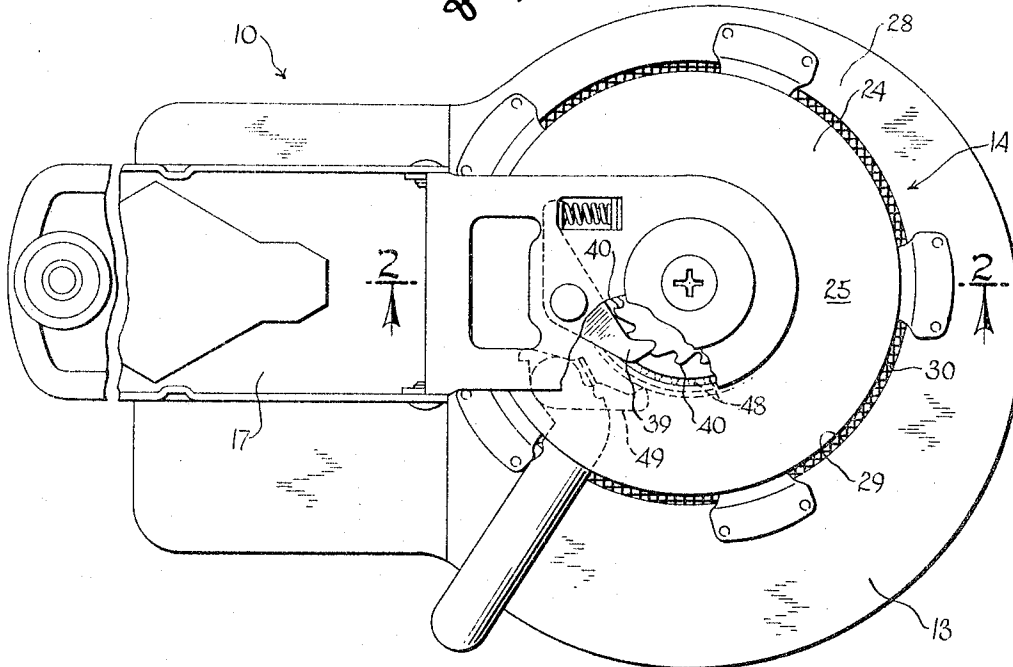
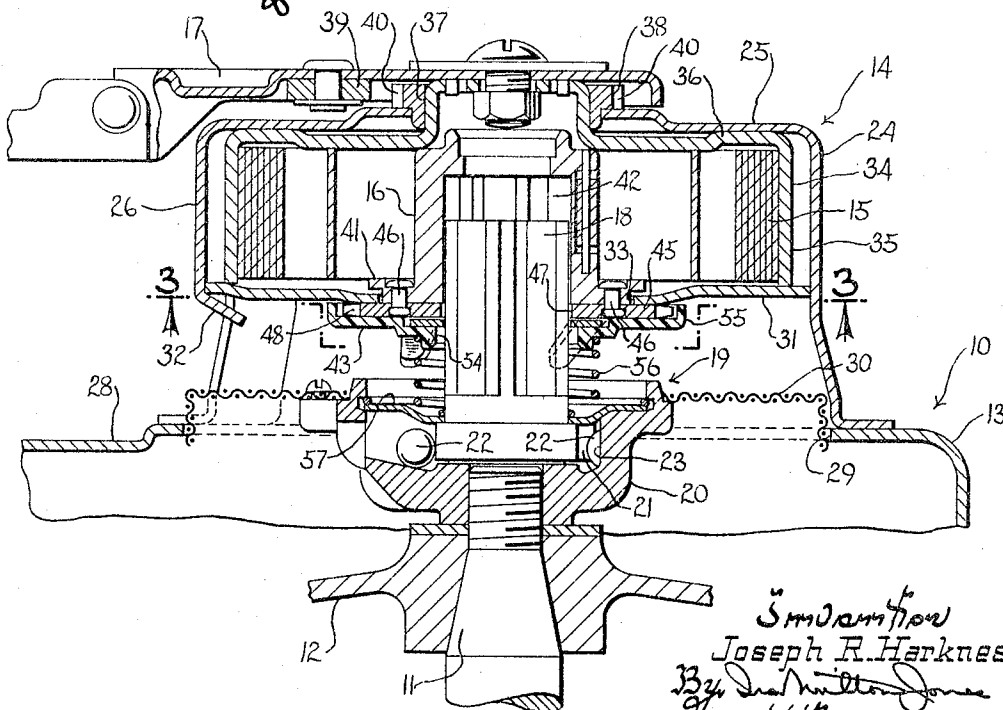


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3 Sheets-Sheet 1




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3,270,732

SPRING STARTER FOR INTERNAL COMBUSTION ENGINE

Filed Aug. 12, 1964

3 Sheets-Sheet 2

Fig. 3.

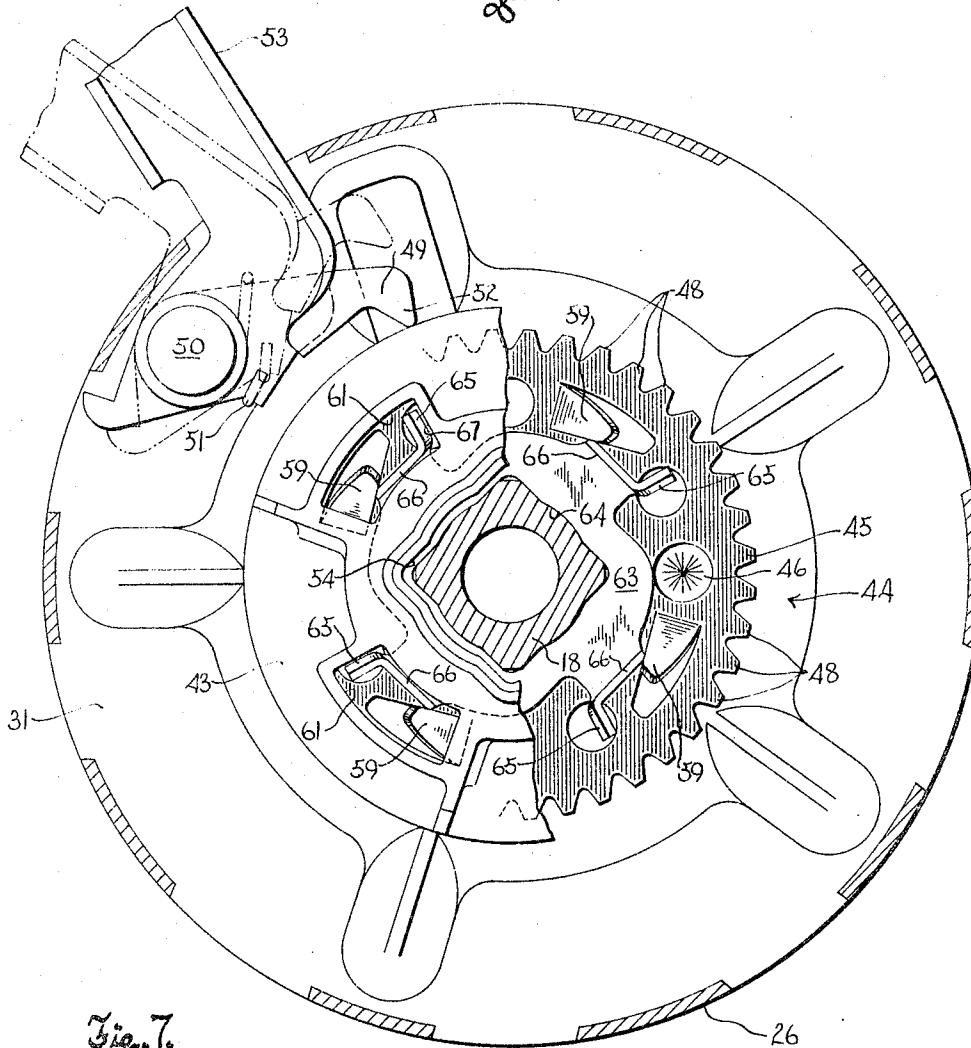
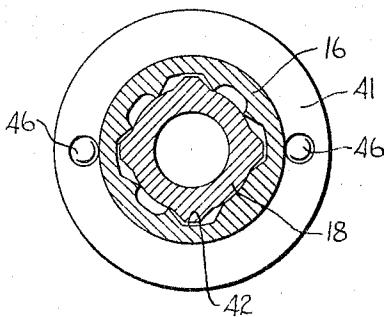


Fig. 7.



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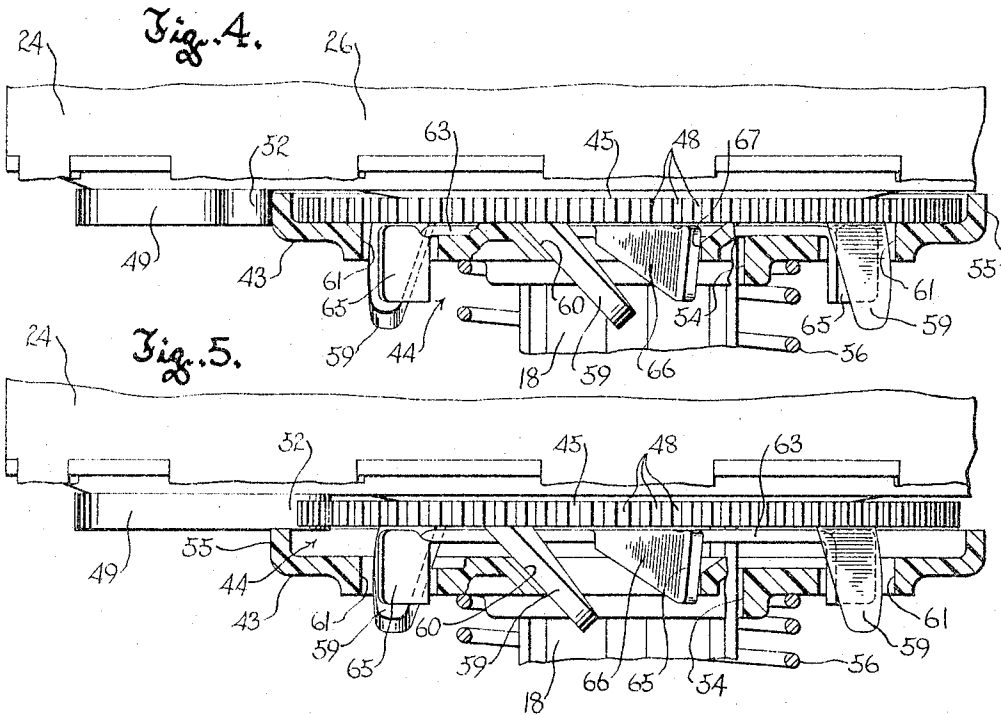
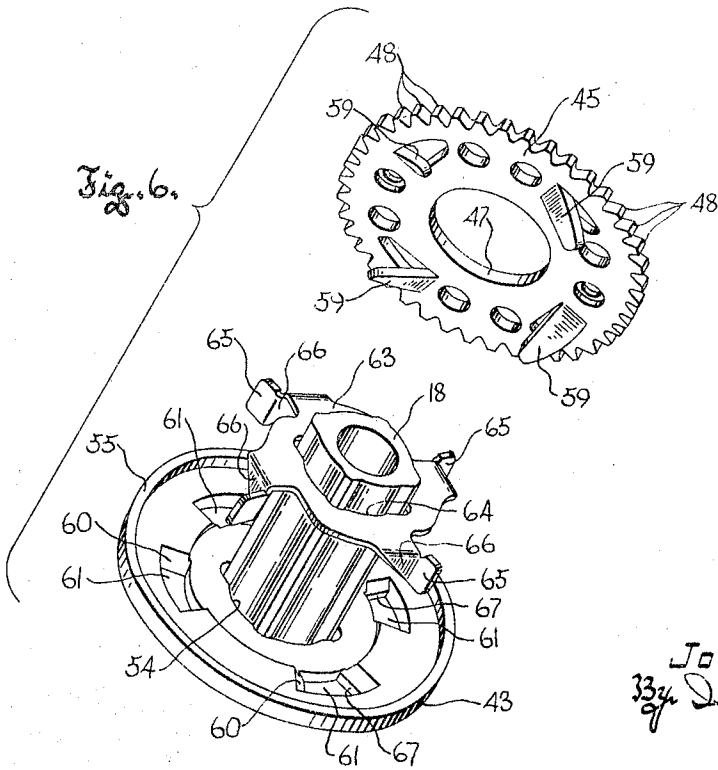
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SPRING STARTER FOR INTERNAL COMBUSTION ENGINE

Filed Aug. 12, 1964

3 Sheets-Sheet 3



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3,270,732

SPRING STARTER FOR INTERNAL COMBUSTION ENGINE

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Filed Aug. 12, 1964, Ser. No. 389,025

6 Claims. (Cl. 123—179)

This invention relates to starters for internal combustion engines, and has more particular reference to engine starters of the spring windup type such as disclosed in the copending application of Ib H. Svendsen, Serial No. 341,828, filed January 22, 1964, now Patent No. 3,165,100 of January 12, 1965.

Like that copending application, the present invention also concerns an engine starter wherein the released energy of a wound up spring imparts starting torque to the crankshaft of the engine through a drive train including a rotatable torque applying member or hub, to which one end of the spring is attached and which therefore must be held against rotation while the spring is wound up, and the rotatable driver of a unidirectional overrunning clutch having its driven element connected to the crankshaft of the engine.

The purposes of this invention are generally the same as those of the aforesaid copending application of Ib H. Svendsen, now Patent No. 3,165,100 of January 12, 1965. Briefly stated, the main objectives consist in the provision of an engine starter with manually releasable means for holding the torque applying member while the starter spring is wound up, which holding means cannot be activated while the engine is running but is automatically rendered operative to hold the torque applying member when the operator begins to wind up the starter spring; and featuring means to effect shock free engagement of the overrunning clutch, before the starter spring is wound up.

The attainment of these objectives depends in part upon the provision of a lost motion but positive torque transmitting connection between the rotatable torque applying member or hub and the driver of the unidirectional clutch, and in part, upon an impositive torque transmitting connection between these same parts through which the clutch is engaged as a consequence of a slight degree of rotary movement that is imparted to the torque applying member by the starter spring as winding thereof is commenced. This impositive torque transmitting connection comprises cooperating cam means on parts of the starter mechanism that are respectively drivingly connected with the torque applying member and with the driver. The cam means operates to impositively transmit initial rotary motion of the torque applying member by the starter spring to the clutch driver to rotate the latter into engagement with the driven element of the clutch. Thereafter, during a further slight degree of rotary motion of the torque applying member by the starter spring, the load of the engine on the driver of the then engaged clutch in effect disables the impositive torque transmitting connection between the torque applying member and the driver, and the cam means functions to render the holding means operative to prevent further rotation of the torque applying member by the starter spring.

In the starter mechanism described, torque is impositively transmitted to the driving element of the clutch to engage the clutch through the cooperation between cams on the torque applying member or hub, and cooperating cam follower means on a lockout member that normally maintains the holding means inoperative. This lockout member is yieldingly biased to a normal or operative position locking out the holding means for the torque applying member. It is cammed to an inoperative posi-

2

tion in consequence of a substantially slight degree of rotary motion of the torque applying member relative to the clutch driver, after the clutch has been engaged in the manner outlined, to enable the holding means to become effective in preventing further rotation of the torque applying member by the starter spring, so that the spring can then be wound up.

The starter of the aforesaid copending application of Ib H. Svendsen, now U.S. Patent No. 3,165,100 of Jan. 12, 1965, is characterized by a close sliding spline connection between the lockout member and the clutch driver, which connection enables clutch engaging rotary movement to be impositively transmitted to the driver from the torque applying member, through the cooperating cam means on it and the lockout member, during initial rotary movement of the torque applying member by the starter spring. This spline connection, of course, permits the lockout member to be axially cammed out of its operative position by slight rotary movement of the torque applying member as soon as the clutch is engaged and the load of the engine is imposed upon the clutch driver to inhibit free rotation thereof. Obviously, unless the lockout member is able to freely slide axially to its inoperative position with respect to the holding means, the latter cannot operate to hold the torque applying member or hub against rotation with the starter spring, and the spring cannot be wound up.

It has now been found that dirt and other foreign matter that tends to collect on the exterior of the clutch driver frequently interfered with sliding of the lockout member to its inoperative position, thus making it impossible to wind up the starter spring. Such malfunctioning was especially prevalent in instances where the starter mechanisms were installed on vertical shaft air cooled engines of the type used to power lawn mowers, and having an impeller to induce a flow of cooling air over the hot parts of the engine. The impellers of such engines draw air inwardly over a shroud or blower housing upon which the starter mechanism is mounted, so that dust, dirt and/or grass clippings which are entrained in the cooling air stream tends to impinge the clutch driver before the air is sucked downwardly through a screened opening in the shroud for passage over the hot parts of the engine.

Even small accumulations of dirt or other foreign matter on the exterior of the clutch driver is thus apt to foul its splined connection with the lockout member, and create resistance to sliding of the lockout member along the driver to its inoperative position under the action of the cooperating cam means on it and on the torque applying member. Moreover, whenever there is even a slight resistance to such sliding movement of the lockout member to its inoperative position, the cooperating cam means on it and the torque applying member function to apply torsional forces to the lockout member that result in greater resistance to its sliding motion, and cause it to firmly seize upon the exterior of the clutch driver.

Accordingly, it is the primary object of this invention to provide a starter mechanism of the character described, wherein the problem of malfunctioning of the lockout member is effectively overcome.

More specifically, it is an object of this invention to provide a spring windup starter of the character described wherein the lockout member very loosely encircles the clutch driver to assure freedom of sliding movement thereof along the clutch driver despite accumulations of dirt and other foreign matter on its exterior, and which starter incorporates a drive plate that is drivingly interconnected between the lockout member and the clutch driver to transmit torque thereto from the lockout member when winding of the starter spring is commenced.

Another object of this invention is to provide a starter of the character described, wherein the drive plate has a substantially close fitting spline connection with the clutch driver and need not slide axially thereof, and wherein cooperating means on the drive plate and the lockout member not only serve to transmit torque from the latter to the clutch driver in the direction to engage the clutch, but also serve to hold the lockout member in substantially concentric relation to the driver without interfering with axial sliding motion of the lockout member between its operative and inoperative positions.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a plan view of a vertical shaft internal combustion engine equipped with the starter of this invention;

FIGURE 2 is a sectional view taken through FIGURE 1 on the plane of the line 2—2;

FIGURE 3 is a cross sectional view taken through FIGURE 2 along the line 3—3, but at an enlarged scale;

FIGURES 4 and 5 are fragmentary elevational views, at an enlarged scale, showing how the lockout member is cammed to its inoperative position;

FIGURE 6 is a group perspective view showing the elements of the starter which effect engagement of the overrunning clutch and movement of the lockout member to its inoperative position before the starter spring can be wound up; and

FIGURE 7 is a detail cross sectional view illustrating the lost motion but positive driving connection between the torque applying member or hub and the driving element of the clutch.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts throughout the several views, the numeral 10 designates generally a vertical shaft single cylinder internal combustion engine of the type now widely used to power rotary lawn mowers. The crankshaft 11 of the engine has a combined flywheel and air impeller 12 mounted on its upper end portion, only the hub portion of said flywheel being illustrated in FIGURE 2 of the drawings.

As is customary, a shroud or blower housing 13 is mounted on the engine to enclose the combined flywheel and air impeller and to direct a flow of cooling air induced by the impeller downwardly over the hot parts of the engine.

The starter 14 of this invention is mounted on the top of the shroud or blower housing 13 and includes a ribbon type spirally coiled torsion spring 15, the inner end of which is drivingly connected to a hub or torque applying member 16 which must be held against rotation while the spring is being wound up. The outer end of the spring is connected with a handle 17 by which the spring can be wound up.

The released energy of the wound up spring imparts engine starting torque to the crankshaft through a drive train that comprises the hub or torque applying member 16, the driver 18 of a unidirectional overrunning clutch generally designated 19, and the driven element 20 of the clutch which is fixed to the upper end of the crankshaft 11 outwardly of the flywheel impeller thereon.

The unidirectional clutch 19 may be of the type forming the subject matter of the Svendsen Patent No. 3,040,853, issued June 26, 1962, and engagement of which re-

quires a small amount of rotation of the driver 18 relative to the driven element 20. The clutch is engaged when a lobe 21 on the driver wedgingly engages one of a number of balls 22 against a cam surface 23 on the driven element of the clutch, to enable rotation to be transmitted from the driver to the driven element in one direction only. After the engine is started and the crankshaft rotates under its own power, the driven element of the clutch overruns the driver and centrifugal force throws the balls 22 outwardly away from the lobe on the driver to thus disconnect the driver from the driven element.

As will be explained later, rotation is imparted to the driver of the unidirectional clutch to engage the clutch in an exceptionally gentle fashion, entirely without shock and before the starter spring is wound up, and the clutch is held engaged right up until the time the energy of the wound up starter spring is released and actual cranking of the engine begins.

The starter spring and hub are contained within a stamped sheet metal starter housing 24 having a substantially flat top wall 25 and a depending cylindrical side wall 26 encircling the spring.

Downwardly extending legs formed on the cylindrical side wall have their lower ends fixed to the top wall 28 of the shroud to mount the starter housing thereon in spaced relation to its top wall and coaxially of the engine crankshaft. The starter housing is thus centered over a substantially large air inlet opening 29 in the shroud, through which cooling air is drawn into the shroud by the flywheel impeller 12. The opening 29, of course, is concentric with the crankshaft and it is fitted with a screen 30 to exclude grass clippings and other foreign matter from the interior of the shroud.

The starter housing is closed at its under side by a substantially flat bottom wall 31 which is held against the lower edges of the cylindrical side wall 26 of the housing by tangs 32 thereon, bent inwardly under the flat bottom wall 31. The bottom wall 31 has a central hole 33 therein, through which the clutch driver 18 projects to the interior of the housing for cooperation with the hub or torque applying member 16.

The starter spring 15 is mounted within an inverted cup-shaped spring cage 34, which has a cylindrical side wall 35 to which the outer convolution of the spring is fastened in a conventional fashion. At its central portion, the top wall 36 of the cage is formed to provide an upwardly projecting cylindrical boss 37 which is journaled in a bearing 38 carried by the top wall 25 of the starter housing. The boss 37 provides for attachment of the handle 17 to the spring cage and hence to the outer end of the starter spring, and for this purpose the handle has its inner portion fixedly connected to the bottom of the boss in any suitable manner.

The handle, which is of the type now in widespread use on spring starters of this nature, has hingedly connected inner and outer sections which may be folded upon one another when not in use, and unfolded or extended to provide an elongated lever when it is desired to wind up the starter spring 15. The handle, of course, must be held against retrograde rotation as the spring is wound up, and for this purpose a pawl 39 is mounted on the underside of the inner section of the handle for cooperation with ratchet teeth 40 on the exterior of the bearing 38, the pawl being biased toward meshing engagement with the ratchet teeth.

The hub or torque applying member 16, to which the inner end of the spring is connected, is of hollow construction. It projects downwardly through the hole 33 in the bottom wall of the starter housing to receive the driver 18 of the unidirectional clutch, as seen best in FIGURE 2. The upper end of the hub bears against the top wall 36 of the spring cage, and a flange 41 thereon encircling its lower end portion overlies the bottom wall 31 of the starter housing adjacent to the edge of the

hole therein to prevent downward displacement of the hub from the spring cage.

As in the aforesaid compending application of Ib H. Svendsen, now Patent No. 3,165,100 of January 12, 1965, the hub or torque applying member 16 has a lost motion but positive torque transmitting connection with the driver 18 of the unidirectional clutch.

For this purpose the driver has a generally square cross-sectional shape, as seen best in FIGURE 7, and the hole 42 in the hub in which the driver is received has a similar cross-sectional shape, although the corner portions of the hole are angularly wider than the projecting corners on the driving element so as to limit relative rotation between the hub and the driver to an angle of approximately 18°.

In the normal condition of the starter, with the engine at rest, the driver 18 is drivingly disconnected from the driven element 20 of the clutch 19, and the driver occupies a position at which its corner portions are in non-driving relation to the wider corner portions of the hole in the hub, as indicated in FIGURE 7. Consequently the hub alone can be rotated slightly in the clockwise direction as viewed in FIGURE 7 by the starter spring as an operator begins to wind up the spring, provided that the hub is not held against rotation at this time. In the present invention, this slight but free rotation of the hub by the starter spring as the operator begins to wind the same is relied upon to, first, impositively transmit rotation to the driver of the clutch in the direction to engage the latter, but without taking up the lost motion in the driving connection between the hub and the driver, and secondly, to impart axial sliding movement to a lockout member 43 to move the same to an inoperative position permitting a hub holding device 44 to become operative in holding the hub or torque applying member to thus enable the starter spring to be wound up.

The hub holding device comprises a ratchet disc 45 which is flatwise secured to the bottom of the hub or torque applying member as by rivets 46 which pass through the disc and the circumferential flange 41 on the lower end portion of the hub. This disc has a central hole 47 through which the clutch driver 18 projects, and it has circumferentially equi-spaced ratchet teeth 48 on its periphery. The ratchet teeth are adapted to be engaged by a pawl 49 to hold the ratchet disc and hence the hub or torque applying member against rotation.

The pawl 49 is pivotally mounted on a stud 50 fixed in the bottom wall 31 of the starter housing, and it is yielding biased by a torsion spring 51 in the direction to meshingly engage a dog 52 thereon with the ratchet teeth. The same spring also exerts yielding bias on a release lever or handle 53 which is mounted on the stud 50 to provide for disengagement of the pawl from the ratchet teeth when the handle is manually moved from a normal position to the release position seen in broken lines in FIGURE 3.

The ratchet disc 45 is slightly larger in diameter than the flange 41 on the lower end portion of the hub or torque applying member, and it is disposed directly beneath the bottom wall 31 of the starter housing.

The lockout member 43 is generally in the nature of a disc having a central hole 54 by which the disc is quite loosely mounted on the driver 18 of the unidirectional clutch. Although, the hole 54 has the same substantially square shape as the driver it is substantially larger than it. Hence the disc may shift radially relative to the clutch driver with the result that it slides freely axially of the driver despite the presence of an accumulation of dirt or other foreign matter that may collect upon its exterior. At its periphery, the lockout disc is provided with a cylindrical rim 55 which projects upwardly and covers the teeth 48 on the ratchet disc when the lockout member is in its normal or operative position to which it is yieldingly biased by a coiled expansion spring 56.

This spring encircles the driver and is expansively confined between the underside of the lockout disc and a cover 57 on the clutch.

In its operative or normal position, the lockout member seats more or less flatwise against the underside of the ratchet disc 45, and its rim 55 covers the ratchet teeth and is interposed between them and the pawl 49 to prevent the dog 52 on the latter from meshing engagement with the ratchet teeth. Hence, in the normal or at-rest position of the starter, the dog 52 is yieldingly urged against the exterior of the cylindrical rim 55 on the lockout member as indicated in FIGURES 3 and 4.

As mentioned previously, the hub or torque applying member 16 has a lost motion but positive torque transmitting connection with the driver 18 of the unidirectional clutch. It is one of the features of this invention that the hub or torque applying member 16 also has an impositive torque transmitting connection with the clutch driver 18, the purpose of which is to enable the driver to be rotated into driving relation with the driven element of the clutch before the actual winding up operation of the spring is commenced.

This impositive torque transmitting connection between the hub or torque applying member 16 and the driver 18 of the clutch is provided by cooperating cam means on the hub and the lockout member, comprising cam lugs 59 on the ratchet disc struck downwardly out of the plane thereof at substantially circumferentially equispaced locations and radially equidistant from its center, and cam follower means or surface 60 on the lockout disc with which the cam lugs cooperate.

The cam follower surfaces 60 are formed at one arcuate end of each of a number of circumferential slots or apertures 61 in the lockout disc, through which the cam lugs 59 project. The lugs 59 and the surfaces 60 with which they engage slope downwardly in the counter clockwise direction as viewed from the top of the starter. Consequently, rotation of the ratchet disc in the clockwise direction, while the lockout member is held against rotation, effects downward axial camming of the lockout member to its inoperative position at which the pawl of the holding device can engage the ratchet teeth and hold the hub or torque applying member against rotation while the starter spring is wound up.

This cam connection between the hub or torque applying member and the lockout disc is also relied upon at the very start of the spring windup operation, while the holding device is maintained inoperative by the lockout member, to translate initial free rotation of the hub or torque applying member by the starter spring into the slight amount of rotary motion of the clutch driver necessary to drivingly engage it with its cooperating driven element, so that the clutch will be engaged before actual winding of the starter spring commences. This desirable result is achieved by reason of the fact that the cam lugs 59 on the ratchet disc normally engage the cam follower surfaces 60 on the lockout member under the yielding bias of the spring 56, so that initial rotation of the hub by the starter spring is translated into rotation of the lockout member 43 in the clockwise direction, as viewed from above, as long as there is no restraint against substantially free rotation of the lockout member.

In accordance with this invention, such rotation of the lockout member through its cam connection with the hub or torque applying member is in turn transmitted to the clutch driver 18 by means of a drive plate 63 on the driver. The drive plate has a substantially square hole 64 in its center to substantially snugly fit the more or less square clutch driver 18, so that the drive plate may be said to be closely splined to the latter. The plate 63 is flatwise confined between the lockout disc and the underside of the ratchet disc, as seen best in FIGURES 4 and 5.

While the drive plate is drivingly connected to the clutch driver 18 by its splined connection therewith, it is

connected to the lockout member or disc 43 by means of a series of drive abutments 65 thereon, one for each slot or aperture 61 in the lockout disc and projecting downwardly through the slot or aperture in confronting relation to the edge thereof at the arcuate end of the slot opposite the cam follower surface 60 thereof. Consequently, when the lockout disc is rotated in the clockwise direction as viewed from above, it causes the drive plate to rotate with it and to thus impart clockwise rotary movement to the driving element 18 of the unidirectional clutch in the direction to engage it with its driven element 20.

Once the clutch is engaged, however, torque can no longer be transmitted to the clutch driver from the torque applying member through the impositive rotation transmitting connection afforded by the cooperating cam means on the ratchet disc and the lockout disc, and the cam means functions to propel the lockout disc axially in the direction to carry its rim away from the ratchet teeth. This allows the dog 52 on the holding device to meshingly engage the ratchet teeth to hold the hub or torque applying member from further rotation, and enable the spring of the starter to be wound up.

The drive abutments 65 on the drive plate are flat and lie substantially in planes that contain the axis of the clutch driver. They are bent outwardly away from the peripheral portion of the driver from downwardly depending lugs 66 on the drive plate, which lugs are adapted to cooperate with the inner surfaces 67 of the slots or apertures 61 in the lockout disc to hold the latter substantially concentric with the driver.

The drive abutments 65 are made long enough axially of the driver as to permit the lockout disc to slide axially to its inoperative position without becoming drivingly disconnected from the drive plate, or more particularly without danger of withdrawal of the lugs and drive abutments from the slots or apertures 61 in the lockout member. Although the degree of relative rotation between the ratchet disc 45 and the lockout disc 43 required to cam the latter to its inoperative position is safely less than that which would carry these parts out of cooperative relationship, to guard against this taking place accidentally, and also to facilitate assembly, the hole 54 in the lockout disc has the non-circular shape described. This limits relative rotation between the lockout disc 43 and the driver 18, and in so doing keeps the lockout disc from being accidentally rotated too far.

In the operation of the starter, if it is assumed that the hub or torque applying member 16 and the clutch driver 18 are in their relative angular positions seen in FIGURE 7, and that the lockout member or disc 43 is in its operative position at which its rim covers the teeth of the ratchet disc 45, the operator starts the winding up operation of the starter spring by turning the handle in a clockwise direction as viewed in FIGURE 1. At the very start of such clockwise motion of the handle the spring imparts a small amount of rotation to the hub or torque applying member 16 in the clockwise direction, which motion is translated into clutch engaging rotary motion of the clutch driver 18 through the impositive torque transmitting connection afforded by the cooperating cam means on the ratchet and lockout disc. When the clutch is engaged the load of the engine is placed upon the clutch driver to resist further rotation of the lockout disc through its cam connection with the torque applying member 16 so that the cams 59 on the ratchet disc then become effective to cam the lockout disc axially downwardly to its inoperative position in consequence of a slight further degree of rotary motion of the hub by the starter spring, relative to the clutch driver, before all of the lost motion is taken up in the connection between the hub and the clutch driver. This is an important feature of the starter mechanism since if at the time the lockout member is cammed to its in-

operative position, the dog 52 on the pawl of the holding device should engage the end of one of the ratchet teeth, a slight further degree of rotation of the torque applying member relative to the clutch driver by the starter spring will carry the thus engaged ratchet tooth past the dog and allow it to snap into the adjacent tooth space.

It will thus be seen that at the very commencement of the spring windup operation, torque is impositively applied to the driver of the clutch to engage the clutch, the lockout member is then moved to its inoperative position at which the holding device becomes operative to prevent further rotation of the torque applying member or hub by the spring and the actual winding up of the spring can then begin. Thereafter, the clutch driver will remain in driving engagement with the driven element of the clutch, during the entire spring winding operation and until such time as the handle 53 is manually actuated to disengage the pawl from the ratchet teeth 40, and thus release the energy of the starter spring to make it available for cranking of the engine.

From the foregoing description, together with the accompanying drawings, it will be readily apparent that this invention solves the problem of malfunctioning of the starter mechanism described, through the provision of a lockout member that is quite loosely carried by the clutch driver so as to be free to slide axially thereof despite accumulations of dirt on the exterior of the driver, and by the provision of a drive plate that serves to transmit rotation to the driver from the lockout member and which does not need to slide axially along the driver.

What is claimed as my invention is:

1. In a spring starter for an internal combustion engine of the type wherein one end of a starter spring is attached to a rotatable torque applying member that must be held against rotation in one direction while the spring is wound up, and the released energy of the wound up spring imparts starting torque to the crankshaft of the engine through a drive train including said torque applying member and the rotatable driving element of a unidirectional clutch which has a driven element connected with the engine crankshaft, and wherein engagement of the clutch entails some rotation of its driving element in said direction relative to the driven element of the clutch, the improvement which comprises:

(A) holding means operable to prevent rotation of the torque applying member while the spring is wound up;

(B) lockout means for said holding means to normally maintain the latter inoperative, said lockout means comprising

(1) a lockout member which is loosely mounted on the driving element of the clutch for free axial sliding movement to and from an operative lockout position with respect to said holding means,

(2) and yieldable biasing means acting upon the lockout member to yieldingly hold it in its lockout position;

(C) means providing a lost motion but positive driving connection between the driving element of the clutch and the torque applying member by which the latter can be rotated in non-driving relation to the driving element a limited extent in said direction by the starter spring as winding thereof is commenced;

(D) and means defining an impositive torque transmitting connection between the driving element of the clutch and the torque applying member through which said non-driving rotation of the latter by the starter spring is translated into rotary movement of the driving element of the clutch to engage the clutch before the lost motion is taken up in the connection between the torque applying member and

the driving element of the clutch, said last named means including

(1) a drive plate connecting the lockout member in driving relation with the driving element of the clutch,

(2) and interengaging cam means on the torque applying member and the lockout member cooperating with said drive plate to translate said initial non-driving rotary movement of the torque applying member by the starter spring into clutch engaging rotary movement of the driving element of the clutch, said cam means being operable after such engagement of the clutch but before all of the lost motion is taken up in the driving connection between the torque applying member and the driving element of the clutch to move the lockout member to its inoperative position to thus render the holding means operative to prevent further rotary movement of the torque applying member by the starter spring while the latter is wound up.

2. The spring starter of claim 1, wherein said lockout member has a disc-like shape and has a central hole in which the driving element of the clutch is loosely received; wherein the drive plate has a splined driving connection with the driving element of the clutch, and is in juxtaposition to the lockout member; and wherein cooperating abutment means on the drive plate and the lockout member cooperate with said cam means to im-

positively translate said initial non-driving rotary movement of the torque applying member into clutch engaging rotary movement of the driving element of the clutch.

3. The spring starter of claim 2, wherein said abut-

lockout member, and a lug on the drive plate projecting through said aperture and cooperating with said one edge thereof.

4. The spring starter of claim 2, wherein said abutment means comprises a series of at least three circumferentially spaced apertures in the lockout member, grouped about its central hole and each having a first edge which faces in said direction, and a second edge which extends substantially circumferentially of the lockout member, and wherein the drive plate is provided with lugs which project through all of said apertures for cooperation with said first and second edges thereof to hold the lockout member substantially concentric with the driving element of the clutch.

5. The spring starter of claim 1, wherein said torque applying member encircles the driving element of the clutch and has a part adjacent to the lockout member; and wherein said drive plate is axially interposed between the lockout member and said part on the torque applying member and is splined to the driving element of the clutch.

6. The spring starter of claim 5, wherein said part on the torque applying member constitutes an element of said holding means and comprises a disc having spaced apart ratchet teeth on its periphery; and wherein the lockout member has a disc-like shape and is provided with a cylindrical rim that covers the drive plate and the toothed periphery of the ratchet disc in the operative lockout position of the lockout member.

No references cited.

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