Oct. 28, 1958 J. L. SKINNER 2,857,984

ENGINE STARTER

Filed March 18, 1957

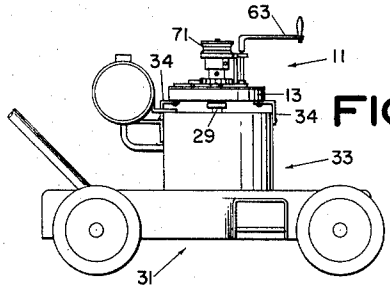


FIG. 1

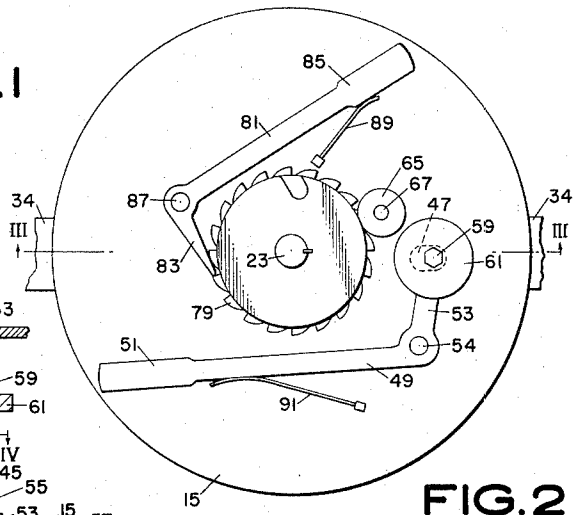


FIG. 2

FIG. 3

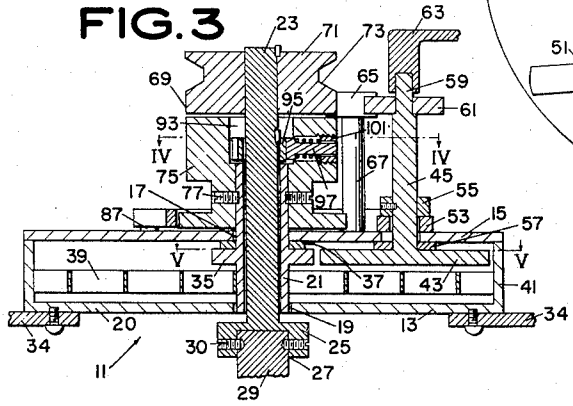
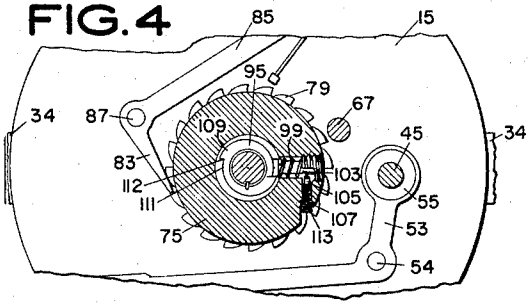


FIG. 4



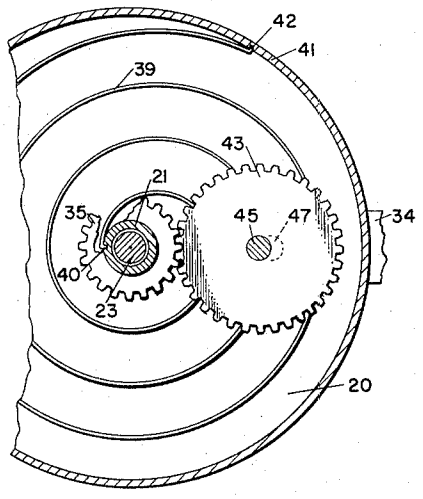


FIG. 5

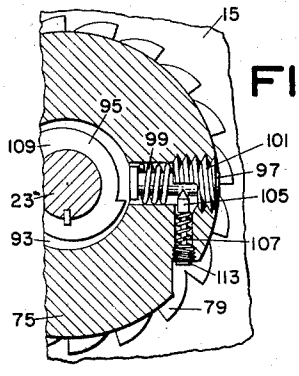


FIG. 7

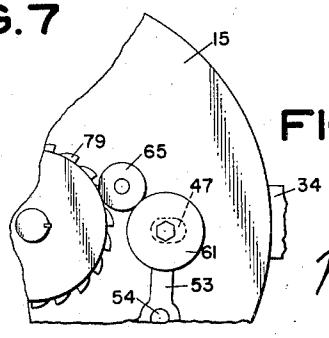


FIG. 6

INVENTOR,
James L. Skinner

BY
Weatherford & Weatherford
Attys

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ENGINE STARTER

James L. Skinner, Memphis, Tenn.

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5 Claims. (Cl. 185—41)

This invention relates to a spring powered engine starter, particularly adapted to be employed in conjunction with small gasoline motors.

The starter of the present invention makes engine starting a much easier procedure by providing a means wherein energy may be stored and then released when desired by a simple manipulation of a lever. Thus, my invention offers a welcome replacement for the well-known and laborious method of starting a gasoline engine with the quick pull of a rope. This well-known prior method generally requires several attempts before the engine starts, frequently causing the operator to become exasperated, whereas in the present invention the engine may be quickly started without effort.

The principal object of my invention is to provide a spring powered engine starter including means for easily and conveniently storing energy and means for releasing that energy to give a sudden spin to the engine in order to start same.

A further object is to provide means for using the power of the engine after started to wind the spring of the energy storing means so that the starter is ready for subsequent use.

A further object is to provide in such a spring powered engine starter, means for automatically disengaging the source of energy from the engine motor after the motor starts.

A further object is to provide spring means, winding means, shift means for engaging and disengaging said winding means and said spring means, releasing means for said spring means, and clutch means which couples said spring means to the motor while being started and which automatically uncouples said spring means from said motor after being started.

A further object is generally to improve the design, construction and efficiency of engine starters.

The means by which the foregoing and other objects of the present invention are accomplished and the manner of their accomplishment will be readily understood from the following specification upon reference to the accompanying drawings, in which:

Fig. 1 is a side elevational view on a reduced scale of a lawnmower with the starter of the present invention employed in conjunction therewith.

Fig. 2 is a top plan view of the starter per se with the winding crank removed and with the winding unit being shown in disengaged disposition.

Fig. 3 is a fragmentary sectional view taken as on the line III—III of Fig. 2, with the winding crank being shown in place.

Fig. 4 is a fragmentary sectional view taken as on the line IV—IV of Fig. 3.

Fig. 5 is a fragmentary sectional view taken as on the line V—V of Fig. 3 with the winding unit being shown in engaged winding disposition.

Fig. 6 is a fragmentary top plan view of the starter showing the disposition of the upper portion of the winding unit when in the engaged winding disposition as of Fig. 5.

Fig. 7 is a fragmentary view on a further enlarged scale, as on the line IV—IV of Fig. 3, illustrating details of the clutch means, shown latched in retracted position of disengagement.

Referring now to the drawings in which the various parts are indicated by numerals, engine starter **11** includes a cylindrical casing **13** having a top **15**, which may be removable. A pair of alined circular openings **17, 19** are respectively provided centrally of top **15** and bottom **20** of casing **13**. A sleeve **21** is journalled in and extends through openings **17, 19** and projects substantially above top **15**, terminating at its lower end substantially at the level of bottom **20**.

An elongated adapter shaft **23** rotatably extends through inner sleeve **21**. The lower end of shaft **23** extends below inner sleeve **21** and casing **13** and is provided with an enlarged portion **25** having a downwardly open socket **27** formed therein. Socket **27** may be bored to the correct diameter to fit on the upper end of a shaft **29** of the particular motor with which the starter **11** is used. Adapter shaft **23** is fixedly and removably attached to motor shaft **29** as by means of set screws **30**.

Although in the present drawings, starter **11** is illustrated in use with a conventional power lawnmower **31** having a gasoline motor **23** of which shaft **29** is a part, it is not intended that the present invention be so limited but it may be employed in other environments, as for example with an outboard motor or other internal combustion engines. In fact, the starter **11** is readily detachable as a unit from the motor with which used, whereby the starter may be shifted from one motor to another. Thus casing **13** is detachably anchored against rotation to motor **33** by suitable brackets **34** and by releasing the brackets and shaft set screws **30** detachment may be readily accomplished.

On the portion of inner sleeve **21** within casing **13** is provided a driven gear **35** integrally formed with inner sleeve **21** and extending radially outwardly from the sleeve. For ease of operation a washer **37** may be provided on inner sleeve **21** between driven gear **35** and top **15**.

Interiorly of casing **13** a spirally coiled spring **39** is fixedly attached at its inner end as at **40** to inner sleeve **21** and fixedly attached at its outer end to the side wall **41** of casing **13**, as at **42**. Also interiorly of the casing, a driving gear **43** is disposed and adapted to be selectively engaged with or disengaged from driven gear **35**. Driving gear **43** is preferably provided with a greater number of teeth than driven gear **35** and is provided with an upwardly extending elongated hub **45** which rotatably extends through an oblong opening **47** provided in top **15**.

A shift lever **49** having a pair of angularly extending arms, a handle arm **51** and an arm **53** of shorter length, is pivotally mounted on top **15** as by a pin **54** fixedly mounted on the top and extending through a socket in lever **49** adjacent the intersection of arms **51, 53**. The distal end of arm **53** is provided with an opening through which rotatably extends hub **45**. A collar **55** is fixedly mounted on hub **45** above lever **49** for holding the assembly together. Additionally, a washer **57** may be provided on hub **45** between driving gear **43** and top **15**.

The upper end **59** of hub **45** is preferably polygonal in cross section and has fitted thereon for rotation therewith a roller **61**. End **59** may extend above roller **61** to provide a stem for receiving a socket provided in the end of a removable winding crank **63**.

An idler wheel **65** is rotatably supported on the upper end of an upstanding spindle **67** mounted on top **15**. Idler wheel **65** frictionally engages the cylindrical lower

portion 69 of a wheel 71, which as shown in preferably in the form of a pulley having a V-groove 73 around the periphery thereof. Pulley wheel 71 is keyed to adapter shaft 23 adjacent the upper end thereof.

An outer sleeve 75 is fixedly mounted as by means of set screws 77 on the upper end of inner sleeve 21 which extends through a major portion of the bore of the outer sleeve. Thus, outer sleeve 75 is disposed intermediate casing 13 and pulley 71. Outer sleeve 75 with inner sleeve 21 forms a rigid assembly which rotates as a unit. Around the periphery adjacent the lower end thereof outer sleeve 75 is provided with ratchet teeth 79 which are engaged by a pawl lever 81 having a pawl arm 83 and a handle 85 angularly extending from arm 83. Pawl lever 81 is pivotally mounted on top 15 by an upstanding stud 87 fixedly mounted on the top and extending through a socket in pawl lever 81 adjacent the intersection of pawl arm 83 and handle 85. A spring 89 mounted from top 15 engages pawl lever 81 to urge the lever into engagement with ratchet teeth 79. An additional spring 91 mounted from top 15 engages handle arm 51 to urge the handle arm inwardly toward the center of starter 11 whereby the arm 53 is urged away from the center of the starter to the position best illustrated in Figs. 2 and 3, wherein it will be seen driving gear 43 is out of engagement with driven gear 35. A pull outwardly on handle arm 51 against spring 91 will move driving gear 43 into engagement with driven gear 35, as best shown in Fig. 5, and will simultaneously move roller 61 into frictional engagement with idler wheel 65, as best illustrated in Fig. 6. It will be understood that the above movement is possible since hub 45 is free to shift in oblong opening 47, under the action of lever 49.

An enlarged portion 93 of the bore of outer sleeve 75 is provided, with enlarged portion 93 extending from adjacent the upper end of inner sleeve 21 to the upper end of outer sleeve 75. Enlarged portion 93 houses a cam 95 which is keyed to adapter shaft 23. A cam follower pin 97 mounted in a socket in outer sleeve 75 is held in engagement with cam 95 by a spring 99 which is interposed between the head of the cam follower and a threaded insert 101. A notch 103 is provided in the body of pin 97 and is adapted to receive a plunger 105 which is urged by a spring 107 against the side of pin 97.

Cam 95 is provided with projections 109 and recesses 111, and at the juncture of the projections and recesses is provided with shoulders 112 for engagement with the side of pin 97. Referring now, in particular to Fig. 4, it will be understood the cam action is as follows: Rotation of cam 95 relative to outer sleeve 75 in a clockwise direction will cause cam follower pin 97 to move outwardly as projection 109 moves towards the cam follower pin. At its position of maximum outward travel pin 97 will be in a position for plunger 105 to engage notch 103 and hold the pin outwardly, as shown in Fig. 7. Rotation of outer sleeve 75 relative to cam 95 in a clockwise direction, as viewed in Fig. 4, and without cam follower pin 97 being held by plunger 105 will cause engagement of the side of pin 97 with one of steps 112 and thereby effect rotation of adapter shaft 23 with outer sleeve 75, thus effectively furnishing clutch means coupling the sleeve with the shaft.

To manually wind the spring engine starter 11, handle arm 51 is moved outwardly to engage driving gear 43 with driven gear 35. Crank 63 is then turned by hand in a clockwise direction as viewed from above the starter, which turns driving gear 43 in a clockwise direction to drive gear 35 in a counter clockwise direction, similarly turning sleeve 21 and the inner end of spring 39, and thus winding spring 39. The tension in spring 39 is retained by pawl arm 83 engaging ratchet teeth 79, which as above described are carried by sleeve 75.

To start the engine, cam follower pin 97 must be in the inward position shown in Fig. 4. If the cam follower pin is not in this position it may be released to this position by pulling outwardly on a knob 113 provided on the outer end of plunger 105 which will remove the plunger from notch 103 and allow the cam follower pin to move inwardly. The handle 85 of pawl lever 81 is pushed inwardly, which will disengage pawl arm 83 from ratchet teeth 79 and release the energy from spring 39 causing inner sleeve 21 and outer sleeve 75 connected thereto to rotate clockwise as viewed in Fig. 4. This clockwise rotation will be transmitted to adapter shaft 23 through the clutch comprising the cam follower pin 97 and cam 95, as heretofore explained. Adapter shaft 23, being fixedly attached to motor shaft 29, will cause the rotation of the latter and start the motor.

When motor 33 picks up sufficient speed to a point at which the motor shaft 29 is rotating faster than outer sleeve 75, cam 95 will be rotating in a clockwise direction relative to outer sleeve 75 and cam follower pin 97 which will cause the cam follower pin to move outwardly under cam action, as heretofore explained, until plunger 105 enters notch 103 and holds the cam follower pin outwardly (Fig. 7). Thus, the starting mechanism is automatically disconnected from the rotating motor shaft 29 and adapter 23 by the overriding action of cam 95.

If desired, the power of the running motor 33 may be utilized to rewind spring 39 making it ready for the next start. This rewinding may be accomplished by moving the handle arm 51 outwardly to engage roller 61 frictionally with idler wheel 65. Since idler wheel 65 is rotating due to its contact with pulley 71, the idler wheel will cause rotation of roller 61 and consequently driving gear 43. Gear 35 will be driven by driving gear 43 since the two are in mesh due to the fact that handle arm 51 is being held outwardly. In turn rotation of driven gear 35 will cause spring 39 to be wound as previously explained.

If for any reason it is necessary to crank motor 33 by hand it may be done in the conventional manner using a rope wound around V-pulley 71.

From the foregoing it is apparent that a convenient and efficient engine starter is provided which offers many advantages heretobefore not possible. Thus, the starter of the present invention is operable with very little effort on the part of the operator, and the starter may be wound easily by hand or using the power of the motor. The stored energy may then be released suddenly to spin the engine shaft to provide a quick start of the motor. Additionally, it is apparent that many advantageous features are provided in the present invention including an effective and unique clutch means which automatically disengages the starter from the motor at the proper time.

I claim:

1. The combination with a motor having a rotatable motor shaft of a starter for the motor comprising a casing, an inner sleeve extending through said casing, an outer sleeve fixedly mounted on said inner sleeve exterior to said casing to form a unitary sleeve assembly, said sleeve assembly being rotatably mounted relative to said casing, a wound spring having one end attached to said casing and the other end attached to said sleeve assembly to urge sleeve rotation, an adapter shaft rotatably extending through said sleeve assembly and fixedly attached to the shaft of said motor for conjoint rotation therewith, a driven gear carried by said sleeve assembly, a driving gear rotatably mounted in said casing and shiftable into and out of engagement with said driven gear, crank means engaging said driving gear for manual rotation thereof to wind said spring; ratchet means carried by said sleeve assembly, casing-carried pawl means engaging said ratchet means restraining said spring against unwinding, means for shifting said pawl means away from said ratchet means to release restraint on said spring, whereby said spring rotates said sleeve assembly in one direction; and clutch means including a cam carried by and keyed to said adapter shaft, said cam comprising lobes extending ec-

centrically from said shaft, cam follower means carried by and rotated with said sleeve assembly removably engaging a lobe of said cam, spring means urging said follower means toward cam engagement, said cam being rotatable by said sleeve assembly through said cam follower means upon rotation of said sleeve assembly in said one direction relative to said cam whereby said clutch means operably connects said starter to said motor during start thereof, said cam follower means being removable from said cam by the action of the cam lobes upon rotation of said cam in said one direction relative to said sleeve assembly whereby said clutch means operably disconnects said motor from said starter after the start of the motor.

2. The combination with a motor having a rotatable motor shaft of a starter for the motor comprising a casing, an inner sleeve, an outer sleeve fixedly mounted thereon to form a unitary sleeve assembly, said sleeve assembly being rotatably mounted in said casing, a wound spring having one end attached to said casing and the other end attached to said sleeve assembly to urge sleeve rotation, an adapter shaft rotatably extending through said sleeve assembly and fixedly attached to the shaft of said motor for conjoint rotation therewith, a driven gear carried by said sleeve assembly, a driving gear rotatably mounted in said casing and shiftable into and out of engagement with said driven gear, means engaging said driving gear for rotation thereof to wind said spring; ratchet means carried by said sleeve assembly, casing-carried pawl means engaging said ratchet means restraining said spring against unwinding, means for shifting said pawl means away from said ratchet means to release restraint on said spring whereby said spring rotates said sleeve assembly in one direction; and clutch means interposed between said sleeve assembly and said adapter shaft for connecting and disconnecting said sleeve assembly and said adapter shaft, said clutch means comprising an eccentric cam fixed to said adapter shaft, a pin-like follower slidably mounted in and extending through said outer sleeve into engagement with said cam, and spring means urging said follower toward cam engagement.

3. The combination with a motor having a rotatable motor shaft of a starter for the motor comprising a casing, an inner sleeve, an outer sleeve fixedly mounted thereon to form a unitary sleeve assembly, said sleeve assembly being rotatably mounted in said casing; a wound spring having one end attached to said casing and the other end attached to said sleeve assembly, an adapter shaft rotatably extending through said sleeve assembly and fixedly attached to the shaft of said motor for conjoint rotation therewith, a pulley fixedly mounted on said adapter shaft, an idler wheel rotatably mounted from said casing and being in frictional contact with said pulley for rotation thereby, a driven gear carried by said sleeve assembly, a driving gear rotatably mounted in said casing and shiftable into and out of engagement with said driven gear, said driving gear including an elongated hub, a roller fixed to said driving gear hub, said roller being shiftable into and out of frictional contact with said idler wheel conjointly upon shift of said driving gear into and out of engagement with said driven gear whereby said spring may be wound from the power of said motor; ratchet means for keeping tension on said spring upon the winding thereof including ratchet teeth formed on said sleeve assembly and a pawl lever pivotally mounted from said casing in engagement with said ratchet teeth, said pawl lever being disengageable from said ratchet teeth whereby the tension in said spring is releasable to rotate said sleeve assembly in one direction by said spring; clutch means including an eccentric cam carried by and keyed to said adapter shaft, pin-like cam follower means carried by said sleeve assembly and removably engaging said cam, follower spring means urging said follower toward cam engagement, said cam being rotatable by said sleeve assembly through said cam follower means upon rotation of said sleeve assembly in said one direction relative to said cam whereby said clutch means operably connects said starter to said motor during start thereof, said cam follower means being retractable against the urging of said follower spring means from said cam by the action of the cam upon rotation of said cam in said one direction relative to said sleeve assembly whereby said clutch means operably disconnects said motor from said starter after the start of the motor.

4. A motor starter comprising a casing, an inner sleeve extending through said casing, an outer sleeve fixedly mounted on said inner sleeve to form a rigid sleeve assembly, said sleeve assembly being rotatably mounted in said casing, a wound spring having one end attached to said casing and the other end attached to said sleeve assembly, an adapter shaft rotatably extending through said sleeve assembly and adapted to be fixedly attached to the shaft of a motor for conjoint rotation therewith, a driven gear carried by said sleeve assembly, a driving gear rotatably mounted in said casing and shiftable into and out of engagement with said driven gear, means engaging said driving gear for rotation thereof to wind said spring; ratchet means engaging said sleeve assembly for keeping tension on said spring upon the winding thereof, said ratchet means being releasable from said sleeve assembly whereby the tension in said spring is releasable to rotate said sleeve assembly in one direction by said spring; and clutch means interposed between said sleeve assembly and said adapter shaft for alternately connecting and disconnecting said sleeve assembly and said adapter shaft, said clutch means comprising an eccentric cam fixed to said adapter shaft, a pin-like follower carried by said outer sleeve, and spring means urging said follower into engagement with said cam.

5. A motor starter in accordance with claim 4, which includes means for detachably mounting said starter on a motor.

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