May 20, 1952 K. F. JOHNSON ET AL 2,597,334

STARTING DEVICE FOR OUTBOARD MOTORS

Filed Sept. 6, 1945 3 Sheets-Sheet 1

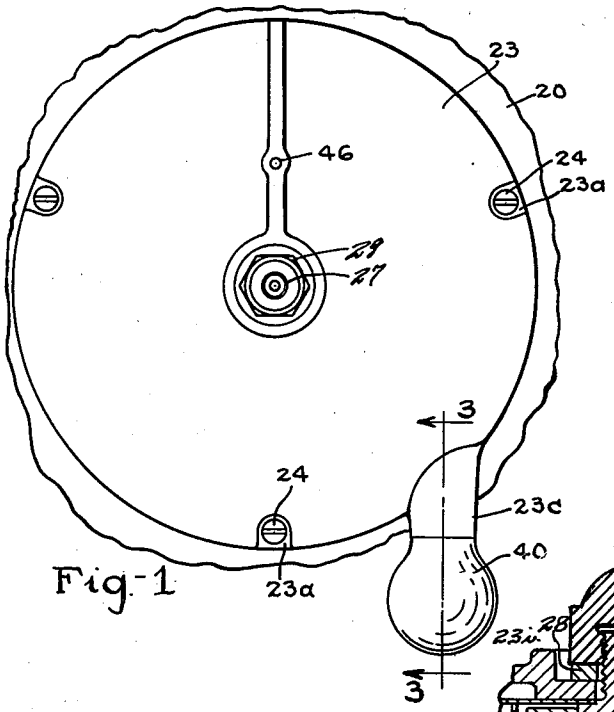

Fig. 1

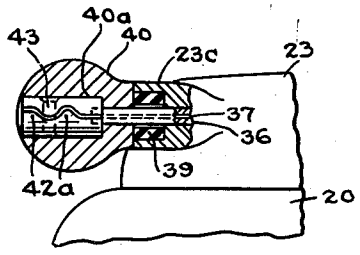

Fig. 3

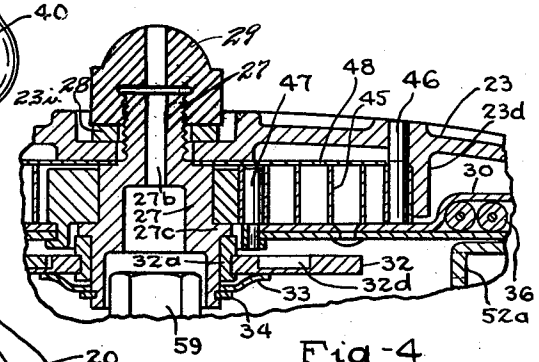

Fig. 4

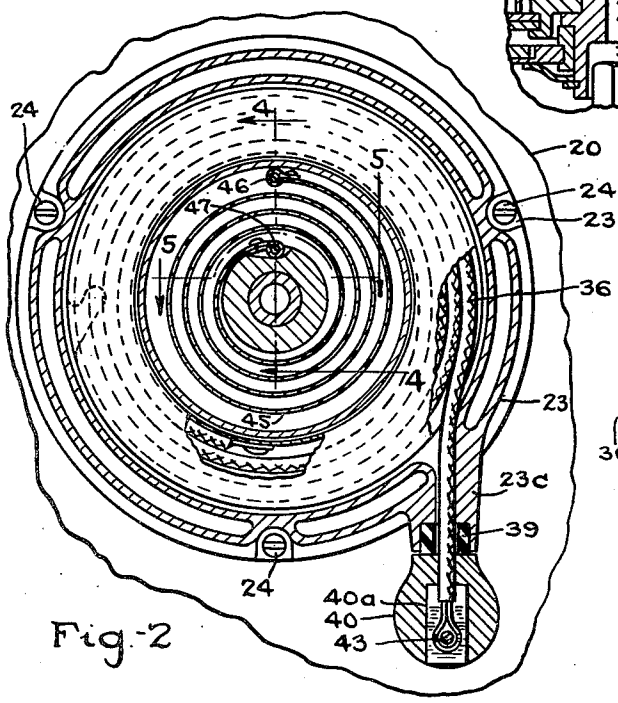

Fig. 2

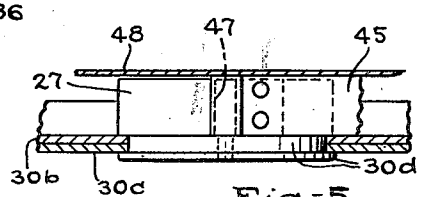

Fig. 5

INVENTORS
KERMIT F. JOHNSON
ALBERT H. EGGERT
BY Chas. C. Reif.
Attorney.

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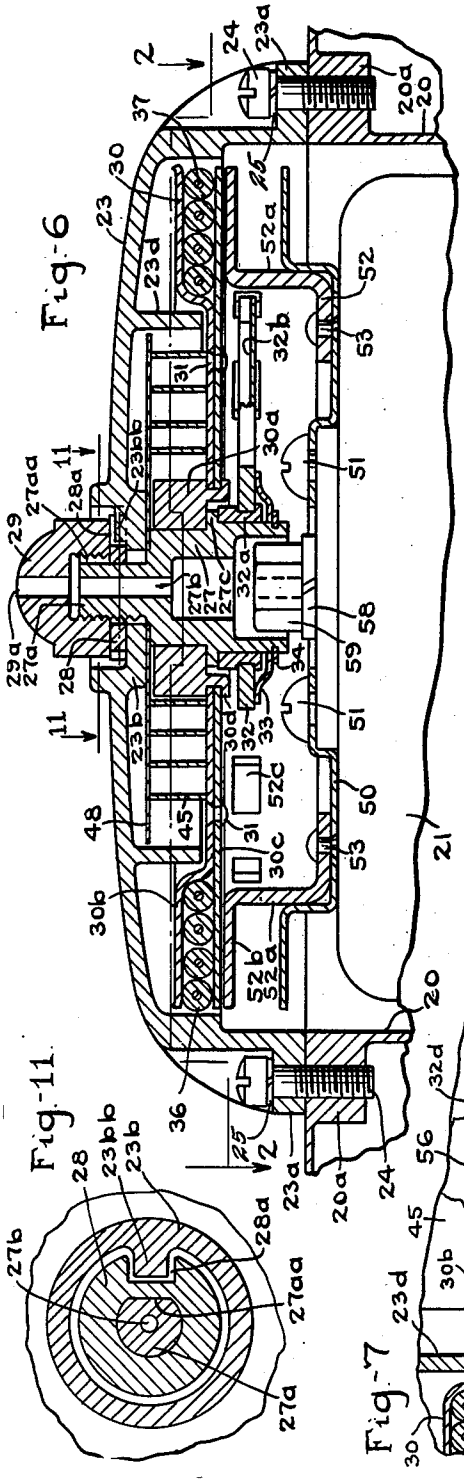

Fig-6

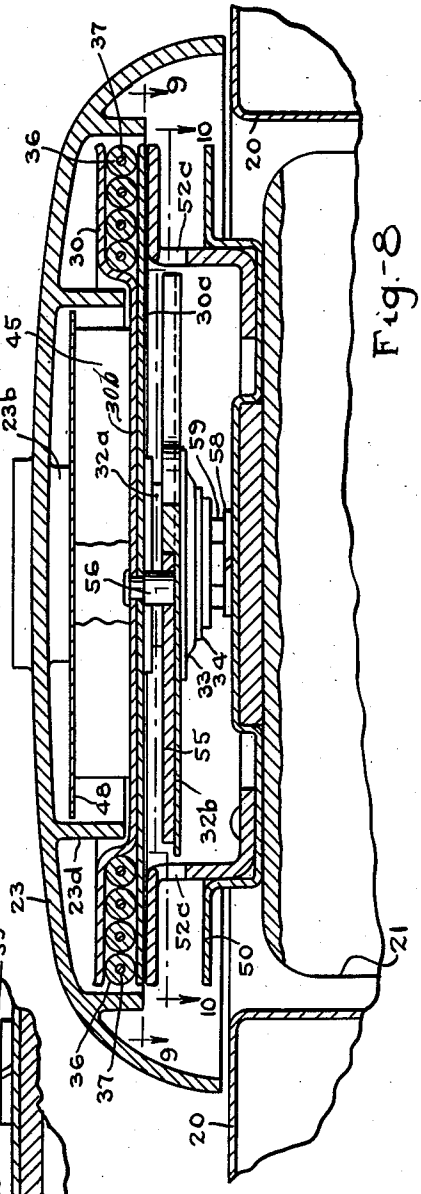

Fig-8

Fig-11

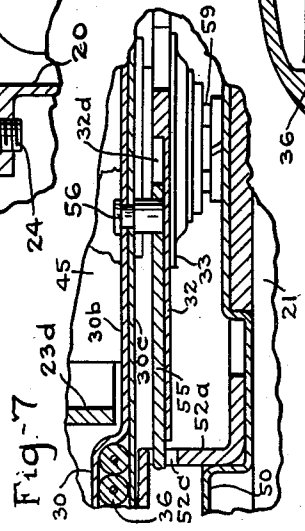

Fig-7

INVENTORS
KERMIT F. JOHNSON
ALBERT H. EGGERT
BY Chas. B. Reif
Attorney

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Fig. 9

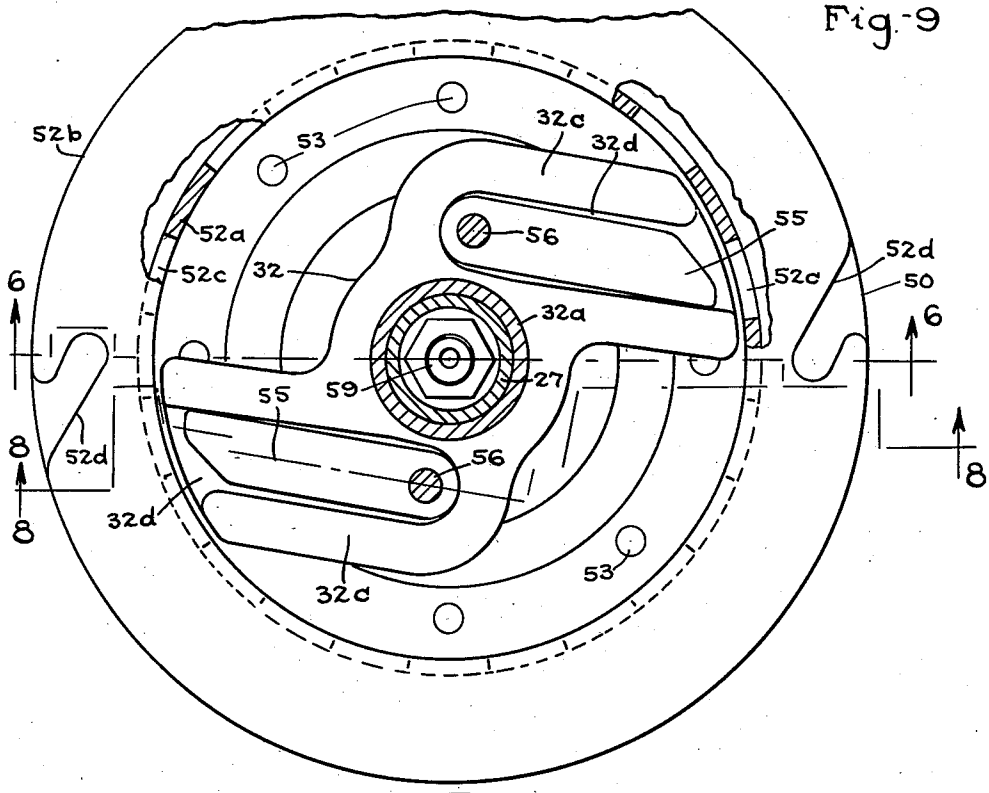
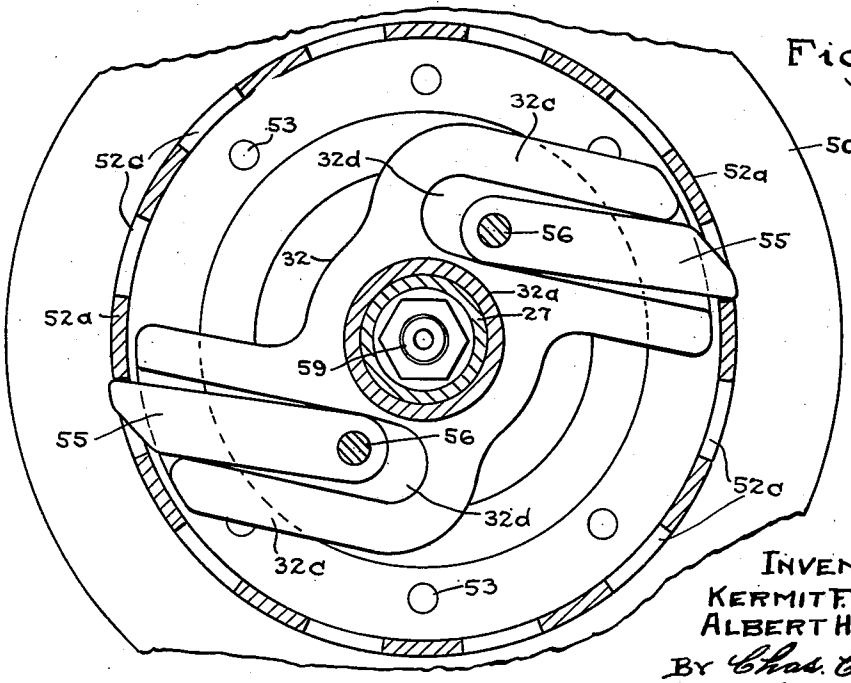


Fig. 10



INVENTORS
KERMIT F. JOHNSON
ALBERT H. EGGERT
BY Chas. C. Reif
Attorney

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STARTING DEVICE FOR OUTBOARD MOTORS

Kermit F. Johnson and Albert H. Eggert, Minneapolis, Minn., assignors to Scott-Atwater Manufacturing Company, Minneapolis, Minn., a partnership

Application September 6, 1945, Serial No. 614,794

12 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, simple and efficient 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 the motor, said device comprising a flexible member for rotating a sheave, said flexible member being attached to the sheave, together with means for connecting said sheave to said rotatable member, which means is operated by pulling upon said flexible member and rotating 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 the motor, a second rotatable member adapted to be actuated by the operator, a pawl moved by said second member and a guide means for said pawl causing the same to be connected to said first mentioned member.

It is still another object of the invention to provide a starting device for a motor, which motor has a member adapted to be rotated to start the motor, a sheave adapted to be rotated by the operator, a spring for returning said sheave to normal position after being rotated, a pawl pivoted for swinging movement connected to said sheave so as to be rotated therewith, a guide means for said pawl causing movement of said pawl upon rotation of said sheave to connect said pawl to said first mentioned member, said guide means being rotatable but held from rotation with said sheave until said pawl is engaged with said first mentioned member or moved to engaging position.

It is also an object of this invention to provide a starting device for a motor, which motor has a member adapted to be rotated to start said motor, a second member adapted to be rotated by the operator, a pair of pawls connected to said second member and pivoted for swinging movement, a guide member for said pawls, said pawls cooperating with said guide member when said second member is rotated to cause swinging movement of said pawls so that said

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pawls will engage said first mentioned member.

It is more specifically an object of the invention to provide a starting device for a motor, which motor has a member adapted to be rotated to start the motor and which comprises a cylindrical wall having circumferentially spaced openings therein, a rotatable rope sheave adapted to be actuated by the operator by pulling upon a rope wound upon said sheave and secured thereto, a guide member rotatable concentrically with said sheave and disposed at one side thereof, friction means normally holding said guide means against rotation, a plurality of oppositely disposed pawls disposed in said guide means, said pawls being pivoted at their inner ends to pins projecting from and connected to said sheave, said pawls being disposed within said cylindrical wall and in alinement with said openings, whereby when said sheave is rotated, said pawls will move therewith and be caused by said guide means to move into certain of said openings and connect said sheave with said first mentioned member, said guide means rotating against the pressure of said friction means after said pawls are engaged.

It is still further an object of the invention to provide such a structure as set forth in the preceding paragraph, together with a spring for returning said sheave to normal position and moving said pawls out of engagement with said cylindrical wall.

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. 6, as indicated by the arrows;

Fig. 3 is a vertical section taken substantially on line 3—3 of Fig. 1, as indicated by the arrows;

Fig. 4 is a partial vertical section taken substantially on line 4—4 of Fig. 2; as indicated by the arrows;

Fig. 5 is a partial vertical section taken substantially on line 5—5 of Fig. 2; as indicated by the arrows;

Fig. 6 is a central vertical section taken substantially on line 6—6 of Fig. 9; as indicated by the arrows;

Fig. 7 is a partial view similar to Fig. 8 but showing the pawls which are used for starting the motor in engaging position;

Fig. 8 is a view partly in side elevation and partly in vertical section taken on line 8—8 of Fig. 9 as indicated by the arrows showing said pawls disengaged;

Fig. 9 is a horizontal section taken substantially on line 9—9 of Fig. 8;

Fig. 10 is a horizontal section taken on line 10—10 of Fig. 8 showing the parts in different positions; and

Fig. 11 is a horizontal sectional view taken on line 11—11 of Fig. 6.

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 secured to casing 20 by circumferentially spaced screws 24 extending through lugs 23*a* formed on casing 23. Spring washers 25 are shown disposed under the heads of screws 24 which engage lugs 23*a*. Screws 24 are threaded into bosses 20*a* formed in casing 20. Casing 23 is thus rigidly held in stationary position. Casing 23 has a central hub 23*b* bored to have pass therethrough a reduced threaded end 27*a* of a shaft or stud 27. Portion 27*a* has a flat portion 27*aa* at one side. Said hub 23*b* is counter-bored at its upper end and a washer 28 surrounds portion 27*a*, the same seating on the bottom of said counter-bore. Washer 28 has a flat side in its opening fitting against flat side 27*aa*. Washer 28 is considerably smaller in diameter than said counter-bore and has a slot 28*a* formed in one side thereof. A lug 23*bb* extends from one side of hub 23*b* into said counter-bore and into slot 28*a* of washer 28, said lug 23*bb* being of considerably less width than slot 28*a*. A cap or acorn nut 29 is threaded on portion 27*a* and engages washer 28. Washer 28 is of greater thickness than the height of lug 23*bb*. Shaft 27 is thus rigidly held in casing 23. Nut 29 has an opening 29*a* extending axially therethrough which is alined with a central opening 27*b* extending through portion 27*a*. Shaft 27 has an intermediate cylindrical portion on which is journaled the hub 30*a* of a sheave or pulley 30. Pulley 30 comprises the superposed plates 30*b* and 30*c*, having central annular engaging portions connected by the circumferentially spaced rivets 31. Plate 30*b* is reversely bent so as to be offset from or spaced from plate 30*c* at the outer portions of said plates so that the same form a peripheral groove for pulley 30. Hub 30*a* has a downwardly projecting annular portion 30*d* which extends through a central opening in plates 30*b* and 30*c* and is turned over or spun outwardly over plate 30*c* so that said plates are firmly connected to hub 30*a*. Shaft 27 has an annular portion or collar 27*c* on which hub 30*a* rests, and said shaft has a cylindrical portion beneath said collar on which is journaled the hub 32*a* of a guide means or member 32. Member 32 comprises a bottom plate 32*b* and oppositely disposed portions 32*c*, as shown in Figs. 9 and 10, each of said portions 32*c* having formed therein a groove 32*d* 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 30*b* by any suitable fastening means. Rope 36 is coiled in the groove of pulley 30 in spiral form, as shown in Figs. 2 and 6, and said rope extends outwardly through the bore in a hub 23*c* projecting at one side of casing 23. Hub 23*c* 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 40*a* 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 42*a*. 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, 2 and 4. 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 30*a*, as shown in Fig. 5. A groove or recess is cut or milled laterally in the side of hub 30*a*, 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 23*c*. Block 39 thus forms a bumper. A plate 48 is disposed above spring 45, the same being bored to surround portion 27*a* 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 23*d*, 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 30*b* and 30*c* 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 secured to plate 50 by the circumferentially spaced rivets 53, plate 52 having a cylindrical portion or wall 52*a* and an outer flange 52*b* extending parallel to and of substantially the same diameter as plate 50. Slots 52*d* extend into the outer

portions of flange 52*b*, as shown in Fig. 9, said slots extending at an acute angle to a line tangent to the edge of flange 52*b* at the center of said slots. Wall 52*a* has a plurality of circumferentially spaced openings 52*c* extending therethrough just below flange 52*b*. Disposed in each groove 32*d* 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 30*b* and 30*c* 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 52*c*, 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 9. 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. 10. 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 plates 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. 9. 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*b* 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 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. 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 knob 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 29*a* and through an opening in the top of the crank shaft.

The opening 27*b* through shaft 27 and the opening 29*a* in nut 29 are thus provided so that a pin can be inserted in said openings and extend downwardly into an opening in the top of the crank shaft on which nut 59 is threaded. This opening is shown in dotted lines in Fig. 6. This will locate shaft 27 and the parts carried thereby concentrically with the crank shaft and with fly-wheel 21. The structure of the lug 23*bb* and the recess 28*a* is provided so that rotation of shaft 27 will be prevented when nut 29 is tightened to clamp shaft 27 into position. The side of recess 28*a* will engage lug 23*bb* and prevent rotation of the shaft while nut 29 is being tightened. 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 stated, 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 starting device for a motor having in combination, a member adapted to be rotated to start said motor and having a cylindrical wall, a rotatable rope sheave, a swingingly mounted pawl adapted to be moved into and out of engagement with said member, a plate-like wall having a

recess therein forming a guideway in which said pawl is disposed and a connection between said sheave and pawl causing said pawl upon rotation of said sheave in opposite directions to be moved in said guideway by engagement of the walls of said guideway with said pawl to cause the latter to respectively engage and disengage said wall.

2. A starting device for a motor having in combination, a member adapted to be rotated to start said motor, a second member adapted to be rotated by the operator, a pawl connected to said second member adapted to move outwardly away from the center of said second member to engage said first mentioned member but normally positioned out of engagement with said first mentioned member, a guide member having a recess therein in which said pawl is disposed adapted to rotate with said second member, friction member normally holding said guide means against rotation, said guide member remaining substantially stationary momentarily and engaging the sides of said pawl to cause the same to engage said first mentioned member upon rotation of said second member, said guide member subsequently rotating against the resistance of said friction means.

3. A starting device for a motor having in combination, a member adapted to be rotated to start said motor, a rotatable rope sheave, a pawl adapted to engage said member and swingable in a plane parallel to the plane of said sheave, a pin projecting from said sheave on which the inner end of said pawl is pivoted, a guide plate for said pawl rotatable concentrically with said sheave and in a plane parallel to the plane of said sheave, said guide plate and pawl being co-planar and said plate acting upon rotation of said sheave to engage the side of said pawl causing the same to oscillate about its pivot and engage said member.

4. The structure set forth in claim 3, friction means engaging said guide means at the side thereof opposite said sheave, to hold said guide means substantially stationary momentarily said guide means being subsequently rotatable with said sheave.

5. A starting device for a motor having in combination, a member adapted to be rotated to start said motor and having a cylindrical wall, said wall having circumferentially spaced means adapted to be engaged by a pawl, a pawl disposed within said wall and adapted to oscillate to move to position out of engagement with said means and to positions to engage said means to move said member, a sheave adapted to be rotated by the operator, means connecting said pawl and said sheave and a guide plate adapted to be engaged by the sides of said pawl upon rotation of said sheave to cause movement of said pawl to engage said means and rotate said first mentioned member, and friction means engaging said guide plate tending to hold it in substantially stationary position momentarily, said guide plate being rotatable with said pawl and sheave after the engaging movement of said pawl.

6. A starting device for a motor having in combination, a member adapted to be rotated to start said motor and having a cylindrical wall, said wall having a plurality of circumferentially spaced openings therein, a pair of oppositely disposed pawls adapted to be moved into certain of said openings at substantially opposite sides of said wall, said pawls normally being out of engagement with said wall, a rotatable rope sheave, pins projecting from one side of said sheave on which said pawls are pivoted adjacent one end thereof, a guide member having grooves in which said pawls are respectively disposed, friction means normally holding said guide means stationary, whereby rotation of said sheave will move said pawls and said guide means will cause said pawls to swing and engage in said openings to rotate said first mentioned member.

7. A starting device for an outboard motor having a fly-wheel, having in combination, a member secured to said fly-wheel, and having a cylindrical wall with a plurality of circumferentially spaced openings therein, oppositely disposed pawls in transverse alinement with said openings, a rope sheave, a shaft on which said sheave is journaled, a rope secured to said sheave and adapted to be pulled upon to rotate said sheave, means carried by said sheave on which one end of said pawls are pivoted, a guide member for said pawls also journaled on said shaft, and adapted upon rotation of said sheave to move said pawls into certain of said openings and connect said sheave to said first mentioned member.

8. A starting device for a motor having in combination, a member to be rotated for starting said motor and having a cylindrical wall, said wall having circumferentially spaced means adapted to be engaged by a pawl, a second plate-like member adapted to be rotated by the operator, a plate-like pawl pivoted adjacent its inner end to said second member and movable to positions out of engagement with and into actuating engagement with said means respectively to disengage and to rotate said first mentioned member, a plate-like guide member for said pawl having a recess therein forming a guide-way in which said pawl is disposed, the walls of which recess are adapted to be engaged by the side edges of said pawl in the movement of said second member to cause said pawl to move outwardly into engagement with said means.

9. The structure set forth in claim 8, a friction means for holding said guide member stationary during said outward movement of said pawl but permitting rotation of said guide member after said pawl has engaged said wall.

10. A starting device for an outboard motor having in combination, a member adapted to be rotated for starting said motor and comprising a cylindrical wall having circumferentially spaced means adapted to be engaged by a pawl, a rotatable plate, a pivot carried by said plate, a pawl mounted at its inner end on said pivot and adapted to swing to engage said means with its outer end, a rotatable guide plate having portions disposed at either side of said pawl to engage said sides for swinging said pawl about said pivot and into and out of engagement with said means respectively, means for rotating said plate for causing said pawl to engage said means, and means for reversely rotating said plate to cause said pawl to disengage said means.

11. The structure set forth in claim 2, and means for reversely rotating said second member to reversely rotate said guide member and cause the same to engage the other side of said pawl to cause said pawl to disengage said first mentioned member.

12. A starting device for a motor having in combination, a casing, a shaft depending in said casing, a pulley having a hub journaled on said shaft, a plate secured to said pulley and rotatable therewith, a pivot pin depending from said plate, a pawl pivotally mounted at its inner end on said

pin, a rotatable guide member concentric with said shaft below said plate and having a trough-like guideway in which said pawl is disposed, and means for retarding the rotation of said guide member when said pulley is rotated to cause said guide member to engage the side of said pawl and swing the same for causing it to engage and rotate said first mentioned member.

KERMIT F. JOHNSON.
ALBERT H. EGGERT.

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