Feb. 21, 1933. F. T. CHRISTIAN 1,898,423

ENGINE STARTER

Filed March 30, 1932

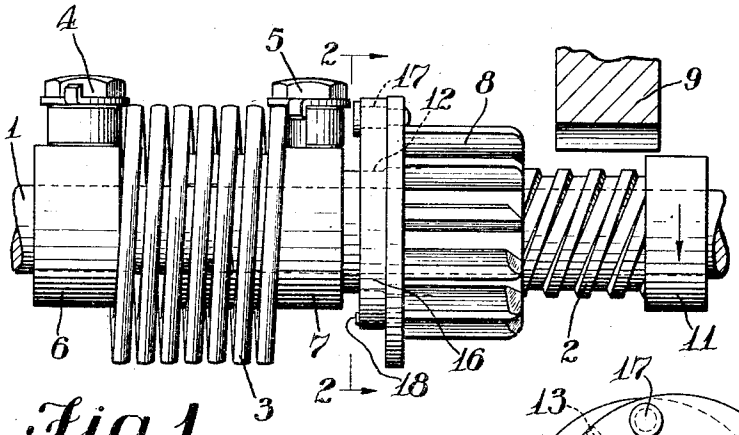


Fig. 1

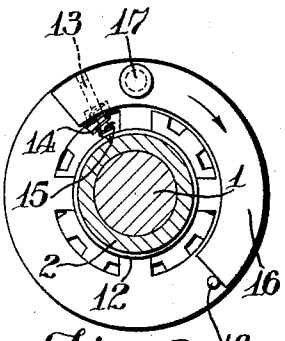


Fig. 2

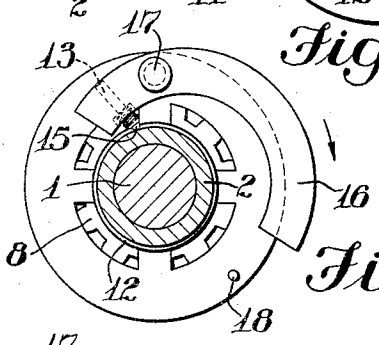
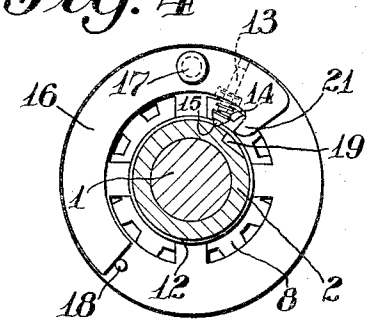


Fig. 3

Fig. 4



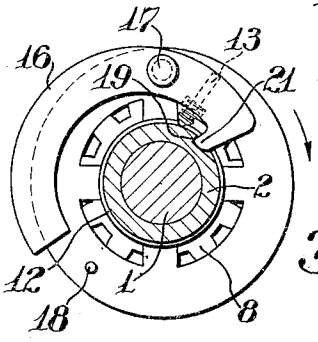


Fig. 5

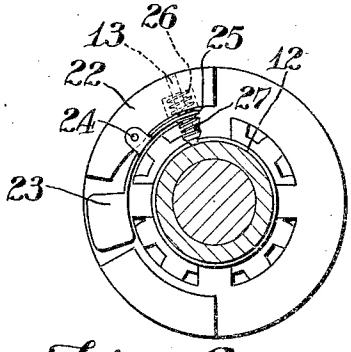


Fig. 6

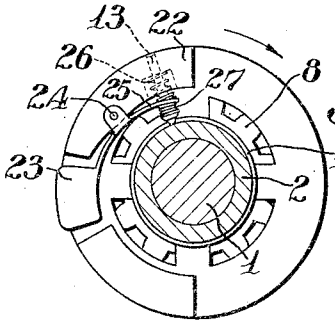


Fig. 7

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UNITED STATES PATENT OFFICE

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ENGINE STARTER

Application filed March 30, 1932. Serial No. 602,085.

This invention relates to engine starters and more particularly to a combined anti-drift and rebound check for starter drives to prevent undesired traversal of the starting pinion toward the engine gear.

In starting mechanism of the type in which a pinion is automatically traversed into and out of mesh with an engine gear, it is desirable to provide means for preventing the pinion from drifting toward the engine gear when the engine is running, and from bounding back toward the engine gear when the pinion is thrown out of engagement therewith as the engine starts.

It is an object of the present invention to provide a novel and improved anti-drift and rebound check for starting pinions.

It is another object of the invention to provide such a device in which a unitary structure is adapted to perform both said functions.

It is a further object to provide such a device in which the rebound checking structure is arranged so as not to interfere with the normal traversal of the pinion into the starting position.

Another object is to provide such a device which is readily adapted to existing types of starting mechanism.

A further object is to provide such a device which is simple and economical in construction and efficient and reliable in operation.

Further objects and advantages will be apparent to those skilled in this art from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a side elevation of a preferred embodiment of the invention showing the parts in idle position.

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 showing the rebound check in operative position.

Fig. 4 is a view similar to Fig. 2 of a second embodiment of the invention.

Fig. 5 is a view of the structure shown in Fig. 4 showing the rebound check in operative position.

Fig. 6 is a view similar to Fig. 2 of a third embodiment of the invention.

Fig. 7 is a similar view of the structure shown in Fig. 6 showing the rebound check in operative position.

Referring first to Fig. 1 of the drawing, there is illustrated a starter drive including a power shaft 1 which is preferably the extended armature shaft of a starting motor not shown. A screw shaft 2 is freely journalled on said power shaft and is adapted to be driven therefrom by suitable yielding means such as a spring 3 anchored at its ends as indicated at 4 and 5 to driving heads 6 and 7 which are fixed in any suitable way to the power shaft 1 and screw shaft 2, respectively.

A driving member in the form of a pinion 8 is threaded on the screw shaft 2 in position to be moved by the threads of said shaft into and out of engagement with an engine member such as a flywheel gear 9. The arrangement of the pinion 8 on the threaded shaft 2 is such that rotation of the shaft 2 from the power shaft 1 in the direction of the arrow causes the pinion to be traversed into engagement with the engine gear 9 until it engages a stop nut 11 on said screw shaft. Further rotation of the shaft causes the pinion to rotate therewith to crank the engine. When the engine starts, the acceleration of the flywheel gear 9 causes the pinion to overrun the screw shaft whereby the pinion is thrown back out of mesh from the flywheel gear to its idle position.

According to the present invention means are provided for preventing the pinion from drifting away from its idle position toward the flywheel when the engine is running, due to vibration or other causes. As here shown this means comprises a circumferential groove 12 formed in the screw shaft 2, and a detent member 13 mounted on the pinion and yieldably engaged in said groove by suitable means such as a spring 14 when the pinion is in its idle position. It will be understood that the edge of the groove 12 and the point 15 of the detent 13 are sufficiently rounded so that when the screw shaft 2 is rapidly accelerated by the energization

of the starting motor, the detent is readily forced out of the groove and does not prevent the traversal of the pinion into engagement with the engine gear.

The present invention further provides means for preventing the pinion from bounding back toward the flywheel gear when it is thrown out of mesh as the engine starts. As here shown, this function is accomplished by mounting the detent 13 for radial sliding movement in the shorter arm of a curved lever 16 which is pivoted unsymmetrically to the pinion 8 as indicated at 17. The lever is normally maintained in the position shown in Fig. 1 by means of the detent spring 14 which reacts to hold the long arm of said lever against a stop such as a pin 18 mounted on the pinion. Rotation of the pinion, however, causes the long arm of the lever to fly out under the action of centrifugal force as illustrated in Fig. 3, thus forcing the detent 13 into the groove 12 with such pressure as to suppress any tendency of the pinion to bound away from its idle position.

In the operation of this embodiment of the invention, rotation of the armature shaft 1 when the motor is energized is transmitted through the spring 3 to the screw shaft in the direction of the arrow whereby the pinion, due to its inertia, is traversed into engagement with the flywheel gear prior to any substantial rotation thereof. Since the pinion is not in rotation at this time, the detent 13 is readily forced out of the groove 12 to allow this traversal to take place.

When the engine starts, the pinion 8 is accelerated by the flywheel gear so as to overrun the screw shaft and the lever 16 is thereby actuated to press the detent 13 against the shaft 2 with a comparatively heavy pressure. When the pinion reaches its idle position, the detent enters the groove 12 and locks the pinion to the shaft preventing any rebounding action.

In the embodiment of the invention illustrated in Figs. 4 and 5, the shafts, pinion, and lever are all arranged similarly as in the first embodiment of the invention and operate in a similar manner. However, the screw shaft 2 is provided with a notch 19 adjacent the detent 13 when in its idle position, and the lever 16 is provided with an inwardly extending hook 21 adapted to engage in said notch and positively latch the pinion to the shaft when the pinion is thrown back to its idle position, as illustrated in Fig. 5.

The operation of this embodiment of the invention is the same as in the first embodiment described, with the addition of the positive latching connection of the lever 16 and screw shaft while the pinion is rotating in its idle position.

A further embodiment of the invention is illustrated in Figs. 6 and 7. As here shown, the detent 13 is slidably mounted in a flange 22 on the pinion and performs its anti-drift function in connection with the groove 12 on screw shaft 2 as previously described. In order to force the detent 13 into the groove 12 to perform its rebound checking function, a weighted lever 23 is pivoted as indicated at 24 to the flange 22 and is provided with a forked arm 25 adapted to embrace the detent 13 and apply pressure thereto when the pinion is spinning. The anti-drift spring for the detent 13 may if desired be formed of two parts 26 and 27, the part 26 being comparatively weak to perform the normal anti-drift function, and the part 27 being comparatively stiff in order to transmit the locking force to the detent 13. If desired the part 27 may be omitted altogether and the fork 25 of the lever 23 may be formed to bear directly on the head of the detent 13.

The operation of this embodiment of the invention is similar to that illustrated in Figs. 1 and 2, in that the spinning of the pinion 8 when it is thrown out of mesh from the engine gear causes the centrifugal lever 23 to force the detent 13 against the screw shaft 2 and into the groove 12 whereby rebound of the pinion is effectively prevented.

Although certain embodiments of the invention have been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the details and arrangements of the parts without departing from the spirit of the invention as defined in the claims appending hereto.

What is claimed is:

1. In an engine starter a shaft, a driving member mounted thereon for rotation thereof and therewith and movement into and out of engagement with a member of the engine to be started, cooperating means on said shaft and driving member for yieldingly restraining longitudinal movement of said driving member toward said engine member, and means responsive to rotation of the driving member for increasing the effectiveness of the restraining means.

2. In an engine starter a shaft, a driving member mounted thereon for rotation thereof and therewith and movement into and out of engagement with a member of the engine to be started, said shaft having a circumferential groove, a detent mounted on said driving member adapted to engage said groove when the driving member is in idle position, yielding means for engaging the detent with the groove, and centrifugal means responsive to rotation of the driving member for holding the detent in said groove.

3. In an engine starter a shaft, a driving member mounted thereon for rotation thereof and therewith and movement into and out of engagement with a member of the engine to be started, said shaft having a circumferential groove, a lever pivoted unsymmet-

rically to said driving member, a detent mounted on the short arm of said lever in position to engage said groove when the driving member is in idle position, means for yieldingly urging said detent against said shaft, the long arm of said lever being arranged to swing out responsive to rotation of the driving member and positively force said detent against said shaft.

4. A starter drive including a shaft, a driving member mounted thereon to be driven thereby and for automatic shifting movement into and out of engagement with a member of an engine to be started, means for yieldingly opposing longitudinal movement of the driving member, and means responsive to rotation of the driving member for increasing the effectiveness of the opposing means and for positively locking the driving member to the shaft when the driving member reaches its idle position.

5. A starter drive including a shaft, a driving member mounted thereon to be driven thereby and for automatic shifting movement into and out of engagement with a member of an engine to be started, a latch member pivoted to said driving member, a detent mounted on said latch in position to engage said shaft, means for yieldingly urging said detent against said shaft and means responsive to rotation of the driving member for swinging said latch to increase the pressure of said detent and to positively latch the driving member in its idle position.

6. A starter drive including a shaft, a driving member mounted thereon to be driven thereby and for automatic shifting movement into and out of engagement with a member of an engine to be started, a latch member pivoted to said driving member, a detent mounted on said latch in position to engage said shaft, said shaft having a notch and said latch having a hook adapted to engage said notch and being unsymmetrically weighted whereby centrifugal force, due to the spinning of the driving member, causes the latch member to force the detent against said shaft and causes said hook to engage the notch in said shaft when the driving member is in idle position.

In testimony whereof, I have hereunto signed my name.

FRANK T. CHRISTIAN.