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ENGINE STARTER GEARING

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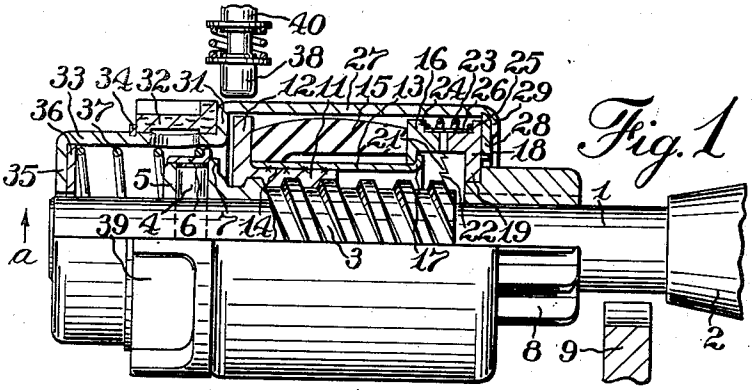


Fig. 1

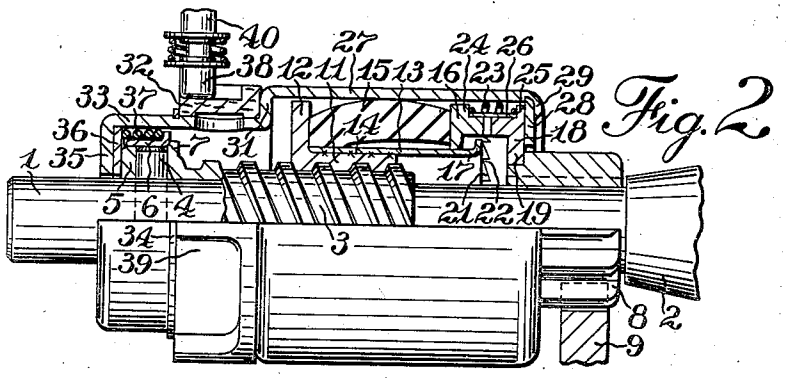


Fig. 2

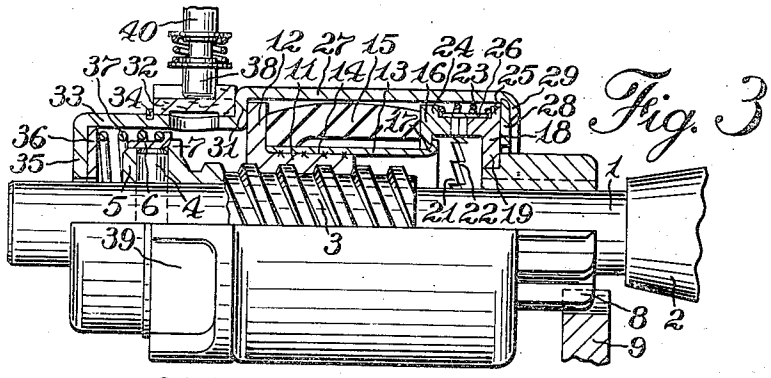


Fig. 3

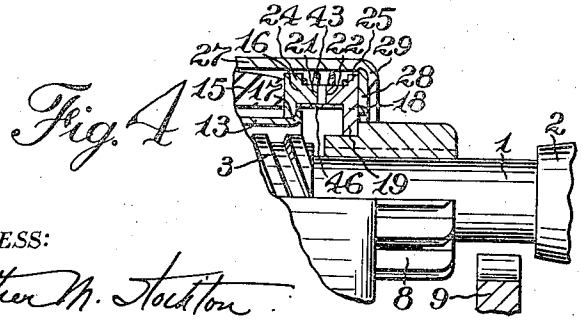


Fig. 4

WITNESS:

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ENGINE STARTER GEARING

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8 Claims. (Cl. 74—7)

1

The present invention relates to engine starter gearing and more particularly to automatically engaging drive gearing which is arranged to maintain its engagement with the engine to be started, as long as the starting system is energized.

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

It is another object to provide such a device incorporating a yielding transmission member of elastically deformable material which is positively held under a predetermined initial compression.

It is another object to provide such a device incorporating a clutch which is arranged to overrun freely when the engine fires, but which reengages promptly so as to resume cranking if the engine does not continue to be self-operative.

It is another object to provide such a device incorporating anti-drift spring means for normally holding the parts in idle position, which means also functions to increase the transmission of torque from the starting pinion to the control nut when the drive is being demeshed.

It is another object of the invention to provide such a device incorporating elastic means for urging the members of the overrunning clutch out of engagement so as to overrun freely, said anti-drift spring being arranged to overcome said means and bring the clutch members into frictional engagement to expedite the demeshing of the pinion from the engine gear.

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 in section of a preferred embodiment of the invention, the parts being shown 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 position assumed when the engine fires and overruns the drive while the starting system remains operative; and

Fig. 4 is a detail showing a variant form of the overruning clutch connection to the pinion.

In Fig. 1 of the drawing, there is illustrated a power shaft 1 which is the extended armature shaft of a starting motor, a portion of which is indicated at 2. A screw shaft 3 is rigidly mounted on the power shaft in any suitable

2

manner as by means of a cross pin 4 which is retained in the enlarged end 5 of the screw shaft by means of a flanged ring 6 seated against a shoulder 7 on the screw shaft.

A pinion 8 is slidably journalled on the power shaft 1 for movement into and out of mesh with a gear 9 of the engine to be started, and means for actuating the pinion from the screw shaft 3 is provided comprising a control nut 11 having a radial flange 12, threaded on the screw shaft 3 and having a sleeve 13 fixed thereon in any suitable manner as by welding or brazing as indicated at 14. A yielding driving member in the form of a cylindrical block 15 of elastically deformable material such as rubber is seated at one end on the control nut 11 and sleeve 13, against the flange 12 of the control nut, and bears frictionally at its other end against a driving overrunning clutch member 16 which is slidably journalled on the free end of the sleeve 13. Clutch member 16 is pressed against the end of the elastic member 15 so as to hold it under initial compression by means of a radial flange 17 formed on the end of the sleeve 13 by flaring or expanding the end of the sleeve after the elastic member and clutch member have been assembled thereon.

A driven overrunning clutch member 18 is rigidly mounted on the pinion 8 as indicated at 19, and the adjacent surfaces of the clutch members 16, 18 are provided with ratchet teeth 21, 22 respectively which are so inclined as to engage positively when the starting motor drives the pinion for cranking the engine but to cam out and overrun when the engine fires and accelerates the pinion 8 above the speed of the starting motor. A light compression spring 23 is located between peripheral shoulders 24 and 25 on the clutch member 16, 18 respectively and urges the clutch members apart while forming a frictional connection therebetween by virtue of the engagement of the end convolutions of the spring with said shoulders 24, 25. A packing sleeve 26 may be seated on the clutch members 16, 18 between the shoulders 24, 25 as indicated in order to prevent any lubricant on the screw shaft from escaping between the teeth 21, 22 of the overrunning clutch members and coming into contact with the elastic member 15.

Means for enclosing the drive and for limiting the meshing movement of the pinion 8 is provided in the form of a barrel member 27 surrounding the control nut 11, elastic block 15 and overrunning clutch members 16, 18. Barrel 27 has a thrust ring 28 retained in its open end as by

spinning over the end of the barrel as indicated at 29, which ring serves as a stop for the driven overrunning clutch member and consequently for the pinion 8.

The barrel member 27 has an inwardly extending shoulder 31 forming an abutment for the flange 12 of the control nut, and a latch ring 32 is rotatably mounted on the reduced portion 33 of the barrel and is retained against said shoulder 31 by a lock ring 34. Reduced portion 33 of the barrel terminates in an inwardly extending flange 35 which loosely surrounds the power shaft 1 and is arranged to come into abutting relation with the adjacent end of the screw shaft 3 so as to define the meshed position of the pinion 8 as shown in Fig. 2; a thrust washer 36 being preferably interposed between the abutting surfaces to reduce wear.

An anti-drift spring 37 is located in the reduced portion 33 of the barrel, being seated at one end on the flanged ring 6 and at its other end bearing against the thrust washer 36, whereby it serves to urge the barrel, and consequently the pinion 8 and its associated parts, toward idle position as shown in Fig. 1. Spring 37 is considerably stiffer than the clutch spring 23 whereby when the parts are in idle position, the clutch spring is compressed and the clutch members 16, 18 are maintained in engagement as illustrated in Fig. 1.

Means are provided for cooperating with the latch ring 32, to restrict the demeshing movement of the barrel and its associated parts as long as the starting circuit is energized. As here shown, this means is in the form of a plunger 38 which is manually controlled, preferably by being mounted on the end of the starting switch plunger 40. When the starting switch is closed, the plunger 38 is projected into engagement with the barrel 27, and when the longitudinal movement of the barrel brings the latch ring 32 into registry with the plunger, the latter enters a peripheral pocket 39 in the latch ring in the manner more fully described and claimed in the application of Oliver, Ser. No. 653,775, filed March 12, 1946, and assigned to the assignee of the present application.

In operation, starting with the parts in the positions illustrated in Fig. 1, energization of the starting system causes the plunger 38 to be projected against the periphery of the barrel 27, while rotation of the power shaft 1 in the direction of the arrow "a" causes the control nut 11 to move the longitudinally movable parts to the right until the pinion 8 is fully meshed with the engine gear 9. The longitudinal movement of the barrel is then arrested by the engagement of the thrust washer 36 against the end of the screw shaft 3, whereupon further rotation of the power shaft 1 and screw shaft 3 causes the control nut 11 to compress the rubber block 15 against the driving clutch member 16 until sufficient torque is built up to cause rotation of the engine gear 9.

When the engine fires, the acceleration of the pinion 8 thereby is transmitted back through the clutch members and the elastic member 15 to the control nut, whereby it moves back on the screw shaft until the flange 12 engages the shoulder 31 of the barrel, at which time the clutch members 16, 18 are disengaged as shown in Fig. 3. Further backward movement of the barrel is arrested by the plunger 38, so that the anti-drift spring 37 has no effect upon the overrunning clutch members which are accordingly held apart by the spring 23 so that they overrun quietly and freely.

If the engine should not continue to run under its own power, as soon as the pinion 8 slows down below the speed of the screw shaft, the control nut 11 is retarded by its frictional connection to the pinion through the clutch spring 23, whereby the control nut and its associated parts are again traversed into operative position, and cranking is resumed.

When the operator is satisfied that the engine is reliably self-operative, he deenergizes the starting system by opening the starting switch, thereby withdrawing the plunger 38.

The anti-drift spring 37 is thereupon effective to urge the parts toward idle position, at the same time pressing together the clutch elements 16, 18, whereby the friction transmitted therethrough assists in returning the control nut to its normal position.

In Fig. 4, there is illustrated an optional variation in the overrunning clutch structure. As there shown, the clutch spring 43 is formed with its end convolutions slightly smaller than the body of the spring so that they grip the clutch members 16, 18, the direction of winding of the spring being such that when the driving clutch member 16 is rotated faster than the driven clutch member 18, the spring will wrap down and grip the clutch members, whereas when the clutch member 18 overruns the clutch member 16, the spring unwraps and releases the clutch members. The packing sleeve 46 is in this case located within the clutch members so as to perform its function without interfering with the action of the clutch spring 43.

The operation of this embodiment is the same as previously described except that the controlling function of the clutch spring 43 is performed more positively in securing reengagement of the clutch members, by virtue of its wrap-down action which increases the frictional connection in the driving direction but reduces the friction during overrun.

Although certain structure 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 drive, a power shaft, a screw shaft fixed thereon, a pinion slidably journalled on the power shaft for longitudinal movement into and out of mesh with a gear of an engine to be started, a control nut threaded on the screw shaft, means for actuating the pinion from the control nut including an elastically deformable member, a driving clutch member in frictional engagement with the elastic member, means for holding the elastic member compressed between the control nut and driving clutch member, a driven clutch member fixed to the pinion, means including a barrel member limiting the travel of the pinion and driven clutch member toward meshing position, means for arresting the demeshing movement of the barrel and control nut, and anti-drift means effective on release of said arresting means for pressing the clutch members together and urging the parts toward idle position.

2. An engine starter drive as set forth in claim 1, including further, yielding means frictionally

connecting the driving and driven clutch members.

3. An engine starter drive as set forth in claim 1, including further, yielding means frictionally connecting the driving and driven clutch members, said yielding means urging the clutch members out of engagement with each other.

4. An engine starter drive as set forth in claim 1, including further, yielding means frictionally connecting the driving and driven clutch members, said yielding means urging the clutch members out of engagement with each other, said anti-drift means being effective to overcome said yielding means and press the clutch members together upon release of the arresting means for the barrel.

5. In an engine starter drive, a power shaft, a pinion slidably journalled thereon for movement into and out of mesh with a gear of an engine to be started, means responsive to acceleration of the power shaft for moving the pinion into mesh with the engine gear and thereafter rotating the pinion from the power shaft, said means including an overrunning clutch, releasable means for holding the pinion in mesh with the engine gear, and anti-drift means including a spring effective on release of the holding means for moving the pinion out of mesh and retaining it in idle position, said anti-drift means including means for pressing together the members of the overrunning clutch to cause the transmission of torque therethrough from the pinion.

6. An engine starter drive as set forth in claim 5, in which the means for rotating the pinion is effective to clamp together the members of the overrunning clutch incidental to the transmission of torque therethrough.

7. An engine starter drive as set forth in claim 5, including further, resilient means urging the

members of the overrunning clutch apart while providing a frictional connection therebetween, said anti-drift means being effective to overcome the resilient means and cause frictional engagement of the overrunning clutch members when the holding means is released.

8. In an engine starter drive, a power shaft, a screw shaft fixed thereon, a pinion slidably journalled on the power shaft, a flanged control nut threaded on the screw shaft, a sleeve fixed to the control nut, a transmission member of elastically deformable material seated at one end on the sleeve, a driving clutch member slidably journalled on the sleeve, said sleeve having means for holding said clutch member and transmission member under compression, a driven clutch member fixed to the pinion, a barrel surrounding the transmission and clutch members having an abutment at one end for engaging the screw shaft, and a stop at the other end limiting longitudinal movement of the driven clutch member; a spring urging the clutch members apart while providing a frictional connection therebetween, an anti-drift spring effective to compress the clutch spring and urge the barrel toward idle position, and a manually controlled latch means for limiting the demeshing movement of the barrel.

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