April 15, 1952 D. A. ARMSTRONG ET AL 2,592,639

OUTBOARD MOTOR STARTING DEVICE

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Fig. 1

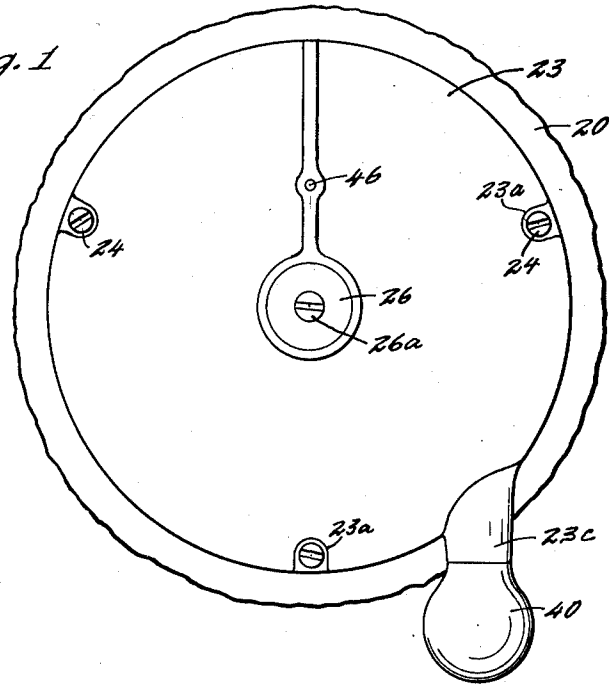
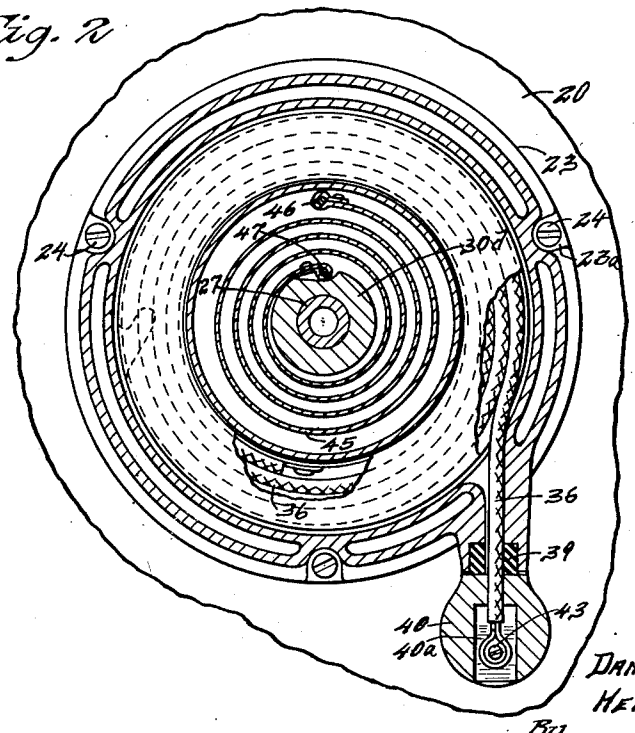



Fig. 2




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Fig. 3

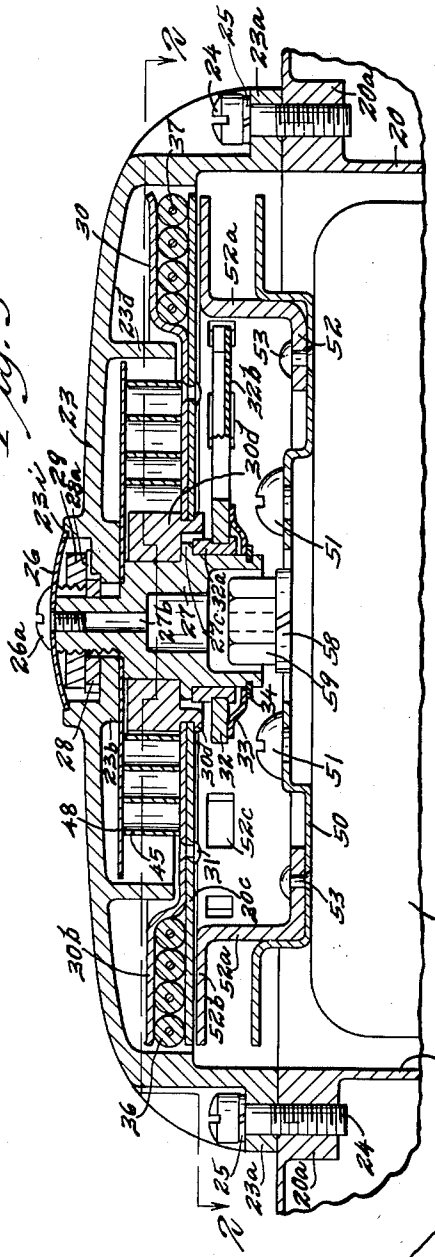


Fig. 4

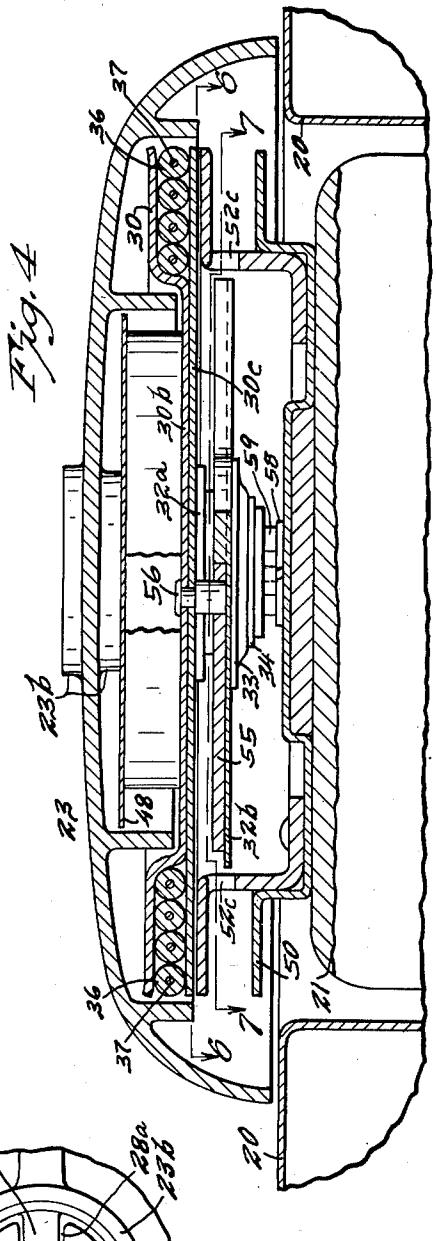
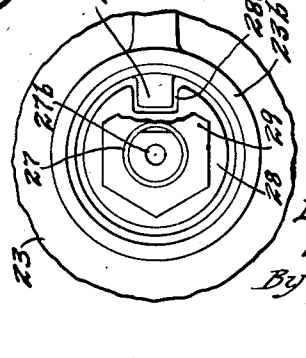


Fig. 5



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Fig. 6

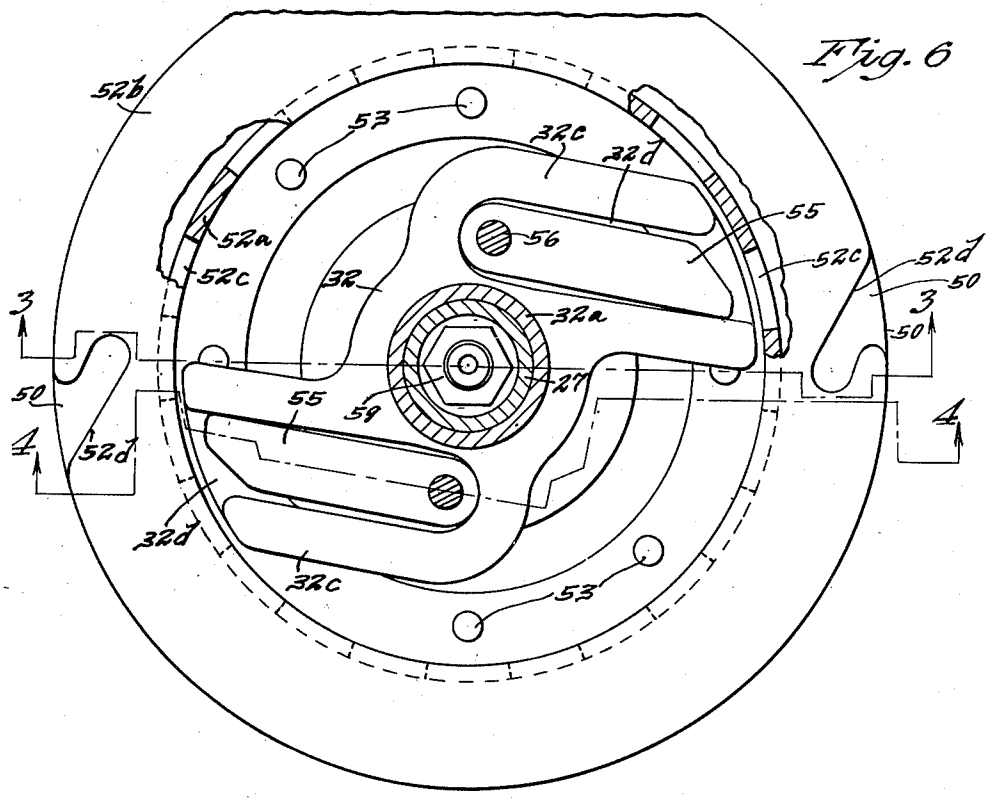
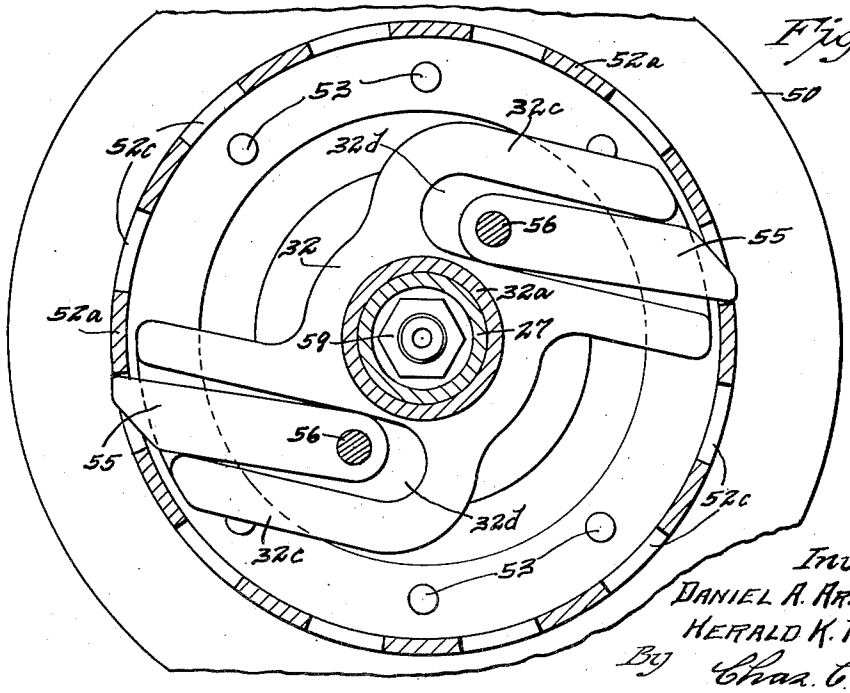



Fig. 7




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## OUTBOARD MOTOR STARTING DEVICE

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Application September 6, 1945, Serial No. 614,792

9 Claims. (Cl. 123—185)

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This invention relates to a starting device for a motor and while the invention might be applicable to various types of motors, it particularly is designed for use in an outboard motor. Outboard motors are now used in large numbers for propelling small boats and it is common to have a starting device which is usually operated by pulling upon a rope or other flexible member.

It is an object of this invention to provide an easily operated, compact and improved structure of starting device for an outboard motor.

It is a further object of the invention to provide a starting device for an outboard motor, which motor has a member adapted to be rotated to start said motor, said device comprising a rotatable sheave, a flexible member, such as a rope, attached to said sheave and adapted to be wound thereon, said flexible member being arranged to be pulled upon by the operator for rotating said sheave and said member in one direction, a spring for rotating said sheave in the opposite direction, said spring being disposed largely within said sheave.

It is another object of the invention to provide a starting device for a motor, said motor having a member adapted to be rotated to start said motor, a sheave having a peripheral groove therein, a flexible member, such as a rope, attached to said sheave and adapted to be wound in said groove, said flexible member being arranged to be pulled upon by the operator for rotating said sheave and member in one direction, and a coiled spring having an outer diameter of smaller dimension than the diameter of the bottom of said groove and disposed inwardly of said groove for rotating said sheave in the opposite direction.

It is still another object of the invention to provide a starting device for a motor, said motor having a member adapted to be rotated to start said motor, a sheave having top and bottom portions defining a peripheral groove in said sheave, a flexible member secured to said sheave and adapted to be wound in said groove, said flexible member being arranged to be pulled upon by the operator for rotating said sheave and member in one direction, and a coiled plate torsion spring arranged coaxially with said sheave and disposed mostly in a vertical direction between the planes of the outer sides of said portions.

It is still further an object of the invention to provide a starting device for a motor comprising a sheave, a flexible member secured to said sheave and adapted to be wound thereon and to be pulled upon by the operator for rotating said sheave in one direction, and a coiled plate spring of spiral form disposed in said sheave for rotating the same in the opposite direction.

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It is also an object of the invention to provide an outboard motor structure comprising a casing having an aperture extending through the top thereof, a shaft having a portion extending through said aperture and having a threaded part, a member to be rotated carried on said shaft, a second member secured to said shaft, inter-engaging means on said second member and casing acting to prevent rotation of said shaft relative to said casing, and a nut threaded on said part for tightening said shaft in said casing, said inter-engaging means acting to hold said shaft from rotation while said nut is being tightened.

It is more specifically an object of the invention to provide a structure such as set forth in the preceding paragraph in which said second member constitutes a washer secured to said shaft and said inter-engaging means comprises a recess in said washer, and a lug projecting into said recess from said casing, said recess preferably being of greater transverse dimension than said lug.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings in which like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a top plan view of the device;

Fig. 2 is a horizontal section taken substantially on line 2—2 of Fig. 3, as indicated by the arrows;

Fig. 3 is a vertical section taken substantially on line 3—3 of Fig. 6, as indicated by the arrows;

Fig. 4 is a partial vertical section taken substantially on line 4—4 of Fig. 6, as indicated by the arrows;

Fig. 5 is a partial top plan view, some parts being broken away;

Fig. 6 is a horizontal section taken substantially on line 6—6 of Fig. 4, as indicated by the arrows; and

Fig. 7 is a horizontal section taken on line 7—7 of Fig. 4, as indicated by the arrows.

Referring to the drawings, a starting device for an outboard motor is shown, which motor has a fixed part or casing 20 surrounding the fly-wheel 21, which casing 20 may comprise the gas tank of the motor. Fly-wheel 21 will as usual be connected to the crank shaft of the motor. A casing 23 of general inverted cup shape is se-

cured to casing 20 by circumferentially spaced screws 24 extending through lugs 23a formed on casing 23. Spring washers 25 are shown disposed under the heads of screws 24 which engage lugs 23a. Screws 24 are threaded into bosses 20a formed in casing 20. Casing 23 is thus rigidly held in stationary position. Casing 23 has a central hub 23b bored to have pass therethrough a reduced threaded end 27a of a shaft or stud 27. Portion 27a has a flat portion 27aa at one side. Said hub 23b is counter-bored at its upper end and a washer 28 surrounds portion 27a, the same seating on the bottom of said counter-bore. Washer 28 has a flat side in its opening fitting against flat side 27aa. Washer 28 is considerably smaller in diameter than said counter-bore and has a slot or recess 28a formed in one side thereof. A lug 23bb extends from one side of hub 23b into said counter-bore and into slot 28a of washer 28, said lug 23bb being of considerably less width than slot 28a. A nut 29 of comparatively small thickness is threaded on portion 27a and engages washer 28. Washer 28 is of greater thickness than the height of lug 23bb. Shaft 27 is thus rigidly held in casing 23. The upper portion of an opening 27b in shaft 27 is threaded to receive a headed screw 26a which engages the top of and holds in place a small cover plate 26 formed of a resilient plate, the outer edge portion of which is disposed in an annular groove 23i formed in the top of hub 23b. Shaft 27 has an intermediate cylindrical portion on which is journaled the hub 30a of a sheave or pulley 30. Pulley 30 comprises the superposed plates 30b and 30c, having central annular engaging portions connected by the circumferentially spaced rivets 31. Plate 30b is reversely bent so as to be offset from or spaced from plate 30c at the outer portions of said plates so that the same form a peripheral groove for pulley 30. Hub 30a has a downwardly projecting annular portion 30d which extends through a central opening in plates 30b and 30c and is turned over or spun outwardly over plate 30c so that said plates are firmly connected to hub 30a. Shaft 27 has an annular portion or collar 27c on which hub 30a rests, and said shaft has a cylindrical portion beneath said collar on which is journaled the hub 32a of a guide means or member 32. Member 32 comprises a bottom plate 32b and oppositely disposed portions 32c, as shown in Figs. 6 and 7, each of said portions 32c having formed therein a grove 32d shown as having substantially parallel sides and being open at its outer end. Member 32 is rotatable on shaft 27 but is restricted in its rotation by a spring washer 33 engaging its underside, which washer is held in place by a retaining ring 34 seated in an annular groove in the lower end of shaft 27. Pulley or sheave 30 is adapted to be rotated by the operator and for this purpose a flexible member 36 is provided, illustrated as in the form of a rope, which rope preferably has disposed axially therein a metal member 37, such as a braided bronze cable. Rope 36 is secured to pulley 30 in any suitable manner as by having cable 37 formed into an eyelet and connected to plate 30b by any suitable fastening means. Rope 36 is coiled in the groove of pulley 30 in spiral form, as shown in Figs. 2 and 3, and said rope extends outwardly through the bore in a hub 23c projecting at one side of casing 23. Hub 23c is bored to receive a block 39 which will be made of some yielding or resilient material such as rubber. A handle or knob 40 is secured to the end of rope 36, and while this could be secured in various ways, in the embodiment of the invention illustrated, knob 40 is provided with a central bore 40a adapted to receive a cylindrical plug 42. Plug 42 is divided substantially on a diametral plane but is provided on said divisions with interfitting ribs and grooves 42a. Cable 37 is disposed between the portions of member 42, which portions are connected by a screw 43. One end of rope 36 may also extend between the parts of plug 42. Cable 37 is formed into an eyelet surrounding screw 43, as shown in Fig. 2, and when the parts of plug 42 are connected together, cable 37 is clamped in sinuous or wavy form between said parts and is thus securely held in plug 42. As stated, plug 42 seats in the bore in knob 40. A spring 45, illustrated as a strip coiled into spiral form, is disposed in pulley 30, one end thereof being reversely bent and riveted to form an eye through which passes a pin 46 which is secured in the top of casing 23 and projects downwardly into said eye, as shown in Figs. 1 and 2. The inner end of spring 45 is also reversely bent and riveted to form an eye through which passes a pin 47 secured at its lower end in any suitable manner as by welding in the lower portion of hub 30a. A groove or recess is cut or milled laterally in the side of hub 30a, in which pin 47 is disposed, as shown in Fig. 2. It is seen therefore that when rope 36 is pulled outwardly by pulling on knob 40 that pulley 30 will be rotated against the tension of spring 45 and when said knob 40 is released, spring 45 will return pulley 30 to its normal position and will pull knob 40 against block 39, which block projects slightly from hub 23c. Block 39 thus forms a bumper. A plate 48 is disposed above spring 45, the same being bored to surround portion 27a of shaft 27 and having its inner portion resting on top of the intermediate portion of shaft 27 on which pulley 30 is journaled. Casing 23 has an annular depending flange 23d, the inner side of which is closely adjacent the edge of plate 48 and said flange acts to form an enclosure for spring 45. The outer wall of casing 23 is disposed quite close to the outer edges of plates 30b and 30c and acts to prevent the outer convolution of rope 36 from leaving the groove in sheave 30.

Secured to the top of fly-wheel 21 is a plate 50 having a cup-shaped annular portion fitting over a central cylindrical projection on fly-wheel 21. Plate 50 is secured by circumferentially spaced headed screws 51. Plate 50 has its outer portion offset and spaced from the top of fly-wheel 21. A cup-shaped annular plate 52 is securd to pleat 50 by the circumferentially spaced rivets 53, plate 52 having a cylindrical portion or wall 52a and an outer flange 52b extending parallel to and of substantially the same diameter as plate 50. Slots 52d extend into the outer portions of flange 52b, as shown in Fig. 6, said slots extending at an acute angle to a line tangent to the edge of flange 52b at the center of said slots. Wall 52a has a plurality of circumferentially spaced openings 52c extending therethrough just below flange 52b. Disposed in each groove 32d of member 32 is a pawl 55. Each of said pawls is apertured at its inner end and a pin 56 secured to pulley 30 by extending through plates 30b and 30c and being riveted thereto has its lower end disposed in the aperture in pawl 55 so that said pawl is pivoted on pin 56. Each pawl 55 has its rear side beveled adjacent its free end. The pawls 55 are disposed so as to be in alinement with the slots or holes 52c, the outer ends

of said pawls being normally disposed close to wall 52*a*. A spring washer 58 is shown surmounting the central top portion of fly-wheel 21 and the nut 59 overlies said washer, said nut being threaded on the crank shaft of the motor and being disposed partially in a bore formed in the lower end of shaft 27.

In operation, the parts normally occupy the position shown in Figs. 1, 2 and 6. When the motor is to be started, the operator grasps knob 40 and pulls the same outwardly. This pulls on rope 36 unwinding the same from pulley 30, and since the rope is attached to said pulley, the same is rotated. Pulley or sheave 30 rotates against the tension of spring 45. As sheave 30 rotates, pins 56 are rotated and this moves the inner ends of pawls 55 with said pins. As said pawls move with said sheave, they engage one side of grooves 32*d* and said pawls are swung about pins 56. This swinging movement of pawls 55 causes the ends thereof to move outwardly and said ends are projected into certain of the openings 52*c*, as shown in Fig. 7. This connects pawls 55 to the wall 52*a* and plate 52 and thus to fly-wheel 21. The engagement of pawls 55 with wall 52*a* takes place very shortly after rotation of sheave 30 begins. The further rotation of sheave 30 thus rotates plate 52 and fly-wheel 21 so that said fly-wheel is given several revolutions. When sheave 30 first rotates, member 32 forming the guide means for pawls 55 is held stationary by the friction of spring washer 33. During this time one side of grooves 32*d* acts on pawls 55 and causes the same to move to engaging position. Pawls 55 swing and their inner ends engage the other sides of grooves 32*d* and lock so that member 32 then also rotates against the friction of spring washer 33. When the operator releases knob 40, spring 45, which has been wound up or placed under tension, causes rotation of sheave 30 in the opposite direction. This rotation of sheave 30 carries pins 56 in the opposite direction and pawls 55 and member 32 take the position shown in Fig. 6. The pawls 55 are thus quickly released from member 52 when the pull or tension on rope 36 is released. The operator can therefore successively pull upon knob 40 as many times as is necessary to cause the motor to start. Should rope 36 be pulled upon after the motor starts, the sides of openings 52*c* merely click against the beveled rear ends of pawls 55. Spring 45 is under considerable tension so as to quickly retract pawls 55. The rope is retained by the device since the same is secured to sheave 30 and it is unnecessary to wind the rope about any pulley or sheave. All that the operator has to do is to pull on the knob 40. As stated, when knob 40 is released or allowed to move toward lug 23*c*, it engages block 39 and the latter forms a yielding bumper for the knob. By placing the spring 45 at the central part of the pulley 30 so that it is largely disposed within the plane of the periphery of the pulley, a very compact structure is formed and the height of the device above member 20 is kept quite small. The mechanism is all nicely covered by casing 23 and said casing is formed to harmonize in appearance with the gas tank 20 so that a very good looking design is produced. Cover plate 26 nicely covers the counter-bore in hub 23*b* and also covers shaft 27. Should anything break or get out of order so that the starter comprising sheave 30 and rope 36 would not operate, casing 23 can be removed by removing screws 24. The outer portions of plates 50 and 52 form a pulley and a knotted rope can be engaged about said pulley with the knot disposed above one of the slots 52*d*. The knotted rope can be pulled upon to rotate plate 50 and fly-wheel 21. Plates 50 and 52 therefore form an emergency pulley by the means of which the motor can be started. To locate shaft 27 and parts thereon concentric with the crank shaft a pin is disposed through openings 27*b* and through an opening in the top of the crank shaft.



The hole 27*b* in shaft 27 is thus provided so that a rod can be inserted in said hole and extend downwardly into a hole formed in the upper end of the crank shaft which is engaged by nut 59. This will locate shaft 27 concentrically with the crank shaft and with fly-wheel 21. The structure of the lug 23*bb* and the recess 28*a* in washer 28 is provided to prevent turning of shaft 27 while nut 29 is being tightened. The side of recess 28*a* will engage lug 23*bb* and prevent rotation of shaft 27 at such time. Without some such means as described it would be difficult to tighten nut 29 as shaft 27 would turn therewith. Lost motion is provided between lug 23*bb* and washer 28 in recess 28*a* both circumferentially and radially to permit some movement of shaft 27 in initially locating the same concentrically with the crank shaft.

From the above description it will be seen that we have provided a simple, efficient and very compact structure of starting device for an outboard motor. The device can be very easily and quickly operated and is very convenient for operation. The parts are very compactly arranged at the top of the motor. The parts are particularly designed for easy assembly. It will be noted that pin 46, as stated, can be placed in position from the top of the casing 23 or can be cast in said casing as an insert. The device has been amply demonstrated in actual practice by long tests, the same has been found to be very successful and efficient and is being commercially made.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts, without departing from the scope of applicants' invention, which generally states, consists in a device capable of carrying out the objects above set forth, in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:

1. A structure including a motor having a crankshaft having in combination, a fly-wheel secured to said crankshaft, a stationary member surrounding said crankshaft, a casing secured to said member above said fly-wheel, a shaft secured in said casing and disposed coaxially with said crankshaft, said shaft having a shoulder thereon, a pulley journaled on said shaft and supported on said shoulder, said pulley having a peripheral groove adapted to receive a cable, a cable wound on said pulley and secured at one end thereto, adapted to be pulled to rotate said pulley, a spring for turning said shaft and pulley in one direction, said spring being disposed partially in the plane of said pulley whereby a very compact structure is provided and means connecting said pulley to said crankshaft when said pulley is rotated by said cable.

2. A structure including an outboard motor equipped with a crankshaft having in combination, a fly-wheel secured to said crankshaft, a gas tank surrounding said fly-wheel, a cup-like casing secured to said gas tank above said fly-wheel, said casing having a central hub with a bore and counterbore therein, a shaft having a threaded

portion extending through said bore and into said counterbore, means engaging said shaft and casing to prevent rotation of said shaft, a nut threaded onto said portion of said shaft for tightening said shaft in said casing, said shaft having a shoulder formed thereon, a pulley having a hub journaled on said shaft and supported on said shoulder, said pulley having a grooved periphery, a cable wound in said periphery for rotating said pulley in one direction and a coiled torsion spring supported on said pulley for rotating said pulley in the opposite direction, means connecting said pulley to said fly-wheel and crankshaft when said pulley is rotated by said cable and a cover plate for said counterbore secured to said shaft.

3. The structure set forth in claim 1, said spring comprising a spiral resilient plate, said casing having an annular flange surrounding said spring and within said peripheral groove, said pulley comprising a pair of superposed annular plates in engagement and connected at their inner portions and spaced adjacent their peripheries, the upper of said plates at its outer portion being in a plane substantially above the bottom of said flange.

4. The structure set forth in claim 1, said last mentioned means comprising a pawl carrying plate carried on said shaft.

5. The structure set forth in claim 1, said spring comprising a spirally wound resilient plate and a plate supported on said shaft overlying said spring, said casing having a depending annular flange adjacent and surrounding said spring.

6. The structure set forth in claim 2, said means comprising a flat portion on said shaft, a washer on said shaft having a bore with a straight side engaging said flat side, said washer having a recess in its periphery and a lug on said casing disposed in said recess.

7. The structure set forth in claim 2, said casing having a central upwardly projecting annular flange at its top having a bore and a shallow counterbore therein, a circular semi-spherical plate having its peripheral portion disposed in said counterbore, and a headed screw extending centrally through said plate into said shaft for holding said plate in place.



8. A structure including a crank shaft having in combination, a fly wheel secured to said crank shaft, a stationary member surrounding said crank shaft, a casing secured to said member above said fly wheel, a shaft secured in said casing and disposed coaxially with said crank shaft, said shaft having a bore in the lower end thereof, a pair of plates secured to said fly wheel having outer vertically spaced horizontal portions, one of said plates having a cylindrical portion between said portions whereby said plates form a pulley, said plates having openings at their central portions and a nut secured to the top of said crank shaft projecting through said openings and disposed in said counterbore.

9. A structure including a crank shaft having in combination, a flywheel secured to said crank shaft, a stationary member surrounding said crank shaft, a casing secured to said member above said fly wheel, a shaft secured in said casing and disposed coaxially with said crank shaft, said shaft having a shoulder thereon, a pulley having a hub journalled on said shaft and supported on said shoulder, said hub having an annular groove in its periphery, said pulley being formed on superposed plates spaced at outer portions, the inner portions of said plates being disposed in said annular groove.

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