Feb. 14, 1933. M. P. WHITNEY 1,897,919

ENGINE STARTER

Filed Oct. 31, 1931

Fig. 1

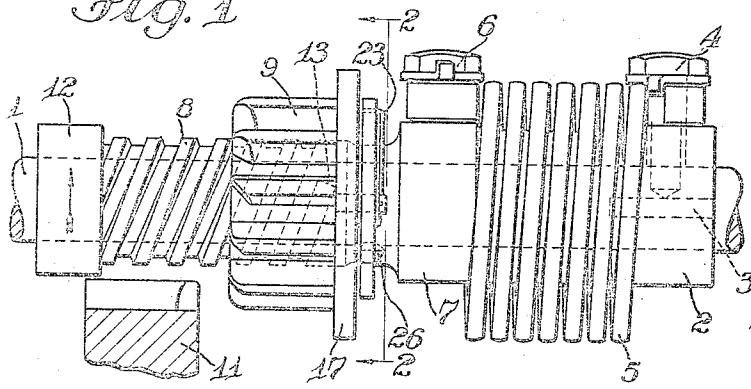


Fig. 2

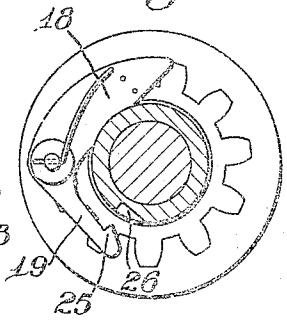


Fig. 3

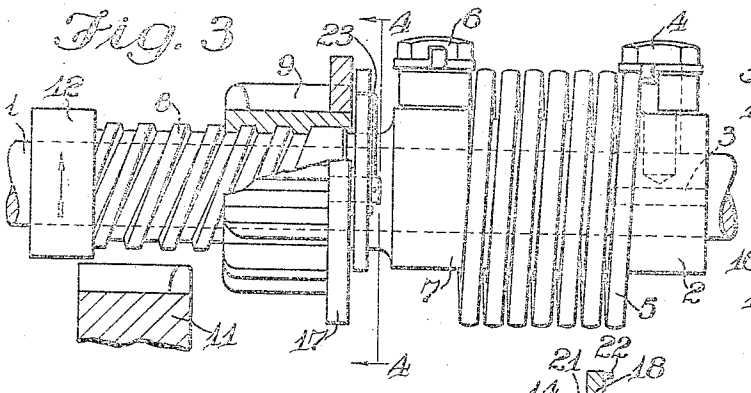
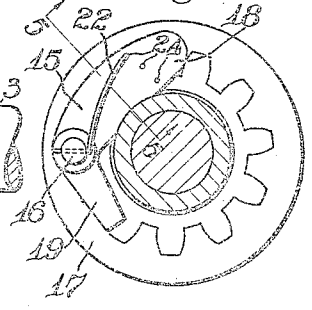


Fig. 4



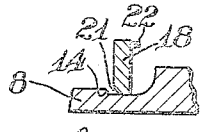


Fig. 5

Fig. 6

Fig. 7

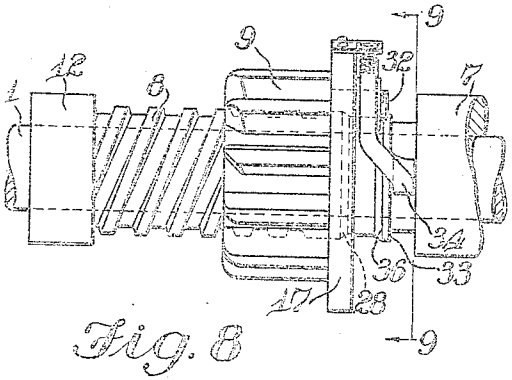


Fig. 8

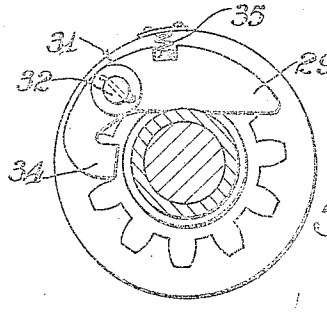


Fig. 9

INVENTOR

BY Maurice P. Whitney

Clinton L. Janes

ATTORNEY

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UNITED STATES PATENT OFFICE

MAURICE P. WHITNEY, OF ELMIRA, NEW YORK, ASSIGNOR TO ECLIPSE MACHINE COMPANY, OF ELMIRA, NEW YORK, A CORPORATION OF NEW YORK

ENGINE STARTER

Application filed October 31, 1931. Serial No. 572,265.

This invention relates to an engine starter and more particularly to a rebound check and anti-drift device for starter drives.

In starter drives of the type in which a driving pinion is automatically traversed into and out of mesh with a member such as a flywheel gear of an engine to be started, some difficulty is occasionally encountered in preventing the pinion from drifting into engagement with the engine member while the engine is running due to vibration or other causes, and it also not infrequently occurs in some installations that the pinion when thrown out of mesh with the engine member as the engine starts will rebound from its idle position and strike the side of the rotating engine member. Both of these conditions are undesirable, since they are productive of unnecessary wear and noise.

It is an object of the present invention to provide a starter drive embodying a novel device for yieldably resisting drifting of a starting pinion into undesired engagement with an engine member and for positively preventing the pinion from bounding back toward the engine member when it is thrown out of engagement therewith.

Another object of the invention is to provide such a device which does not interfere with the automatic traversal of the pinion into mesh with the engine member when the starting mechanism is actuated.

A further object is to provide such a device which is readily adaptable without undue expense to various existing types of drive.

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 starter drive embodying one preferred form of the invention;

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

Fig. 3 is a view similar to Fig. 1 of a second embodiment of the invention;

Fig. 4 is a cross section taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a detail in section substantially on the line 5—5 of Fig. 4 showing the anti-drift device in operative position;

Fig. 6 is a similar detail showing the rebound check in operative position;

Fig. 7 is an enlarged sectional detail showing the shoulder formed on the screw shaft for cooperating with the retaining means on the pinion;

Fig. 8 is a side elevation of another embodiment of the invention;

Fig. 9 is a cross section taken substantially on the line 9—9 of Fig. 8.

Referring first to Figs. 1 and 2 of the drawing, there is illustrated a shaft 1 which may be the extended armature shaft of a starting motor (not shown) and having a driving head 2 fixed thereon as by means of a key 3 and stud 4. The stud 4 serves as an anchorage for a driving spring 5 the other end of which is anchored as by means of a stud 6 on the driving head 7 formed on the end of a power member in the form of a screw shaft 8 which is freely journaled on the shaft 1. A driving member in the form of a pinion 9 is threaded on the screw shaft 8 and is adapted to be traversed into and out of mesh with an engine member such as a flywheel gear 11, the driving position of the pinion being defined by a suitable stop 12 on the screw shaft 8, and the idle position of the pinion being defined by shoulders 13 formed on the ends of the shaft threads.

According to the present invention, means are provided for yieldably resisting traversal of the pinion 9 away from its idle position when the screw shaft 8 is not being rotated, and for positively preventing such traversal when the parts are rotating rapidly at the time the pinion is thrown out of mesh with the engine member 11. For this purpose, a shoulder 14 (Figs. 5 and 6) is formed on the screw shaft 8, and a retaining member 15 (Fig. 2) in the form of a bell crank lever is pivoted at 16 on a flange 17 of the pinion in such position that either of the arms 18 or 19 of the retaining member may move into engagement with the screw shaft and bear against the shoulder 14 thereon. The arm 18 of the retaining member 15 is rounded on its inner edge as at 21 (Fig. 5) and is yield-

ingly maintained in engagement with the screw shaft when the parts are stationary by suitable means such as a spring 22 which is mounted on the pivot pin 16 in position to serve as a retaining means for the lever 15, and is bent at right angles at its outer end as indicated at 23 (Fig. 3) in order to engage any one of the openings 24 in the arm 18 for adjustably urging said arm into engagement with the screw shaft. The arm 19 is rectangular in cross section forming a radial shoulder adapted to engage the shoulder 14 of the screw shaft and thus positively prevent relative longitudinal motion between the pinion and screw shaft. The arm 18 is weighted sufficiently to overbalance the arm 19 and move outwardly under centrifugal force when the pinion is rotating rapidly, thus bringing the arm 19 into engagement with the screw shaft.

As illustrated in Fig. 2, the arm 19 may be provided with a hook or claw 25 adapted to engage in a recess 26 to form a latch which is brought into engagement by the action of centrifugal force on the arm 18 to retain the pinion in its idle position.

In the embodiment of the invention illustrated in Figs. 3 and 4, the hook 25 and latch 26 are omitted, and the locking function of the arm 19 is performed entirely by the engagement of the side of said arm against the shoulder 14 of the screw shaft 8, as illustrated in Fig. 6. Fig. 7 illustrates the shoulder 14 on an enlarged scale, showing a beveled surface 26 arranged to engage the rounded edge 21 of the arm 18 and a radial surface 27 adapted to engage the square side of the locking arm 19. The remaining parts of the drive are the same as those illustrated in Figs. 1 and 2 and are similarly numbered.

Figs. 8 and 9 illustrate an embodiment of the invention in which shoulders corresponding to the beveled surface 26 and radial surface 27 of Fig. 7 are formed in axially separated planes on the screw shaft, and the retaining means cooperating therewith are formed in separate axial planes. As there illustrated, a beveled shoulder 28 is formed on the screw shaft in position to be engaged by an arm 29 of a retaining member 31 pivoted at 32 on the pinion 9; and a radial shoulder 33 is formed on the screw shaft in position to be engaged by a locking arm 34 of the retaining member 31 which arm is offset axially from the arm 29 as clearly seen in Fig. 8.

The arm 29 is normally urged into engagement with the screw shaft by suitable means such as a spring 35 and is weighted so as to move outwardly under the action of centrifugal force, thus bringing the arm 34 into engagement with the screw shaft when the pinion is rapidly rotating. The shoulder 33 on the screw shaft is preferably bevelled on its forward side as indicated at 36 so as to allow the arm 34 to pass over the shoulder when the pinion is being returned to its idle position. The remaining parts of the drive illustrated in Figs. 8 and 9 are also similar to those shown in Figs. 1 and 2 and are similarly numbered.

In operation, the pinion 9 is normally retained in its idle position on the screw shaft 8 by the engagement of the arm 18 (Figs. 1 and 2) or 29 (Figs. 8 and 9) which is yieldably held against the screw shaft in engagement with the bevelled shoulder thereon. When the shaft 1 is operated, rotation is transmitted through the drive spring 5 to the screw shaft 8 in the direction of the arrow in Fig. 1. Pinion 9, due to its inertia is not immediately set into rotation and is therefore traversed along the threads 8 into engagement with the engine member, the anti-drift member 18 or 29 being cammed out by the inclined shoulders on the screw shaft. When the engine starts the pinion is rapidly accelerated so as to overrun the screw shaft and is therefore thrown back to its idle position on said shaft. Due to the rapid rotation of the pinion at this time, the locking arm 19 or 34 thereof is forcibly urged against the screw shaft by the action of centrifugal force whereby said arm is caused to lodge back of the radial shoulder on the screw shaft and positively prevent rebounding of the pinion toward the engine member. When the starting motor is deenergized, the parts of the drive are rapidly decelerated, thus maintaining the pinion 9 in its idle position until rotation ceases, whereupon the anti-drift arm 18 or 29 engages the screw shaft and yieldably resists traversal of the pinion until the starting mechanism is again actuated.

Although certain embodiments of the invention have been shown and described in detail, it will be understood that various changes may be made in the proportions and arrangements of the parts and certain elements used without other elements if so desired without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:—

1. A starter drive comprising a power member, a driving member mounted thereon for longitudinal movement into and out of engagement with a member of an engine to be started, and for rotary movement thereof and therewith, detent means for yieldably resisting traversal of the driving member away from idle position and locking means operable by centrifugal force to positively prevent such traversal.

2. A starter drive comprising a power member, a driving member mounted thereon for longitudinal movement into and out of engagement with a member of an engine to be started, and for rotary movement thereof and therewith, said members having detent means to resist traversal of the driving mem-

ber from idle position, said members also having locking means adapted to cooperate to positively prevent such traversal, and means normally maintaining said detent means in cooperative relation and said locking means out of cooperative relation, but yieldable under the influence of centrifugal force to allow the cooperation of said locking means.

3. A starter drive comprising a screw shaft, a driving pinion threaded thereon for automatic traversal into and out of engagement with a member of an engine to be started, one of said members being shouldered, the other member having a pair of elements adapted to cooperate therewith, one yieldingly and the other positively, to retain the driving pinion in idle position, means for normally retaining the yielding element in operative position, and centrifugal means for moving the positive element into operative position.

4. A starter drive comprising a screw shaft, a driving pinion threaded thereon for automatic traversal into and out of engagement with a member of an engine to be started, one of said members having an inclined shoulder and a radial shoulder, the other member having a pair of elements formed as the arms of a lever pivoted thereto, one arm adapted to cooperate with the inclined shoulder on the other member to yieldingly retain the pinion in idle position, and the other arm being adapted to cooperate with the radial shoulder to positively lock the pinion on the shaft, said lever being movable by centrifugal force to bring the locking arm into operation.

5. A starter drive comprising a screw shaft, a driving pinion threaded thereon for automatic traversal into and out of engagement with a member of an engine to be started, said shaft being shouldered adjacent the outer position of the pinion, said pinion having an arm pivoted thereto and adapted to have an inclined sliding engagement with the shouldered portion of the shaft, said pinion having a second arm pivoted thereto, adapted to make positive latching engagement therewith, yielding means for moving the first arm into engagement with the shaft and the second arm out of such engagement, and centrifugal means for reversing the position of the arms.

6. A starter drive comprising a screw shaft, a driving pinion threaded thereon for automatic traversal into and out of engagement with a member of an engine to be started, said shaft being shouldered adjacent the outer position of the pinion, said pinion having a latch in the form of a bell crank lever pivoted thereto, one arm thereof being rounded to make an inclined frictional engagement with a shoulder on the shaft, and the other arm having a radial surface to engage positively a radial shoulder on the shaft, a spring for swinging the lever to move the rounded arm into engagement with the shaft, said rounded arm being weighted whereby centrifugal force moves it outward and causes the other arm to engage and lock with the shaft.

In testimony whereof I have signed this specification.

MAURICE P. WHITNEY.