March 27, 1951 A. R. TOBIAS 2,546,954

ENGINE STARTER GEARING

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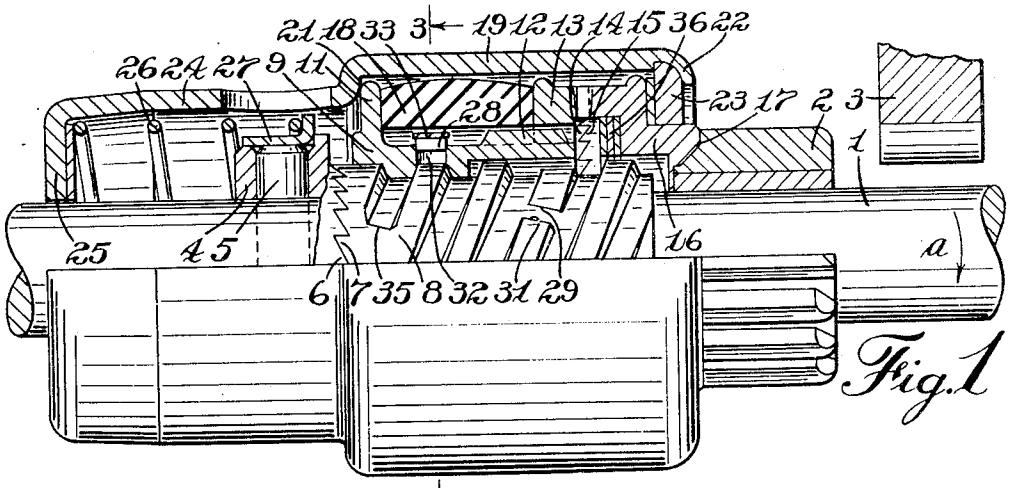


Fig. 1

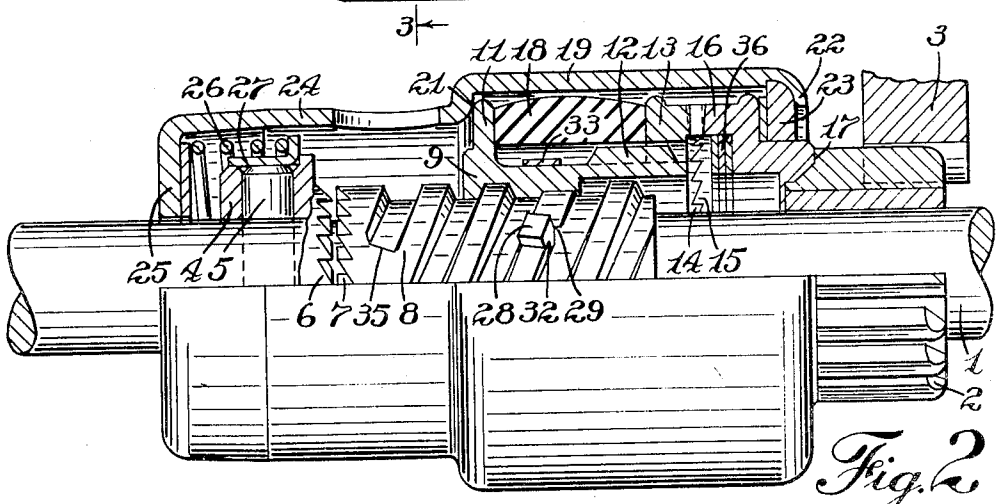


Fig. 2

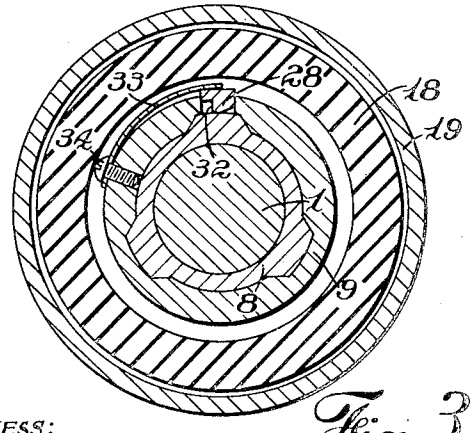


Fig. 3

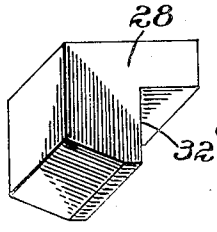


Fig. 4

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ENGINE STARTER GEARING

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3 Claims. (Cl. 74—7)

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The present invention relates to engine starter gearing, and more particularly to a drive of the automatically engaging and disengaging type having provision for preventing disengagement of the gearing until the engine is reliably self-operative.

It is an object of the present invention to provide a starter drive of this type which is simple in construction and reliable in operation while being entirely self-contained, without extraneous controlling means.

It is another object to provide such a device in which the disconnection of the drive is controlled by a centrifugal latch which is rotated in accordance with the speed of the engine so long as the latch is engaged.

It is another object to provide such a device in which the latch is normally engaged by spring means, and disengaged by centrifugal force; and incorporating additional provisions for preventing the escape or displacement of the latch.

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 similar view showing the parts in the positions assumed after the engine has been started while the drive pinion is held in mesh with the engine gear.

Fig. 3 is a section taken substantially on the line 3—3 of Fig. 1; and

Fig. 4 is an enlarged detail in perspective of the centrifugal latch element.

In Fig. 1 of the drawing there is illustrated a power shaft 1 having a pinion 2 slidably journalled thereon for longitudinal movement into and out of mesh with a gear 3 of the engine to be started. Means for actuating the pinion from the power shaft are provided comprising a drive head 4 fixedly mounted on the power shaft 1 as by means of a cross pin 5 and having overrunning clutch teeth 6 adapted to cooperate with similar teeth 7 on the end of a screw shaft 8 which is slidably journalled on the power shaft 1.

A control nut 9 having a flange 11 is threaded on the screw shaft 8 and is provided with splines 12 on which is slidably but non-rotatably mounted a driving coupling member 13. Said coupling member has teeth 14 cooperating with similar teeth 15 of a driven coupling member 16 fixed in any suitable manner as indicated at 17 on the pinion 2.

A cylinder 18 of elastically deformable material such as rubber is mounted on the control nut 9 between the flange 11 thereof and the driving coupling member 13, and means are pro-

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vided for maintaining said cylinder and coupling under initial compression in the form of a barrel member 19 having a shoulder 21 abutting against the flange 11 of the control nut and being spun over at its open end as shown at 22 so as to retain a thrust ring 23 which bears against the driven coupling member 16. The barrel 19 has an extension 24 of reduced diameter terminating in an inturned flange 25 bearing on the power shaft 1 and arranged to abut against the driving head 4 to limit the longitudinal movement of the barrel and thus define the meshing position of the pinion 2. An anti-drift spring 26 normally retaining the parts in idle position is interposed between flange 25 of the barrel and a flanged ring member 27 mounted on the driving head 4 and acting as a retainer for the anchor pin 5.

Means are provided for holding the pinion 2 in mesh with the engine gear 3 until the engine is reliably self-operative. As here shown, this means is in the form of a latch member 28 mounted on the control nut 9 with freedom for radial sliding movement therein into and out of engagement with the screw shaft 8. One of the threads of the screw shaft is notched as shown at 29 to provide a radial shoulder 31 in position to be engaged by the radial surface 32 of the latch which is arranged parallel thereto. The pinion 2 is thus prevented from moving out of mesh with the engine gear 3. A spring 33 (Fig. 3) is anchored in any suitable manner as indicated at 34 on the periphery of the control nut 9 and bears at its free end on the latch 28 so as to yieldingly press it against the screw shaft.

The cylindrical sleeve 18 of elastically deformable material has an internal diameter somewhat larger than the body of the control nut 9, leaving a space there-between sufficient for the latch 28 to move radially outward for a short distance. Before the surface 32 of said latch is disengaged from the shoulder 31 of the screw shaft, the top of the latch engages the interior surface of the cylinder 18 so that the final disengaging movement of the latch by centrifugal force is elastically resisted by the sleeve 18. Said sleeve thus serves to limit deflection of the latch spring 33 and prevents the latch from moving radially outward sufficiently to disengage itself from the control nut 9.

The idle position of the control nut 9 on the screw shaft 8 is defined by shoulders 35 at the inner ends of the threads of the screw shaft. The anti-drift spring 26 thus serves as a unitary means both for drawing the pinion 2 back toward idle position, and for urging the over-running clutch teeth 6 and 7 into engagement after the control nut 9 has engaged the shoulders 35 of the screw shaft.

Thrust washers 36 are provided within the driven coupling member 16 to limit the travel of the control nut 9 toward the driven coupling member so as to thereby limit the compression of the cylinder 18 and permit the teeth 14, 15 of the coupling members to slide past each other responsive to a predetermined overload.

In operation, starting with the parts in the positions illustrated in Fig. 1, rotation of the power shaft 1 in the direction of the arrow a by the starting motor, not illustrated, causes traversal of the control nut 9, barrel 19, and pinion 2 until the pinion has meshed with the engine gear 3, and its longitudinal movement is arrested by the abutment of the flange 25 of the barrel against the driving head 4. Rotation of the shaft 1 is then transmitted through the overrunning clutch 6, 7 to the screw shaft 8, said overrunning clutch being at this time compressed by the screw-jack action of the screw shaft and nut. Longitudinal movement of the control nut 9 is yieldingly arrested by the cylinder 18 whereby a yielding driving connection through the coupling members 13, 16 to the pinion 2 is established for cranking the engine.

During the meshing movement of the control nut 9, the latch member 28 is moved along the screw shaft 8 into registry with the notch 29, whereupon the latch is moved into the notch by the latch spring 33. When the engine starts and accelerates the gear 3 and the drive pinion 2, the control nut 9 overruns the screw shaft 8 until the latch 28 engages the shoulder 31 formed by the notch 29 in the screw shaft whereby the demeshing movement of the pinion 2 is arrested. The overrunning clutch teeth 6, 7 then ratchet over each other so as to permit the pinion with its associated parts of the drive to overrun without driving the starting motor.

If the engine should not remain self-operative, as soon as the speed of the starting motor reaches a speed corresponding to that of the engine, the overrunning clutch teeth 6, 7 are engaged by virtue of the pressure exerted by the anti-drift spring 26 so that cranking is resumed. When the engine reaches a predetermined speed indicative of the fact that it is reliably self-operative, the centrifugal force acting on the latch 28 becomes sufficient to overcome the force of the latch spring 33 and the compressive action of the elastic cylinder 18 so as to permit the latch to disengage from the shoulder 31 of the screw shaft. The

control nut and pinion barrel are then restored to idle position by the combined effect of the overrunning of the parts on the screw shaft and the traversing action of the anti-drift spring 26, which latter thereafter maintains the parts in idle position.

Although certain structure has been shown and described in detail, it will be understood other embodiments are possible and that various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In an engine starter drive a power shaft, a pinion slidably journaled thereon for longitudinal movement into and out of mesh with a gear of the engine to be started; means for actuating the pinion from the power shaft including a screw shaft, means for rotating the screw shaft from the power shaft, a nut threaded on the screw shaft and a driving connection from the nut to the pinion including a sleeve of elastically deformable material surrounding the nut; said screw shaft having a notch formed therein; and centrifugally releasable means for holding the pinion in mesh with the engine gear including a latch member mounted on the nut within said sleeve in position to engage the notch in the screw shaft when the pinion approaches its driving position, said sleeve serving to confine the latch on the nut.

2. An engine starter drive as set forth in claim 1, in which the means for rotating the screw shaft from the power shaft includes an axially separable overrunning clutch; said drive also including unitary means comprising a spring for urging the clutch toward closed position, and the pinion toward idle position.

3. An engine starter drive as set forth in claim 1, including further a spring on the nut pressing the latch against the screw shaft, said sleeve surrounding the spring and limiting the outward deflection thereof.

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The following references are of record in the file of this patent:

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