Nov. 17, 1942. J. E. BUXTON 2,302,295

ENGINE STARTER GEARING

Filed June 21, 1941

Fig. 1

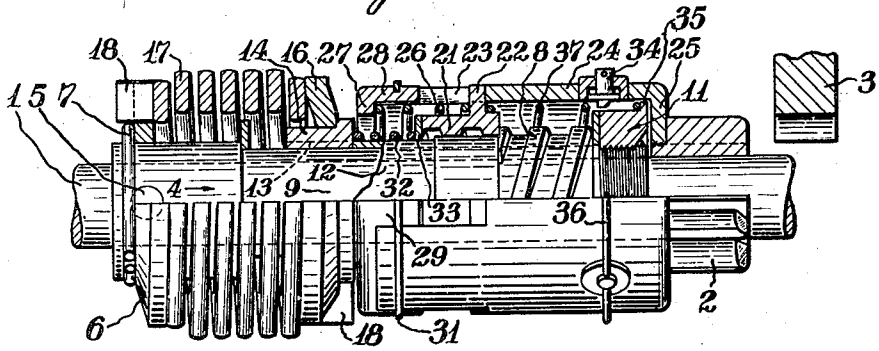


Fig. 2

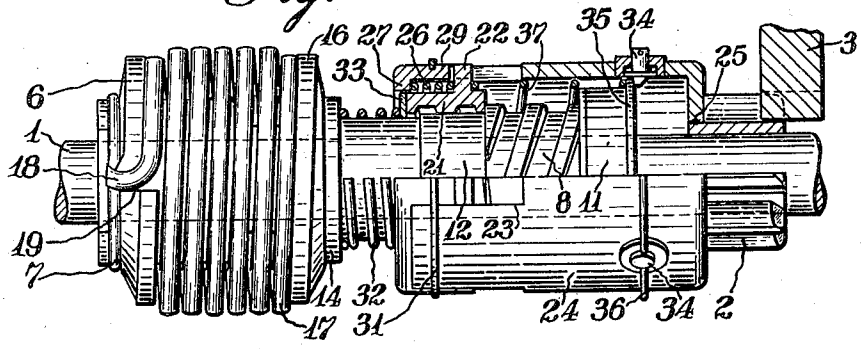
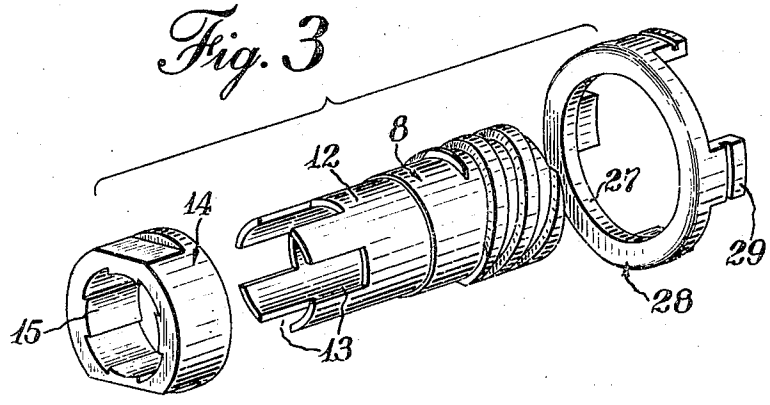


Fig. 3



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Patented Nov. 17, 1942

2,302,295

UNITED STATES PATENT OFFICE

2,302,295

ENGINE STARTER GEARING

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Application June 21, 1941, Serial No. 399,160

5 Claims. (Cl. 74—7)

The present invention relates to engine starter gearing and more particularly to an automatically engaging and disengaging starter drive which is arranged to maintain its engagement with a member of the engine to be started until said engine is reliably self-operative.

It is an object of the present invention to provide a novel starter drive which is efficient and reliable in operation and simple and economical in construction.

It is another objects to provide such a device in which a pinion is arranged to automatically engage an engine member and is held in such engagement until it is rotated above a predetermined speed.

It is another object to provide such a device in which an overrunning connection is provided between the starting motor and the pinion.

It is a further object to provide such a device in which the overrunning connection is a feature of the means for traversing the pinion into and out of operative position.

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 showing a preferred embodiment of the invention with the parts in normal or idle position.

Fig. 2 is a similar view showing the parts in the positions assumed when the engine starts and overruns the drive, while the pinion is maintained in engagement with the engine gear; and

Fig. 3 is a detail in perspective of the screw shaft, driven head member and annular retaining member shown in disassembled relation.

In Fig. 1 of the drawing there is illustrated a power shaft 1 which may be the extended armature shaft of a starting motor not illustrated. A pinion 2 is slidably journalled thereon for longitudinal movement into and out of engagement with a member such as a gear 3 of an engine to be started. A sleeve 4 is fixed on the power shaft as by means of a cross pin 5 and has non-rotatably mounted thereon a driving flange member 6 which is retained by means of a split lock ring 7.

A screw shaft 8 (Fig. 3) is slidably mounted on a reduced portion 9 of the sleeve 4 normally in abutting relation with a stop nut 11 fixed on the end of said sleeve. Screw shaft 8 is provided with a reduced extension 12 which is slotted as indicated at 13 to form tongues. A driven head member 14 is slidably mounted on the reduced portion 12 of the screw shaft 8 and is provided internally with ribs 15 slidably engaging the tongues on the end of the screw shaft so as to form a splined connection with the screw shaft.

A driven flange member 16 is non-rotatably mounted on the driven head member 14, and a yielding driving member in the form of a coiled spring 17 is mounted between the flange members 6 and 16 and provided with out-turned ends 18 entering anchoring slots 19 in said flanges, whereby the driven head member 14 and screw shaft 8 are yieldably connected to the sleeve 4 and consequently to the power shaft 1.

A nut 21 is mounted on the screw shaft 8 and is provided with radial lugs 22 which extend into longitudinal slots 23 in a barrel member 24 which is rigidly fixed as indicated at 25 to the pinion 2. Means normally maintaining the nut 21 with its lugs 22 at the forward end of slots 23 is provided in the form of a coiled spring 26 bearing at one end against said lugs, and at the other end against an inturned flange 27 of an annular retaining member 28 (Fig. 3). Member 28 is provided with projections 29 extending into the slots 23 of the barrel and retained by a suitable split locking ring 31.

The threads of the screw shaft 8 are arranged to terminate adjacent the normal idle position of the nut 21 so that the nut may run off the ends of the threads and overrun freely. Means for insuring re-engagement of the nut on the threads upon rotation of the screw shaft is provided in the form of a re-entry spring 32 which bears in one end against the driven head member 14 and at the other end against a thrust washer 33 slidably mounted on the reduced portion of the screw shaft and normally bearing on the end of the nut 21.

According to the present invention means are provided for holding the pinion 2 in a partial mesh with the engine gear 3 until the pinion is rotated above a pre-determined speed, the splined connection 22, 23 between the barrel and nut being so arranged as to permit the nut to run off the ends of the threads of the screw shaft while the pinion is so retained in mesh with the engine gear. As here shown this retaining means is in the form of a latch 34 mounted in the barrel 24 in position to engage a radial flange 35 on the stop nut 11 and thereby prevent the return of the pinion to idle position. Latch 34 is mounted with freedom for limited radial movement by centrifugal force sufficient to disengage from the flange 35, spring means such as a spring ring 36 being provided for resisting such radial movement and permitting it to take place only above a pre-

determined rotary speed of the pinion and barrel member.

Means normally retaining the parts in their idle positions is provided in the form of an anti-drift spring 37 bearing at one end against the flange 35 of the stop nut and at its other end against the lugs 22 of the pinion control nut 21.

In operation, starting of the parts as illustrated in Fig. 1 rotation of the power shaft by the starting motor is transmitted to the screw shaft 8 through the yielding driving connection, whereupon the control nut 21 is threaded along the screw shaft into engagement with the stop nut 11. The longitudinal movement of the nut is transmitted through the barrel 24 to the pinion 2 causing it to mesh with the engine gear 3. Further rotation of the power shaft causes the screw shaft 8 to move back, compressing the drive spring 17, until the torque transmitted through the drive spring is sufficient to cause the pinion to rotation the engine gear 3.

When the engine fires, the consequent acceleration of the engine gear causes the pinion 2 to normally overrun the power shaft 1, whereupon the nut 21 overruns the screw shaft 8, permitting the screw shaft to return to its normal position against the stop nut 11 under the expansive force of the drive spring 17. Further overrunning of the nut causes it to be threaded back along the screw shaft, the barrel 24 being moved longitudinally therewith by means of the spring 26. When the latch 34 engages the flange 35 on the stop nut 11, backward movement of the barrel 24 and pinion is arrested as shown in Fig. 2, but if the pinion continues to overrun the power shaft, the nut 21 will continue its movement along the screw shaft 8, compressing the spring 26 until the nut runs off the ends of the threads of the screw shaft.

If the engine continues to fire and becomes reliably self-operative, the speed of rotation of the pinion 2 and barrel member 24 will rise sufficiently to cause the latch 34 to be withdrawn by centrifugal force from its engagement with the flange 35. The de-meshing motion of the pinion and barrel member will be resumed under the influence of the springs 26 and 37, and the parts will be returned to their idle positions. If, however, the engine fails to continue in operation after the first few explosions, the consequent deceleration of the pinion and barrel member permits the screw shaft 8 to be rotated by the power shaft 1 more rapidly than the nut 21, whereupon the nut will again thread itself along the screw shaft into operative position, moving the pinion into full engagement with the engine gear, and cranking will be resumed until the engine has become reliably self-operative.

Although but one embodiment of the invention has been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention as defined in the claims appended hereto:

What is claimed is:

1. In an engine starter a power shaft, a pinion slidably journalled thereon to engage and drive a gear of an engine to be started, actuating means for the pinion including inter-threaded members, and centrifugal means for holding the pinion in engagement with the engine gear, said inter-threaded members being formed to disconnect and allow the pinion to overrun the power shaft while maintaining its engagement with the engine gear.

2. In an engine starter a power shaft, a pinion slidably journalled thereon to engage and drive a gear of an engine to be started, actuating means for the pinion including inter-threaded members, centrifugal means for holding the pinion in engagement with the engine gear until it is rotated above a pre-determined speed, said inter-threaded members being formed to disconnect and allow the pinion to overrun the power shaft while maintaining its engagement with the engine gear, and means for re-establishing the inter-threaded connection when the rotation of the power shaft exceeds that of the pinion.

3. In an engine starter a power shaft, a pinion slidably journalled thereon for engagement with an engine gear, actuating means for the pinion including a screw shaft connected to rotate with the power shaft, and a nut on the screw shaft having a splined connection with the pinion, said screw shaft, nut and splined connection being so proportioned that the nut may run off the ends of the threads on the screw shaft while the pinion is engaged with the engine gear, and means for maintaining the engagement of the pinion with the engine gear until the pinion is rotated above a predetermined speed.

4. In an engine starter drive a member adapted to engage and drive a member of an engine to be started, a barrel fixed to the driving member, a nut non-rotatably connected to the barrel and having limited longitudinal movement with respect thereto, actuating means for the nut including a rotatable screw shaft, yielding means in the barrel engaging the nut to normally hold the barrel at the limit of its movement with respect to the nut in a direction to disengage the driving member from the engine member, means for holding the driving member in engagement with the engine member, said yielding means being arranged to permit the nut to run off the ends of the threads on the screw shaft while the driving member is so held.

5. An engine starter drive as set forth in claim 4 in which the holding means for the driving member is arranged to release the driving member at a pre-determined speed of rotation thereof, and including further means thereupon operative to move the driving member to idle position and to cause re-engagement of the nut with the threads of the screw shaft.

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