O. E. WADEWITZ.

SPRING POWER ENGINE STARTER.

APPLICATION FILED MAY 28, 1912.

1,066,868.

Patented July 8, 1913.

2 SHEETS—SHEET 1.

Fig. 2.

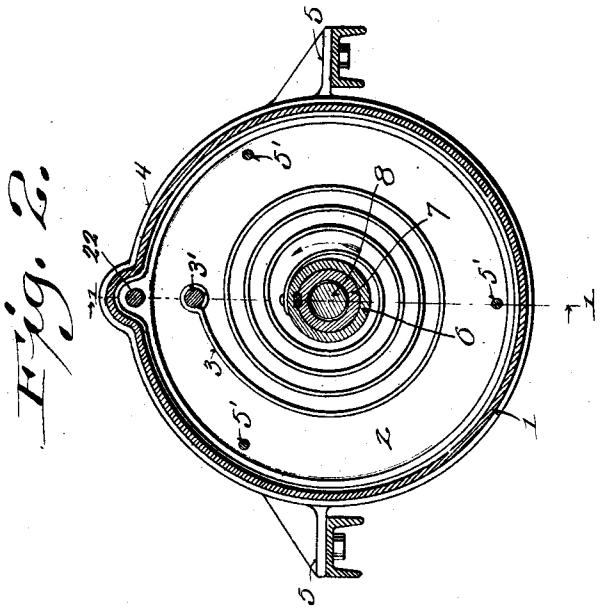
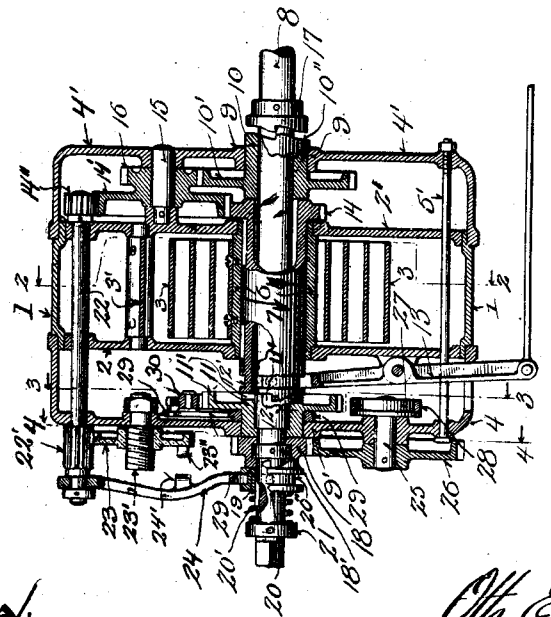


Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 4.

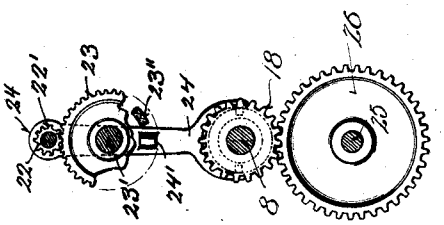
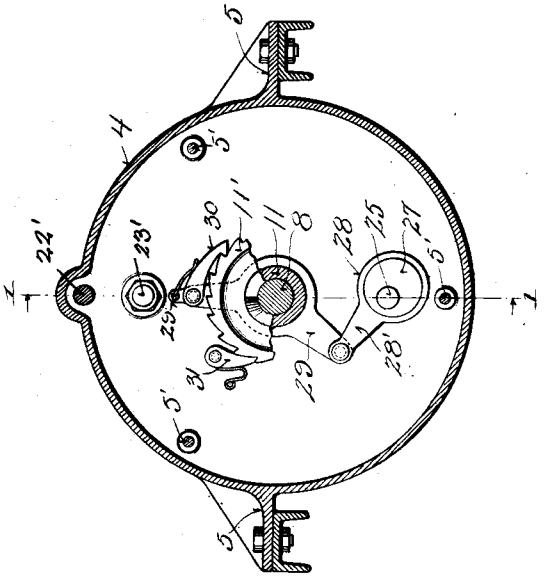


Fig. 3.



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UNITED STATES PATENT OFFICE.

OTTO E. WADEWITZ, OF RACINE, WISCONSIN.

SPRING-POWER ENGINE-STARTER.

1,066,868. Specification of Letters Patent. Patented July 8, 1913.

Application filed May 28, 1912. Serial No. 700,287.

To all whom it may concern:

Be it known that I, OTTO E. WADEWITZ, a citizen of the United States, and resident of Racine, in the county of Racine and State of Wisconsin, have invented certain new and useful Improvements in Spring-Power Engine-Starters; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention refers to internal combustion engine starters of the spring motor type, the object being to provide a simple, economical and effective means for loading or winding the motor spring to a predetermined tension, the same being effected through a back-gear connection to an intermittent driven shaft. The construction and arrangement of the mechanism is such that after the desired tension of said motor-spring is obtained through a predetermined number of revolutions of a winding mechanism, said winding mechanism is uncoupled from the driven shaft by a worm-actuated tappet wheel that is geared to said winding mechanism. The stored power of the spring is then locked by a pawl and ratchet element of the winding mechanism, said power being manually released and transmitted to the driven shaft by a suitable clutch-controlled gear connection therewith whereby the driven shaft is given a portion of a turn or one or more complete turns to effect a starting operation of the engine, it being understood that when the shaft is thereafter driven by the engine power that it will rewind the spring for future use and after such rewinding, the winding mechanism is automatically released as stated.

With the above objects in view the invention consists in certain peculiarities of construction and combination of parts as hereinafter set forth with reference to the accompanying drawings and subsequently claimed.

In the drawings Figure 1 represents a longitudinal sectional view of an engine starter embodying the features of my invention, with parts broken away, other parts in full to more clearly illustrate certain structural features, the section being indicated by line 1—1 of Fig. 3; Fig. 2, a sectional face view of the same, the section being indicated by line 2—2 of Fig. 1; Fig. 3, a sectional face view of the starter mechanism, the section being indicated by line 3—3 of Fig. 1; and Fig. 4, another detailed sectional face view of the starter, the section being indicated by line 4—4 of Fig. 1.

Referring by characters to the drawings, 1 represents a cylinder to which are fitted heads 2, 2′, the same in conjunction with the cylinder forming a housing for a coiled spring 3. The cylinder has also fitted thereto upon opposite ends a pair of cylindrical shells 4, 4′, which shells in conjunction with the heads 2, 2′, and cylinder 1 constitute a casing for the starter mechanism, the shells being provided with projecting feet 5, whereby the said casing is secured to the frame of an automobile or other device to which the starter is applied. The casing members constituting the heads 2, 2′, and shells 4, are clamped together by longitudinally disposed bolts 5′ which pass through said casing as best shown in Fig. 1. The casing heads 2 are each provided with a centrally disposed circular aperture, into which is journaled the ends of a tubular hub member 6, the said hub member being fitted to a sleeve 7 that is in spline connection with the hub member, whereby it is capable of rotation therewith but free to reciprocate therein. The inner coil of the spring 3 is secured to the hub member 6 and its outer coil is rigidly secured to the casing by means of a stud 3′, about which stud the aforesaid spring end is looped. An intermittently driven engine shaft 8 extends through end apertures 9, 9′ of the shells and through the bore of the sleeve 7, which bore is of greater diameter than said shaft. The shaft is journaled in the end aperture 9 of the shell 4′ through loose engagement with the hub 10 of a gear-wheel 10′, which hub extends through the shell and is provided with a clutch faced end 10″ as shown, the toothed gear-wheel 10′ being housed within said shell. The opposite end of the engine shaft is similarly supported through its loose engagement with the hub 11 of a ratchet wheel 11′, the hub being interposed between said shaft and aperture 9′ of the shell member 4. The inner face of the ratchet wheel hub 11 is provided with a clutch-face 11″, said hub being held against end-play in one direction by a shoulder that is formed about the shaft, while end-play in the opposite direction of said hub is limited through abutting engagement of the ratchet wheel web with a bearing-sleeve for said hub that is formed about the aperture 9′ of the shell.

That end of the sleeve 7 which is adjacent

to the clutch face 11'' of the ratchet-wheel hub is provided with a corresponding ratchet-face 12 which is adapted to engage said hub ratchet-face, whereby a coupling connection between the ratchet-wheel and hub is effected. The sleeve at this end is also provided with an annular recess 12' into which is fitted the spanner end of a controlling lever 13, the lever being fulcrumed between ears that project from the head 2. This controlling lever is provided for the purpose of manually shifting the sleeve, whereby the same may be coupled to or uncoupled from the ratchet-wheel hub at the will of the operator. The opposite end of the sleeve is provided with a toothed pinion 14 that meshes with a gear wheel 14', which in this instance is approximately twice the diameter of the toothed pinion, the gear-wheel being provided with a toothed pinion 16, which pinion in turn meshes with the gear-wheel 10' previously mentioned, said gear-wheel being approximately twice the size of the pinion with which it has meshing engagement. The gear-wheel 14' and its integral pinion 16, as shown in Fig. 1, are loosely mounted upon a stud 15, which stud is fitted within suitable apertures formed in the adjacent head 2 and wall of the shell 4'. Hence it is apparent that when motion is imparted to the sleeve 7, the back-gear connection to the gear-wheel 10' will cause the latter to rotate at a speed approximately one-fourth of that imparted to the sleeve pinion 14.

The end of the sleeve, as shown in Fig. 1, is adapted to have abutting engagement with the hub 10 of the gear-wheel 10' and hence when a shift movement is imparted to the sleeve for effecting disconnection between the latter and the ratchet wheel 11', movement of said sleeve will cause the gear-wheel to slide outwardly upon shaft 8 and effect clutching engagement between the clutch-face 10'' of its hub and a clutch member 17 that is secured to said shaft.

Loosely mounted upon the engine shaft 8, adjacent to the outer face of the shell 4 is a pinion 18, which pinion is held against lateral play between the collar 18'' that is carried by the shaft and the adjacent face of the shell about its aperture 9'. The outer hub end of the pinion 18 is provided with a clutch-face 19 which face is adapted to engage a corresponding face of a clutch member 20 that is in spline connection with the engine shaft, the said clutch member being held in clutched engagement with the pinion by a coiled spring 20' which surrounds the shaft and is interposed between the clutch member 20 and a collar 21 that is carried by said shaft, the outer end of the aforesaid shaft as shown terminating with a squared head for the reception of a hand-crank not shown whereby the engine shaft may be rotated in the usual manner in an emergency, it being understood that the inner end of the shaft which projects through the casing carries the usual engine cranks and fly-wheel not shown.

The counter-shaft is journaled in apertures formed in the heads 2, 2', and shell 4, the end of said shaft being extended beyond the shell head 2 for the reception of a sleeve pinion 22'. The sleeve pinion 22' is meshed with a toothed tappet wheel 23 which tappet-wheel is provided with a bored hub that is internally threaded for engagement with a threaded stud 23' that is rigidly secured to the shell 4. The tappet-wheel also carries a tappet lug 23'' which is arranged to actuate a clutch lever 24 when said wheel has been run out upon the threaded stud due to drive imparted thereto from the sleeve pinion 22'. The counter-shaft 22 is driven through the pinion 14'' from gear-wheel 14'. The lever 24 is fulcrumed upon the outer end of the shaft between the hub of the sleeve pinion and a collar carried by said shaft, the opposite end of the clutch lever being provided with a spanner that is adapted to engage an annular groove 20'' that is formed in the spring-controlled clutch member 20, this construction being best shown in Figs. 1 and 4 of the drawings. Thus it will be seen that the sleeve-gear 22' operates a tappet-wheel which in conjunction with the stud constitutes a worm or cam-driven member that is adapted to rotate and travel longitudinally whereby the path of travel of its tappet is brought into alinement with a shoe 24' upon the clutch lever to shift the position of said lever or said worm-actuated tappet-wheel will recede upon a reversing action of the counter-shaft to free the tappet and shoe engagement, this operation being more fully described hereinafter.

Journaled in a suitable bearing provided in the face of the shell member 4 is a stud 25, which stud carries a gear-wheel 26 that meshes with the pinion 18 that is loosely mounted upon the engine shaft, the said gear-wheel being approximately twice the size thereof. The stud projects into the shell 4 and its inner end carries an eccentric 27, upon which eccentric is mounted a strapped end 28 of a link 28', the link being connected to one arm 29 of an oscillatory bell-crank lever. The other arm 29' of the bell-crank lever carries a spring-controlled pull-pawl 30 which is adapted to engage the teeth of the ratchet-wheel 11'. The oscillatory bell-crank as shown is journaled upon a sleeve extension that is formed about the aperture 9' of the shell 4, said bell-crank being interposed between the inner face of the shell and ratchet-wheel as best shown in Fig. 1. A take-up spring-controlled ratchet-pawl 31 is also provided for engagement

with the ratchet-wheel 11, the said pawl being fulcrumed upon a stud that is carried by the shell 4 as best shown in Fig. 3.

When the parts of the spring motor assume positions, as shown in the drawings, the spring is being wound, due to the clutched engagement between the hub member 20 and pinion 18, which causes rotation of the stud 25 through its gear connection with said pinion, the engine shaft being driven in the direction as indicated by the arrow. The eccentric 27 will make one revolution with each rotation of the engine shaft due to the back-gear connection and in the rotation of said eccentric, its strap connection with the bell-crank will cause the ratchet gear-wheel to feed forward one tooth. The hub 11 of the ratchet gear-wheel and sleeve 7 being in clutch connection will consequently cause said sleeve and hub member, to rotate in the opposite direction, as indicated by the arrow, from that in which the engine shaft is rotated. Consequently the spring will be gradually wound up by draw upon the inner coil thereof. This winding is effected by a predetermined number of revolutions of the sleeve and incidental to said winding the counter-shaft 22 makes a predetermined number of revolutions, due to its constant gear connection with said sleeve. Thus the tappet-carrying gear-wheel 23 is rotated and caused to travel outwardly upon its threaded stud 23′ and incidental to completion of the spring-winding movement the tappet 23″ of said wheel will move into an engaging position relative to the clutch lever shoe 24′ whereby said lever is positively forced outward in opposition to the spring 20′ that controls movement of clutch member 20 to thus disengage the latter from the clutch-faced hub of the pinion 18. Hence said clutch member being disengaged from the clutch-faced hub of the pinion 18, the winding mechanism is thrown out of action. The engine shaft 8 will thereafter revolve freely. It is apparent that when the engine shaft is rotated free the teeth of the clutch member 17 will, by their cam action automatically thrust the hub clutch teeth 10″ inwardly and thus free the gear-wheel 10′ from its rotative engagement with the shaft and at the same time this end thrust will cause the sleeve 7 to automatically effect coupling engagement with the wheel 11′ through engagement of its end clutch teeth with the clutch teeth 11″. To start the engine after a stop, the lever 13 is manually operated, whereby it is shifted to effect disengagement between the ratchet-wheel hub and sleeve 7 and incidental to the shift, the opposite end of said sleeve that carries the pinion 14 will engage the hub of gear-wheel 10′, causing the same to slide upon the shaft, whereby clutching engagement with the clutch member 17 and said gear-wheel is effected. Thus it is apparent that as soon as the sleeve 7 is freed from its locked or clutched engagement, with the hub 11 of the ratchet-wheel 11′ that the stored power of the spring 3 will be instantly exerted to cause rotation of said sleeve in the same direction as the engine shaft. Thus the spring power is transmitted through the train of starting gears directly to the engine shaft, in the same direction as the latter would ordinarily travel, whereby one or more complete turns is imparted to said engine shaft to effect a starting operation, the stored power of the spring being imparted at a ratio of 4 to 1 to obtain efficiency in the expenditure of said stored power for the purpose stated.

As the spring 3 unwinds its power is applied to the engine shaft for starting the same in its running position and in the meantime the counter-shaft 22 will be rotated in a reverse direction from that taken in a spring winding operation, causing the tappet-carrying gear-wheel 23 to move inwardly upon its threaded stud, covering the same distance as it previously traversed outwardly until checked by engagement of its hub with the face of the shell 4, which check consequently locks the counter-shaft and further expansion of the coils of the spring is thereby prevented, the check or lock serving to maintain a predetermined minimum stored spring power.

I claim:

1. An engine starter comprising a fixed casing, an intermittently driven shaft extending therethrough, a longitudinally shiftable rotatory sleeve mounted about the shaft, a manually controlled means for coupling the sleeve to said shaft when said sleeve is moved in one direction, means for automatically releasing the sleeve and shaft after a manual coupling operation, a coiled spring disposed about the aforesaid sleeve having its inner end in connection therewith, means for securing the outer end coil of the spring to the casing, a spring winding gear-wheel train loosely mounted about the driven shaft, means for locking the same against rotation in one direction, means for coupling the spring winding gear-wheel to the sleeve when the latter is manually moved to effect its disconnection with the shaft, means for effecting clutching engagement between the spring winding mechanism and shaft, a counter-shaft in gear connection with the sleeve, a tappet-carrying wheel in gear connection with the counter-shaft, and means engageable with the tappet of said tappet-carrying wheel for releasing the clutch engagement between said winding mechanism and shaft, when the spring is wound to a predetermined tension.

2. An engine starter comprising a fixed casing, an intermittently driven shaft ex-

tending therethrough, a longitudinally shiftable sleeve mounted about the shaft, a coiled spring having its inner end in rotative connection with the sleeve, means for securing the outer coiled end of the spring to the casing, a spring winding mechanism having clutching means engageable with the shaft and sleeve, means for effecting a clutching engagement between the sleeve and shaft, means for locking the winding mechanism against rotation in one direction, a worm controlled releasing means for effecting disconnection between the drive shaft and spring winding mechanism, and a manually controlled coupling means in connection with the sleeve for releasing the same from the winding mechanism incidental to effecting a coupling connection between the aforesaid shaft and sleeve.

3. An engine starter comprising a casing, an engine shaft extending therethrough, a reciprocative sleeve encircling the shaft, manually controlled means for actuating the sleeve in one direction, a hub in spline engagement with said sleeve, a coiled spring surrounding the hub having its inner end secured thereto, a ratchet-wheel, means for effecting clutching engagement between the ratchet-wheel and sleeve, a pinion loosely mounted upon one end of the engine shaft, means in gear connection with said pinion for actuating the ratchet-wheel, a clutch member in spline engagement with the engine shaft adapted to lock the pinion to said shaft, a gear-wheel loosely mounted upon the other end of the engine shaft having a clutch member, a back gear train connecting the last named gear-wheel with the aforesaid sleeve, a clutch member secured to the engine shaft for engagement with the gear-wheel clutch member, a counter-shaft in gear connection with the back-gear train, a fixed threaded stud, a tappet-carrying wheel in threaded union therewith, the tappet-carrying wheel being in gear connection with the counter-shaft, an oscillatory lever engageable with that clutch member which controls the shaft driving pinion of the ratchet-wheel adapted to be engaged by the tappet-carrying gear-wheel when the latter is moved in one direction upon its threaded stud, and means for limiting travel of the tappet-carrying gear-wheel upon its threaded stud in the opposite direction.

In testimony that I claim the foregoing I have hereunto set my hand at Racine in the county of Racine and State of Wisconsin in the presence of two witnesses.

OTTO E. WADEWITZ.

Witnesses:
E. H. WADEWITZ,
A. H. WADEWITZ.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."