May 17, 1955 J. E. BUXTON 2,708,370

ENGINE STARTER GEARING

Filed May 13, 1954 2 Sheets-Sheet 1

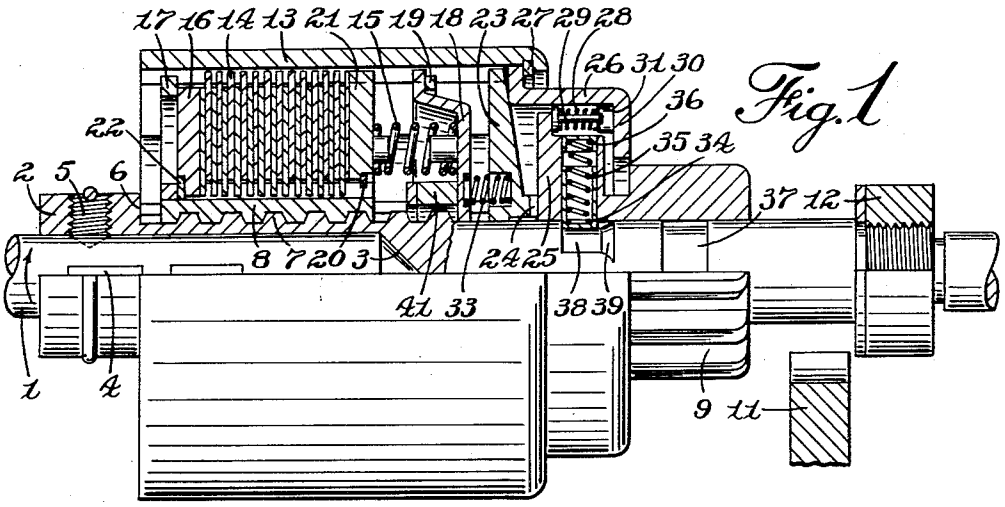

Fig. 1

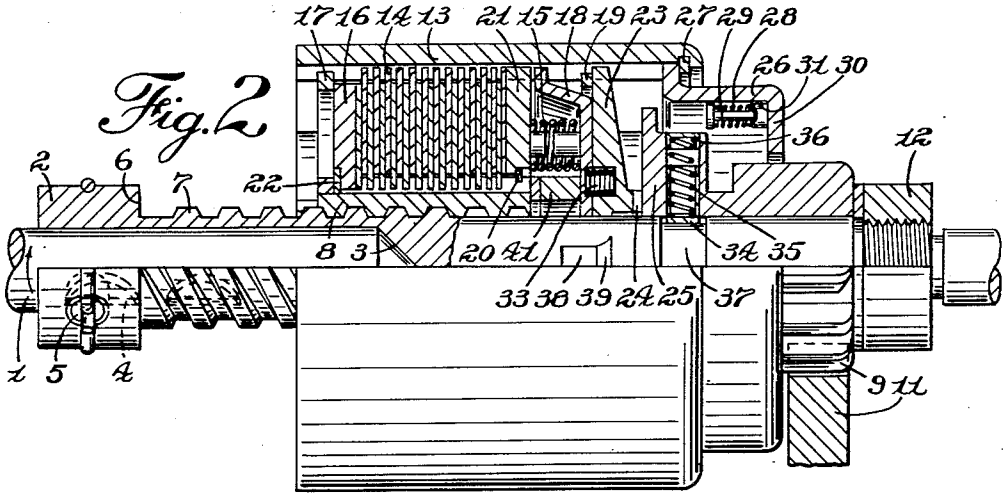

Fig. 2

WITNESS:

Esther M. Stockton

INVENTOR.
James E. Buxton

BY Clinton S. James

ATTORNEY

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Fig. 3

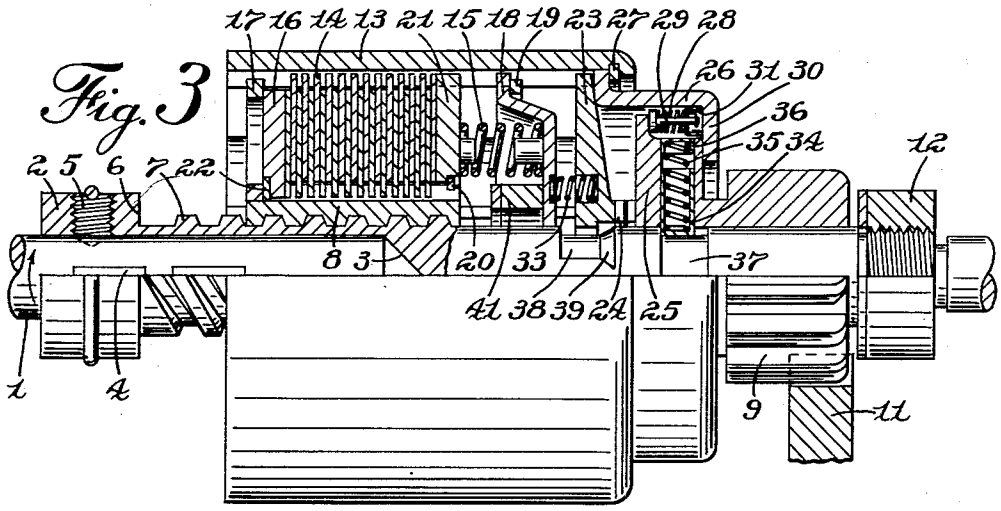


Fig. 4

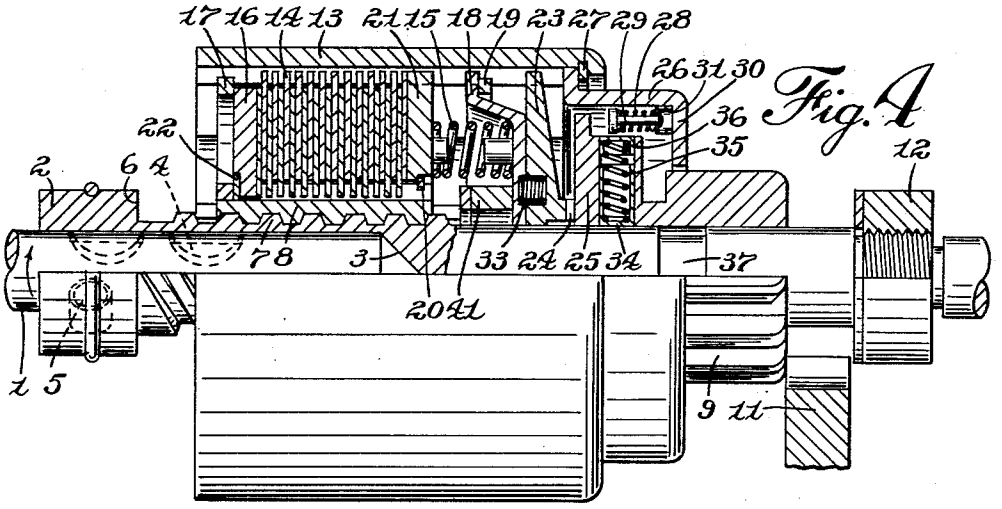
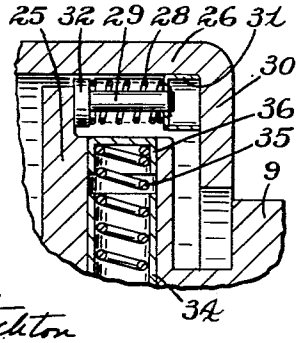


Fig. 5



WITNESS:

Esther M. Stockton

INVENTOR.
James E. Buxton

BY

Clinton L. Jones

ATTORNEY

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ENGINE STARTER GEARING

James E. Buxton, Elmira, N. Y., assignor to Bendix Aviation Corporation, a corporation of Delaware

Application May 13, 1954, Serial No. 429,533

8 Claims. (Cl. 74—7)

The present invention relates to engine starter gearing, and more particularly to a heavy duty type of drive which maintains its engagement with the engine until it is in satisfactory operation.

It is an object of the present invention to provide a novel heavy duty starter drive of this type which is efficient and reliable in operation, simple and economical in construction and small in overall dimensions relative to its torque capacity.

It is another object to provide such a device which is largely self-contained and enclosed against access of foreign matter.

It is another object to provide such a device incorporating a friction coupling which is normally spring-loaded with light pressure, but which is automatically compressed as the driving load is assumed.

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 showing the parts in normal or idle position;

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

Fig. 3 is a similar view showing the parts in the positions assumed while the engine is running with the drive maintained in mesh;

Fig. 4 is a similar view showing the relationship of the parts in case of tooth abutment between the pinion and engine gear during the meshing operation; and

Fig. 5 is an enlarged detail of the spring structure controlling the overrunning clutch.

In Fig. 1 of the drawing there is illustrated a power shaft 1 which may be the extended armature shaft of the starting motor not illustrated. A drive shaft 2 which is hollowed out for a portion of its length as shown at 3 is telescoped over the end of the power shaft and fixed thereon as by means of keys 4 and set screw 5. The drive shaft is reduced in diameter from a point adjacent its anchorage to the power shaft 1, thus forming a shoulder 6. This reduced section is threaded for a portion of its length as indicated at 7, and a control nut 8 is mounted on said threaded portion for rotary and traversing movement. A pinion 9 is slidably journalled on the unthreaded portion of the drive shaft 2 for movement into and out of mesh with a gear 11 of the engine to be started, the meshing position of the pinion being defined by a stop nut 12 fixedly mounted on the drive shaft.

Means for actuating the pinion 9 from the control nut 8 is provided comprising a barrel member 13, and a plurality of friction coupling discs 14 splined alternately to the control nut and barrel member and yieldingly pressed together by means of compression springs 15. For this purpose, a pressure disc 16 is held in the barrel 13 by a lock ring 17, and a dished annular thrust member 18 is similarly positioned in the barrel 13 by a lock ring 19; the springs 15 being located between the thrust plate 18

and a thrust plate 21 retained on the control nut 8 by a lock ring 20.

In order to transmit the longitudinal movement of the control nut 8 to the barrel 13 in the meshing direction, the thrust disc 16 is anchored to the control nut by any suitable means such as a lock ring 22.

Means for actuating the pinion from the barrel 13 is provided in the form of driving clutch disc 23 splined in the barrel and provided with overrunning clutch teeth 24 normally engaging similar teeth on a flange 25 formed on the hub of the pinion. Means for normally holding the clutch teeth in engagement is provided comprising a thimble 26 retained in the end of the barrel 13 by a lock ring 27 surrounding the flange 25 of the pinion and having an inwardly directed flange 30. A plurality of light compression springs 28 (Fig. 5) are mounted on studs 29, loosely retained in an annular channel member 31 seated against the flange 30. The heads 32 of the studs 29 bear against the flange 25 of the pinion and thus yieldingly press the pinion against the driving clutch disc 23.

A series of mesh-enforcing compression springs 33 are located between the thrust plate 18 and the driving clutch disc 23 to normally maintain the parts in extended relation, as shown in Fig. 1.

Means are provided for latching the pinion 9 in mesh with the engine gear 11 until the pinion is rotated above a predetermined minimum speed. For this purpose a latch member 34 is mounted for radial sliding movement in the flange 25 of the pinion, and is yieldingly pressed against the driving shaft 2 by means of a spring 35 retained by a cup member 36 having a press fit in the pinion flange. The drive shaft is provided with an annular recess 37 in position to receive the latch member 34 when the pinion is meshed with the engine gear, and thereby prevent the demeshing movement of the pinion until the latch is withdrawn by centrifugal force.

In order to prevent the pinion from drifting away from its idle position, a recess 38 is formed in the drive shaft in position to receive the latch member 34 when the parts are in idle position, and the recess is formed with an inclined shoulder 39 which cooperates with the latch to yieldingly resist such drifting movement of the pinion.

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 is transmitted to the drive shaft 2, and thus causes the control nut 8, together with the barrel and pinion assembly, to be traversed to the right until the movement of the pinion and the clutch disc 23 is arrested by the stop nut 12. Thereafter, the screw-jack action of the screw shaft and control nut moves the thrust member 18 against the driving clutch disc 23, compressing the mesh-enforcing springs and forcing together the overrunning clutch teeth 24. Since the longitudinal movement of the thrust member 18 is thus stopped, further movement of the control nut 8 forces the coupling discs 14 against the preloaded springs 15 until sufficient torque is built up to cause the pinion 9 to rotate the engine gear 11, as shown in Fig. 2.

Preferably the pressure on the coupling discs 14 is limited in order to permit them to slip in case of overload. For this purpose, a thrust ring 41 is interposed between the control nut and the thrust plate 18 in order to limit the compression of the springs 15.

When the engine starts, the acceleration of the pinion 9 by the engine gear causes it to rotate faster than the starting motor, whereby the control nut 8 moves back on the drive shaft 2 sufficiently to allow the overrunning clutch teeth 24 to disengage, as shown in Fig. 3. This condition continues until the rotation of the pinion is sufficiently rapid to withdraw the latch 34 by centrifugal force, after which the parts are traversed back to idle position, as shown in Fig. 1.

In case, during the meshing movement, tooth abutment should occur between the pinion and engine gear, as shown in Fig. 4, the mesh-enforcing springs **33** permit the barrel and control nut to move forward while building up sufficient torque to index the pinion into proper registry with the teeth of the engine gear. The springs **33** then expand and snap the pinion into initial mesh, thus avoiding milling the ends of the teeth.

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

I claim:

1. In an engine starter drive, a drive shaft threaded for a portion of its length, a control nut threaded thereon, a pinion slidably journaled on the smooth portion of the drive shaft for movement into and out of mesh with an engine gear, and means for actuating the pinion from the control nut including a barrel member, a friction coupling between the control nut and barrel member, and an overrunning clutch connection between the barrel and pinion.

2. An engine starter drive as set forth in claim 1 including further centrifugal latching means for holding the pinion in meshed position until it exceeds a predetermined rotative speed.

3. An engine starter drive as set forth in claim 1 including further means responsive to the screw-jack action of the drive shaft and control nut for increasing the torque capacity of the friction coupling.

4. An engine starter drive as set forth in claim 1 in which said overrunning clutch connection comprises a driving clutch disc splined in the barrel member, a driven pinion clutch member, means yieldingly urging the clutch members into engagement, and an abutment on the drive shaft defining the meshed position of the pinion.

5. An engine starter drive as set forth in claim 4 including further a pressure disc splined in the barrel member between the coupling discs and said clutch disc, a heavy compression spring between the coupling discs and the pressure disc, a lighter mesh enforcing spring between the pressure disc and the clutch disc, and means for limiting the expansion of the heavy compression spring.

6. An engine starter drive as set forth in claim 5 including further means for limiting the compression of the coupling discs.

7. An engine starter drive as set forth in claim 6 including further means for limiting the expansion of the mesh-enforcing spring, and means including a light compression spring for yieldingly pressing the pinion clutch member against the driving clutch disc.

8. An engine starter drive as set forth in claim 2 including further means on the drive shaft defining the idle position of the control nut, said drive shaft also having means cooperating with said latching means for yieldingly holding the pinion in idle position.

No references cited.