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MECHANICAL STARTER FOR INTERNAL COMBUSTION ENGINES

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This invention relates in general to mechanical starters for internal combustion engines, and more particular to those engines of the marine outboard type.

5 One of my principal objects is to provide improvements in a safety device to protect the starting mechanism from damage, as well as the operator from injury, due to a kick-back or in back-firing during the starting operation.

10 More particularly stated it is my object to provide an improved ratchet means between the starting mechanism and the motor that is both dependable in operation and relatively cheap to construct, and can easily be attached to any conventional type outboard motor.

15 It is my further object to provide a ratchet means between the starter and the motor, whereby, during the starting operation the same are engaged, and means whereby during the operation of the motor, centrifugal force acts to disengage the motor from the starter, and a re-engagement is prohibited until the motor comes to rest.

20 A still further object of my invention is to provide an improved starting cord handle, a method of attaching same, and an efficient anchoring member for attaching the starting cord to the cord pulley to which the cord is easily applicable to facilitate replacement.

In the drawing:

30 Fig. 1 is a plan view in partial cross section taken along line 1—1 of Fig. 2.

Fig. 2 is a cross sectional view of the device taken along line 2—2 of Fig. 1.

35 Fig. 3 is a plan view of engaging mechanism of the device taken along line 3—3 of Fig. 2, showing the pawls in disengaged position.

Fig. 4 is a plan view of the engaging mechanism, also taken along line 3—3 of Fig. 2, showing the pawls in engaged position.

40 Fig. 5 is a side view of a cup-shaped engagement plate.

Fig. 6 is an end view of the handle with cover removed.

45 Fig. 7 is a fragmentary cross section of an anchoring member by means of which the inner end of the cord is anchored.

Fig. 8 is a cross section of the cord.

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

50 Fig. 2 shows the upper portion of a conventional outboard motor with fly wheel 13, drive shaft 14, and frame or housing 15 to which my starter is fastened by means of screws 16. The exterior of the device consists of a lower annular casing 17 and an upper casing 18 which is rotatively

mounted to casing 17, an integral annular rib 19 of casing 18 being recessed in an annular groove 20 of casing 17 and secured therein by an annular band 22 which is secured to casing 17 by screws 23. A ball detent 25 is recessed in socket 24 of casing 18 and is held in pressure engagement midway between the casings 17 and 18 by spring 26, under confinement in bore 27. Rotative movement between the casings 17 and 18 is ordinarily prohibited by detent 25, but under conditions of undue stress between the members, as for example in a case of backfiring of the motor, detent 25 will be depressed into bore 27 and casing 18 will be free to rotate to save the parts from injury.

15 Within the casing is a rotatively mounted driving unit 33' provided with a rewinding spring, and a driven unit 62'. The driving unit 33' is provided with a pulley to accommodate a starting cord 12 and a depending cup-shaped element 38 with peripheral teeth and adjacent peripheral channels. Driven unit 62' is secured to and rotatable with the motor crank shaft and carries oscillatable pawls for engagement with the ratchet teeth of unit 33'.

Construction of the unit is as follows.

25 Unit 33' is rotatably mounted from casing 18 on shouldered stud 34 and is comprised of a hub 33, to which is riveted a circular plate 39, and a depending cup-shaped plate 38 with notched periphery. Plate 39 is provided with an integral annular rib 39', to which is secured annular plate 40 to provide the pulley. Plates 39 and 40 are preferably marginally divergent to guide the starting cord 12 into the pulley groove.

35 Unit 62' is made interchangeable with, and replaces the conventional starter pulley. Casting 62, upon which the ratchet pawl mechanism is mounted is in itself a pulley and may be so used for emergency starting upon removal of the casings 18 and 17. Said pulley casting is secured to crankshaft 14 by nut 64 and to flywheel 13 by screws 66. Pins 73 extend through relatively rigid sections 67 of pulley 62 and are secured by nuts 68. Pawls 72 are oscillatably mounted thereon and are secured adjacent shoulder 65 by split washers 74 disposed in annular pin grooves.

40 Pawls 72 are provided with upwardly projecting pins 67 with adjacent washers 76, said pins being loosely disposed in sockets 77 in annular ring 69. Ring 69 performs the function of connecting said pawls 72 so that during the operation of the device the pawls operate evenly and simultaneously. Because each pin travels on an arcuate path it is necessary to provide sockets 77 of slightly larger

diameter than pins 67 to permit some relative movement.

When the motor is at rest the pawls assume the position shown in Fig. 4 with their long arms resting against nut 64, due to the springs 75, which are interposed between pins 73 and 67 biasing the pawls to rotate them in a clockwise direction as viewed in Fig. 4. The short arms of pawls 72 extend into the peripheral notches of element 38, thus providing an engagement between the starter mechanism and the motor during the clockwise rotation of the starting unit 33' as viewed in Figs. 3 and 4.

Coil spring 30 is disposed about hub 33 and has its inner end fastened to said hub by pin 32 and its outer end fastened to casing 18 by pin 31, and is still under some tension when cord 12 is in its normal wound up position.

Cord 12 is comprised of a stranded bronze core 57, Fig. 8, and a braided cotton cover 56, and is anchored by means of anchoring member 51 to plate 39, said member being hooked to plate 39 through an opening therein near the inner wall of the pulley groove. Member 51 is provided with a bore, 53, a smaller bore, 54, and a notch, 52. The braided covering, 56, is cut away to expose a portion of the stranded bronze core, 57, which is drawn through bore 54 and soldered in said notch. The shank of the member is flattened to provide pressure contact between the cord covering the bore 53.

The free end of cord 12 passes through a substantially tangential opening 19', Fig. 1, in casing 18 and is provided with a handle 11, the shaft of which is provided with a center bore leading to a recess 42, in an integral grip, where said cord terminus is disposed in a figure eight position and securely held in place by plate 10, fastened by screws 10', said screws extending through the inner loops of the figure eight to prevent slippage of the cord.

The operation of the device is as follows:

An outward pull of handle 11 unwinds cord 12, winds up recoil spring 30, and rotates central unit 33' in a clockwise or engine starting direction as viewed in Fig. 1. Teeth 9 during this operation are engaged with pawls 72, hence a like rotation is imparted to the motor through unit 62', and the motor is started in this manner. With the starting of the motor, the short arms of pawls 72 will trail over teeth 9 until centrifugal force due to motor rotation becomes greater than the tension exerted on the pawls by springs 75, at which point the pawls are oscillated outwardly about pins 73 to contact lugs 81, in which position they rest until the motor is stopped, or the speed thereof becomes retarded to a point at which the said spring tension overcomes the outward thrust of centrifugal force and moves the pawls toward positions for re-engagement with teeth 9.

When the cord handle is released, spring 30 unwinds, with resultant rotation of central unit 33' in a counter-clockwise direction, Fig. 4, thereby winding up the cord until handle 11 is disposed in the casing opening 19'. A shank of handle 11 is provided with a terminus 64' of substantially frusto-conical shape, said terminus being somewhat elliptical rather than circular in cross-section, as viewed in Fig. 8, socket 19 of casing 18 being complementary thereto whereby to hold handle 11 non-rotatably in a position to facilitate its grasp by the operator.

I claim:

1. The combination with an engine having a starting mechanism, said starting mechanism

having a casing member fixed to the engine, a second casing member rotatably mounted upon said fixed member and carrying a centrally and rotatably mounted engagement device, of a ball detent, releasably connecting said casing members to prohibit relative movement therebetween during ordinary stresses accompanying the starting operation and to allow rotation of the mounted casing member in respect to the fixed casing member under conditions of extraordinary stress therebetween.

2. In an engine starting mechanism, the combination with a fixed casing member and a rotatably mounted casing member, of a rotatably mounted engine starter including a pulley member rotatably mounted on said rotatable casing member, said pulley member comprising a hub, to which is secured a circular plate provided with an annular rib, an annular plate secured to said rib in pulley groove forming relation to the plate, and a cup-shaped clutch member having depending peripheral teeth centrally secured to said circular plate and to said hub, said pulley and clutch members being removable with the rotatable casing member as a unit.

3. In an engine starting mechanism, the combination with a starter casing comprising a fixed member and a member rotatably mounted thereon, said rotatable casing member having the form of an inverted cup provided with an inner annular rib, forming a channel in which is disposed a spirally coiled rewinding spring, a ratchet member, mounted for rotation within said cup-shaped casing member and having secured thereto one end of said spring, the opposite end of the spring being secured to said cup-shaped casing member.

4. In an outboard motor starter, the combination with a cup-shaped driving member provided peripherally with teeth, of a driven member at least partially housed within the driving member and provided with an annular series of pawls each pivoted at an intermediate point upon the driven member and provided at corresponding ends with fingers engageable with said teeth, means biasing the respective pawls toward positions for such engagement, each of said pawls being provided with a centrifugally operable weighted end opposite its finger portion, whereby to retract its finger portion from the path of said teeth when the driven member is in motion, said driven member being provided with stops in annular series engageable by the weighted ends of the respective pawls to limit the centrifugally caused movement thereof and to define the retracted positions for said pawls out of contact with said teeth.

5. In an outboard motor starter, an engine winding cord handle comprising a hand grip with integral shank, said grip provided with a figure eight channel, said shank provided with a central bore leading into said channel, a plate disposed in the channel opening and secured to said handle, a pair of snubs provided in said channel opposite the central bore, whereby to anchor a cord extending through the shank bore and disposed in figure eight fashion about said snubs said snubs being adapted to secure said cord by pressure engagement between the channel wall and said plate.

6. In a device of the type described, an anchoring member for starting cords comprising a shank and integral hook with notched end, said shank provided with a center bore reduced at its inner end and leading to said notch whereby to pro-

vide means for securing a metal centered cord thereto.

7. A rotatable starter mechanism for an engine comprising the combination of a starting pulley rotatable with the crank shaft, an oscillatably mounted pawl on the starting wheel, an outer casing including a fixed member and a releasably mounted rotatable member, an auxiliary starting pulley on the rotatable casing member and provided with a ratchet tooth adapted to engage said pawl in the operation of the device for transmission of motion from one pulley to the other.

8. The combination with an engine provided with a flywheel, of an outer casing provided with a non-rotatable mounting on said engine, said casing enclosing the flywheel and having two sections, one of which is rotatably mounted on the other, said mounted section being provided with a relatively rotatable starting member mounted therein and operatively connected with the flywheel.

9. The combination with an engine provided with a flywheel, of an outer casing having two sections, one of which is rotatably mounted on the other to provide support for a rotatable starter member, a starting pulley attached to the engine flywheel and provided with oscillatably mounted pawls, a retaining ring operatively connected with the pawls for controlling their relative simultaneous movements in or out of engaging position and pins mounted upon the pawls and loosely engaged in said sockets, and a second starting pulley carried by the rotatable casing section.

10. The combination with an engine having a flywheel, of a rotatably mounted engine starter carried by the flywheel, an outer casing for said starter having two sections, one of which is rotatably mounted on the other, a detent connecting the rotatable section to hold it against rotation relative to the first section under ordinary conditions of stress, an auxiliary starting member rotatably mounted on the rotatable casing section and comprising a starter pulley and cord, spring means carried by said rotatable section and operatively connected with the pulley to rewind said cord, a cup-shaped element with depending peripheral teeth, operatively connected with oscillatably mounted pawls carried by said first mentioned starter whereby to provide means for engaging said auxiliary starting member with the starter on the flywheel.

11. In a device of the type described, the combination with an engine flywheel, of a centrifugally operable clutch mechanism comprising a plurality of pawls carried by said flywheel and adapted to oscillate in a radial plane, a ring operatively connecting the pawls, whereby to oscillate the pawls in unison, a plurality of stop lugs, carried by said flywheel in position to hold the pawls in retracted position during operation of the motor, and a starting pulley engageable with said pawls during a motor starting operation.

12. The combination with an engine having a starter mechanism, of a casing housing said mechanism and including one casing element secured to the engine and a second casing element rotatably mounted on said first element, said mechanism being supported at least in part by said second casing element, and a detent, biased for securing said casing elements against relative rotation under ordinary conditions of motor starting stress and adapted to allow said second mentioned casing element to rotate on said first mentioned casing element under stress between said elements exceeding a predetermined degree.

13. In an outboard motor starter applicable to the engine of an outboard motor over the fly wheel thereof, the combination with a first casing section of such form as to be adapted to surround the fly wheel and provided with means for mounting it non-rotatably upon the engine, of a second casing section constituting a cover for the first over the fly wheel and rotatably mounted on said first mentioned section, said sections having complementary parts in interlocking engagement for holding the sections together while permitting relative rotation therebetween, detent means normally restraining said second casing section against relative rotation upon the first casing section, and a starting mechanism housed within said second casing section and including a starter part mounted thereon for predetermined range of relative rotation respecting said second section, said range of rotation being sufficient to impart starting motion to an engine fly wheel enclosed by said sections, said detent being adapted to relieve said second section for rotation upon the first section in the event said predetermined range of relative movement of said part is exceeded in one direction.

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