

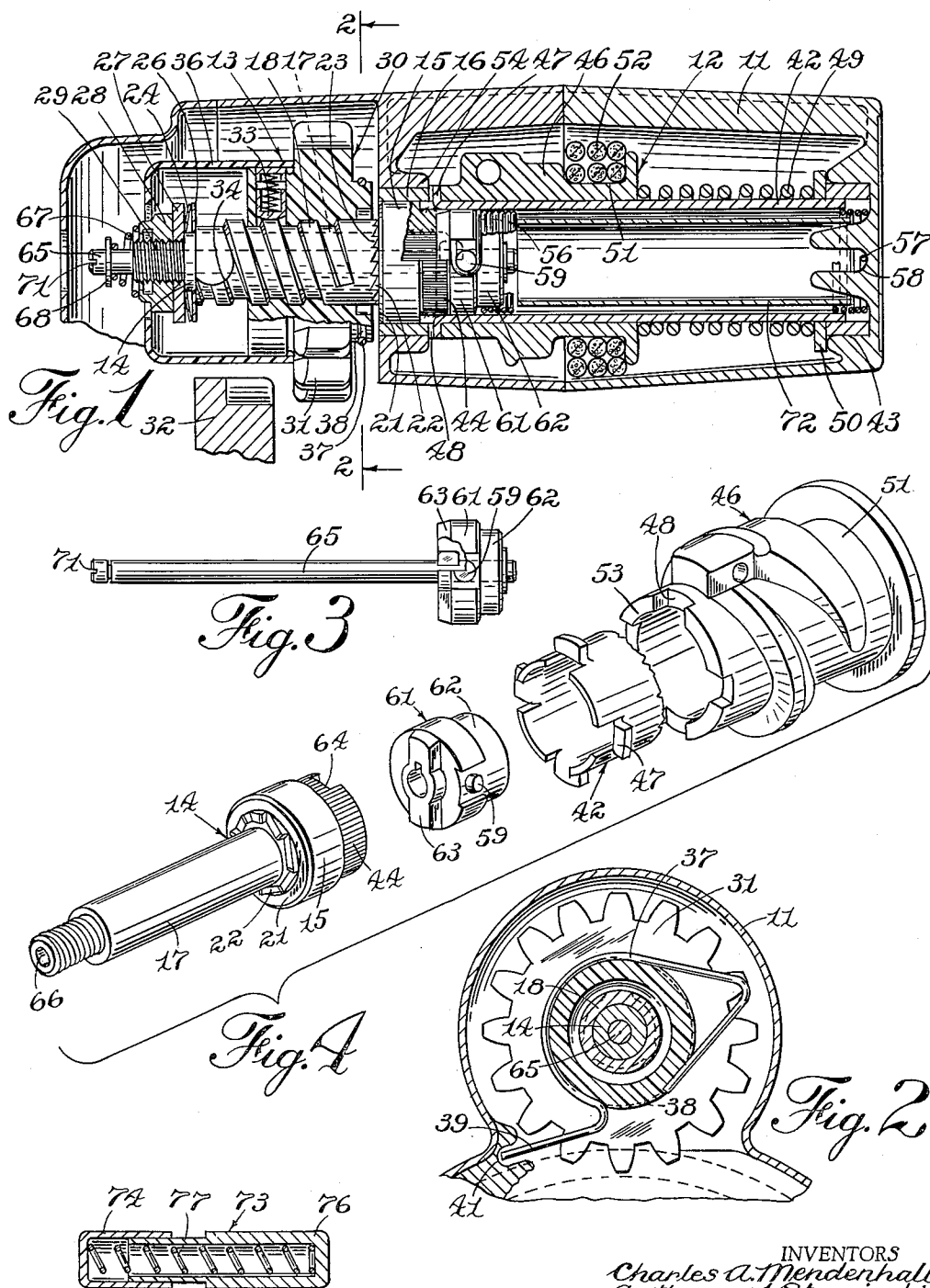
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ROPE ACTUATED STARTER GEARING FOR INTERNAL COMBUSTION ENGINES

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1

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ROPE ACTUATED STARTER GEARING FOR INTERNAL COMBUSTION ENGINES

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The present invention relates to rope actuated starter gearing for internal combustion engines, and more particularly to gearing of the automatically engaging and disengaging type.

It is an object of the present invention to provide a novel gearing device of this type which is efficient and reliable in operation while being simple and economical in construction.

It is another object to provide such a device which engages promptly upon initial actuation of the rope drum and disengages freely when the engine starts, with no tendency after disengagement for the drive pinion to rebound towards the engine gear.

It is another object to provide such a device which maintains its engagement with the engine gear throughout the tractive actuation of the rope irrespective of the initial or irregular explosions of the engine.

It is another object to provide such a drive including means for rewinding the rope on the drum after each actuation thereof and novel means for adjusting the tension of the rewinding means.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which:

FIG. 1 is a side elevation, partly broken away and in section, of a preferred embodiment of the invention;

FIG. 2 is a sectional detail taken substantially on the plane of line 2—2 of FIG. 1;

FIG. 3 is a side elevation, partly broken away, of the rewind spring tension adjusting rod and clutch member;

FIG. 4 is an exploded detail perspective of the sleeve, rewind spring clutch member, tubular housing member and the rope drum; and

FIG. 5 is a reduced sectional detail of an expander member for use in a modified version of the preferred embodiment.

In FIG. 1 of the drawing there is illustrated a casing 11 supporting and housing a manual rope actuated starting assembly generally indicated at 12 and a starter drive assembly generally indicated at 13.

The starter drive assembly 13 is supported on a sleeve 14 having a bearing and clutch member 15 formed integrally therewith. Said bearing and clutch member is rotatably and slidably supported in a bushing 16 provided in a wall portion of the casing 11. The sleeve 14 has a smooth portion 17 upon which a screw shaft 18 is rotatably and slidably journaled. The bearing and clutch member 15 of the sleeve 14 has a radial shoulder 21 formed with dentils 22 which engage and cooperate with dentils 23 formed in the end of the screw shaft 18 thereby making the screw shaft a driven coupling member and in concert with the bearing and clutch member 15 providing an overrunning driving coupling. The screw shaft is axially biased by a spring washer 24 journaled on the sleeve 14 and interposed between a pinion thrust washer 26 and an end washer 27, whereby the dentils 22 are yieldably maintained in engagement with the dentils 22. A stop nut 28 secured to the threaded extremity 29 on the sleeve 14, as an incidental function, retains the spring 24 and washers 26 and 27 in their proper axial relationship.

A pinion assembly 30 is threaded on the screw shaft 18 and during starter operation, hereinafter described, is longitudinally traversed on the screw shaft 18, causing

2

the pinion 31 to mesh with a gear 32 of the engine to be started. Within the pinion assembly 30 is a spring actuated detent member 33 which bears upon the threads of the screw shaft and in the pinion-meshed condition engages a locking pocket 34 in said screw shaft, locking the pinion assembly in mesh until the engine causes the pinion to rotate beyond a predetermined rate. A dust cover 36 is fixedly secured to the pinion assembly to effectively shield the starter drive assembly from the ingress of foreign and deleterious substances.

To insure that the pinion assembly 30 will longitudinally traverse the screw shaft a retarder spring 37 is seated in a circumferential groove 38 formed in the pinion frictionally bearing therein. A free end of the spring 37 is outturned, as at 39, a sufficient amount to allow it to engage in an axial recess 41 formed in the casing 11 thereby effectively limiting the rotational displacement of the spring while allowing the spring and the associated pinion assembly relatively unrestrained longitudinal movement.

The manual rope actuated starting assembly 12 includes a rewind spring tubular housing member 42 which is rotatably supported at one extremity by an appropriate bearing means formed in the casing 11, as at 43, and at its opposite extremity is fixedly coupled to the knurled extension 44 provided on the bearing and clutch member 15. Relative rotation between the tubular housing 42 and the member 15 is prevented by fixedly secured these components together as by brazing.

A drum 46 is mounted on the external surface of the tubular housing 42 and connected for rotation therewith by means of radial tongues 47 projecting outwardly from said tubular housing and engaging cooperating slots 48 formed in said drum. Longitudinal displacement of the starter drive assembly 13 away from the engine gear is resisted by a mesh-enforcing spring 49 wound or wrapped about the external surface of the tubular housing 42 compressively engaging both the drum 46 and a thrust washer 50 seated against the bearing 43 of casing 11.

Movement of the starting assembly 12 in the meshing direction towards the engine gear is limited by a radial shoulder 53 of the drum 46 abutting the casing bushing support 54.

The drum 46 is formed so as to receive a starter rope 52 which is coiled on the drum and anchored thereto as shown at 51, thus providing the means to tractively actuate the drum and starting assembly in the normal manner.

A multi-coil rewind spring 56 is contained in the tubular housing 42 with the spring extremity adjacent the casing 11 being formed with an inturned leg 57 anchored to the casing in any convenient manner, as at 58. The opposite extremity of the rewind spring 56 is wrapped about a pin-like member 59 of a spring rewind clutch member 61. The clutch member 61 rotatably and slidably fits within the tubular housing 42 and has a short guiding boss 62 upon which a portion of the rewind spring is seated. Extending from said clutch member are diametrically opposed lugs 63 which disengageably coast with slots 64 formed in the extremity of the knurled portion 44 of the bearing and clutch member 15. An adjusting rod 65 coaxially aligned with the tubular housing 42 and the sleeve 14 extends from the clutch member 61 and is slidably and rotatably journaled in the bore 66 of the sleeve 14 to project beyond the starter drive cover 36. A compression spring 67 is retained on the end of the adjusting rod 65 by suitable means such as a split thrust washer 68 and bears against the stop nut 28 on the sleeve 14.

The spring 67 thus exerts an axial force on the clutch member 61 normally keeping the lugs 63 interengaged with the slots 64 in the bearing and clutch member 15, and incidentally, overcoming a reasonable amount of opposing bias exerted by the rewind spring 56. A kerf 71 is provided in the end of the adjusting rod 65 to receive

a screw driver or the like for adjustment of the rewind spring tension.

A tube or rod 72 confined within the rewind spring 56 is provided to assure the proper alignment of the spring 56 and to effectively prevent the rewind spring 56 from winding upon itself when initial torsional energy is imparted thereto. The rod 72 preferably loosely fits within the spring's inner diametric dimensions, but lengthwise it is substantially shorter than the rewind spring to provide the necessary space or clearance for the longitudinal movement of the clutch member 61 during the disengagement of the lugs 63 and the slotted extremity of bearing and clutch member 15.

In Fig. 5 there is illustrated a modified expandable tube 73 for replacing the tube member 72. The expandable tube 73 comprises a pair of telescoping closed tubes 74 and 76 and confined within said tubes is a compression coil spring 77. The spring 77 yieldingly urges the tube members 74 and 76 into abutting engagement with the adjacent portions of the casing 11 and the clutch member 61 thus maintaining the clutch member 61 and bearing and clutch member 15 in their engaged, but disengageable, condition. Utilization of the expandable tube 73 will eliminate the need for the compression spring 67 and the associated washer 68 since the bias exerted by the tube on the clutch will cause the adjusting rod to operably protrude freely beyond the dust cover 36.

In operation, the adjusting rod 65 is depressed against the force exerted by the spring 67 or the expandable tube 73 by a suitable tool such as a screw driver so that the clutch member 61 is disengaged from the bearing and clutch member 15. Rotation of the adjusting rod 65 by said tool, will cause the rewind spring 56 to be wound up and assume a desired degree of torsional tension. Release of the depressive force on the adjusting rod when the lugs 63 and slots 64 are in registry will allow the clutch member 61 and the bearing and clutch member 15 to again assume a unitary driving relationship. Any tendency for the starting assembly to unwind or unleash the torsional energy stored in the rewind spring 56 will be restrained by the engagement of the starter rope handle (not shown) abutting the casing 11.

To start the engine the actuator rope 52 is rapidly withdrawn from the drum 46 causing the drum to rotate at an appreciable rate of speed. Rotation of the drum is transferred to the tubular housing 42 and the driving clutch member 15 by means of the tongue and slot engagements 47 and 48, respectively. Rotation of the drum has a two-fold effect:

(1) Increasing torsional energy stored in the rewind spring 56;

(2) Rotating the screw shaft 18 through the dentil overrunning driving coupling, which in turn will cause the rotationally retarded pinion assembly 30 to longitudinally traverse the screw shaft and mesh the pinion 31 with the engine gear 32. Longitudinal traverse of the pinion assembly after complete meshing engagement is limited by the stop nut 28 and thereafter the rotational energy of the screw shaft is transferred to the pinion and thence to the engine to be started. The screw jack action between the pinion and screw shaft forces the screw shaft back against the dentils 22 of the bearing and clutch member 15, thus insuring against premature disengagement of the overrunning driving coupling.

In the meshed position the pinion detent 33 will drop into the locking pocket 34 and maintain the pinion in the engaged condition until the engine has started and attained a predetermined speed. When the engine has attained the predetermined speed, the detent 33 is withdrawn by centrifugal force. Of course, whenever the speed of the pinion attains a speed greater than the diminishing speed of the starting assembly the driving coupling formed by dentils 22 and 23 will be caused to be overrun, and thus effectively disconnect the starter drive assembly 13 from the starting assembly 12.

The release of the tension on the actuator rope 52 by the operator will allow the rewind spring 56 to release its stored torsional energy whereby the manual starting assembly 12 is revolved in a reverse direction to its initial position causing the actuator rope 52 to be properly rewound on the drum 46.

It can be appreciated that the initial storage of torsional energy in the rewind spring is most desirable and is necessary to supplement the torsional energy imparted to the spring during actuation thereby insuring proper and complete operation of the rewind structure during weak or partial starts.

Although but one form of the invention has been shown and described in detail, it will be understood that changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

We claim:

1. In a manually operable starting device for internal combustion engines a casing, a tubular member rotatably mounted therein, a driving drum mounted on the tubular member and connected thereto for rotation in unison, a hollow sleeve fixedly united to the tubular member, a screw shaft slidably journaled on said sleeve, an overrunning driving connection from the sleeve to the screw shaft, a pinion threaded on the screw shaft for movement into and out of mesh with a gear of an engine to be started, an abutment on said sleeve limiting the meshing movement of the pinion, means including the driving drum for rotating said tubular member from its initial position to cause the pinion to engage and rotate the engine gear, and yielding means operatively engaging said tubular member for rotating it backwards to its initial position.

2. A starting device as set forth in claim 1 including further, means including a rod slidably journaled in said sleeve for engaging and adjusting the tension of said yielding means.

3. A device as set forth in claim 1 in which the tubular member and hollow sleeve are axially slidable in the casing, abutment means limiting axial movement thereof in the direction to mesh said pinion with the engine gear, and yielding means urging said tubular member and sleeve toward said abutment means.

4. A device as set forth in claim 2 including further a clutch and bearing member journaled in said casing uniting the tubular member and hollow sleeve, said yielding means for rotating the tubular member backward including a torsion spring therein anchored at one end of the casing, and said adjusting means including a clutch member having the free end of said torsion spring attached thereto, the clutch member being rotatably and slidably mounted in said tubular member and having a disengageable connection with said clutch and bearing member.

5. A device as set forth in claim 4 in which said clutch member is rigidly mounted on said tension adjusting rod for rotation therewith, and for axial movement thereby into and out of clutching engagement with said clutch and bearing member; and further comprising means exerting a biasing force upon said clutch member yieldingly urging said clutch member into engagement with said clutch and bearing member.

6. In the device set forth in claim 5, the biasing means comprising a pair of opposed telescoping tubular elements confined within said yielding means, and a spring member compressively confined within the telescoping tubular elements whereby the tubular elements are biased into engagement with the casing and clutch member to maintain the engagement of the disengageable clutch connection.

7. A device as set forth in claim 1, including further a bearing and clutch member uniting the tubular member and the hollow sleeve, said bearing and clutch member having a dentil overrunning coupling engagement with said screw shaft and thereby limiting the travel of the screw shaft on said sleeve away from the engine gear, and

5

yielding means urging the screw shaft toward the clutch and bearing.

8. A device as set forth in claim 7, including further centrifugally released detent means for resisting demeshing movement of the pinion on the screw shaft until the pinion has reached a predetermined rotational speed. **5**

9. A device as set forth in claim 1, further character-

6

ized by means within the tubular member for maintaining the proper alignment of said yielding means.

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