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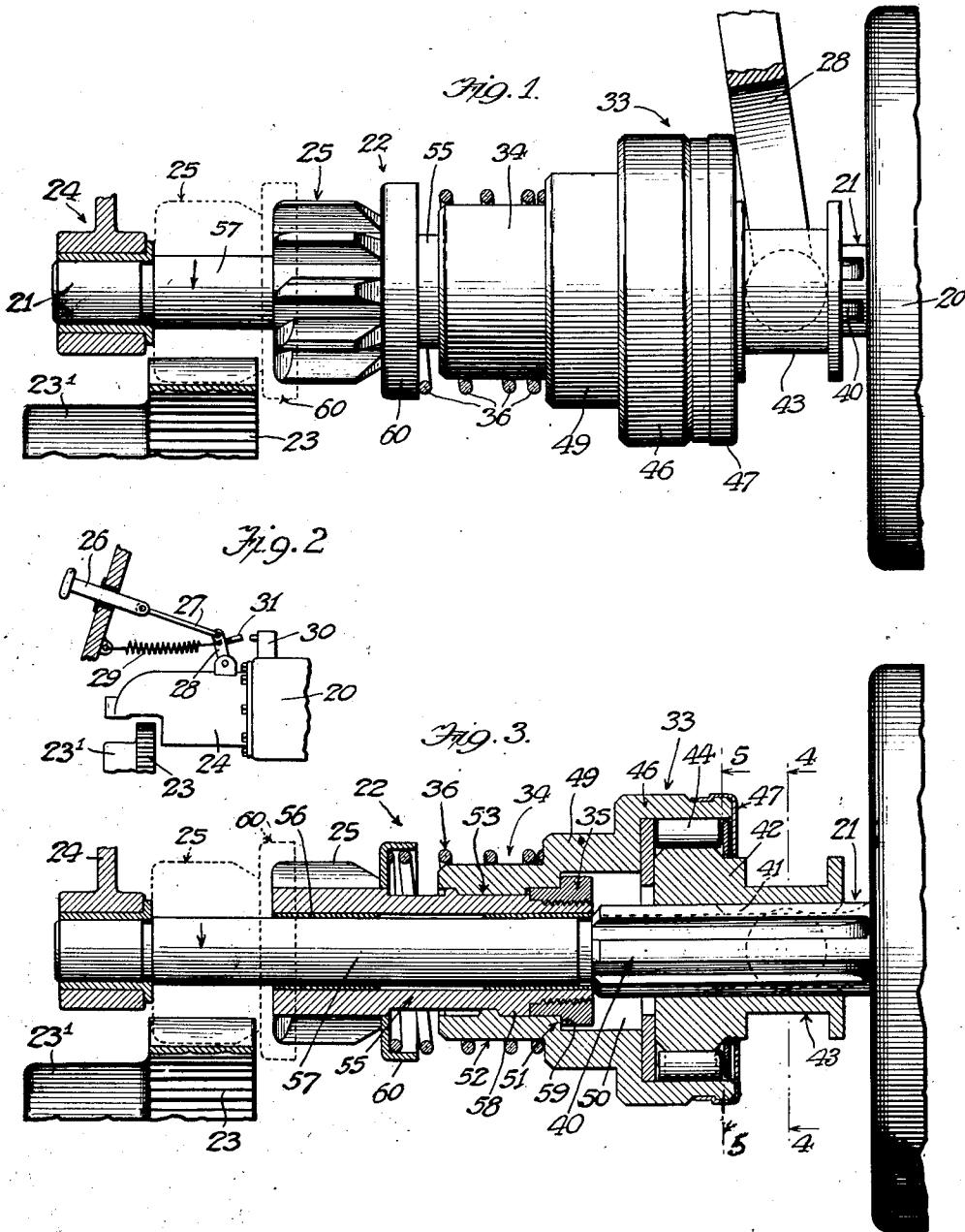
W. L. McGRATH

1,820,945

ENGINE STARTER

Filed April 5, 1928

4 Sheets-Sheet 1



Inventor
William L. McGrath.

Witness
Martin H. Olsen.

By Victor Stephens & Associates
Attys.

Sept. 1, 1931.

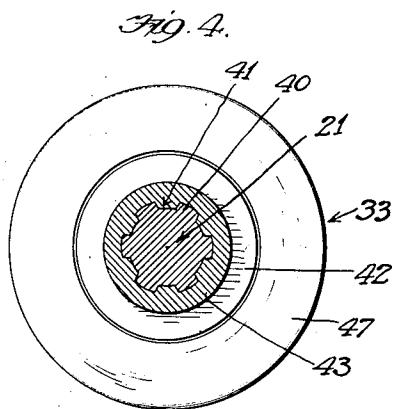
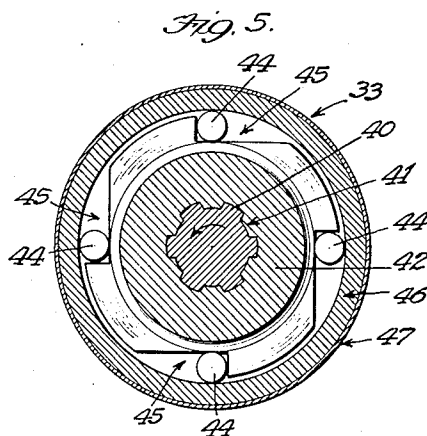
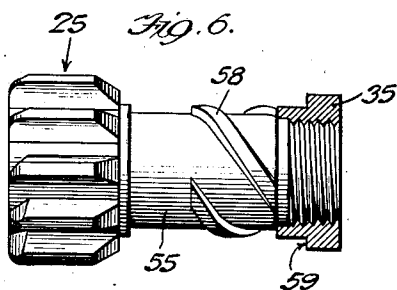
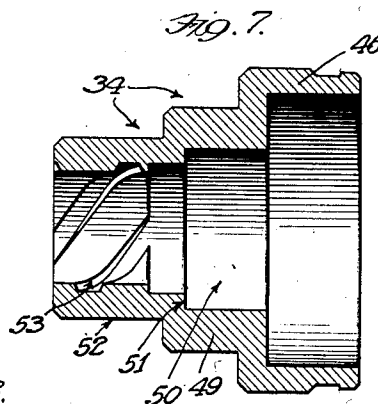
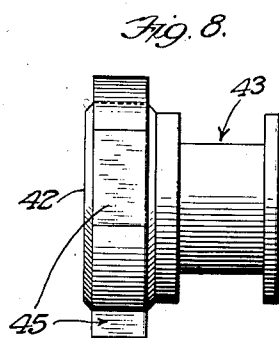
W. L. McGRATH

1,820,945

ENGINE STARTER

Filed April 5, 1928

4 Sheets-Sheet 2



Witness
Martin H. Olsen.

Inventor
William L. McGrath
By *Rector Olsen* *Charles H. Hansen*
Atty's

Sept. 1, 1931.

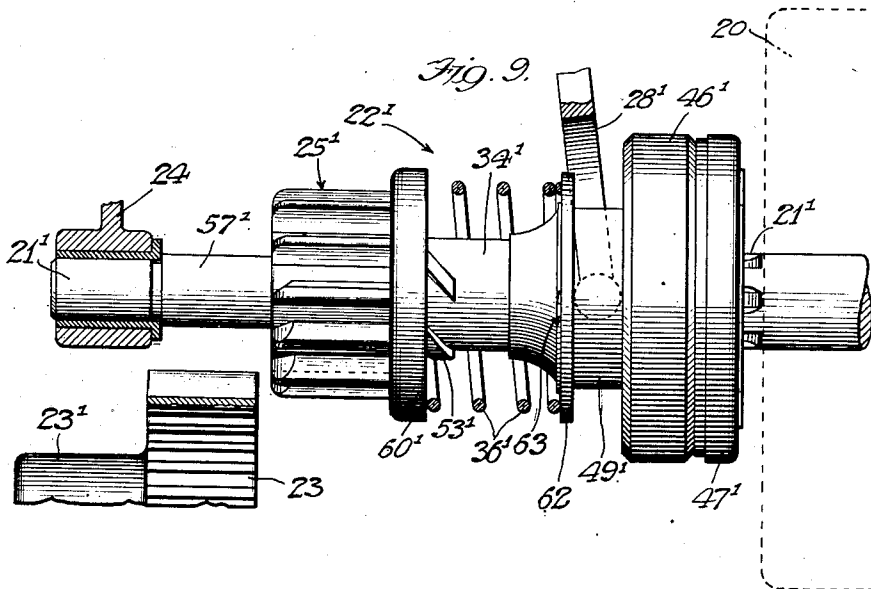
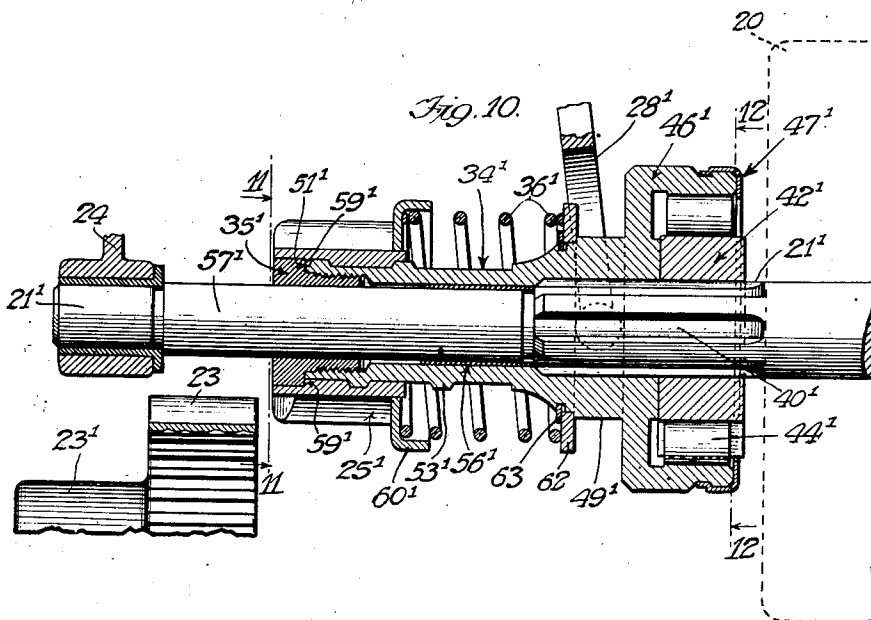
W. L. McGRATH

1,820,945

ENGINE STARTER

Filed April 5, 1928

4 Sheets-Sheet 3



Witness
Martin H. Olsen.

Inventor
William L. McGrath
By Rector, & Paken, Davis & McCauley.
Atty's

Sept. 1, 1931.

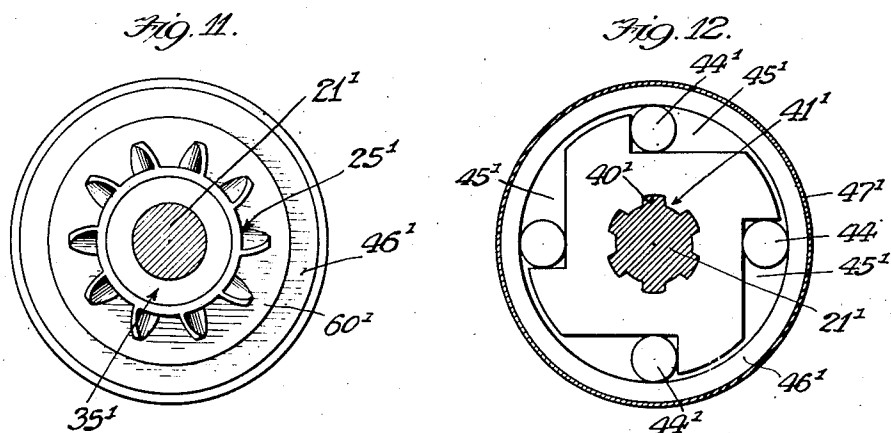
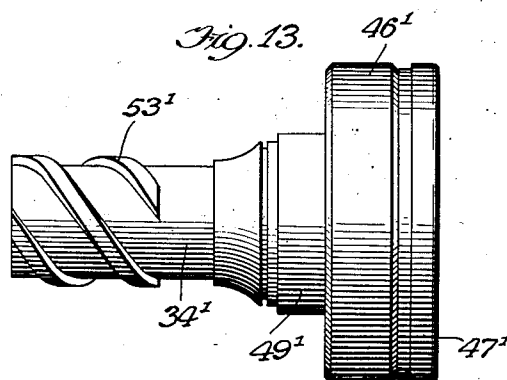
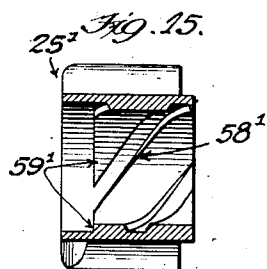
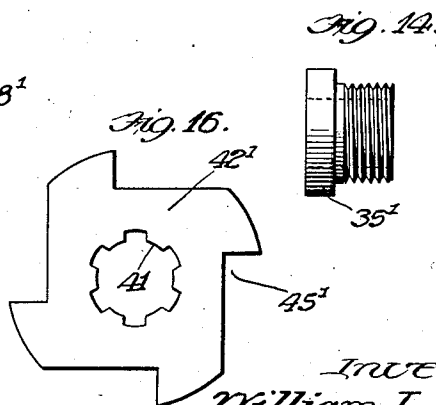
W. L. McGRATH

1,820,945

ENGINE STARTER

Filed April 5, 1928

4 Sheets-Sheet 4



Witness
Martin H. Olsen.

Inventor
William L. McGrath
By Pastor, H. E. Olsen, Davis & Macauley
Attys.

UNITED STATES PATENT OFFICE

WILLIAM L. McGRATH, OF ELMIRA, NEW YORK, ASSIGNOR TO ECLIPSE MACHINE COMPANY, OF ELMIRA, NEW YORK, A CORPORATION OF NEW YORK

ENGINE STARTER

Application filed April 5, 1928. Serial No. 267,717.

My invention relates to engine starting apparatus for the starting of internal combustion engines, more particularly but not necessarily automobile engines, and the general object thereof is to provide a simple, efficient and reliable apparatus involving a drive of the "manual-shift" type, that is to say, one in which the operator shifts the drive-assembly longitudinally on the motor-driven power shaft to bring the driving pinion into engagement with a gear member of the engine to be started, the pinion being arranged to remain in such engagement until the operator frees the manual actuating means for return thereof, and of the drive as a whole, to normal, idle position.

Some manual shift drives employ a one-way clutch to insure application of motor torque through the clutch and the driving pinion to the engine gear, but to prevent inverse transmission of torque when, the engine having "picked up", it operates under its own power, and one of the objects of my invention is to improve drives so characterized.

In manual shift drives generally, it is desirable that in the event the driving pinion chances to meet the engine gear with the teeth of these two parts in non-registering abutment, rotative mesh-insuring adjustment shall be automatically imparted to the driving pinion to bring about proper tooth-registry and mesh between the stated gear parts before the starting motor is set in operation, and another object of my invention is to make novel, effective and advantageous provision for so doing.

Other objects of my invention are to provide constructions and combinations for functioning as within described, which are susceptible to inexpensive manufacture and assembly and which coact to insure certainty of operation, freedom from crippling wear or injury in service and minimum demand for service-attention. And other and further objects of my invention will become apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a side elevation, with parts

broken away, of an engine starter drive embodying my invention;

Fig. 2 is a reduced, diagrammatic side elevation of the engine starting apparatus installed on an automobile, parts whereof are fragmentarily shown;

Fig. 3 is a longitudinal vertical section of Fig. 1, with parts in elevation;

Fig. 4 is a cross section on line 4—4 of Fig. 3;

Fig. 5 is a cross section on line 5—5 of Fig. 3;

Fig. 6 is a side elevation of the form of driving pinion member shown in Fig. 3;

Fig. 7 is a longitudinal vertical section through the screw-sleeve and secondary clutch member, with the sleeve portion of which the pinion member coacts;

Fig. 8 is a side elevation of the primary member of the clutch for co-action with the clutch portion shown in Fig. 7;

Fig. 9 is a side elevation, with parts broken away, showing a modified drive embodying features of my invention;

Fig. 10 is a vertical longitudinal section, with parts in elevation of the drive shown in Fig. 9;

Fig. 11 is a cross section on line 11—11 of Fig. 10;

Fig. 12 is a cross section on line 12—12 of Fig. 10;

Fig. 13 is a side elevation of the combined sleeve member and clutch member shown in Fig. 10;

Fig. 14 is a side elevation of a stop nut sectionally shown in Fig. 10;

Fig. 15 is a vertical longitudinal section through the driving pinion detached; and

Fig. 16 is a front elevation of the primary clutch member shown in Fig. 12 detached.

In both constructions, shown respectively in Figs. 1 and 9, the prime mover 20 is desirably an electric motor and an extension 21 of its armature shaft conveniently forms the power shaft for the drive-assembly (22 in Fig. 1 and 22' in Fig. 9) which is shown as directly mounted on it. Such shaft desirably extends forwardly beyond the engine-member to be driven, here shown as a peripheral gear 23 on the engine flywheel

23', and the outboard end of the shaft finds bushed bearing in the housing 24 which is shown in Fig. 2 as a frame extension of motor 20.

5 In each instance herein shown the drive assembly, 22 or 22', is bodily shiftable longitudinally along the power shaft 21 in order to move the driving pinion element (25 in Fig. 1, 25' in Fig. 9) from normal
10 retracted position to the advanced position (shown in dotted lines in Fig. 1) where it drivingly engages the engine-gear 23, and this advancement should be substantially completely effected, to engage the pinion
15 and the engine gear, before the motor 20 is started in operation. Provision by which the operator advances the drive along its power shaft and starts the motor at an appropriate point in the longitudinal advance
20 of the drive may comprise a plunger pedal 26 linked as at 27 to a shifter lever 28 which has suitable yoke connection with a part of the drive assembly and is acted on by a spring 29 to normally hold the plunger
25 raised and the drive retracted. The motor starting push-switch 30 is here shown as arranged in the path of movement of an adjustable striker 31 on the shifter lever 28 which acts to close and open the motor circuit
30 in appropriate time-relation to the advance and retraction of the drive.

First to describe in detail the drive shown in Figs. 1 to 8: numeral 33 indicates a one-way clutch structure that is bodily shiftable
35 along the power shaft 21 by the shifter lever 28. The primary or driving member of said clutch engages the shaft 21 for rotation therewith and movement longitudinally thereof, while the secondary or driven member
40 of said clutch carries a screw sleeve structure 34 which is concentric with the power shaft 21 but is free from it with respect to both longitudinal and rotary motion. The driving pinion 25 is also concentric
45 with the power shaft but is free from it for both longitudinal and rotary movement and such pinion has screw-thread provision engaging the long-lead threads of the sleeve structure 34, so that it is capable
50 of spiral movement or simultaneous longitudinal and rotative displacement, with respect to the sleeve. The forward movement of said pinion 25 with respect to the sleeve is here shown as limited by a stop 35 carried
55 by one of these threaded parts and the pinion is normally held in its forwardmost position with respect to the screw sleeve, but yieldingly, by a compression spring 36 abutting at opposite ends against portions of the
60 pinion structure and the clutch structure respectively.

In the particular embodiment shown in Figs. 1 to 8, the power shaft 21 has an enlarged rear portion longitudinally splined
65 as at 40 to receive the straight splines 41

(Fig. 5) of the primary or driving member 42 of the one-way clutch 33, and for manual shifting of the clutch such clutch member 42 directly receives the yoke of the shifter lever 28 in its grooved collar-extension 43. Rollers 44 in the peripheral clutch-pockets 45 of the body of such member 42 coact with the inner periphery of the secondary clutch member 46, which is desirably of cup form, and a retainer ring 47 of suitable construction, spun on or otherwise secured to cup 46, unites the clutch parts against relative longitudinal displacement. It will be understood that unidirectional clutches of other appropriate forms may be employed, but that here illustrated is one available form.

The screw-sleeve structure 34 is preferably made integral with the secondary member of the clutch 33, and as shown in Fig. 3 it extends forwardly from the clutch-cup 46 in spaced relation to the power shaft. An enlarged rear portion, 49, of this sleeve 34 is chambered as at 50 and beyond the front wall 51 of the chamber the sleeve is externally reduced in diameter as at 52 and its reduced portion is provided with internal long-lead threads or spiral splines 53, best shown in Fig. 7. The drive pinion 25 here shown has a tubular rearward extension 55 which is preferably bushed as at 56 and is rotatably fitted on the smooth forward portion 57 of the power shaft 21, such extension 55 being exteriorly threaded or spirally splined as at 58 (Fig. 6) throughout an appropriate part of its length for co-action with the internal threads or splines of the sleeve structure 34.

The stop collar 35 is securely fixed to the rear end of the pinion-extension 55 to form an enlargement of the latter within the chamber 50, and the annular stop surface 59 of said collar normally abuts against the shoulder 51 of said chamber to drivingly lock together the screw-sleeve structure 34 and the pinion 25 when torque is being transmitted from the shaft through the clutch to the screw-sleeve structure and through the screw threads to the pinion, the direction of taper of the clutch-pockets 45 and the direction of thread-lead of the screw-sleeve being appropriate for this purpose.

To normally maintain the pinion structure 25 in forwardmost position relative to the screw sleeve 34, the compression spring 36 is arranged to surround the reduced portion 52 of the screw sleeve. As shown it bears at its rear end against the external shoulder of the sleeve and at its forward end bears against a cupped collar 60 slipped over the pinion extension and abutting against the toothed head of the pinion. The normal, retracted position of the assembly is determined by the contact of the rear end
120
125
130

of pinion-extension 55 against the enlarged portion 40 of the power shaft.

Describing a cycle of operation of the construction shown in Figs. 1 to 8, the operator's depression of plunger pedal 26 rocks shifter lever 28 to advance the drive assembly 22 bodily along the splined power shaft 21 of the electric motor 20, and at an appropriate point in this manual shifting of the drive, after the teeth of pinion 25 have substantially fully meshed with the teeth of engine gear 23, the striker 31 closes push-switch 30 to start the motor 20.

Upon starting up of the electric motor, rotation of the motor shaft 21 in arrow-indicated direction actuates the one-way or over-running clutch 17 in its torque-transmitting direction, thus rotating the sleeve 34. This sleeve drivingly rotates the pinion structure 25, by virtue of the threaded engagement between them and of the contact of stop collar 35 against the abutment 51 of the sleeve, and accordingly the pinion drives the engine-gear 23.

When the engine "picks up" the pinion 25 will remain in engagement therewith until the operator releases plunger 26 so that spring 29 may retract the drive as a whole, but the engine-driven speed of the pinion 25 is greater than the speed of the motor-shaft 21 and consequently the one-way clutch 33 releases, thus preventing the motor 20 from being engine-driven at excessive speed.

In the event that the advancement of the drive toward the position shown in dotted lines in Fig. 1 brings the pinion teeth into end abutment with the teeth of the engine-gear, longitudinal advancement of the pinion stops but the sleeve structure 34 continues to advance moving along the pinion-extension 55, and the threaded engagement between these parts 34 and 55 acts to displace the pinion structure rotatively relatively to the clutched-together sleeve 34 and shaft 21. This slight rotative displacement of the pinion brings its teeth into registry with those of the engine-gear, so insuring proper mesh between these parts, and spring 36 thereupon exerts its force tending to advance pinion 25 to forwardmost position on the threads. Thus, when the motor starts such pinion will be in, or instantly will be screw-advanced into, full mesh with the engine-gear.

Describing now the construction shown in Figs. 9 to 16, power shaft extension 21', somewhat shortened in its splined portion 40', has the primary clutch member 42' making spline engagement therewith as at 41' and the cupped secondary member 46', rotatively loose with respect to the shaft, co-acts with the primary clutch member substantially as heretofore described, through the appropriate provision of clutch rollers

44' and connection ring 47'. The elongated sleeve structure 34', integral with and extending forwardly from the secondary element of the clutch, is bushed as at 56' to bear on the smooth forward portion 57' of the power shaft. This sleeve is threaded or spirally splined externally at 53' adjacent its forward end to co-act with internal threads 58' of the pinion structure 25' which, as shown in Fig. 10, extends back of its external teeth only sufficiently to receive the cupped collar 60'. In this construction, stop member 35' is secured in a counterbore in the forward end of the screw sleeve 34' and its stop-shoulder 51' enters a counterbore at the forward end of the pinion 25' to co-act with internal shoulder 59' of said pinion. Compression spring 36' is interposed between the spring collar 60' of the pinion and a collar 62 on the screw sleeve, such collar being a solid ring detachably secured on the shouldered rear portion 49' of the sleeve and held in place by a spring ring 63. The fork of the shifter lever 28' conveniently engages the shiftable structure between collar 62 and the cup-enlargement of the clutch.

The cycle of operation of this embodiment of my invention is substantially the same, descriptively, as heretofore set forth in connection with Figs. 1 to 8, and where the pinion member may be of larger diameter consistent with the provision of a larger number of teeth, the form of construction last described affords certain advantages, although where minimum pinion diameter, consistent with a small number of pinion teeth, is essential, the compact and sturdy body formation of the construction shown in Fig. 1 is desirable.

While I have herein described two particular embodiments of my invention for purposes of full disclosure and indicating that many changes in detail may be made without departure from the broader spirit of my invention, it will be understood that other changes in construction and arrangement of parts may be made within the spirit of my invention and within the scope of the appended claims.

I claim:

1. An engine starter including a shaft, a one-way clutch longitudinally shiftable relative to and rotarily actuated by said shaft, a pinion adapted to engage when advanced a gear of the engine to be started, and operative connections between said clutch and pinion adapted and arranged to advance said pinion with and forwardly rotate it from said clutch and to effect rotary registry-insuring adjustment of the pinion if said advancement of said pinion is stopped by non-meshing abutment thereof against said engine-gear, said connections including parts respectively associated with

the pinion and the clutch for effecting relative rotation between the pinion and the clutch incidentally to relative longitudinal movement between them and setting the clutch on advancement of the clutch relative to the pinion.

2. An engine starter including a shaft, a one-way clutch longitudinally shiftable relatively to and rotarily actuated by said shaft, manual means for longitudinally shifting said clutch, a pinion adapted to engage when advanced a gear of the engine to be started, and operative connections between said clutch and pinion adapted and arranged to advance said pinion with and forwardly rotate it from said clutch and to effect rotary, registry-insuring adjustment of the pinion if said advancement of said pinion is stopped by non-meshing abutment thereof against said engine-gear during the manual shifting of said clutch, said connections including a threaded pinion-extension and, coacting therewith, a threaded extension of said clutch arranged to set said clutch when the latter is advanced relative to said pinion.

3. In an engine starter, the combination with an engine-gear, a starting motor and a manual shifter adapted to start the motor after substantially full shifter-advancement, of a one-way clutch longitudinally shiftable by said shifter and rotarily actuatable by said motor, a pinion adapted to engage said engine gear when advanced, and operative connections between said clutch and pinion adapted and arranged to advance said pinion with said clutch, forwardly drive it therefrom, and rotatively adjust said pinion for mesh-insurance when advancement of said pinion is stopped by non-registering abutment against the engine-gear while the clutch is being manually advanced, said connections including an externally threaded pinion-extension and, coacting therewith, an internally threaded extension from a part of said clutch arranged to set said clutch when the latter is advanced relative to said pinion.

4. An engine starter including a shaft to be motor-driven; a one-way clutch longitudinally shiftable thereon, the primary clutch-member being rotatable by, and the secondary clutch-member rotatively free from, said shaft; a pinion adapted to engage when advanced a gear of an engine to be started; and operative connections between said pinion and said secondary clutch-member, adapted and arranged to shift said pinion with and forwardly drive it from said clutch-member and to effect rotary displacement of the pinion relative to said clutch-member when longitudinal advancement of said pinion with said clutch-member is stopped by non-meshing abutment of the pinion against the engine-gear, said connec-

tions including an externally threaded pinion-extension and, coacting therewith, an internally threaded extension from said secondary clutch-member arranged to set said clutch when the latter is advanced relative to said pinion.

5. An engine starter including a shaft to be motor-driven; a one-way clutch longitudinally shiftable thereon, the primary clutch-member being rotatable by, and the secondary clutch-member rotatively free from, said shaft; manually operable means for shifting said clutch; a pinion adapted to engage when advanced a gear of an engine to be started; and operative connections between said pinion and said secondary clutch-member, adapted and arranged to shift said pinion with and forwardly drive it from said clutch-member and to effect rotary displacement of the pinion relative to said clutch-member when longitudinal advancement of said pinion with said clutch-member is stopped by non-meshing abutment of the pinion against the engine-gear during the manual advancement of said clutch, said connections including an integral externally threaded pinion-extension and, coacting therewith, an internally threaded integral extension of said secondary clutch-member arranged to set said clutch when the latter is advanced relative to said pinion.

6. An engine starter comprising a motor-driven shaft, a one-way clutch longitudinally shiftable thereon and rotatable thereby, a pinion adapted to engage when advanced a gear of an engine to be started and free for rotary and longitudinal movement relative to said shaft, and combined pinion-driving and registry-adjusting means connecting said clutch with said pinion for advancing and drivingly rotating the latter and for effecting setting the clutch and rotary mesh-insuring adjustment of said pinion relative to said clutch when advancement of said pinion with said clutch is stopped by non-meshing abutment of said pinion against said engine-gear.

7. In an engine starter, a motor-driven shaft; a one-way clutch longitudinally shiftable thereon and rotatable thereby, a pinion adapted to engage when advanced a gear of an engine to be started, operative connections between said pinion and said clutch adapted and arranged to advance said pinion with and drivingly rotate it from said clutch, said connections including threads whereon said pinion is spirally displaced relative to said clutch in direction to set said clutch when longitudinal advancement of said pinion with said clutch is stopped by non-meshing abutment of the pinion against the engine-gear, and means for positioning said pinion forwardly on said threads when said clutch is retracted.

8. In an engine starter, a motor-driven

shaft; a one-way clutch longitudinally shiftable thereon, the primary clutch-member being rotatable by, and the secondary clutch-member rotatively free from, said shaft;

5 a pinion adapted to engage when advanced a gear of an engine to be started, said pinion being rotatable and longitudinally shiftable relatively to said shaft; operative connections between said pinion and said secondary clutch-member adapted and arranged to advance said pinion with and drivingly rotate it from said clutch-member, said connections including threads whereon said pinion is spirally displaced relative to said clutch-member in direction to set said clutch when longitudinal advancement of said pinion with said clutch-member is stopped by non-meshing abutment of the pinion against the engine-gear, and means interposed between said pinion and said secondary clutch-member for positioning said pinion forwardly on said threads when said clutch is retracted.

9. In an engine starter, a motor-driven shaft; a one-way clutch longitudinally shiftable thereon and rotatable thereby, a pinion adapted to engage when advanced a gear of an engine to be started, operative connections between said pinion and said clutch adapted and arranged to advance said pinion with and drivingly rotate it from said clutch, said connections including threads whereon said pinion is spirally displaced relative to said clutch in direction to set said clutch when longitudinal advancement of said pinion with said clutch is stopped by non-meshing abutment of the pinion against the engine-gear, and spring means for positioning said pinion forwardly on said threads when said clutch is retracted.

10. In an engine starter, a motor-driven shaft; a one-way clutch longitudinally shiftable thereon, the primary clutch-member being rotatable by, and the secondary clutch-member rotatively free from, said shaft; a pinion adapted to engage when advanced a gear of an engine to be started, said pinion being rotatable and longitudinally shiftable relatively to said shaft; operative connections between said pinion and said secondary clutch-member adapted and arranged to advance said pinion with and drivingly rotate it from said clutch-member, said connections including threads whereon said pinion is spirally displaced relative to said clutch-member in direction to set said clutch when longitudinal advancement of said pinion with said clutch-member is stopped by non-meshing abutment of the pinion against the engine-gear, and a spring interposed between said pinion and said secondary clutch-member for positioning said pinion forwardly on said threads when said clutch is retracted.

11. In an engine starter, a motor driven shaft and a drive thereon, said drive includ-

ing a one-way clutch having primary and secondary members bodily shiftable together longitudinally of said shaft, the primary clutch-member being rotatable with said shaft and the secondary clutch-member being rotatably free from said shaft; a screw-member connected with said secondary clutch-member for longitudinal and rotary movement therewith; a pinion adapted to engage when advanced a gear of an engine to be started and operatively associated with the threads of said screw-member for spiral displacement thereon in direction to set said clutch and to be drivingly rotated by said screw member when in forward position thereon; and means positioning said pinion forwardly on said screw member when said screw member is retracted.

12. In an engine starter, a motor driven shaft and a drive thereon, said drive including a one-way clutch having primary and secondary members bodily shiftable together longitudinally of said shaft, the primary clutch-member being rotatable with said shaft and the secondary clutch-member being rotatably free from said shaft; a screw-member connected with said secondary clutch-member for longitudinal and rotary movement therewith; a pinion adapted to engage when advanced a gear of an engine to be started and operatively associated with the threads of said screw-member for spiral displacement thereon in direction to set said clutch and to be drivingly rotated by said screw member when in forward position thereon; and yielding means normally positioning said pinion forwardly on said screw member.

13. In an engine starter, a motor driven shaft and a drive thereon, said drive including a one-way clutch having primary and secondary members bodily shiftable together longitudinally of said shaft, the primary clutch-member being rotatable with said shaft and the secondary clutch-member being rotatably free from said shaft; a screw-member connected with said secondary clutch-member for longitudinal and rotary movement therewith; a pinion adapted to engage when advanced a gear of an engine to be started and operatively associated with the threads of said screw-member for spiral displacement thereon in direction to set said clutch and to be drivingly rotated by said screw member when in forward position thereon; and a spring interposed between said pinion and said secondary clutch-member for normally positioning said pinion forwardly on said screw member.

14. An engine starter including a starter motor, a motor driven shaft, a one-way clutch having primary and secondary members bodily shiftable together longitudinally of said shaft, the primary clutch-member being rotatable with said shaft and the sec-

ondary clutch-member rotatably free from said shaft, manual means for advancing said clutch on said shaft and thereafter starting said motor, a pinion adapted to engage a gear of an engine to be started when advanced, thread-including operating connections between said pinion and said secondary clutch-member for drivingly rotating said pinion from said clutch-member and permitting spiral displacement of said pinion relative to said clutch-member in direction to set said clutch in the event of tooth abutment, said threaded connections including a sleeve carried by one of said connected parts and bearing on said shaft to slide and turn thereon.

15. An engine starter including a starter motor, a motor driven shaft, a one-way clutch having primary and secondary members bodily shiftable together longitudinally of said shaft, the primary clutch-member being rotatable with said shaft and the secondary clutch-member rotatably free from said shaft, manual means for advancing said clutch on said shaft and thereafter starting said motor, a pinion adapted to engage a gear of an engine to be started when advanced, thread-including operating connections between said pinion and said secondary clutch-member for drivingly rotating said pinion from said clutch-member and permitting spiral displacement of said pinion relative to said clutch-member in direction to set said clutch in the event of tooth abutment, said threaded connections including a sleeve carried by one of said connected parts and bearing on said shaft to slide and turn thereon, and means normally positioning said pinion forwardly in its thread-controlled range of movement relative to said sleeve.

16. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members, the primary member being rotatable with and shiftable along the splined shaft-portion, a pinion slidable and rotatable on said smooth shaft portion, threaded operating connections between said pinion and said secondary clutch-member for drivingly rotating said pinion when in forward position on the threads and permitting relative longitudinal movement of said pinion and said clutch-member in direction to set said clutch in the event of tooth-abutment, said connections including a sleeve carried by one of the connected parts and bearing on the smooth shaft portion to slide and rotate thereon, and means positioning said pinion forwardly on said threads when said sleeve is in retracted position.

17. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch

having primary and secondary members, the primary member being rotatable with and shiftable along the splined shaft-portion, a pinion slidable and rotatable on said smooth shaft portion, threaded operating connections between said pinion and said secondary clutch-member for drivingly rotating said pinion when in forward position on the threads and permitting spiral displacement of said pinion relative to the clutch-member in direction to set said clutch in the event of tooth-abutment, said connections including a sleeve carried by one of the connected parts and bearing on the smooth shaft portion to slide and rotate thereon, and a spring interposed between said pinion and said clutch for positioning said pinion forwardly on said threads when said clutch is in retracted position.

18. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members the primary member being rotatable with and shiftable along the splined shaft portion, a spirally threaded member connected with said secondary clutch-member for longitudinal and rotary movement therewith and extending forwardly around said smooth shaft-portion, a pinion adapted to engage when advanced a gear of an engine to be started and rotatable about and longitudinally shiftable with respect to said smooth shaft-portion and operatively associated with the threads of said screw member for spiral displacement with respect thereto in direction to set said clutch in the event of tooth-abutment and to be drivingly rotated by said screw-member when in forward position on said threads, and means positioning said pinion forwardly on said screw member when said screw member is retracted.

19. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members the primary member being rotatable with and shiftable along the splined shaft portion, a spirally threaded member connected with said secondary clutch-member for longitudinal and rotary movement therewith and extending forwardly around said smooth shaft-portion, a pinion adapted to engage when advanced a gear of an engine to be started and rotatable about and longitudinally shiftable with respect to said smooth shaft-portion and operatively associated with the threads of said screw member for spiral retreat with respect thereto and to be drivingly rotated by said screw-member when in forward position on said threads, and a spring interposed between said pinion and said screw member for

normally positioning said pinion forwardly on said screw threads.

20. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members the primary member being rotatable with and shiftable along the splined shaft-portion, a pinion mounted on said smooth shaft-portion to slide and rotate thereon and having an externally threaded rear extension, a screw sleeve carried by said secondary clutch-member making internally threaded engagement with said pinion extension to drivingly rotate said pinion when the latter is in forward position and to permit spiral displacement of said pinion in direction to set said clutch when advance of the latter with said clutch-member is prevented, and means positioning said pinion forwardly on its threads when said sleeve is retracted.

21. In an engine starter, a power shaft having a longitudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members the primary member being rotatable with and shiftable along the splined shaft-portion, a pinion mounted on said smooth shaft-portion to slide and rotate thereon and having an externally threaded rear extension bearing on said shaft, a screw sleeve carried by said secondary clutch-member bearing on and making internally threaded engagement with said pinion extension to drivingly rotate said pinion when the latter is in forward position and to permit spiral retreat of said pinion in direction to set said clutch when advance of the latter with said clutch-member is prevented, and a spring interposed between said pinion and said secondary clutch-member for normally holding said pinion in forward position of threaded engagement with said clutch-member.

22. In an engine starter, a motor having a shaft, a one-way clutch having primary and secondary members, the primary member being rotatable with and shiftable longitudinally of said shaft, manual means for bodily advancing said clutch and thereafter starting said motor, a pinion adapted to engage when advanced a gear of an engine to be started and having a rearward extension, said pinion and extension slidably and rotatably bearing on said shaft, a stop member on the rear end of said extension, a sleeve structure carried by said secondary clutch element and surrounding said pinion-extension in spirally threaded engagement therewith and having a stop abutment for said stop member, and means for normally positioning said pinion-structure forwardly with respect to the secondary clutch-member.

23. In an engine starter, a motor having an armature shaft provided with a longi-

tudinally splined rear portion and a smooth front portion, a one-way clutch having primary and secondary members, the primary member being rotatable with and shiftable longitudinally of said splined shaft-portion, manual means for bodily advancing said clutch and thereafter starting said motor, a pinion adapted to engage when advanced a gear of an engine to be started and having a rearward extension, said pinion and extension slidably and rotatably bearing on said smooth shaft-portion, a stop member on the rear end of said extension, a sleeve structure carried by said secondary clutch element and surrounding said pinion-extension in spirally threaded engagement therewith and having a stop abutment for said stop member, a spring-collar on said pinion and a compression spring interposed between said spring collar and said secondary clutch-member.

WILLIAM L. McGRATH.

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