May 6, 1947. J. E. BUXTON ET AL 2,420,283

STARTING MECHANISM

Filed June 5, 1945

Fig. 1

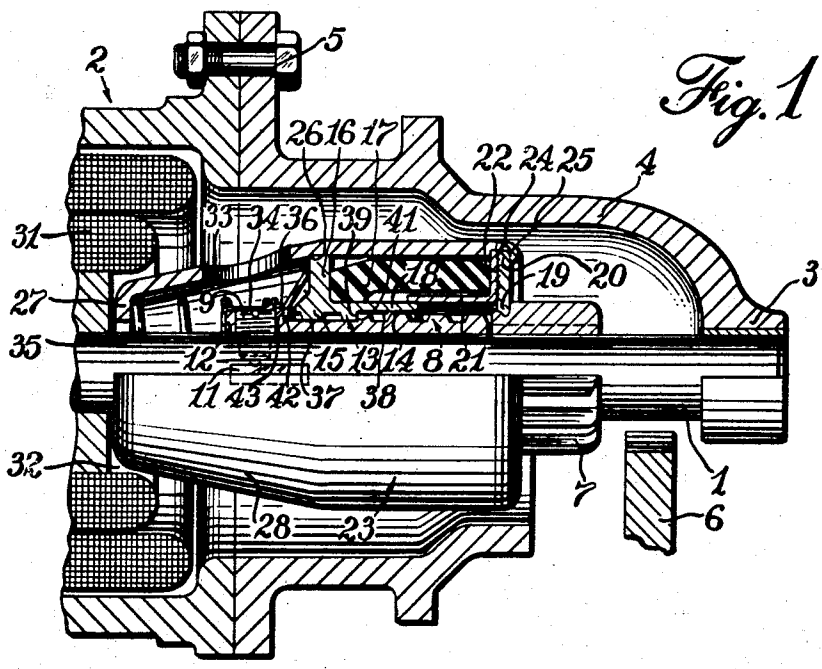



Fig. 2

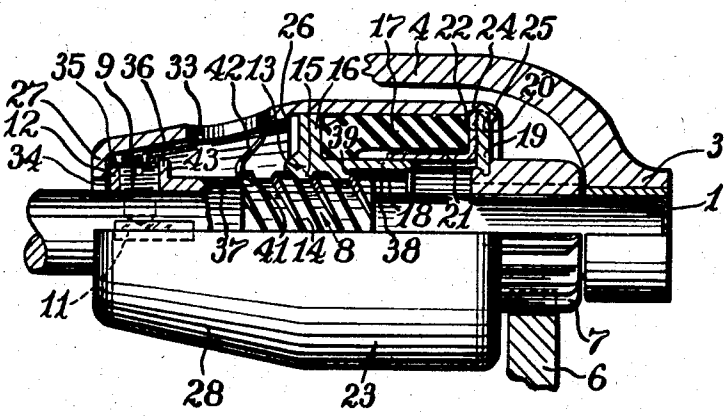
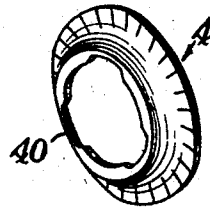



Fig. 3




WITNESS

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Patented May 6, 1947

2,420,283

# UNITED STATES PATENT OFFICE

2,420,283

## STARTING MECHANISM

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Application June 5, 1945, Serial No. 597,642

3 Claims. (Cl. 74—7)

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The present invention relates to a starting mechanism for internal combustion engines and more particularly to that type of starter in which a driving member is automatically engaged with a member on the engine to be started responsive to energization of the starting motor on which it is mounted.

It is an object of the present invention to provide a novel starting mechanism which is simple and economical to manufacture, composed of few parts and self-contained.

It is another object to provide a starter drive of the "outboard" type in which the driving member moves away from the starting motor as it engages with the engine member; which drive is arranged in telescopic relation to the motor so as to provide a compact unit, and eliminate the necessity of an intermediate bearing for the motor shaft.

A further object is to provide such a device wherein the internal parts are protected from dirt and grease by a housing which is so shaped as to conform to the design of the starting motor and reduce the combined overall dimensions to a minimum.

It is a further object to provide such a device embodying a unitary housing for the starting drive with a stop shoulder for limiting traversal of the pinion.

It is a further object to provide such a device in which an abutment surface on the screw sleeve cooperates with a stop shoulder on the housing to arrest traversal of the pinion when it reaches full engagement with the engine gear.

Further objects and advantages will be apparent to those skilled in the art by referring to the accompanying specification and drawing in which:

Fig. 1 is a side elevation of the starting mechanism partly in section and shown in idle position;

Fig. 2 is a view similar to Fig. 1, illustrating the starter in engaged position; and

Fig. 3 is a perspective view of the thread remeshing spring.

In Fig. 1 of the drawing, there is shown a power shaft 1 which may be the extended armature shaft of an electric starting motor 2, said shaft being journalled in an outer bearing 3 on an extension 4 of the motor frame, rigidly attached to said frame at 5. A member for driving a part on the engine to be started, such as a fly-wheel gear 6, is provided in the form of a pinion 7 which is slidably journalled on the shaft 1 for movement into and out of mesh with said gear.

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Means for actuating the driving pinion 7 from the power shaft are provided including an operating member in the form of a screw sleeve 8 fixed in any suitable manner to the power shaft as by means of a key 11 and a set screw 9 threaded in the head portion 12 of the operating member. The actuating means further includes a control member having an inclined connection with the sleeve 8 in the form of a nut 13 threaded on the screw sleeve by means of screw threads 14, 15 on the operating and control members respectively, and having a radial flange 16. A resilient driving connection between the nut 13 and the pinion 7 is provided in the form of a ring 17 of elastic material such as rubber, one end of which is seated on a hublike extension 18 of the nut member while the other end bears against a flange 19 fixed in any suitable manner to the pinion. In order to protect the threads 14, 15 from the entrance of foreign matter, a thimble 21 is telescopically mounted on the extension 18 of the nut 13 and united to the pinion flange 19 as by welding at 22.

Unitary means for enclosing the drive, maintaining initial compression of the elastic ring 17, and limiting the travel of the pinion 7 is provided in the form of a housing member or casing 23 having a recess 24 forming a seat for the thimble 21 and pinion flange 19. The thimble and flange are anchored in said seat by crimping over the end of the housing as shown at 25, the edge of the flange 19 being preferably provided with gashes or scallops 20 to ensure a rigid torque-transmitting connection between the barrel and pinion. The housing provides means for maintaining the driving connection through the ring 17 under a slight initial pressure in the form of an interior shoulder 26 providing an abutment for the flange 16 of the nut 13. The housing is further arranged to provide means for governing the meshed position of the pinion. For this purpose, the housing is formed with a rearwardly extending portion 28 terminating in a flange 27 which abuts the end of the screw sleeve 8 when the pinion is in driving position, as shown in Fig. 2.

According to the present invention, the starter drive is formed to partially telescope within the armature of the starting motor so as to reduce the length of the starting unit and shorten the armature shaft to such an extent that the intermediate bearing usually employed with outboard drives is rendered unnecessary. To secure this result, the radial flange 27 of the housing is made smaller in diameter than the recess 32

within the armature windings 31, thus allowing the end of the housing to enter therein when the drive is in idle position, as shown in Fig. 1.

In this embodiment of the invention, the extended portion 28 of the housing is shown as a tapered or conical section, having a clearance hole 33 therein through which the set screw 9 may be inserted and removed. Unitary means are provided for locking the screw 9 in assembled position and opposing drifting of the pinion 7 out of idle position in the form of a flanged collar 34 overlying the screw 9 and pressed by a spring 35 against a shoulder 36 on the head 12 of the screw sleeve 8. The other end of the spring 35 bears against the radial flange 27 of the housing 23 to maintain the pinion out of mesh with the gear 6 when the starting mechanism is idle.

In order to prevent rebounding of the pinion into contact with the engine gear 6 as it is thrown back to idle position, the threads 14, 15 are partly cut away as shown by the smooth portion at 37 on the sleeve 8 and the counterbore 38 of the nut 13 so as to permit the nut to run off the threads 14 and rotate freely. The thread ends 39, 41 are held in contact with each other under a light pressure supplied by a disc spring 42 interposed between the nut 13 and a shoulder 43 on the sleeve 8 as best illustrated in Fig. 3. The disc 42 bears slidably on the smooth portion 37 of sleeve 8, and is gashed interiorly as shown at 40 to permit it to be screwed on over the threads 14 on the sleeve.

In assembling the starter mechanism, the spring 42 is threaded onto the sleeve 8, followed by the nut 13 and the elastic ring 17. The collar 34 is then slid over the head 12 and spring 35 placed thereon. Then, the elements thus far assembled are slid into the casing until the flange 16 seats against the shoulder 26, and the pinion 7, pinion flange 19 and thimble 21 are assembled to the housing and anchored thereto by crimping over the end of the housing as shown at 25. The key 11 is seated in the armature shaft 1 preliminary to assembling the drive on the shaft. The drive is then slid on the shaft until the key enters the head 12 and the threaded opening for the set screw 9 lines up with a pilot hole in the shaft 1, as observed through the opening 33 in the housing, the collar 34 being held off the end of the sleeve 8 by means of a suitable tool inserted through the opening 33. The set screw 9 is then inserted and tightened up to hold this drive rigidly on the shaft. As a final operation, the motor frame member 4 is slid over the drive until the end of the shaft 1 enters the bearing 3 and anchored in place by the bolts 5.

In operation, energization of the starting motor 2 rotates the power shaft 1, and the nut 13 is thereupon traversed to the right in Fig. 1 due to the rotational inertia of the nut and its associated parts. The pinion 7 is accordingly traversed into mesh with the fly-wheel gear 6 until stopped by the abutment of flange 27 against the head 12 of the screw shaft. Further rotation of the shaft 1 causes the elastic member 17 to be compressed between the flanges 16 and 19 until sufficient torque is built up to crank the engine. Upon self-energization of the engine, the gear 6 accelerates more rapidly than the starting motor causing the nut 13 to thread itself back on sleeve



8 toward the left in Fig. 1 until it runs off the ends of the threads 14, its final endwise movement being cushioned by the reentry spring 42. The movable parts of the drive are thus returned to idle position where they are maintained by the anti-drift spring 35.

Although but one embodiment of the invention has been shown and described in detail, it will be understood that other forms and arrangements of the parts are possible without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In an engine starter, a motor having a frame, an extension fixed to the frame having a bearing in its end, an armature shaft journalled at one end in said bearing, a pinion slidably journalled on the shaft for longitudinal movement into and out of mesh with a gear of an engine to be started, a hollow shaft fixed on the armature shaft externally threaded at one end and having an abutment surface at the other end, a nut threaded on the hollow shaft, a yielding driving connection between the nut and pinion including a ring of elastically deformable material and a housing completely enclosing the nut, ring and hollow shaft and rigidly attached to the pinion; said housing having an inwardly extended flange adapted to engage the abutment on the end of the hollow shaft to thereby limit the meshing movement of the pinion.

2. In an engine starter drive a starting motor having a frame, an extension having a bearing fixed to the frame, an armature shaft journalled in the bearing, a pinion slidably journalled on the shaft for longitudinal movement thereon toward the bearing into mesh with a gear of an engine to be started, a screw shaft mounted on the power shaft, a nut threaded on the screw shaft, a yielding driving connection between the nut and pinion, a housing fixed to the pinion completely enclosing the screw shaft, nut and yielding driving connection, and means for anchoring the screw shaft on the power shaft, said housing having an opening providing access to the anchoring means.

3. An engine starter drive as set forth in claim 2 in which said screw shaft has a driving head portion formed with an abutment, and said housing has a terminal flange adapted to engage the abutment to limit the longitudinal movement of the pinion into mesh with the engine gear, and including further spring means cooperating with the abutment and flange to move the pinion to idle position, said spring means surrounding the anchoring means for the screw shaft and preventing loosening thereof.

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