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ENGINE STARTER GEARING

Filed Oct. 17, 1956

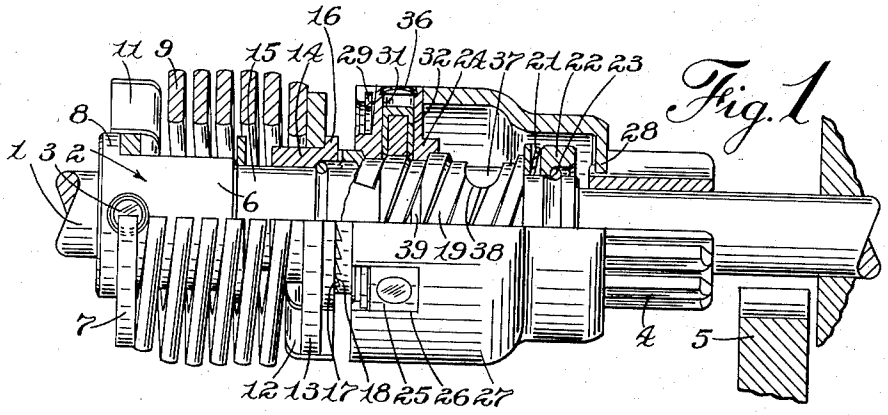

Fig. 1

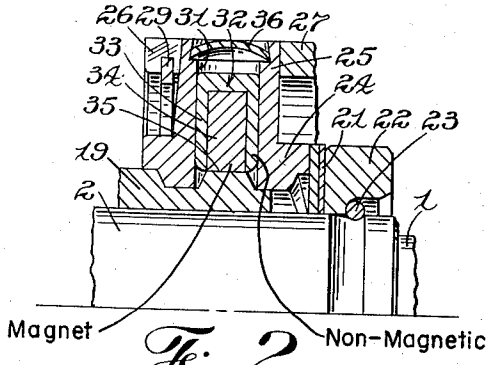

Fig. 2

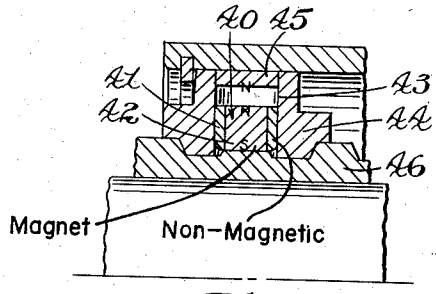

Fig. 3

WITNESS:

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ENGINE STARTER GEARING

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3 Claims. (Cl. 74—6)

The present invention relates to engine starter gearing and more particularly to that type of automatically traversing drive in which the engagement of the drive pinion with the engine gear is maintained until the engine is operating under its own power above a predetermined speed.

In starter drives of this type, such as disclosed for instance in the patent to Miller 2,624,202 where a spring-loaded centrifugal detent is used to control the demeshing of the pinion, it may happen that a succession of abortive explosions of the engine with consequent brief accelerations of the pinion may unseat the detent and gradually work it out, permitting demesh of the pinion prior to reliable self-operation of the engine.

It is an object of the present invention to provide a novel starter drive of the above type in which the centrifugal detent is prevented from creeping out of its seat during cranking and/or false starts of the engine.

It is another object to provide such a device which is so constructed that the maximum resistance to withdrawal of the detent is encountered when the detent is in its seat, such resistance diminishing rapidly as the detent moves away from its seat. By this arrangement the detent is held firmly to its seat until the desired predetermined speed of the engine is attained, and then the detent is rapidly and completely disengaged.

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, showing a preferred embodiment of the drive in normal or idle position;

Fig. 2 is an enlarged detail of the centrifugal detent and its associated parts in the positions assumed during cranking; and

Fig. 3 is a view similar to Fig. 2 showing a modified form of detent structure.

In Fig. 1 of the drawing there is illustrated a power shaft 1 on which a hollow sleeve 2 is fixedly mounted as indicated at 3. A pinion 4 is slidably journalled on the power shaft 1 for axial movement into and out of mesh with an engine gear 5.

The sleeve 2 is formed with a driving head portion of non-circular contour 6 on which a driving anchor plate 7 is non-rotatably mounted against a terminal flange 8. A drive spring 9 has an outturned end 11 entering a radial slot in the anchor plate 7, and at its other end is provided with a similar attachment portion 12 entering a slot in an anchor plate 13 which is non-rotatably mounted on a driving clutch member 14 slidably journalled on a reduced portion 15 of hollow sleeve 2 and formed with a flange 16 confining the anchor plate thereon.

The clutch member 14 is provided with overrunning clutch teeth 17 cooperating with similar teeth 18 on the end of a screw shaft 19 which is slidably and non-rotatably mounted on the smooth portion 15 of said sleeve and is yieldably maintained in engagement with the clutch member 14 by a spring washer 21 located between the

end of the screw shaft 19 and a stop ring 22 positioned on the end of said sleeve by a lock ring 23.

A control nut 24 is threaded on the screw shaft 19 and is provided with radial lugs 25 received in slots 26 in the open end of a barrel member 27 the opposite end of which is rigidly connected to the pinion 4 as indicated at 28. The lugs 25 are confined in said slots by a lock ring 29.

One or more of the lugs 25 of the control nut 24 are provided with a cylindrical radial passage 31 in which a detent 32 is slidably mounted. As best shown in Fig. 2, this detent is formed of a body 33 of suitable non-magnetic material, in which is mounted in any suitable manner a permanent magnet 34 which is radially polarized, the inner pole 35 extending flush with the end of the detent so as to come into engagement with the adjacent surface of the screw shaft 19. A cap 36 is fixedly mounted in the outer end of the passage 31 to close said passage and prevent escape of the detent.

The screw shaft 19 is formed with a notch 37 so located as to receive the inner end of the detent 32 when the pinion has been traversed into mesh with the engine gear. The notch 37 is formed with a shoulder 38 forming an abutment for the detent 32 and preventing demeshing movement of the pinion and barrel assembly until such time as the detent is released from its seat by centrifugal force.

The screw shaft 19 is also provided with a reduced portion adjacent the idle position of the detent 32, forming an inclined shoulder 39 which cooperates with the detent to resist the tendency of the pinion assembly to drift away from idle position.

In operation, starting with the parts in the positions illustrated in Fig. 1, rotation of the power shaft 1 causes the control nut with the associated barrel and pinion to be traversed to the right until the movement of the control nut is arrested by the stop ring 22 on the sleeve 2. During this meshing movement of the pinion assembly, the detent 32 slides on the surface of the screw shaft 19, the magnet 34 maintaining its proximity to the screw shaft, and entering its seat in the notch 37 of the screw shaft when the pinion 4 has become meshed with the engine gear 5. The attraction of the magnet for the screw shaft maintains the detent firmly seated in the notch 37 in spite of any minor accelerations which might be caused by intermittent explosions of the engine prior to becoming reliably self-operative. When a successful start has been secured, as evidenced by rotation of the pinion assembly above the predetermined minimum speed, the consequent centrifugal force on the detent causes it to leave its seat on the screw shaft 19 whereupon the attraction between the magnet and screw shaft is rapidly reduced causing the detent to move outward freely in such manner as not to interfere with the demeshing movement of the pinion assembly. The acceleration of the pinion and control nut is thus permitted to return the parts to idle position where they are maintained yieldably by reengagement of the detent with the screw shaft back of the inclined shoulder 39 when the parts come to rest.

In Fig. 3 of the drawing there is illustrated a modified form of detent structure in which the flux of the magnet is used both in attraction and in repulsion.

As there shown, the detent 40 comprises a sleeve 41 of suitable non-magnetic material in which a permanent magnet 42 is fixedly mounted. In this case the sleeve and magnet are substantially coextensive in length so that both poles are exposed as indicated at N and S.

The detent 40 is slidably mounted in the radial passage 43 in the control nut 44, and a second permanent magnet 45 is fixedly mounted in the outer end of said passage. Magnet 45 is spaced sufficiently from the detent 40 to permit the latter to move out of engagement with

screw shaft 45, 46 but is arranged as indicated with a like pole in juxta-position with the adjacent pole of magnet 42. The magnet 42 is thus caused to oppose release of the detent 40 both by attraction to the screw shaft 45, 46 and by repulsion from the magnet 45.

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

I claim:

1. In an engine starter drive a power shaft, a screw shaft, means including an overrunning clutch for rotating the screw shaft from the power shaft, a pinion slidably journalled on the power shaft for movement into and out of mesh with a gear of an engine to be started, a control nut threaded on the screw shaft, a barrel member connecting the control nut and pinion, a latch member slidably mounted in the control nut for radial movement into and out of contact with the screw shaft, and magnetic means for holding the latch member in contact with the screw shaft until the screw shaft and control nut are rotated above a predetermined speed; in which the

magnetic means includes a permanent magnet fixedly mounted in said latch member with one of its poles adjacent to the screw shaft, and said magnet is mounted in a non-magnetic carrier which encloses the magnet except for the pole adjacent the screw shaft.

2. An engine starter drive as set forth in claim 1 in which the control nut has a plurality of lugs and the barrel has a plurality of slots receiving said lugs, one of said lugs having a radial passage in which the latch member is slidably mounted.

3. An engine starter drive as set forth in claim 2 including further a second permanent magnet fixed in the outer end of said passage spaced from said detent and having a like pole in juxta-position to the adjacent pole of the first-mentioned magnet.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,863,320

December 9, 1958

Charles A. Mendenhall

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, lines 69 and 70, for "non-rotatably" read -- rotatably --.

Signed and sealed this 10th day of November 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents