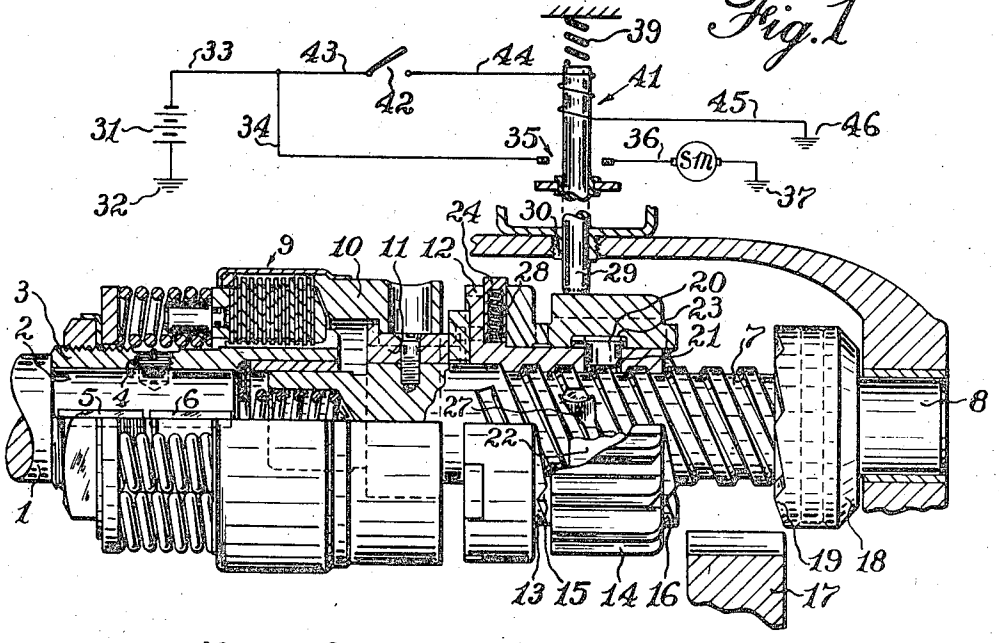
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ENGINE STARTER

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Fig. 1



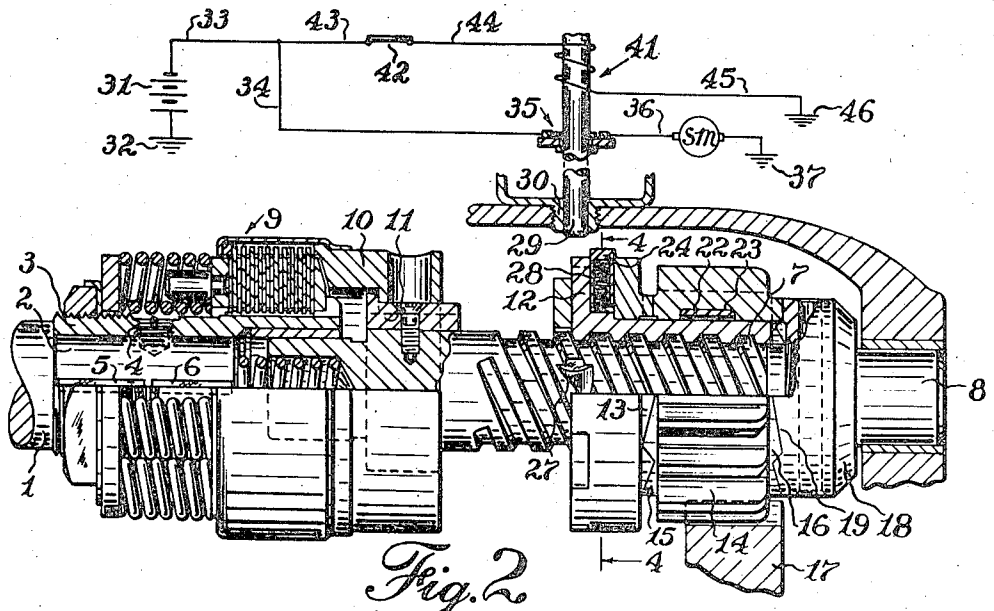


Fig. 2

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Fig. 3

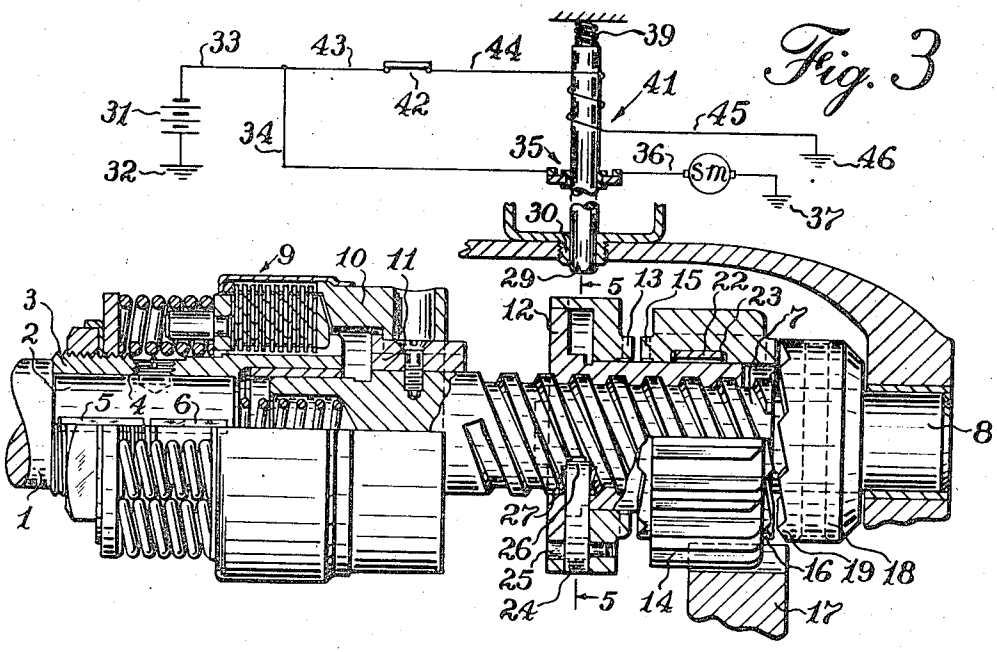


Fig. 4

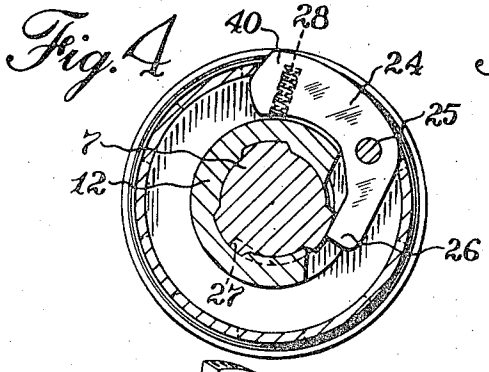


Fig. 5

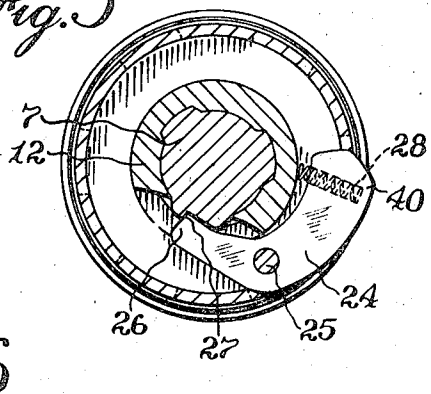
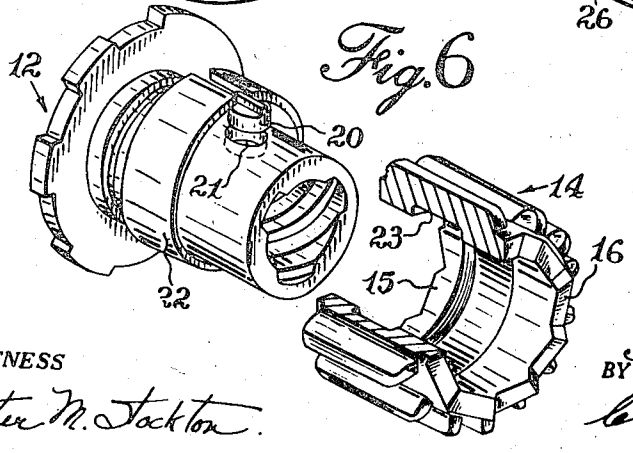


Fig. 6



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2,446,458

ENGINE STARTER

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Application October 29, 1945, Serial No. 625,325

3 Claims. (Cl. 74—7)

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The present invention relates to engine starter gearing and more particularly to a starter drive of the automatically engaging type.

It is an object of the present invention to provide a novel engine starter in which engagement of the gearing is under complete control of the operator.

It is another object to provide such a device having clutch means allowing the engine to overrun the drive while the drive gear is maintained in mesh.

It is another object to provide a device which is adapted for heavy duty installations.

It is another object to provide such a device in which the gear is engaged by energization of the starting circuit and held in mesh as long as the starting circuit is energized.

It is a further object to provide such a device embodying unitary means for frictionally maintaining the parts in idle position and for controlling the engagement of the clutch.

Further objects and advantages will be apparent from the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a side elevation partly in section of a starter drive forming a preferred embodiment of the invention showing the parts in idle position, the other elements of the starting system being shown diagrammatically;

Fig. 2 is a similar view showing the parts in the positions assumed during the cranking operation;

Fig. 3 is a similar view showing the parts in the positions assumed when the engine starts and overruns the drive while the starting motor is still in operation;

Fig. 4 is a cross-section of the starter drive taken substantially on the line 4—4 of Fig. 2 showing the latch member in idle position;

Fig. 5 is a section taken substantially on the line 5—5 of Fig. 3 showing the latch member in operative position; and

Fig. 6 is a detail in perspective of the pinion and control nut in disassembled relation, certain of the parts being shown in section for the sake of clarity.

In Fig. 1 of the drawings, there is illustrated a motor shaft 1 which has a reduced extension 2 on which a sleeve 3 is mounted and held in place longitudinally by a set screw 4 and rotatably by keys 5 and 6. A screw shaft 7 journalled in an outboard bearing 8 is yieldingly driven from the motor shaft 1 by means of a friction disc clutch, indicated generally by numeral 9, connecting the drive sleeve to the screw shaft through a driven

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clutch housing 10 and key 11. A control nut 12, having inclined abutments 13 on its forward side, is threaded on the screw shaft 7 and a pinion 14 is slidably journalled on said control nut in position to be carried thereby into and out of mesh with a gear 17 of an engine to be started. Pinion 14 is provided with inclined abutments 15 and 16 on its advancing and retreating sides respectively, similar in form to abutments 13 of the control nut, and a stop nut 18 having like inclined abutment surfaces 19 is fixed on the screw shaft in position to be engaged by the advancing side of the pinion 14 to thereby define the cranking position of the pinion and cause the inclined abutments to form an overrunning clutch between the pinion and screw shaft.

Unitary means are provided for normally holding the parts in idle position, which means serve also to retain the pinion on the control nut and to provide a frictional drag between the pinion and the control nut to insure the proper functioning of the clutch connection. As shown, this means is in the form of a pin 20 slidably mounted in a radial opening 21 in the control nut and extending into an annular recess 23 in the interior of the pinion, and a flat spring ring 22 seated in said annular recess and bearing at its ends on shoulders formed on the inner end of the pin so as to press the pin into frictional engagement with the screw shaft.

The engagement of the outer end of the pin 20 in the annular internal recess 23 of the pinion limits the longitudinal movement of the pinion to the right in Fig. 1 with respect to the control nut, thereby constituting means for restricting the longitudinal movement of the pinion on the control nut. The frictional engagement of the spring 22 with the interior of the pinion, and the fact that its engagement with the end of the pin 20 compels the spring to rotate with the control nut, cause the spring to form a light frictional connection between the pinion and control nut. Beside performing these functions, the pin 20 and spring 22 cooperate to constitute means for retaining the pinion in idle position. That is to say, the frictional engagement of the inner end of the pin with the screw shaft under the pressure of the spring 22 causes the pin to perform the function of an anti-drift pin and oppose any tendency of the control nut to drift away from its idle position due to vibration etc. while the engine is running.

Means for holding the pinion in mesh with the engine gear is provided in the form of a latch member 24 pivoted at 25 on the control nut which

latch has a nose 26 adapted to enter a notch 27 in the screw shaft by the action of a spring 28. Manually controlled releasing means for said latch is provided in the form of a plunger 29 which is slidably mounted in a holder 30 threaded in the starting motor casing, and is arranged to be actuated as an ancillary function of the operation of the starting switch. As here shown, the starting circuit includes a battery 31 grounded at 32 and connected by leads 33 and 34 to a magnetic starting switch 35 which in turn is connected by a lead 36 to the starting motor SM which is grounded at 37 to complete the starting circuit.

According to the present invention, the plunger 29 is formed as an extension of the magnetic plunger of starting switch 35. It is arranged to be normally projected into the path of rotation of the latch 24 either by gravity or by means of a spring 39, so as to engage a projecting portion 40 of the latch and thereby withdraw the nose 26 of the latch from the notch 27 in the screw shaft. The plunger 29 is withdrawn from the path of the latch incidental to closure of the starting switch by means of a solenoid 41. A control circuit for said solenoid is provided comprising a manually operable switch 42 connected by a lead 43 to the battery lead 33 and by a lead 44 to one end of the solenoid. The opposite end of the solenoid is connected by the lead 45 to the ground at 46 to complete the control circuit.

In operation, closure of the manual switch 42 by the operator energizes solenoid 41 which closes the starting switch 35, causing actuation of the starting motor SM and at the same time retracting the plunger 29 out of the path of the latch 24. Rotation of the power shaft by the starting motor is transmitted through the yielding connection to the screw shaft whereby the control nut 12 and the pinion 14 are traversed longitudinally on the screw shaft to mesh the pinion with the engine gear 17. When the pinion engages the stop nut 18 on the screw shaft, as shown in Fig. 2, the pinion is clamped between the control nut and the stop nut, and thereby caused to rotate with the screw shaft to crank the engine.

When the engine fires, the acceleration of the engine causes the pinion to overrun the control nut which backs away sufficiently to release the clutch faces 13, 15 and 16, 19, the backward movement of said control nut being limited by engagement of the latch member 24 in the notch 27 of the screw shaft. The width of the annular recess 23 in the pinion is sufficient to allow disengagement of the clutch elements 13, 15 before the pin contacts the side of the recess, as shown in Fig. 3.

While the pinion is overrunning the control nut, the flat spring 22 transmits a light frictional drag from the pinion to the control nut which causes the nose 26 of the latch to be pressed into notch 27 of the screw shaft as shown in Fig. 5. If the engine should fail to continue self-operative, as soon as the speed of the pinion falls below that of the screw shaft and control nut, the drag of the spring 22 retards the control nut, thus causing it to be traversed to the right on the screw shaft 7 to thereby reestablish the clutch connection with the pinion, and cranking is resumed. When the engine becomes reliably self-operative, the operator opens the manual switch 42, thus causing the starting switch 35 to open, and the plunger 29 to engage the projecting part 40 of latch 24. The nose 26 of the latch is thus retracted from the notch 27 in the screw shaft, permitting the control nut and pinion to overrun the screw shaft and return to idle position, where they are yieldably maintained by the frictional engagement of the anti-drift pin 20 with the screw shaft.

What is claimed is:

1. In an engine starter a power shaft, a screw shaft, a driving connection therebetween, a control nut threaded on the screw shaft, a pinion slidably journalled on the control nut, means movably mounted in the control nut for restricting the longitudinal movement of the pinion on the control nut, spring means forming a light frictional coupling between the control nut and pinion, said coupling means being arranged to press the restricting means into frictional engagement with the screw shaft to normally retain the control nut and pinion in idle position, an overrunning clutch connection between the control nut and pinion, and an abutment on the screw shaft defining the operative position of the pinion.

2. In an engine starter a power shaft, a screw shaft, a driving connection therebetween, a control nut threaded on the screw shaft, a pinion slidably journalled on the control nut and having an internal annular recess, said control nut having a radial opening registering with said recess, a pin slidably mounted in said opening and extending within the recess, an annular spring in the recess bearing on the pin, holding the pin in frictional contact with the screw shaft, an abutment on the screw shaft defining the operative position of the pinion, the control nut having means for clamping the pinion against the abutment to form a driving connection from the screw shaft to the pinion.

3. An engine starter as set forth in claim 1 including further a latch pivotally mounted on the control nut in position to engage the screw shaft, said screw shaft having a notch adapted to receive the latch and thereby limit the movement of the control nut away from operative position, and means under the control of the operator for withdrawing the latch.

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