

April 1, 1958

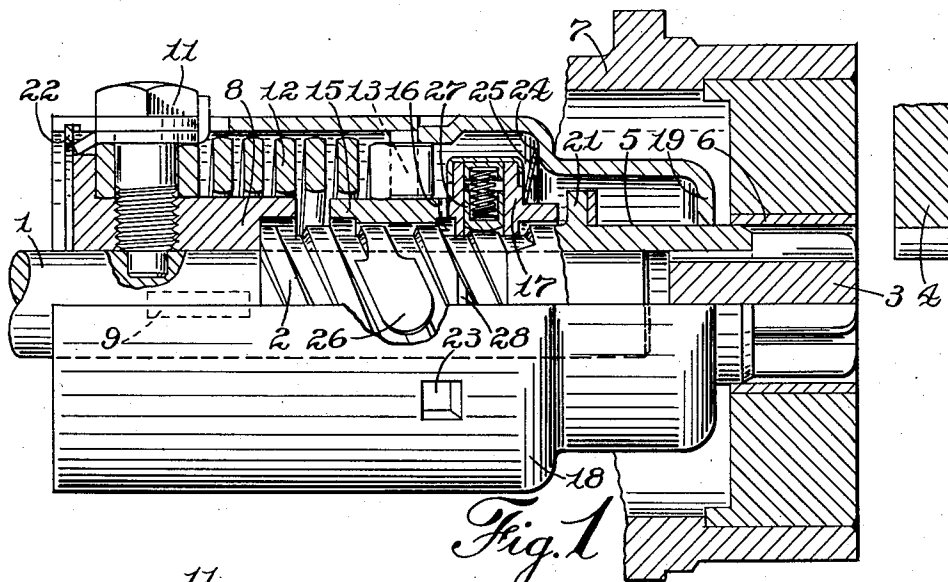
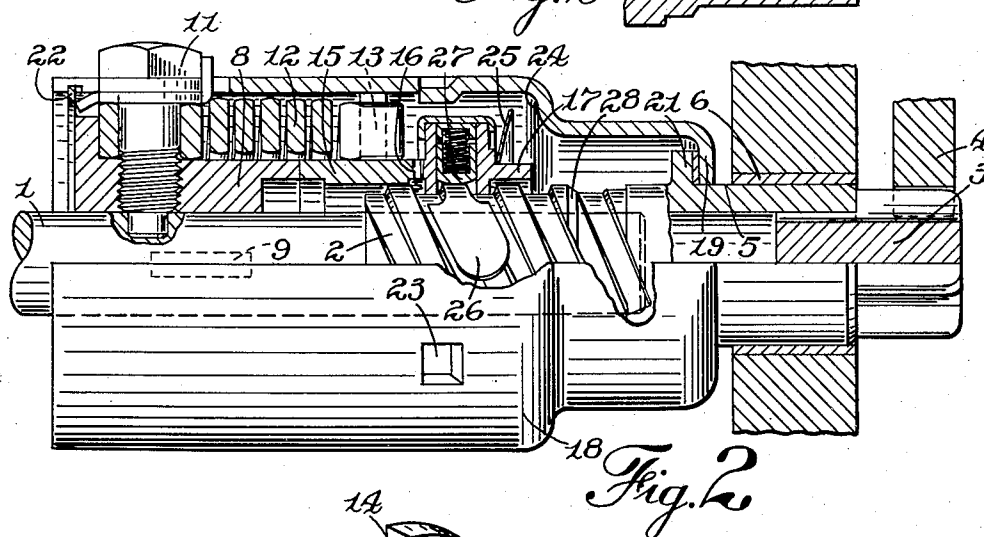
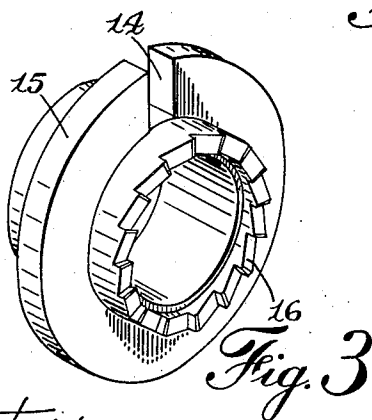
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2,828,630

ENGINE STARTER GEARING

Filed May 14, 1956

2 Sheets-Sheet 1



WITNESS:

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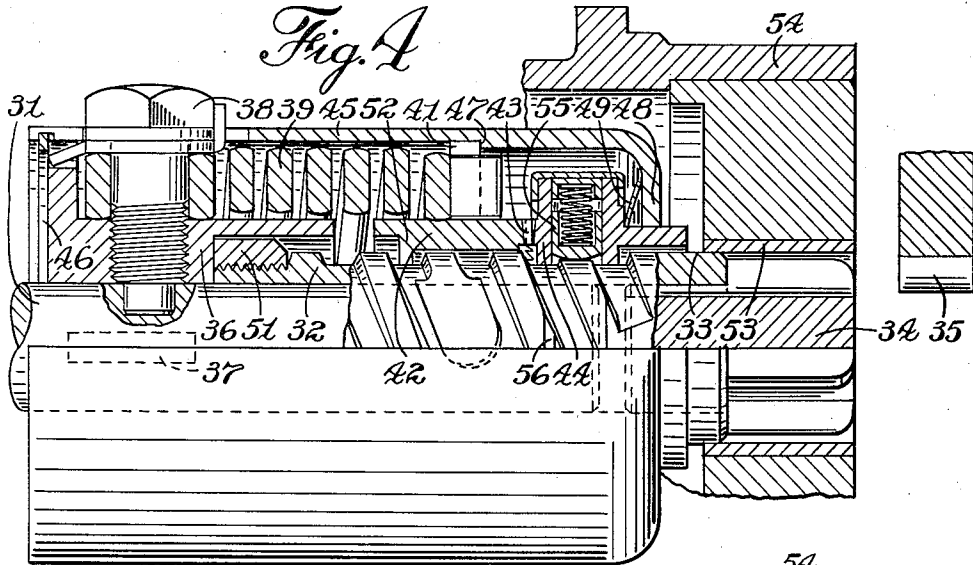
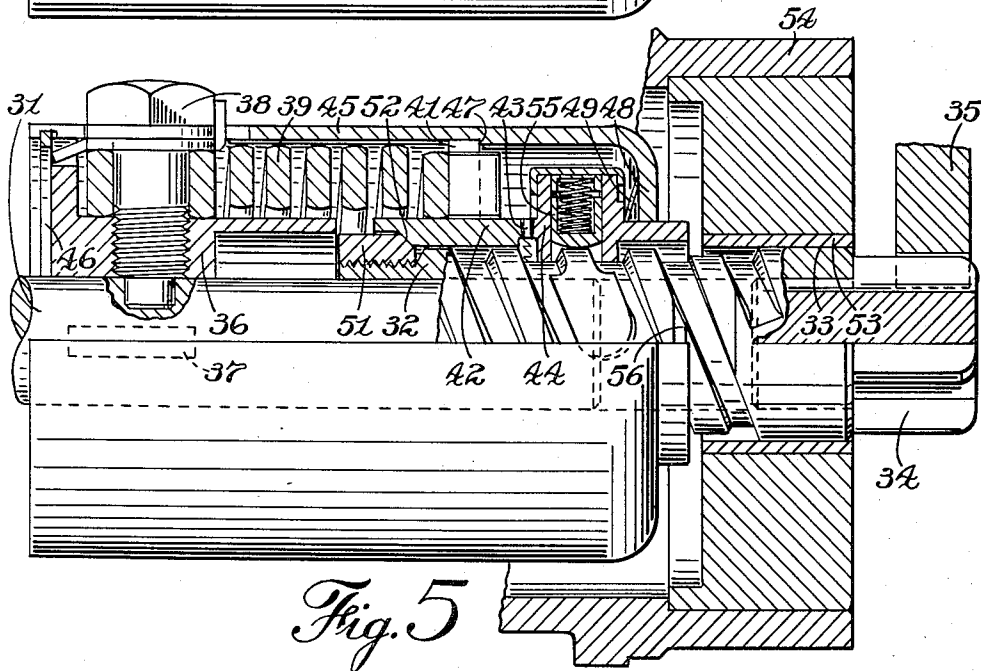
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ENGINE STARTER GEARING

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2 Sheets-Sheet 2



WITNESS:

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ENGINE STARTER GEARING

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7 Claims. (Cl. 74—7)

The present invention relates to engine starter gearing and more particularly to that type in which a drive pinion is advanced into engagement with an engine gear upon actuation of the starting motor and is retracted by overrunning the motor when the engine starts.

It is an object of the present invention to provide a novel starter drive of this type which permits the use of a very small solid pinion in order to secure a high gear reduction to the engine gear.

It is another object to provide such a device in which the rotating parts of the drive are enclosed in a housing which serves to define the meshing position of the pinion and also cooperates to compress the overrunning clutch and drive spring during cranking.

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

Fig. 1 is a side elevation, partly broken away and in section of a preferred embodiment of the invention showing the parts in normal or idle position;

Fig. 2 is a similar view showing the parts in cranking position;

Fig. 3 is a detail in perspective of the driving overrunning clutch member;

Fig. 4 is a view similar to Fig. 1 of a second embodiment of the invention; and

Fig. 5 is a view similar to Fig. 4 showing the parts in cranking position.

In Fig. 1 of the drawing there is shown a power shaft 1 on which a hollow screw shaft 2 is slidably journaled. The screw shaft extends beyond the end of the power shaft 1, and a solid pinion 3 is fixedly mounted in the extension of the screw shaft, projecting therefrom for engagement with a gear 4 of an engine to be started. The extended portion of the screw shaft is formed with a smooth bearing surface as indicated at 5 for cooperation with a stationary bearing member 6 mounted in the end 7 of the starting motor frame which is not further illustrated.

Means for actuating the screw shaft 2 from the power shaft 1 is provided comprising a driving head 8 rigidly mounted on the power shaft as by means of a key 9 and stud 11. A coiled drive spring 12 is anchored at one end on the stud 11 and at its other end has an out-turned portion 13 entering a slot 14 in a driving overrunning clutch member 15 (Fig. 3) which is loosely journaled on the screw shaft. Clutch member 15 has overrunning clutch teeth 16 cooperating with similar teeth on a control nut 17 threaded on the screw shaft 2.

A barrel member 18 surrounds and encloses the elements of the driving connection from the power shaft 1 to the screw shaft 2, and is provided with an abutment flange 19 adapted to be engaged by a radial flange 21 on the screw shaft to define the meshing position of the pinion 3 as shown in Fig. 2. The barrel member 18 is anchored to the driving head 8 by means of a lock ring 22.

The barrel member is formed with internal abutments

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23 which are engaged by the rim of the driving clutch member 15 to thereby hold the driving spring 12 under initial compression. The barrel member is also formed with an internal shoulder 24, and a light compression spring 25 is located between said shoulder and the control nut 17 in order to urge the control nut toward the driving clutch member 15 and normally maintain the overrunning clutch teeth in engagement.

In order to prevent premature demeshing of the pinion 3 when the engine starts, the periphery of the screw shaft 2 is formed with a notch 26, and a spring pressed latch member 27 is mounted for radial movement in the control nut 17 in position to engage in the notch and hold the pinion in meshed relation to the engine gear 4 until the latch is disengaged by centrifugal force at a predetermined rotational speed.

In the operation of this embodiment of the invention, starting with the parts in the positions illustrated in Fig. 1, rotation of the power shaft 1 by the starting motor is transmitted through the driving head 8 and spring 12 to the driving clutch member 15, which transmits its rotation through the clutch teeth 16 to the control nut 17 whereby the screw shaft 2 and pinion 3 are traversed to the right, such traversal being assisted by the detent action of the bearing member 6 on the smooth portion 5 of the screw shaft.

When the pinion has moved into mesh with the engine gear 4, the flange 21 of the screw shaft engages the abutment 19 of the barrel 18 which arrests further longitudinal movement of the screw shaft and pinion. The screw-jack action of the screw shaft and control nut thereupon moves the control nut 17 backward, which motion is transmitted to the driving clutch member 15, further compressing the drive spring 12 until the control nut engages with the driving head 8 as shown in Fig. 2. The control nut and clutch member are thus wedged tightly together, and rotation of the power shaft 1 is transmitted yieldingly through the spring 12 to cause the pinion 3 to rotate the engine gear.

When the engine starts, the pinion and screw shaft are accelerated, permitting the control nut 17 to move to the right sufficiently to disengage itself from the driving clutch member and thereby allow the pinion and screw shaft to overrun. When the engine rotates at sufficient speed to cause the latch member 27 to be withdrawn from the notch 26, the screw shaft and pinion are permitted to thread themselves back to idle position. The screw shaft is preferably provided with an inclined shoulder 28 (Fig. 2) which is engaged by the latch member 27 when the parts are in idle position in order to oppose drifting of the screw shaft and pinion toward the engine gear.

In Figs. 4 and 5 of the drawing there is illustrated an embodiment of the invention involving a somewhat different utilization of the barrel member in defining the operative positions of the drive pinion.

As there shown, a power shaft 31 has a hollow screw shaft 32 slidably journaled thereon, having a smooth extension 33 within which a solid pinion 34 is fixedly mounted in any suitable manner, and is movable thereby into and out of mesh with an engine gear 35.

A driving head 36 is fixed on the power shaft 31 by means of a key 37 and stud 38 which stud also forms one anchorage for a drive spring 39, the other end of which is anchored in a flange 41 of a driving overrunning clutch member 42. Clutch member 42 is slidably journaled on the screw shaft 32 and is provided with overrunning clutch teeth 43 adapted to engage similar teeth on a control nut 44 which is threaded on the screw shaft.

A barrel member 45 is mounted at one end on the driving head 36, being retained thereon by a lock ring 46. The barrel member is provided with an internal

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shoulder 47 forming an abutment for the flange 41 of the driving clutch member 42, and is also provided with a terminal flange 48 bearing on the control nut 44. A clutch spring 49 is located between the flange 48 and the control nut to urge the control nut into engagement with the driving clutch member 42.

In this embodiment of the invention, a stop nut 51 is fixedly mounted on the inner end of the screw shaft 32 for engagement with an internal abutment surface 52 in the clutch member 42 to thereby limit the meshing movement of the screw shaft, the position of the clutch member being defined by the shoulder 47 in the barrel 45.

A bearing 53 in the end of the motor housing 54 provides a steady rest for the projecting end of the screw shaft and the pinion during the cranking operation as shown in Fig. 5.

In the operation of this embodiment of the invention, rotation of the power shaft 31, transmitted through the drive spring 39 to the clutch member 42 causes the control nut 44 to rotate and traverse the pinion 34 and screw shaft 32 until the stop nut 51 engages the abutment 52 in the clutch member as shown in Fig. 5. The clutch member and control nut are then clamped together by the screw-jack action of the control nut and screw shaft, and caused to rotate as a unit with the screw shaft to crank the engine.

When the engine starts, the overrunning action releases the control nut from its clamping engagement, permitting the screw shaft and nut assembly to overrun the clutch member 42.

Return of the parts to idle position is preferably controlled by a centrifugal latch 55 as in the first embodiment of the invention, said latch also cooperating with an inclined shoulder 56 on the screw shaft to maintain the parts in idle position until subsequent operation of the motor shaft.

Although certain structure 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 as pointed out in the claims.

I claim:

1. In an engine starter drive, a power shaft, a hollow screw shaft slidably journaled thereon, and having a smooth portion extending beyond the end of the power shaft, a pinion member rigidly mounted in the smooth extension of the screw shaft and projecting therefrom for engagement with a gear of an engine to be started, a driving overrunning clutch member loosely mounted on the screw shaft, means including a drive spring member

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connecting said clutch member to the power shaft, a driven clutch member and control nut threaded on the screw shaft, and means including a barrel member enclosing the screw shaft and clutch members for limiting the meshing movement of the screw shaft and pinion.

2. An engine starter drive as set forth in claim 1 including further an abutment for the driving clutch member on the power shaft, cooperating abutments on the screw shaft and the barrel member for limiting the projection of the screw shaft from the barrel, and means for anchoring the barrel to the power shaft.

3. An engine starter drive as set forth in claim 2 in which the barrel member is provided with an abutment cooperating with the driving clutch member to normally maintain the drive spring under initial compression, the abutment on the power shaft being positioned to limit the backward movement of the driving clutch member responsive to the screw-jack action of the screw shaft and control nut member.

4. An engine starter drive as set forth in claim 1 including further an outboard bearing for the screw shaft, said pinion, when in idle position, being retracted within said bearing.

5. An engine starter drive as set forth in claim 1 including further spring means in the barrel urging the driven clutch member and control nut toward the driving clutch member, and centrifugally releasable latch means on the driven clutch member and the screw shaft for holding the screw shaft in projected position.

6. In an engine starter drive a power shaft, a hollow screw shaft slidably journaled thereon and extending beyond the end of the power shaft, a pinion fixedly mounted in the end of the screw shaft for movement thereby into and out of mesh with a gear of an engine to be started, a control nut threaded on the screw shaft, means including a yielding transmission member for rotating the control nut from the power shaft, a barrel member enclosing the control nut and transmission member, and means including abutments on the screw shaft and barrel member for defining the operative position of the pinion.

7. An engine starter drive as set forth in claim 6 in which the means for rotating the control nut includes a driving clutch member loosely mounted on the screw shaft having clutching engagement with the control nut, and having abutment surfaces cooperating with the abutments on the screw shaft and the barrel member to define the operative position of the pinion.

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