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ENGINE STARTER GEARING

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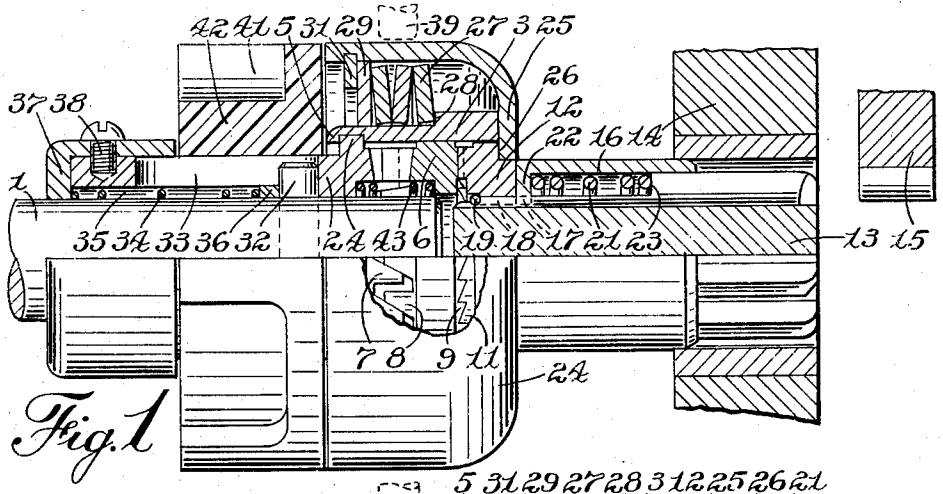


Fig. 1

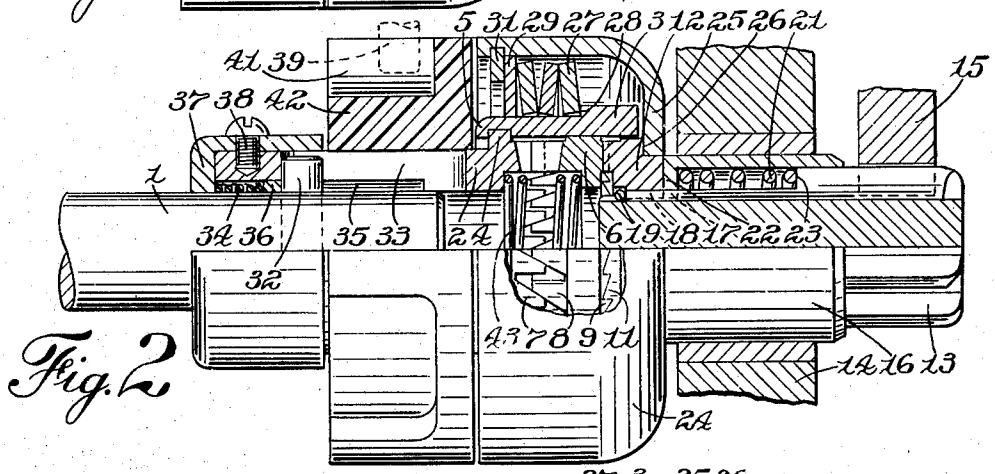


Fig. 2

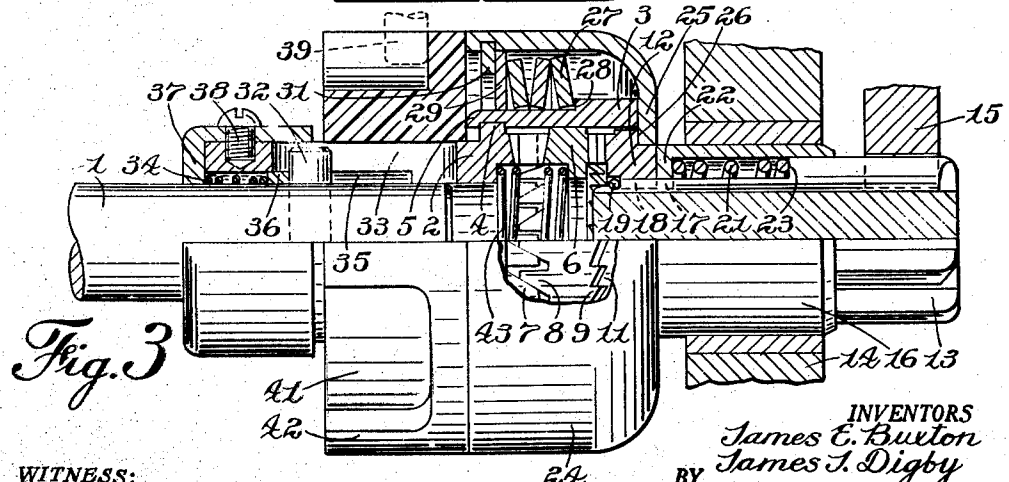


Fig. 3

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ENGINE STARTER GEARING

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The present invention relates to engine starter gearing and more particularly to that type of starter drive in which the pinion is traversed into mesh by acceleration of a starting motor, and returned to idle position by overrunning when the engine starts.

It is an object of the present invention to provide a novel starter drive of this type incorporating means under the control of the operator for holding the pinion in mesh with the engine gear.

It is another object to provide such a device in which the pinion is positively held in meshed position as long as the operator keeps the starting switch closed.

It is another object to provide such a device incorporating an overload slip coupling.

It is another object to provide such a device incorporating a dental type of overrunning clutch which is compressed by the coupling responsive to cranking torque.

It is another object to provide such a device having a pinion and an inclined slot type of traversing means for the pinion assembly, which does not affect the operation of the overload slip coupling during cranking.

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 idle position;

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

Fig. 3 is a similar view showing the parts in the positions assumed after the engine starts, while the pinion assembly is still held in meshed position.

In Fig. 1 of the drawing there is illustrated a power shaft 1 on which a hollow shaft and driving coupling member 2 is slidably journalled. A sleeve 3 is fixedly mounted on a radial flange 4 near the end of the coupling shaft 2 as indicated at 5, and an annular transmission member 6 is slidably journalled in said sleeve. The coupling shaft 2 and transmission member 6 are provided with interengaging inclined driving projections 7 and 8 respectively, and the transmission member is also provided with overrunning clutch teeth 9 adapted to engage similar teeth 11 on a driven clutch member 12 which is also journalled in the sleeve 3.

A pinion member 13 is slidably and rotatably supported in a fixed outboard bearing member 14 coaxially with the power shaft 1, for movement into and out of mesh with an engine gear 15. The bearing support of the pinion 13 is provided by a bearing bushing 16 splined on the pinion as indicated at 17 and slidably journalled in the bearing 14. The driven overrunning clutch member 12 is also splined on the end of the pinion 13 as indicated at 18 and is retained thereon by a lock ring 19. A compression mesh-enforcing spring 21 is mounted on the hub of the pinion 13 and bears at its ends against the splined flange 22 of the bushing 16 and shoulders 23 formed by the ends of the teeth of the pinion respectively,

so as to normally press the clutch member 12 against its abutment ring 19 on the pinion hub.

A barrel member 24 is arranged to surround and enclose the sleeve 3 and the coupling and clutch members, and is provided at one end with an inturned flange 25 against which the end of the sleeve 3 normally abuts, and which also engages a radial shoulder 26 on the driven clutch member 12. Yielding means for normally pressing the end of the sleeve against the flange 25 is provided comprising a heavy compression spring 27 bearing at one end against a shoulder 28 on the exterior of the sleeve, and at the other end against a thrust ring 29 retained in the barrel by means of a lock ring 31. The coupling shaft 2, intermediate transmission member 6, driven clutch member 12 and pinion 13 are thus coupled together as an assembly which is slidable as a unit with respect to the power shaft 1 to move the pinion 13 into and out of mesh with the engine gear 15.

Means responsive to energization of the power shaft for moving the pinion assembly into meshed position is provided comprising a pin 32 fixedly mounted in the power shaft 1 and projecting at its ends into suitably inclined slots 33 in the coupling shaft 2, the travel of the pinion being limited by engagement of the pin 32 with the ends of the slots as shown in Figs. 1 and 2 respectively.

Yielding means are provided for normally holding the pinion assembly in idle position comprising an anti-drift spring 34 received in a counterbore 35 in the coupling shaft 2 and bearing at one end against a thrust ring 36 which engages the pin 32. At its other end spring 34 bears against a thimble 37 slidably fitting the power shaft 1 and anchored to the coupling shaft 2 by suitable means such as indicated at 38.

Means under the control of the operator are provided for positively holding the pinion assembly in meshed position. As here shown this means comprises a latch member 39 which is positioned to be engageable in recesses 41 formed in a latch ring 42 swiveled on the coupling shaft 2 between the barrel 24 and thimble 37. The periphery of the ring 42 is preferably of the same diameter as the barrel 24.

The latch 39 is arranged to be projected into frictional engagement with the barrel 24 by electromagnetic means actuated concurrently with the energization of the starting motor to rotate the power shaft 1. Since this structure is illustrated and described in the patent to Oliver No. 2,444,109 it is believed that illustration and further description of the latch-actuating means is unnecessary.

In the operation of this device, starting with the parts as illustrated in Fig. 1, energization of the power shaft causes the pin 32 to traverse the slots 33 in the coupling shaft 2 and move the pinion and coupling assembly into meshed position as shown in Fig. 2. Since the latch 39 is energized concurrently with the power shaft 1 it bears frictionally on the barrel 24 as a detent hindering rotation of the barrel and consequently insuring its traversal by the inclined pin and slot connection to the power shaft. As soon as the latch ring 42 moves sufficiently to bring its recessed portion 41 opposite the latch 39 said latch enters a recess as shown in Fig. 2. When the pin 32 is engaged by the ends of the slots 33, the coupling shaft 2 is forced to rotate with the power shaft 1, and this rotation is transmitted by the inclined coupling projections 7, 8 to the transmission member 6. The transmission member is thereby forced against the driven clutch member 12, this pressure being cushioned by the coupling spring 27 which permits the projections 7, 8 to slide past each other when necessary to dissipate overloads.

In case, during the meshing movement, tooth abutment should occur between the pinion 13 and engine gear 15,

the meshing movement of the pinion is temporarily arrested, while being yieldingly pressed against the engine gear by the mesh-enforcing spring **21**. When torque has been built up sufficiently to index the pinion, the spring **21** completes the meshing movement.

When the engine starts, the pinion **13** and clutch member **12** overrun the remaining parts of the assembly, but the assembly is prevented from returning to idle position by the engagement of the latch **39** in the latch ring **42** as shown in Fig. 3. In case of a false start, therefore, cranking is immediately resumed, engagement of the overrunning clutch teeth **9**, **11** being assured by a clutch spring **43**.

When the engine is reliably self-operative, the operator deenergizes the starting motor and the latch **39**, whereby the parts are permitted to be returned to idle position by the inclined connection **32**, **33** assisted by the anti-drift spring **34**.

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

We claim:

1. In an engine starter drive a power shaft, a hollow driving coupling shaft slidably journalled on the power shaft and having an inclined driving connection therewith, a sleeve fixedly mounted on the end of the coupling shaft, a fixed outboard bearing in alinement with the power shaft, a pinion, means slidably and rotatably supporting the pinion in the bearing, a driven clutch member non-rotatably mounted on the pinion, a transmission member loosely mounted in the sleeve intermediate the driving coupling shaft and the driven clutch member, means including a barrel member for enclosing the coupling and clutch members and transmitting longitudinal movement from the coupling shaft to the pinion, and means energized concurrently with actuation of the power shaft for preventing the pinion from returning to idle position.

2. A starter drive as set forth in claim 1 in which the inclined connection from the power shaft to the coupling shaft includes means for limiting the longitudinal movement of the coupling shaft and pinion.

3. A starter drive as set forth in claim 1 in which the driven clutch member is splined on the pinion, and including further an abutment retaining the driven clutch member on the pinion, and yielding means on the pinion pressing the driven clutch member against said abutment.

4. A starter drive as set forth in claim 3 including further a bearing bushing slidably mounted on the pinion, journalled in said bearing, seated against said driven clutch member and enclosing said yielding means.

5. An engine starter drive as set forth in claim 1 in which said sleeve is anchored at one end on the coupling shaft, said coupling shaft and transmission member having interengaging inclined driving projections, and means including a spring cooperating with said sleeve and barrel member for resisting movement of the driven clutch member in the direction away from the coupling shaft.

6. An engine starter drive as set forth in claim 1 in which the means for preventing the pinion from returning to idle position includes a recessed ring member swivelled on the coupling shaft, and a latch member movable into and out of engagement with said ring, positioned to enter a recess therein when the parts are in cranking position.

7. In an engine starter drive a power shaft, a driving coupling member mounted thereon, means responsive to rotation of the power shaft for traversing said coupling member for a predetermined distance on the power shaft and thereafter causing the coupling member to rotate with the power shaft, a fixed outboard bearing in alinement with the power shaft, a solid pinion member, means slidably and rotatably supporting the pinion member in said bearing for movement into and out of mesh with a gear of an engine to be started, a rotary and traversing connection from the coupling member to the pinion member including a transmission member having a wedging dental connection to the coupling member, and a clutch member having a dental overrunning clutch connection to the transmission member and a splined connection to the pinion member; and a mesh-enforcing spring transmitting meshing movement of the clutch member to the pinion.

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