clutch element 14 is similarly inverted or reversed. In the structure of FIG. 4, engagement between clutch element 14 and the lower forward gear provides forward propulsion with a left-hand propeller 4. To provide for ratcheting between the clutch element 14 and the lower forward gear of FIG. 4, a coil tension spring 35 is employed in the linkage means 28. Spring 35 normally biases the slide member 15 downwardly so that pin means 33 on the slide member normally engages with the lower end of slot 34 in the link member 30 rendering the link member effective for moving the slide member upwardly to shift the clutch element 14 into engagement with the upper reverse gear with corresponding pivotal movement of sector gear 26. Spring 35 is effective for moving the slide member downwardly to shift the clutch element into engagement with the lower forward gear with corresponding movement of the sector gear. In accordance with FIG. 4, slot 34 provides for relative movement between slide member 15 and link member 30 so that clutch element 14 can ratchet on the lower forward gear against the bias of spring 35 with a sudden speed reduction in the forward gear.

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:

In an outboard drive for boats, a vertical shaft, a horizontal shaft, a beveled gear secured to the end of one of said shafts and facing the other shaft, a pair of forward and reverse beveled gears freely rotatable on said other shaft and continuously meshing with said first named beveled gear, a dog clutch member rotationally secured on said other shaft and axially movable therewith between said pair of beveled gears, a dog clutch member with the corresponding forward and reverse gears when said clutch member is shifted to engage the same, said interlock means between said member and said forward gear comprising ratcheting type clutch teeth adapted to transmit driving forces in the direction of forward drive and to provide for cam-out of the interlock in the opposite direction, means to shift said member from a neutral intermediate position selectively into interlocking engagement with either of said forward and reverse gears, a lost motion connection in said shift means adapted to avoid positive shifting of said member when driving interlock with said forward gear when said shift means is actuated to forward drive position, and resilient means associated with said lost motion connection and urging the same in a direction to shift said member into driving interlock with said forward gear when said shift means is actuated to reverse drive position, said resilient means being yieldable to release said ratchet interlock under conditions of free wheeling drive.

In an inboard-outboard drive for watercraft, an inboard engine, an outboard propulsion unit having a generally vertical driven shaft, a horizontal drive shaft connected to said inboard engine to drive said inboard engine, having a generally vertical driven shaft, reversing gear means between said drive shaft and said drive shaft comprising a beveled gear on the end of said drive shaft and continuously meshing with a pair of spaced oppositely rotating forward and reverse gears mounted for free rotation upon said drive shaft and an axially movable dog clutch member rotationally secured to said driven shaft between said pair of spaced gears, means operative from inside the watercraft to shift said dog clutch from a neutral intermediate position selectively to a position engaging either of said pair of gears to effect a driving connection therewith of said drive shaft to drive the latter, a ratchet tooth interlock between said dog clutch member and the forward drive gear of said pair of gears, a lost motion connection in said shift means to provide freedom of movement of said dog clutch member in a direction releasing the same from said forward drive gear, and resilient means urging said lost motion connection in a direction to effect ratchet interlock between said dog clutch member and said forward drive gear when said shift means is actuated to effect the forward drive of said driven shaft, said resilient means providing for a forward free-wheeling of said driven shaft when said drive shaft is rapidly reduced in speed.

The construction of claim 2 in which said shift means comprises a push-pull link member disposed to transmit shift movements axially thereof, an actuating member connected to one end of said link member, carrier means for said dog clutch member connected to the other end of said link member, one of said connections for said link member comprising a lost motion pin and slot with the slot disposed in the general direction of movement of said link member, and said resilient means comprises a spring disposed between said link member and the member that is connected thereto by said pin and slot to urge said pin normally to one end of said link member.
directions, a clutch element keyed on said driven shaft intermediate the spaced gears and movable axially to selectively engage with said gears and thereby effect rotation of said driven shaft and propeller in a corresponding direction, ratchet type clutch teeth provided on said forward gear and engageable by complementary ratchet type teeth on said clutch element, means to actuate said clutch element to selectively engage said gears, a lost motion connection in said actuating means adapted to provide freedom for movement of the clutch element in a direction away from said forward gear, and resilient means urging said lost motion connection in a direction to effect engagement of the ratchet teeth on the clutch element and forward gear when the actuating means is moved to effect forward gear engagement, said resilient means providing for ratchetting between the clutch element and forward gear when the driven shaft and propeller overrun the drive means upon rapid speed reduction of the drive means to substantially lessen trail out of the propulsion unit.

5. The invention as set forth in claim 4 wherein the clutch element actuating means comprises a link member disposed to transmit shift movements generally axially thereof, an actuating member connected to one end of said link member, carrier means for said clutch element connected to the other end of said link member, one of said connections for said link member comprising a lost motion pin and slot with the slot disposed in the general direction of movement of said link member, and said resilient means comprises a spring disposed between said link member and the member connected thereto by said pin and slot to urge said pin normally toward one end of said slot.

No references cited.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,136,172

June 9, 1964

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2 and 12, and in the heading to the printed specification, lines 4 and 5, for "Kiekhofer Corporation", each occurrence, read -- Kiekhaefer Corporation --.

Signed and sealed this 29th day of September 1964.

(SEAL)

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