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H. BURTON

1,815,047

ENGINE STARTER

Filed Oct. 1, 1928

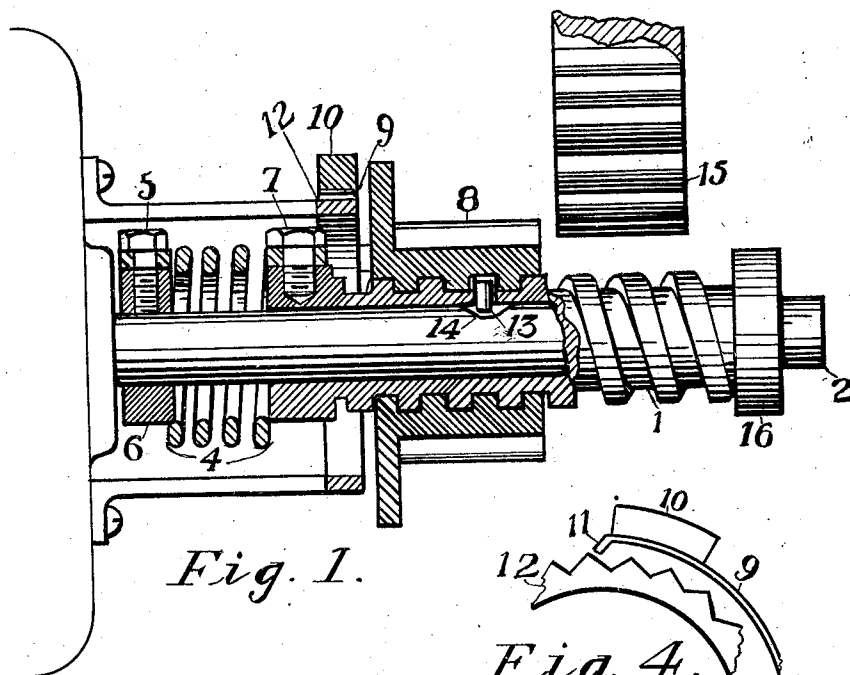


Fig. 1.

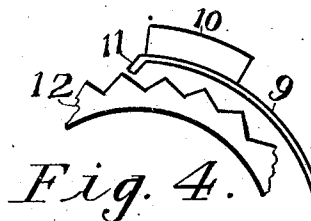


Fig. 4.

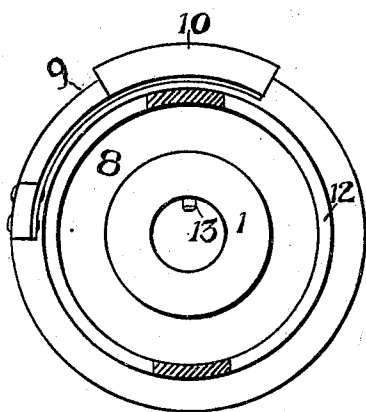


Fig. 2.

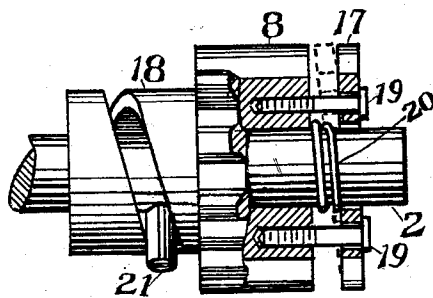


Fig. 3.

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ENGINE STARTER

Application filed October 1, 1928. Serial No. 309,572.

My invention relates to a well known type of engine starter, in which a normally idle driving pinion is shifted endwise into mesh with a gear attached to the engine, 5 by the action of the starting motor. Usually the driving shaft is provided with screw threads and the pinion acts as a nut threaded thereon, or the pinion is provided with an extension sleeve having helical slots 10 in which operate radial projections of the shaft. In any case the shifting of the pinion into and out of mesh with the driven gear is contingent upon a slippage or relative rotation between the pinion and the 15 driving element.

The general characteristics of a starter representative of this type is fully disclosed in Patent No. 1,095,696, May 5th, 1914, Joseph Bijur.

20 Starters of the type referred to, are also in general use on automobiles and are well known to persons skilled in the art, therefore it is deemed unnecessary to encumber this specification with illustrations and 25 descriptions of the accessory elements, such as source of power, means for connecting and controlling the same and the manner of supporting the starter relative to the engine with which it operates.

30 As usually constructed, starters of the type referred to possess two particular disadvantages, one of which is the very abrupt start of the motor necessary to turn the driving element relative to the pinion, 35 which is usually held from simultaneous rotation therewith only by its inertia. This abrupt start results in the gears meshing with severe shock disagreeable from an operating standpoint and the cause of excessive wear and tear, materially shortening 40 the life of the parts involved. The low resistance to rotation possessed by the pinion in idle position often results in a failure of the device to function, as when the motor 45 starts slowly, due to weak power, or when there is excessive friction between the pinion and driving element.

The other objection is the lack of a positive and certain means to position the pinion teeth with reference to the teeth of the 50

driven gear so as to insure the meshing of same. The teeth of the pinion often clash with the teeth of the engine gear, the result being chipped and broken gear teeth and often a complete lock of the mechanism. 55

The object of my invention, is, first, to provide a simple and positive means that will hold the pinion against rotation in its idle position and until after it has shifted into engagement with the driven gear, yet 60 will offer no impediment to the free rotation on its return movement; and, second, to provide simple and positive means to so position the teeth of the pinion with reference to the teeth of the driven gear that they will 65 enter into mesh easily and without clashing.

In describing the invention, reference is had to the accompanying drawings, in which:

Fig. 1 is a half section of the starter mounted on the extended armature shaft of 70 the starting motor, showing also a part of the engine gear and its position relative to the starter.

Fig. 2 is a rear end elevation of the starter removed from the armature shaft. 75

Fig. 3 shows an alternative construction of the means for turning the pinion to a position requisite for entering its teeth into mesh with the teeth of the driven gear.

Fig. 4 illustrates an alternative construction of the brake or locking device. 80

Referring to Fig. 1, the screw threaded sleeve 1 fits freely upon the driving shaft 2 and is yieldingly held thereon by the coil spring 4, one end of which is secured to the 85 driving shaft by the set screw 5 threaded through the collar 6, the opposite end being anchored to the end of the sleeve 1 by the cap screw 7.

The driving pinion 8 is threaded on sleeve 1 and is free to rotate and travel longitudinally thereon within the limits of the threaded portion thereof. 90

On the back of pinion 8 is formed or attached a flange carrying the curved spring 95 leaf 9, on the free end of which is the weight 10 and the brake member 11 (see Figs. 2 and 4).

The member 11 normally engages the ring 12 stationary and concentric with reference 100

to the pinion 8, sleeve 1 and shaft 2. The ring 12 is supported in any convenient manner, preferably upon the end of the motor housing, as shown.

At a point midway of the threaded portion of the sleeve 1 is a hole into which is loosely fitted the pin 13. Pin 13 is slightly longer than the thickness of the wall of the sleeve 1, is rounded on the inner end and projects through the wall of the sleeve into the V-shaped notch 14 in the driving shaft. The pinion 8 is somewhat longer than its longitudinal travel so that it will at all times cover the pin 13 and will retain it in place in the wall of the sleeve.

The action of the device is as follows. When the shaft 2 is rotated, the sleeve 1 rotates with it. The pinion 8 is held from rotation by the brake member 11 in contact with the stationary brake member or ring 12. The pinion is screwed forward along the threads of the sleeve, drawing the brake member longitudinally along the ring 12.

Before the brake member 11 has traveled out of contact with the ring 12 the pinion teeth will have engaged the engine gear 15 and the pinion will continue to move longitudinally until stopped by the collar 16, when no further longitudinal motion being possible, the pinion must revolve with sleeve 1 and start the engine.

The brake members will now be out of contact and will offer no resistance to rotation of the pinion.

When the engine starts on its own power, the pinion 8 is driven at a speed greater than that of sleeve 1 and is screwed back to its starting point. Now, however, the pinion is revolving and the weight 10 by reason of the centrifugal force draws the member 11 out of contact with the ring 12 and also causes the pinion to bind on the sleeve so that it continues to revolve with it and will not again travel toward the engine gear.

When the shaft 2 and sleeve 1 come to rest, the pinion of course stops and the spring 9 presses the member 11 into engagement with the ring 12 and holds the pinion from creeping on the sleeve as it would tend to do by reason of vibration of the engine or car to which it is attached.

The above sequence of actions presupposes that the teeth of the pinion and engine gear are so positioned relative to each other that they will enter into mesh without opposition. In the event that the teeth of the pinion and gear meet in opposition, the forward longitudinal motion of the pinion 8 is of course arrested.

Continued rotation of the sleeve 1 screws it backward out of the pinion against the resilience of the spring 4 until the pin 13 rides upon the inclined side of the notch 14 and it wedged out against the inner surface of the pinion 8, clamping it tight on the

sleeve 1, so that no more forward thrust is applied and no greater pressure can be exerted against the ends of the teeth than is required to compress the spring 4.

The continued rotation of the driving shaft rotates the pinion so that its teeth move past the teeth of gear 15. As they come opposite the spaces between the teeth of gear 15, opposition to the forward movement of the pinion is removed, spring 4 expands and pushes the sleeve 1, together with the pinion forward meshing the gears.

The pin 13 slides into notch 14, releases the pinion on the sleeve 1 and the normal operation proceeds as hereinbefore described.

The operation of the structure shown in Fig. 3 is similar. In this construction the pilot 17 has teeth of the same form and pitch as the pinion 8. It is supported slightly in advance of the face of the pinion and is held in a plane vertical to the axis of the shaft by the coil spring 20 and the studs 19. The holes through which the studs 19 pass are somewhat larger than the studs and the bore of the pilot fits the shaft loosely.

Normally the pilot 17 acts as an integral part of the pinion 8. If when pinion 8 approaches the gear 15 it is so positioned that its teeth are in opposition to the teeth of the gear, the teeth of the pilot will meet the gear teeth end on and the pilot will be canted (as shown in dotted lines) so as to bind on the shaft 2 and the effect will be to cause pinion 8 to turn with the shaft until the teeth are out of opposition when the spring 20 will straighten up the pilot as its teeth enter into mesh with the gear 15; otherwise the operation is as hereinbefore described.

Referring to the modified construction illustrated in Fig. 4, the ring 12 is provided with teeth and the member 11 is simply the end of the spring 9 formed so as to engage the said teeth. In this construction care is used to adjust the spring 9 and shape the teeth of the ring 12 so that the resistance to rotation of the pinion may be overcome by the full torque of the motor, as the meshing of the gears sometimes requires a slight turn of the pinion before the brake is released. The specific means by which the pinion is shifted is immaterial to the invention intended to be herein described. However, the shifting means illustrated in Fig. 3 may be, and sometimes is, used and for simplicity of construction it may be preferable to use the gear meshing means there illustrated with that form of shifting means, inasmuch as the sleeve 1 and spring 4 may be omitted.

It will be understood that minor changes in the size, form and construction of the various parts of my improved engine starter may be made and substituted for those here-

in shown and described without departing from the spirit of my invention, the scope of which is set forth in the appended claims.

I claim as my invention:

- 5 1. The combination in an engine starter of the character described, of a driving shaft, a driving member adapted to shift longitudinally of said driving shaft into and out of engagement with a driven member; a locking means adapted to oppose rotation of the driving member, when said driving member is at rest in normal position and means, responsive to the centrifugal force of rotation of the driving members adapted to render the locking means inoperative during operation of the starter subsequent to engagement of the driving and driven members.
- 20 2. The combination in an engine starter of the character described, of a driving shaft, a driving member adapted to shift longitudinally of said driving shaft into and out of engagement with a driven member; a stationary locking element, a locking element associated with the driving member, normally cooperating with said stationary locking element, means responsive to the centrifugal force of rotation of the driving members, adapted to prevent cooperation of said locking elements during operation of the starter subsequent to engagement of the driving and driven members.
- 30 3. The combination in an engine starter of the character described, of a driving shaft, a driving member adapted to shift longitudinally of said driving shaft into and out of engagement with a driven member; a locking element, flexibly attached to the driving member, a stationary locking element, a resilient element, adapted to normally cause cooperation of the locking elements and a weight associated with the first named locking element, revolvable with the driving members responsive to centrifugal force of said rotation, adapted to move and to hold said locking elements out of cooperative relation, as an incident of the rotation of the driving members during operation of the starter.
- 50 4. An engine starter of the character described comprising in combination a motor, a driving shaft operated thereby, a screw-threaded sleeve, rotatable therewith and movable axially thereof a spring connecting the screw threaded sleeve and driving shaft, an internally threaded pinion adapted to travel longitudinally of said sleeve, into and out of engagement with a driven gear, a clamping element associated with the screw-threaded sleeve, movable relative thereto, and means associated with the driving shaft whereby a slight axial movement of the sleeve relative to the shaft actuates the clamping element into clamping cooperation with the pinion.
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5. An engine starter of the character described, comprising in combination a motor, a driving shaft, operated thereby, a screw-threaded sleeve, rotatable therewith and movable axially thereof a spring connecting the screw threaded sleeve and driving shaft, an internally threaded pinion adapted to travel longitudinally of said sleeve into and out of engagement with a driven gear, a clamping member in the wall of the screw-threaded sleeve, movable radially thereof and means associated with the driving shaft whereby a slight axial movement of the sleeve relative to the shaft serves to actuate the clamping element radially into clamping cooperation with the driving pinion.

6. An engine starter comprising in combination, a notched driving shaft, a sleeve, movable axially thereof, a spring connecting the sleeve and driving shaft, a driving pinion adapted to shift axially of said sleeve and driving shaft, into and out of engagement with a driven gear and clamping means, associated with the sleeve, coacting with a notch in the driving shaft to clamp the driving pinion to the driving shaft at an intermediate stage of its axial travel thereof, incident to relative axial movement between the sleeve and driving shaft, whenever the teeth of said driving pinion abut against the teeth of the driven gear.

In testimony whereof I affix my signature.

HENRY BURTON.

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