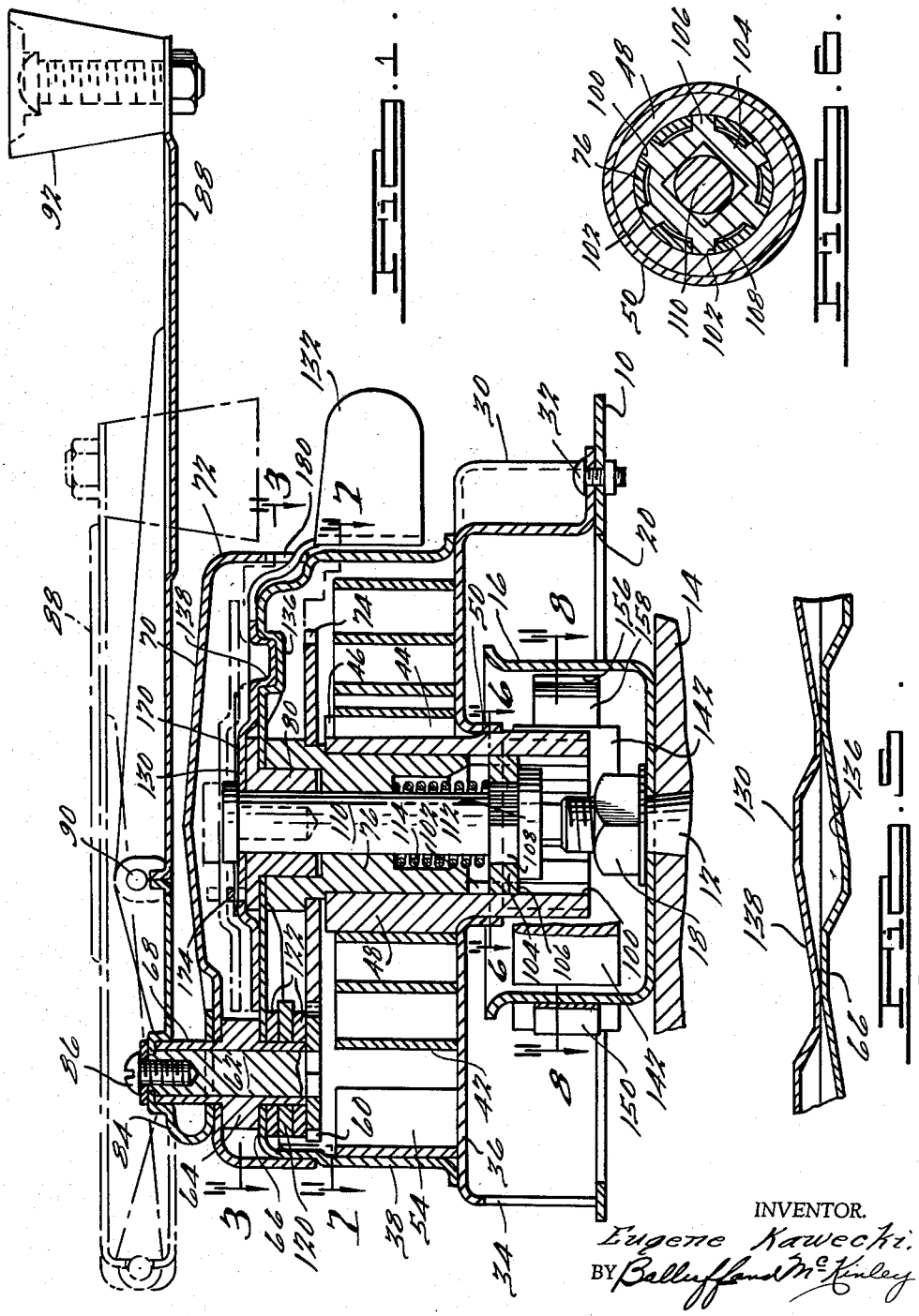
July 4, 1961 E. KAWECKI 2,990,827

SPRING STARTER FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 8, 1958 3 Sheets-Sheet 1



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SPRING STARTER FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 8, 1958 3 Sheets-Sheet 2

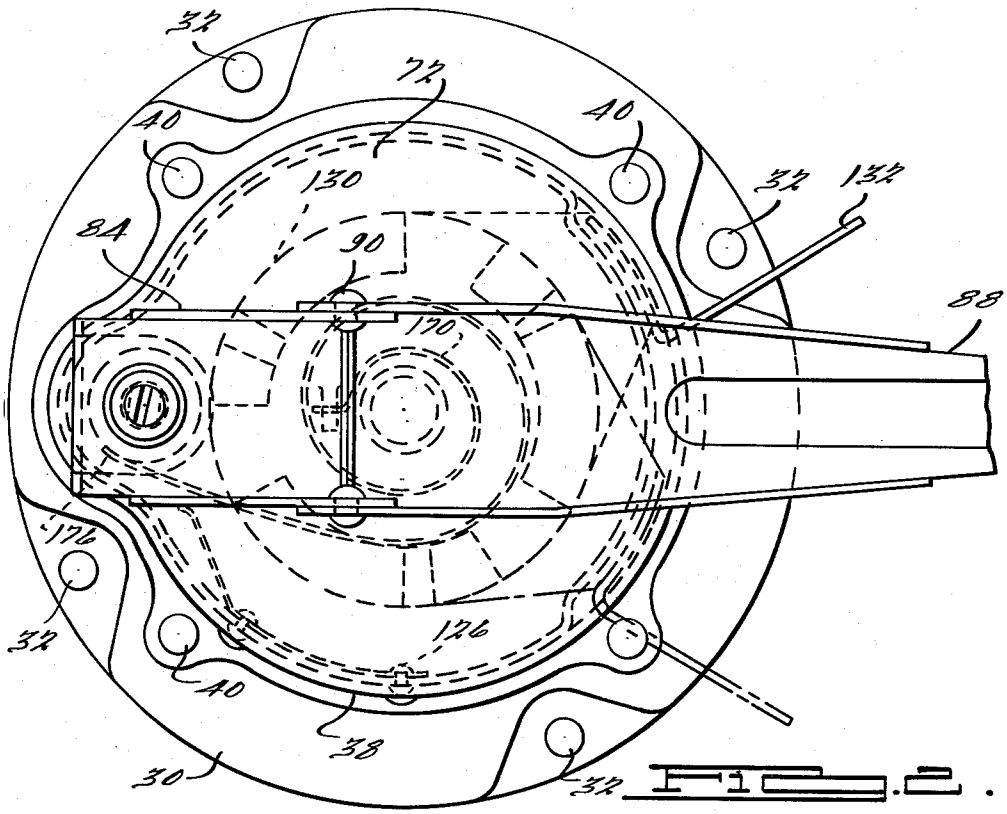


FIG. 2.

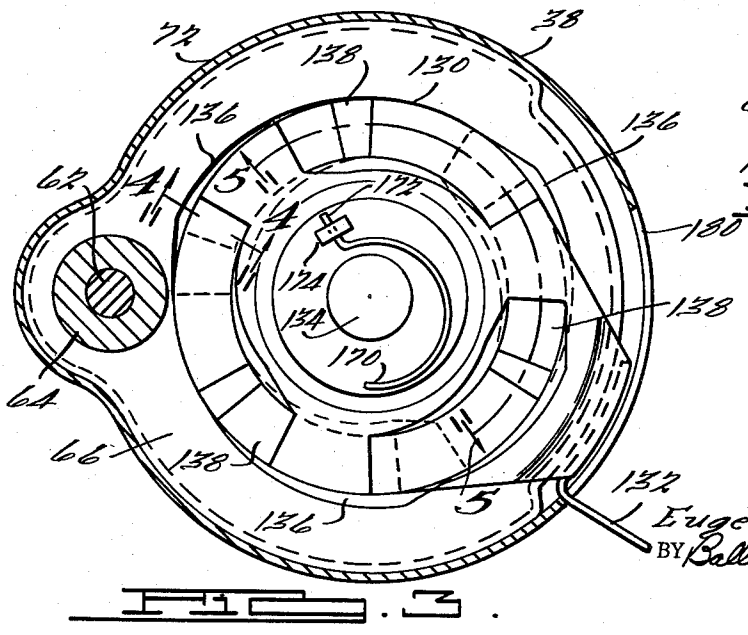


FIG. 3.

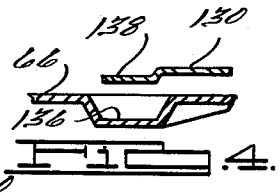


FIG. 4.

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Filed Dec. 8, 1958 3 Sheets-Sheet 3

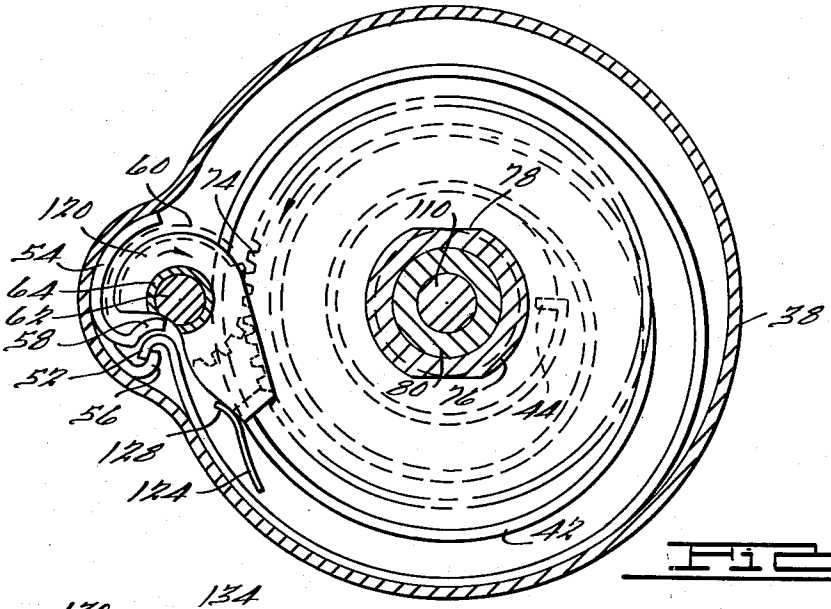


Fig. 7.

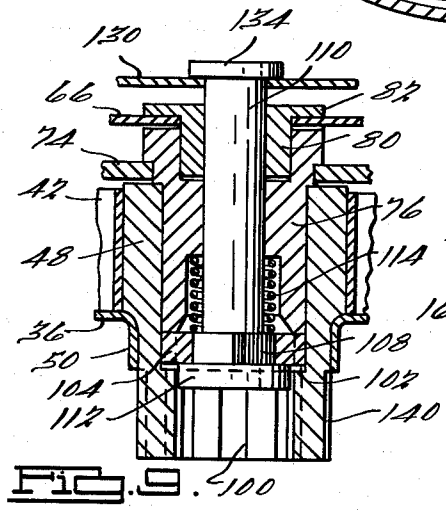


Fig. 9.

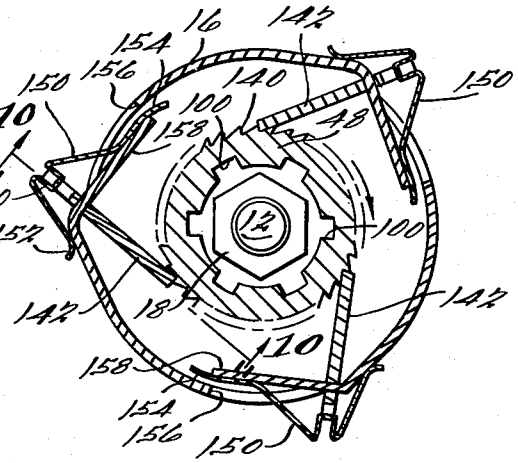


Fig. 8.

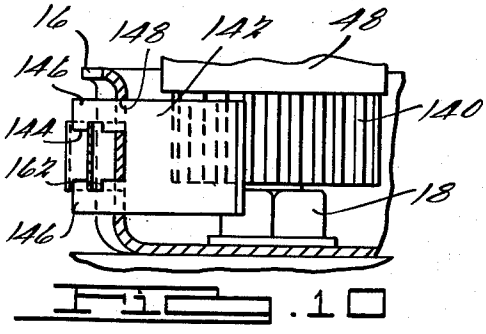


Fig. 10.

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SPRING STARTER FOR INTERNAL COMBUSTION ENGINES

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Filed Dec. 8, 1958, Ser. No. 778,893
5 Claims. (Cl. 123—179)

This invention relates to a starter for an internal combustion engine and more particularly to a spring powered starter for small internal combustion engines such as the single cylinder engines commonly employed on lawn mowers.

In general, a starter according to the present invention includes a coil spring which has one end fixed to the starter housing and its other end secured to a part which may be rotated through a winding mechanism to wind up the spring and to store energy therein. A release mechanism is provided to allow the spring to unwind and supply its stored up energy to a part rotatable with the engine crankshaft for cranking the engine. The connection between the spring and the engine is such that the spring and all parts of the starter are completely disengaged from the engine after the engine has been started.

A principal object of the invention is to provide a new and improved spring starter for internal combustion engines.

Another object of the invention is to provide a spring starter for internal combustion engines in which the starting mechanism is completely disengaged from the engine after the engine has been started.

Another object of the invention is to provide a starter of the type described which can be wound up manually with a minimum of effort and then released by a simple manual operation whenever it is desired to start the engine.

A further object of the invention is to provide a spring starter of the type described in which means are provided for preventing the engine from transmitting a turning force on the crank mechanism either during normal running of the engine or in the event of an engine backfire.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawings, of which there are three sheets, which by way of illustration show a preferred embodiment of the invention and what I now consider to be the best mode in which I have contemplated applying the principles of my invention. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

FIG. 1 is a vertical sectional view through a starter constructed according to the present invention;

FIG. 2 is a to plan view of the starter;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken on line 5—5 of FIG. 3;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 1;

FIG. 7 is a sectional view taken on line 7—7 of FIG. 1;

FIG. 8 is a sectional view taken on line 8—8 of FIG. 1;

FIG. 9 is a fragmentary sectional view similar to FIG. 1 and showing the winding mechanism in its released position as the spring is unwinding; and

FIG. 10 is a sectional view taken on line 10—10 of FIG. 8.

The starter is shown in FIG. 1 mounted upon the shroud or blower housing 10 of a single cylinder internal combustion engine having a crankshaft 12 and a flywheel 14 secured on the end of the crankshaft 12. A starter cup 16 is secured to the flywheel 14 by a nut 18 threaded onto the outer end of the crankshaft 12. The starter cup 16 extends through an opening 20 in the shroud 10 through which air is drawn by the flywheel 14 as is conventional with engines of this type.

The starter includes a base 30 secured to the shroud 10 by screws 32 and having suitable openings 34 in its peripheral wall through which air is drawn by the flywheel 14. The base 30 includes a horizontal wall 36 enclosing the starter cup 16. A housing 38 is secured to the top wall 36 of the base 30 by screws 40. A coil spring 42 has its inner end 44 secured within a slot 46 in a sleeve 48, which is rotatably journaled within a collar 50 formed on the wall 36 of the base 30. The outer end 52 of the spring 42 is secured to the housing 38 by a clip 54 having a hooked end 56 receiving the hooked end 52 of the spring. The clip 54 is suitably secured to the housing 38 and has an arm 58 overlying the end 52 of the spring to prevent accidental disengagement of the spring from the clip 54.

The winding mechanism for winding up the spring 42 includes a pinion 60 secured on a shaft 62 which is rotatably journaled in a bushing 64. The lower end of the bushing 64 is supported within an opening in the top wall 66 of the housing 38. The upper end 68 of the bushing 64 extends upwardly through the top wall 70 of a cover 72 which is suitably secured to the housing 38 with the top wall 70 of the cover spaced from the top wall 66 of the housing 38. The pinion 60 is meshed with a gear 74 secured on a hub or drive member 76. The hub 76 is provided with a pair of flats 78 engaging within a correspondingly shaped hole in the gear 74 so as to be rotatable with the gear. The drive hub 76 is rotatably journaled on a bushing 80 having a collar 82 seated against the upper surface 66 of housing 38. The sleeve 48 is freely rotatable on the drive hub 76.

A hinge member 84 is rotatable on the upper end 68 of the bushing 64 and is secured to the pinion shaft 62 by a screw 86. A crank lever 88 is hingedly connected to the hinge member 84 by rivets 90 and is provided with a knob 92 at its outer end. The crank lever may be rotated manually to rotate the gear 74 and drive hub 76 through the pinion 60. The crank lever 88 may be folded over about the hinge pins 90 into the dotted-line position shown in FIG. 1.

The lower end of the sleeve 48 is provided interiorly thereof with a series of longitudinal grooves 100 and the lower end of the drive hub 76 is provided with a comparable number of downwardly opening slots 102. A key 104 is provided with a series of splines 106 engaging within the slots 102 in the hub 76. The key 104 is secured on a squared portion 108 of a shaft 110 extending through and slidable axially within the hub 76 and the bushing 80. The shaft 110 is provided with an enlarged shoulder 112 at its lower end for retaining the key 104 thereon. A spring 114 surrounds the shaft 110 and reacts between the hub 76 and the key 104 to urge the shaft 110 and the key carried thereby downwardly to the position shown in FIG. 1 in which the key 104 engages within the slots 102 in the hub 76 and also within the grooves 100 in the sleeve 48. The key 104 provides a driving connection between the hub 76 and the sleeve 48 so that upon rotation of the gear 74 by means of the crank handle 88 the sleeve 48 will be rotated with the hub 76 to wind up the spring and store up energy therein.

A pawl **120** confined between a pair of washers **122** is rotatable on the lower end of the bushing **64** and is engaged with the teeth of the gear **74** as shown in FIG. 7. A spring **124** is secured by rivets **126** to the side wall of the housing **38** and has its free end **128** engaging the pawl **120** to urge the latter into engagement with the gear **74**. The pinion **60** is rotated in a clockwise direction by the crank handle **88**, thus rotating the gear **74** in a counterclockwise direction. The pawl **120** prevents reverse rotation of the gear **74** and thereby prevents rotation of the drive hub **76** and the pinion **60** and crank handle **88** except in a direction to wind up the spring. After spring **124** has been wound up in the manner described, the crank handle may be released and the spring will remain wound because the sleeve **48** is held against rotation by the key **104**, the hub **76** and gear **74** being held by the pawl **120** at such time.

A release lever **130** having a handle **132** is provided for releasing the key **104** from engagement with the sleeve **48** when it is desired to start the engine. The release lever **130** is generally circular as shown in FIGS. 2 and 3 and engages the top wall **66** of the housing **38**. The release lever **130** is rotatably journaled on the shaft **110** and is confined beneath the head **134** of the shaft **110**. The release lever **130** and the top wall **66** of the housing **38** are provided with complementary cam surfaces for elevating the shaft **110** and the key **104** upon rotation of the release lever. The top wall of the housing **38** is provided with three inclined grooves or ramps **136** and the lever **130** is provided with three similarly shaped ramps **138**. The ramps **136** and **138** on the housing and release lever are more clearly illustrated in FIGS. 3, 4 and 5, which show the release lever in its released or elevated position relative to the housing **38**. The release lever is turned to the position shown in solid lines in FIG. 2 when the spring is to be wound up and the key **104** will then be in the position shown in FIG. 1 in which it provides a driving connection between the hub **76** and the sleeve **48**. When the engine is to be started, the release lever **130** is turned clockwise to the position shown in FIG. 3 and in dotted lines in FIG. 2. The camming action of the ramps **136** and **138** will raise the lever and the shaft **110** and key **104** carried thereby to raise the key out of engagement with the grooves **100** in the sleeve **48**, thereby allowing the spring to unwind as the sleeve **48** rotates about the hub **76**.

The sleeve **48** is provided with a series of teeth **140** on its outer surface. The starter cup **16** carries three pawls or blades **142** engageable with the teeth **140** on the sleeve **48** for cranking the engine when the spring is released. Each of the blades **142** is provided with a slot **144** at its outer end defining a pair of ears **146** extending through notches **148** in the cup **16**. The blades extend inwardly into engagement with the teeth **140** and are pivoted for swinging movement into and out of engagement with the teeth **140**. The blades **142** are urged into engagement with the teeth **140** on the sleeve **48** by springs **150**. The spring **150** has one end **152** engaging the outer surface of the cup **16** and its other end **154** extending through an opening **156** in the cup **16** defined by a lug **158** struck out from the peripheral wall of the cup **16**. The intermediate portion **160** of the spring **150** is received within an enlarged portion **162** of the slot **144** in the blade **142** and the springs are formed so as to normally urge the blades into engagement with the teeth **140**. It will be seen that upon release of the spring **42** in the manner previously described the stored up energy of the spring will drive the starter cup **16** and the engine crankshaft in a clockwise direction through the engagement of the teeth **140** on the sleeve **48** with the blades **142** carried by the starter cup. As soon as the engine starts and picks up speed, the centrifugal force resulting therefrom will cause the inner ends of the blades **142** to swing outwardly out of engagement with the teeth **140** and the sleeve **48** and all other parts of the starting mechanism will be completely disengaged from the starter cup **16** or any other part of the engine while the engine is running. When the engine stops, the springs **150** will return the blades **142** to engagement with the teeth on the sleeve **48**. As the spring **42** is being wound up, the sleeve **48** turns in a counterclockwise direction and the teeth **140** will slide past the ends of the blades **142** during the winding operation.

A spring **170** has one end **172** secured to the release lever **130** by a tang **174** struck from the body of the lever **130** and by means of which the spring is clamped to the lever **130**. The other end **176** of the spring **170** engages the bushing **64**. The spring **170** is stressed so that it tends to hold the release lever **130** in its released position after the spring **42** has been unwound and the engine started. By reason of this construction there is no possibility of a drive being transmitted from the sleeve **48** back through the hub **76** and the gear reduction to the crank handle **88**. When the engine comes to a stop, the blades **142** will engage the sleeve **48** and, even though the crankshaft may turn a few degrees in the opposite direction as the engine finally stops, this driving force imparted to the sleeve **48** cannot be transmitted back to the crank handle.

When the engine is to be started, the handle **132** of the release lever is swung in a counterclockwise direction through the slot **180** in cover **72** back to the position shown in FIG. 2, which will drop the shaft **110** and key **104** downwardly until the key engages within the slots **100** in the sleeve **48**. The gear reduction provided by the pinion **60** and gear **74** enables the spring **42** to be wound up with very little effort and enables the use of a power spring which is sufficiently strong to insure instant starting of the engine.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification, and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A starter for an internal combustion engine, comprising a starter casing, a drive hub rotatably journaled in said casing, means for rotating said hub, a sleeve rotatable on said hub, a spiral spring having one end secured to said sleeve and its other end secured to said casing, a shaft slidable axially within said hub and rotatable therewith, a key on said shaft engageable with said sleeve in one axial position of said shaft for rotating said sleeve with said hub to wind up said spring, a pawl for preventing reverse rotation of said hub, a release lever rotatable against a part of said casing and engaging said shaft, cam means on said release lever and casing operable upon rotation of said lever for shifting the same and said shaft axially to disengage said key from said sleeve to permit rotation of said sleeve on said hub and unwinding of the spring, a starter cup secured to the engine crankshaft, and a pawl carried by said cup and engaging said sleeve whereby unwinding of said spring will rotate said cup to crank the engine, said pawl being movable out of engagement with said sleeve in response to centrifugal force upon starting of the engine.

2. A starter for an internal combustion engine, comprising a starter casing, a gear rotatably journaled in said casing, a crank lever and a pinion thereon for rotating said gear, a drive hub rotatable with said gear, a sleeve rotatably mounted in said casing, a spring having one end secured to said sleeve and its other end secured to said casing, a key rotatable with said hub and engageable with said sleeve for rotating said sleeve with said hub to wind up said spring, a pawl for preventing reverse rotation of said hub, a release lever rotatable against a part of said casing and engaging said shaft, cam means on said release lever and casing operable upon rotation of said lever for

shifting the same and said shaft axially to disengage said key from said sleeve to permit unwinding of the spring, a starter cup secured to the engine crankshaft, said sleeve having axially extending teeth on its outer surface and extending into said starter cup, and a pawl carried by said cup and engaging said teeth on said sleeve whereby unwinding of said spring will rotate said cup to crank the engine, said pawl being movable out of engagement with said sleeve in response to centrifugal force upon starting of the engine.

3. A starter for an internal combustion engine having a part rotatable with the crankshaft of the engine, comprising a starter casing, a gear rotatably journaled in said casing, a pinion meshed with said gear, a crank lever for rotating said gear through said pinion, a drive hub rotatable with said gear, a sleeve rotatable on said hub, a spiral spring having one end secured to said sleeve and its other end secured to said casing, a shaft slidable axially within said hub and rotatable therewith, a key on said shaft engageable with said sleeve in one axial position of said shaft for rotating said sleeve with said hub to wind up said spring, a pawl for preventing reverse rotation of said hub, a release lever rotatable against a part of said casing and engaging said shaft, cam means on said release lever and casing operable upon rotation of said lever for shifting the same and said shaft axially to disengage said key from said sleeve to permit unwinding of the spring, a starter cup secured to the rotatable engine part, said sleeve having axially extending teeth on its outer surface and extending into said starter cup, and a pawl carried by said cup and engaging said teeth on said sleeve whereby unwinding of said spring will rotate said cup to crank the engine, said pawl being movable out

of engagement with said sleeve in response to centrifugal force upon starting of the engine.

4. A starter for an internal combustion engine, comprising a starter casing, a gear rotatably journaled in said casing, a pinion meshed with said gear, a crank lever for rotating said gear through said pinion, a drive hub rotatable with said gear, a sleeve rotatable on said hub, a spiral spring having one end secured to said sleeve and its other end secured to said casing, a key slidable axially within said hub and rotatable therewith, said key engaging with said sleeve in one axial position thereof for rotating said sleeve with said hub to wind up said spring, a pawl for preventing reverse rotation of said hub, a rotatable release lever engaging said key, cam means on said release lever and casing operable upon rotation of said lever to one position for shifting the same and said key axially to disengage said key from said sleeve to permit unwinding of the spring, a part rotatable with the engine crankshaft, and a pawl carried by said rotatable engine part and engaging said sleeve whereby unwinding of said spring will rotate said part to crank the engine, said pawl being movable out of engagement with said sleeve in response to centrifugal force upon starting of the engine.

5. A starter according to claim 4 including a spring urging said release lever toward said one position.

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