

July 29, 1952

W. H. SCHNACKE

2,604,882

INTERNAL-COMBUSTION ENGINE STARTER

Filed July 20, 1950

2 SHEETS—SHEET 1

FIG. 2

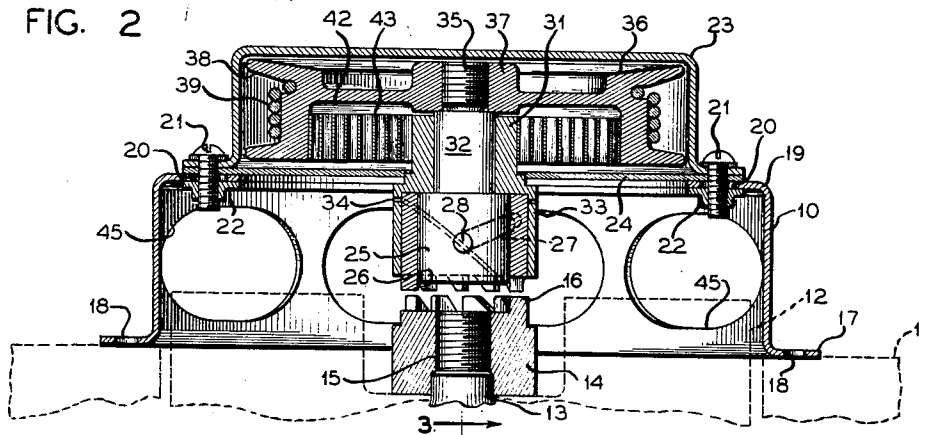
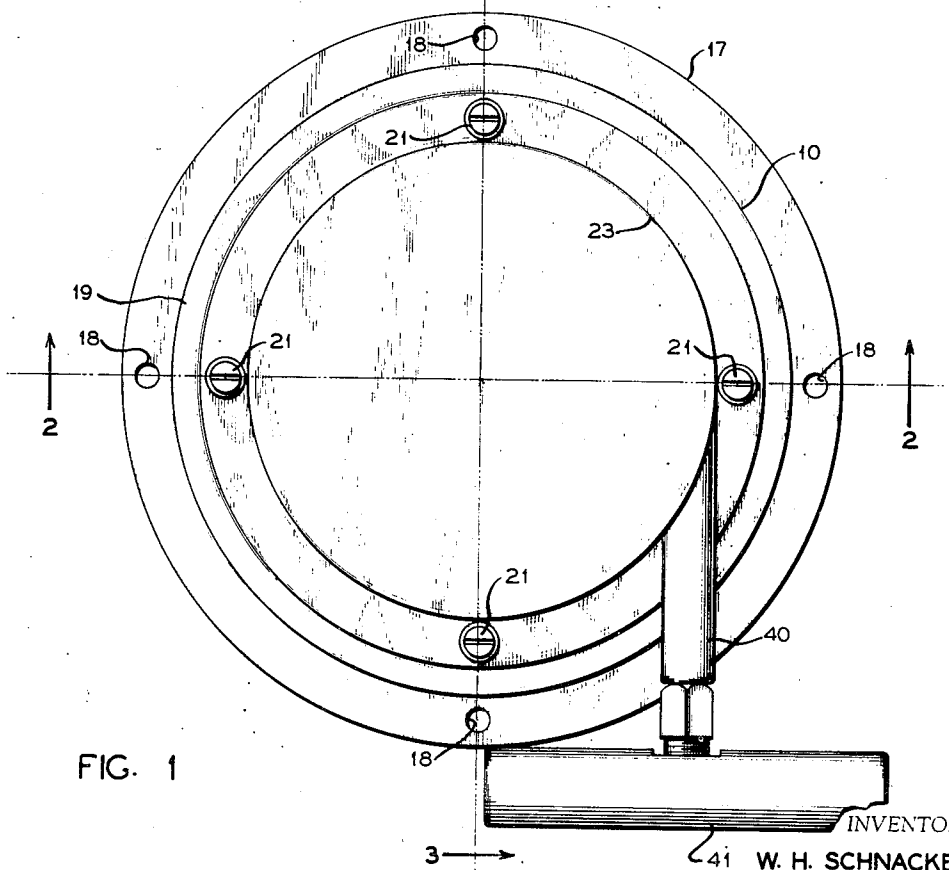


FIG. 1



INVENTOR

W. H. SCHNACKE

BY

*Myatt Dowell*  
ATTORNEY

July 29, 1952

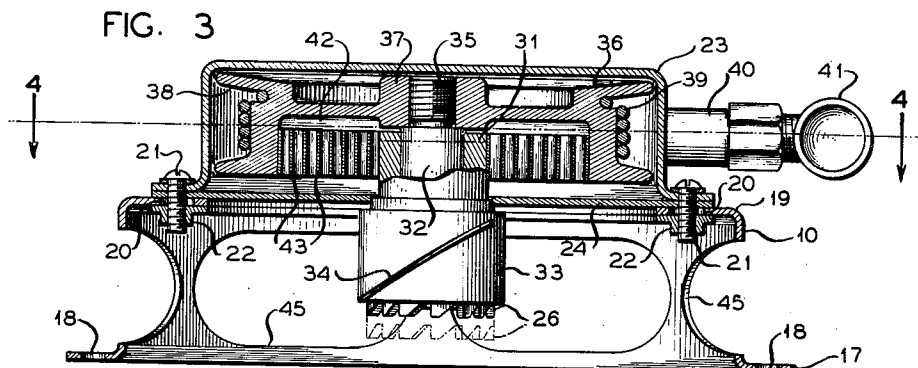
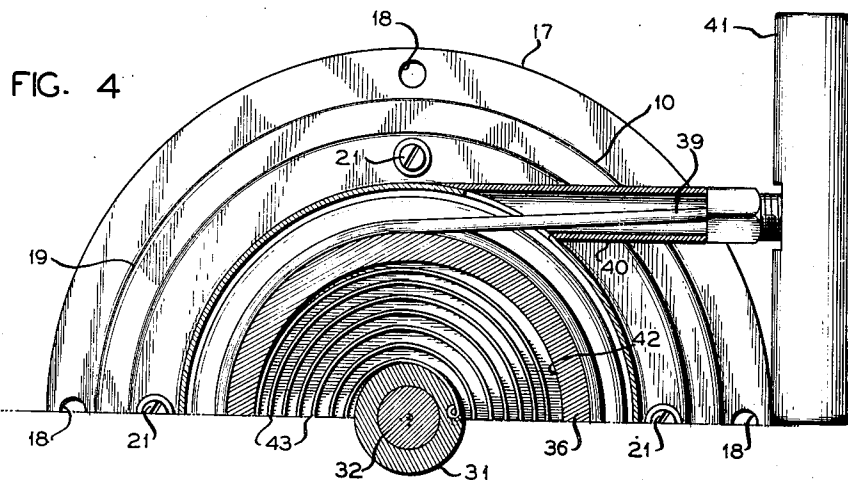
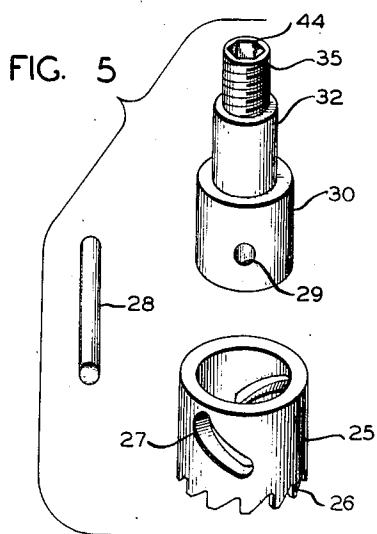
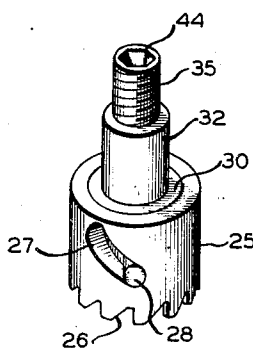
W. H. SCHNACKE

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INTERNAL-COMBUSTION ENGINE STARTER

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2 SHEETS—SHEET 2



INVENTOR.

W. H. SCHNACKE

BY

*Hyatt D. Dowell*

ATTORNEY

## UNITED STATES PATENT OFFICE

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## INTERNAL-COMBUSTION ENGINE STARTER

Walter H. Schnacke, Evansville, Ind.

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7 Claims. (Cl. 123—185)

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This invention relates to internal combustion engines and more particularly to starters of the pull type which are commonly used on outboard motors and other relatively small internal combustion engines.

Heretofore many starters of this type have been proposed and utilized but these possessed numerous disadvantages such as complexity of construction and liability to damage or failure, thus necessitating frequent repair bills and consequent loss of time in use. Many of these prior art starters required complicated pawl and ratchet mechanisms, also centrifugal clutches and the like which of necessity were rather complicated and unless of extremely rugged construction extremely liable to breakage or other failure.

In the case of outboard motors and other relatively small internal combustion engines weight must be kept to a minimum and also all mechanisms such as starters must be foolproof as possible. In using such motors the owner often ventures far from shore, in a case of an outboard motor, and a failure of the starter or other component part may well result in spending an uncomfortable night on the water or in some instances might result in serious consequences due to storms and the like. Consequently, any mechanism used in such applications must be relatively simple, of extremely rugged and light construction and not susceptible of frequent failure.

It is accordingly an object of this invention to provide an internal combustion engine starter of the pull type in which a minimum number of parts are utilized and in which the parts may be of extremely rugged construction and thus not susceptible of failure.

It is a further object of this invention to provide an internal combustion engine starter of the pull type in which clutch means is provided for automatically engaging and disengaging the starter mechanism with the crank shaft of the engine to be started and in which the driving and driven clutch members are automatically engaged and disengaged simply by the operation of pulling the starting rope and releasing the same upon starting of the engine.

It is a further object of the invention to provide an internal combustion starter of the pull type in which a minimum number of parts are utilized and which may be applied to existing motors or supplied as original equipment with the same.

It is a further object of the invention to provide an internal combustion engine starter of the

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pull type in which relatively few parts require accurate machine work and which, consequently, may be economically manufactured and produced for sale in a highly competitive market.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

Fig. 1 is a top plan view of the starter of this invention;

Fig. 2, a sectional view on the line 2—2 of Fig. 1 and showing the internal construction of the starter of this invention;

Fig. 3, a sectional view similar to Fig. 2 on the line 3—3 of Fig. 1 with certain parts in elevation for greater clarity;

Fig. 4, a fragmentary sectional view on the line 4—4 of Fig. 3;

Fig. 5, an exploded view of the driving clutch member and associated parts; and

Fig. 6, an elevational view of the driving clutch member assembled with its associated parts.

With continued reference to the drawing, there is shown particularly in Fig. 2 an inverted cup-shaped housing 10 which is adapted to be secured to a motor part 11 such as the gasoline tank or other appropriate structure, the housing 10 serving to cover and enclose the flywheel 12 mounted on the crank shaft 13 of the motor. The flywheel 12 is held in place on the crank shaft 13 by a driven clutch member 14 provided with an internally threaded bore 15 which engages mating threads on the crank shaft 13 to securely clamp the flywheel 12 in place. The driven clutch member 14 replaces the nut normally supplied with the motor to clamp the flywheel 12 in place. On the upper surface of driven clutch member 14 there is provided a series of saw-tooth shaped clutch teeth 16 which serve to engage with other clutch teeth presently to be described. The housing 10 may be provided with an annular flange 17 having apertures 18 for the reception of screw-threaded fasteners or the like for securing the starting mechanism in place on the motor.

Adjacent the upper end of the housing 10 there is provided an inwardly extending annular flange 19 having a series of apertures 20 provided therein for the reception of screw-threaded fastening means or the like 21 which threadedly engage a clamping ring 22 disposed below the flange 19 and serve to firmly secure in position a cover 23 and a driving clutch supporting plate 24. The apertures 20 are somewhat larger than the screw-threaded fastening means 21 for a purpose to be presently described.

As best shown in Figs. 5 and 6, driving clutch

member 25 comprises a generally cylindrical member having a series of saw-tooth shaped teeth 26 on the lower surface thereof, these teeth serving to mate with and engage the teeth 16 on the driven clutch member 14. Driving clutch member 25 is provided with a pair of diametrically opposed spiral slots 27 which are engaged by a pin 28 disposed in an aperture 29 in a clutch shaft or spindle 30. Clutch spindle 30 is rotatably mounted within clutch driving member 25 and the rotational movement thereof relative to the clutch member 25 is limited by the pin 28 disposed in spiral slots 27.

Fixed to the plate 24 and carried thereby is a clutch spindle bearing 31 having a bore therein for rotatably receiving a reduced portion 32 of the clutch spindle 30. Integral with the bearing 31 is a friction sleeve 33. As best shown in Fig. 3, sleeve 33 is provided with opposed spiral slots 34 which form resilient spiral fingers. The split sleeve 33 serves to grip the outer surface of the driving clutch member 25 for a purpose to be presently described.

The upper end of the spindle 30 is provided with a screw-threaded portion 35 for threadedly receiving a winding drum 36 having a hub 37 and an outer grooved periphery 38 which serves to receive a flexible cable 39 having one end secured to the drum 36 and the opposite end projecting through a sleeve 40 provided on the cover 23, the cable terminating in a pull handle 41 exteriorly of the starting device.

As will be seen from an inspection of Figs. 2 and 3, the winding drum 36 is provided with an annular recess 42 which serves to receive a spiral spring 43, one end of which is attached to the bearing portion 31 secured to the plate 24 and the opposite end of the spring 43 being attached to the winding drum 36. For convenience in assembling the device, the clutch shaft 30 may be provided at the upper end thereof with a hexagonal recess 44 for the reception of a wrench to permit convenient tightening of the shaft 30 in the hub 37 of the winding drum 36.

In assembling the device on a completed motor or in assembling the device on motor during factory assembly it is only necessary to apply the nut 14 to the crank shaft 13 thus securing the fly-wheel 12 in place, nut 14, as stated above, forming the driven clutch member of the starter and in the case of an already completed motor this nut would replace the conventional nut supplied with the motor; and next assembling the starting unit on the motor by clamping the housing 10 in place by screw-threaded fastening means or the like extending through apertures 18 in flange 17. The driving clutch member 25 is centered with relation to the driven clutch member 14 by moving the plate 24 which serves to carry bearing 31 and driving clutch member 25 and its associated clamping screws 21 in the enlarged apertures 20 until the driving clutch member 25 is accurately centered with relation to the driven clutch member 14 whereupon the clamping screws 21 are securely tightened in place. This serves also to retain the cover 23 which houses the winding drum 36 in place on the assembly. It will be noted that the housing 10 is provided with a series of apertures 45 to permit suitable ventilation around the upper part of the motor.

The operation of the device may be explained with particular reference to Fig. 2 of the drawing in which the driving clutch member 25 is shown as out of engagement with the driven

clutch member 14 and the rotor may be assumed to be at rest or stopped. When it is desired to start the motor, it is only necessary for the operator to grasp the handle 41 and pull the same toward him in which case the winding drum 36 will be rotated in a clock-wise direction to turn the clutch spindle or shaft 30 and pin 28 carried thereby, this pin moving in the spiral slots 27 in the driving clutch member 25 to project the clutch member downwardly and the teeth 26 thereof into engagement with teeth 16 on the driven clutch member 14. This relative movement of the driving clutch member 25 is accomplished by reason of the frictional engagement of the split sleeve 33 with the outer surface of the clutch member 25. As will clearly be seen from an inspection of the drawing, this frictional engagement prevents rotary movement of the clutch member 25 with relation to the shaft or spindle 30 until the pin 28 engages the end of spiral slots 27, thus causing the slots to act as a cam and force the clutch member 25 downwardly, into engagement with the driven clutch member 14. Continued movement of the handle 41 outwardly causes rotation of the motor and starting thereof. This movement of the handle 41 also serves to wind the spring 43 causing sufficient tension to return the handle 41 to original position when the same is released after starting of the motor.

Upon starting of the motor the handle 41 is released or permitted to move inwardly toward the starting mechanism whereupon under the action of spring 43 which became tensioned by the outward movement of the handle 41 the winding drum 36 is rotated in the opposite direction thus rotating the clutch shaft 30 in the same direction and causing the pin 28 to move in the slots 27 to retract the driving clutch member upwardly and cause disengagement of the teeth 26 with the teeth 16 on the driven clutch member 14. Such upward movement of the driving clutch member 25 is caused by the frictional engagement of the split sleeve 33 with the external surface thereof in the same manner as described above in connection with the projection of the driving clutch member downwardly. Upward movement of the driving clutch member 25 is also assisted by the inclined engaging surfaces of the saw-tooth shaped clutch teeth 26 and 16 since upon starting of the motor the crank shaft 13 and driven clutch member 14 carried thereby overruns the driving clutch member 25 and the clutch teeth exercise a camming action which tends to urge the driving clutch member 25 upwardly. During operation of the motor, downward movement of the driving clutch member 25 is precluded by the frictional engagement of split sleeve 33 with the external surface thereof, since it is necessary for clutch member 25 to rotate with relation to clutch shaft 30 in order for the same to move downwardly and teeth 26 to come into engagement with the teeth 16.

It will be seen that by the above-described invention there has been provided an extremely simple, economically manufactured starting mechanism which may be conveniently applied to new motors or to motors already in existence and one in which inadvertent engagement of the clutch teeth during operation of the motor is precluded.

It will be obvious to those skilled in the art that various changes may be made in the invention, without departing from the spirit and scope thereof and, therefore, the invention is not limited by that which is shown in the drawings and

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described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. An internal combustion engine starting device comprising a driven clutch member fixed to the crank shaft of the engine and having saw-tooth shaped teeth, a housing secured to a fixed part of said engine and having an inwardly extending flange, a plurality of angularly spaced apertures in said flange, a plate engaging the upper surface of said flange, a centrally disposed bearing extending through said plate and supported thereby, a split sleeve extending axially from said bearing toward said driven clutch member, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle within said sleeve, said sleeve frictionally engaging the external surface of said driving clutch member, diametrically disposed spiral slots in said driving clutch member, a pin extending through said spindle and engaging said slots to limit relative rotation between said driving clutch member and said spindle, complementary teeth on said driving clutch member for engaging the teeth on said driven clutch member, a winding drum secured to the opposite end of said spindle, a spiral spring secured to said winding drum and said bearing, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device, a clamping ring disposed beneath said flange and having threaded apertures, a cover for said winding drum and fastening means for said cover extending through said plate and the apertures in said flange and engaging the threaded apertures in said clamping ring to secure said plate, bearing and parts carried thereby in position, the apertures of said flange being larger than said fastening means to permit adjustment of the parts, whereby upon movement of said flexible member to rotate said winding drum in one direction said spring will be tensioned and said driving clutch member will be projected by said pin and slot into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said spring, said driving clutch member will be retracted, the operation of said pin and slot being caused by the frictional engagement of said sleeve with said driving clutch member, the retraction of said driving clutch member being assisted by said saw-tooth shaped teeth.

2. An internal combustion engine starting device comprising a driven clutch member fixed to the crank shaft of the engine and having teeth, a housing secured to a fixed part of said engine and having an inwardly extending flange, a plurality of angularly spaced apertures in said flange, a plate engaging the upper surface of said flange, a centrally disposed bearing extending through said plate and supported thereby, a split sleeve extending axially from said bearing toward said driven clutch member, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle within said sleeve, said sleeve frictionally engaging the external surface of said driving clutch member, diametrically disposed spiral slots in said driving clutch member, a pin extending through said spindle and engaging said slots to limit relative rotation between said driving clutch

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member and said spindle, complementary teeth on said driving clutch member for engaging the teeth on said driven clutch member, a winding drum secured to the opposite end of said spindle, a spiral spring secured to said winding drum and said bearing, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device, a clamping ring disposed beneath said flange and having threaded apertures, a cover for said winding drum and fastening means for said cover extending through said plate and the apertures in said flange and engaging the threaded apertures in said clamping ring to secure said plate, bearing and parts carried thereby in position, the apertures of said flange being larger than said fastening means to permit adjustment of the parts, whereby upon movement of said flexible member to rotate said winding drum in one direction said spring will be tensioned and said driving clutch member will be projected by said pin and slot into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said spring said driving clutch member will be retracted, the operation of said pin and slot being caused by the frictional engagement of said sleeve with said driving clutch member.

3. An internal combustion engine starting device comprising a driven clutch member fixed to the crank shaft of the engine and having teeth, a housing secured to a fixed part of said engine, a plate engaging the upper surface of said housing, a centrally disposed bearing extending through said plate and supported thereby, a split sleeve extending axially from said bearing toward said driven clutch member, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle within said sleeve, said sleeve frictionally engaging the external surface of said driving clutch member, diametrically disposed spiral slots in said driving clutch member, a pin extending through said spindle and engaging said slots to limit relative rotation between said driving clutch member and said spindle complementary teeth on said driving clutch member for engaging the teeth on said driven clutch member, a winding drum secured to the opposite end of said spindle, a spiral spring secured to said winding drum and said bearing, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device, a cover for said winding drum and fastening means for securing said cover, said plate, bearing and parts carried thereby in position, whereby upon movement of said flexible member to rotate said winding drum in one direction said spring will be tensioned and said driving clutch member will be projected by said pin and slot into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said spring said driving clutch member will be retracted, the operation of said pin and slot being caused by the frictional engagement of said sleeve with said driving clutch member.

4. A device, as defined in claim 3, in which said sleeve is provided with diametrically disposed spiral slots to form spirally disposed spring fingers.

5. An internal combustion engine starting device comprising a driven clutch member fixed to

the crank shaft of the engine, a housing secured to a fixed part of said engine, a plate engaging the upper surface of said housing, a centrally disposed bearing extending through said plate and supported thereby, a split sleeve extending axially from said bearing toward said driven clutch member, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle within said sleeve, said sleeve frictionally engaging the external surface of said driving clutch member, diametrically disposed spiral slots in said driving clutch member, a pin extending through said spindle and engaging said slots to limit relative rotation between said driving clutch member and said spindle, complementary means on said driving clutch member and said driven clutch member for providing driving engagement therebetween, a winding drum secured to the opposite end of said spindle, a spiral spring secured to said winding drum and said bearing, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device, a cover for said winding drum and fastening means for securing said cover, said plate, bearing and parts carried thereby in position, whereby upon movement of said flexible member to rotate said winding drum in one direction said spring will be tensioned and said driving clutch member will be projected by said pin and slot into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said spring, said driving clutch member will be retracted, the operation of said pin and said slot being caused by the frictional engagement of said sleeve with said driving clutch member.

6. An internal combustion engine starting device comprising a driven clutch member for attachment to the crank shaft of the engine, a housing having means for mounting on a fixed part of said engine, a plate engaging the upper surface of said housing, a centrally disposed bearing extending through said plate and supported thereby, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle, friction means mounted on said plate and engaging said driving clutch member, diametrically disposed spiral slots in said driving clutch member, a pin extending through said spindle and engaging said slots to limit relative rotation between said driving clutch member and said spindle, complementary means on said driving clutch member and said driven clutch member for providing driving engagement therebetween, a winding drum secured to the opposite end of said spindle, resilient means secured to said winding drum and a fixed portion of said device, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device,

a cover for said winding drum and common fastening means for securing said cover, said plate, bearing and parts carried thereby in position, whereby upon movement of said flexible member to rotate said winding drum in one direction said resilient means will be tensioned and said driving clutch member will be projected by said pin and slot into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said resilient means, said driving clutch member will be retracted, the operation of said pin and slot being caused by said frictional engaging means.

7. An internal combustion engine starting device comprising a driven clutch member for attachment to the crank shaft of the engine, a housing having means for mounting on a fixed part of said engine, a plate engaging the upper surface of said housing, a centrally disposed bearing extending through said plate and supported thereby, a clutch spindle rotatably mounted in said bearing and extending therefrom in both directions, a driving clutch member rotatably received on said spindle, means fixed to said plate and frictionally engaging said driving clutch member, cooperating cam means on said spindle and said driving clutch member whereby upon relative rotation therebetween said driving clutch member will be extended or retracted, complementary means on said driving clutch member and said driven clutch member to provide driving engagement therebetween, a winding drum secured to the opposite end of said spindle, resilient means secured to said winding drum and a fixed portion of said device, a flexible member having one end secured to said winding drum and the other end terminating in a handle exteriorly of said device and common fastening means for securing said plate, bearing and parts carried thereby in position, whereby upon movement of said flexible member to rotate said winding drum in one direction said resilient means will be tensioned and said driving clutch member will be projected by the action of said cam means into engagement with said driven clutch member to rotate the same and upon reverse rotation of said winding drum under the action of said resilient means said driving clutch member will be retracted, the operation of said cam means being caused by the engagement of said frictional means with said driving clutch member.

WALTER H. SCHNACKE.

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