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AUTOMATIC PREMESHING MECHANISM

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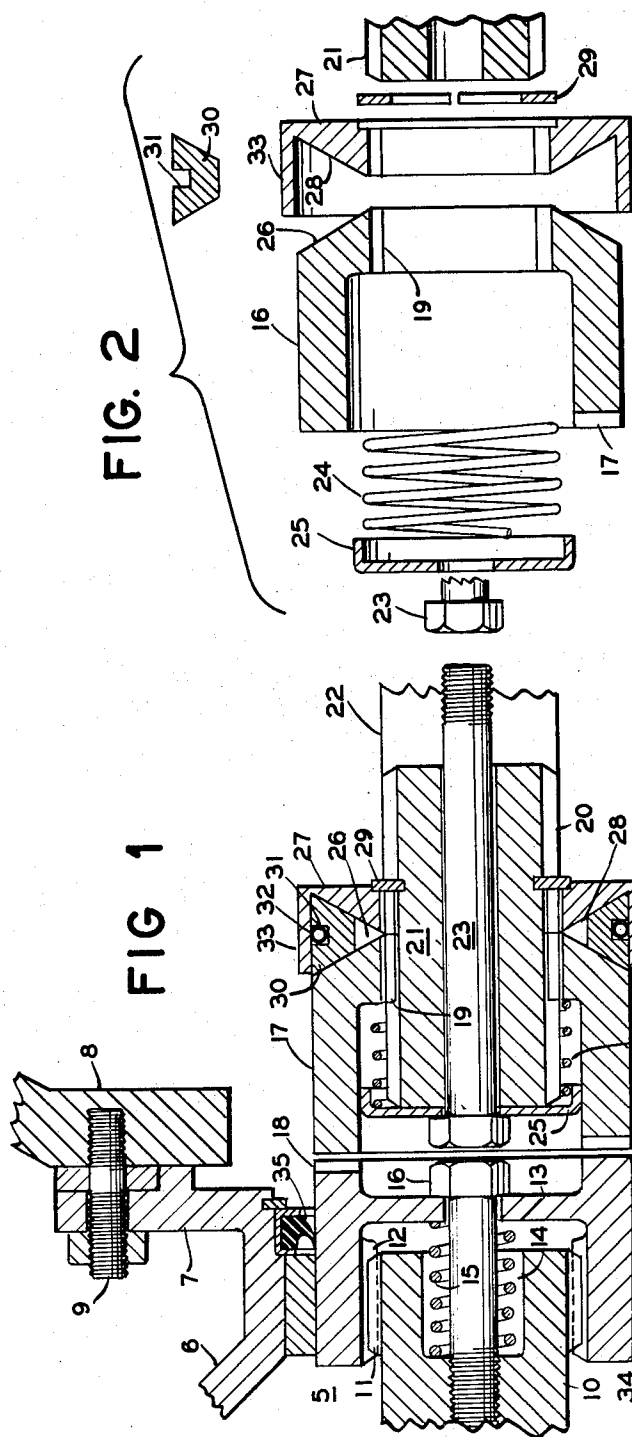


FIG. 2

FIG. 1

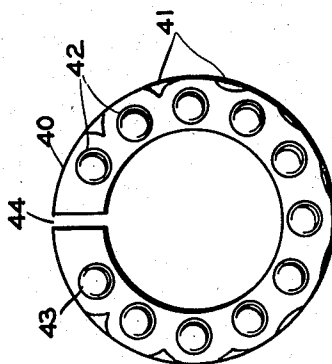


FIG. 3

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AUTOMATIC PREMESHING MECHANISM

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The present invention relates to engine starters and particularly to jaw meshing mechanism for use with engine starters.

With the advent of aircraft turbine engines and of larger internal combustion engines, the power requirements for starters have been greatly increased. In high powered engine starters, such as the turbine type, the power element of necessity has a high moment of inertia. Therefore, if meshing is delayed for as little as one revolution of the power element, severe shock is transmitted to the jaws and gearing. One means of reducing the shock is the use of torque limiting clutches, however they have many limitations and many failures due to shock have been experienced. The present invention overcomes the above disadvantages by keeping the jaws in mesh at all times except during operation of the engine by providing a centrifugal controlled meshing mechanism on the engine shaft.

An object of the invention is to provide novel jaw meshing means for an engine starter.

Another object of the invention is to provide improved engine starter means.

Another object of the invention is to provide means for premeshing starter and engine jaws.

Another object of the invention is to provide novel means on the engine shaft for meshing with the starter jaw.

The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawing wherein two embodiments of the invention are illustrated by way of example.

In the drawings:

Figure 1 is a cross-sectional view of a portion of a starter and an engine jaw embodying the invention.

Figure 2 is an exploded view of the jaw meshing mechanism of Figure 1.

Figure 3 illustrates a modification of the invention.

Referring now to Figures 1 and 2 of the drawing, a starter 5 is provided with a housing 6. Only a fragmentary portion of the starter 5 is illustrated, it is understood however, it will comprise driving means and reduction gearing as is well known in the art. A mounting flange 7 is adapted to be secured to an engine housing 8 by means of studs 9 or in any other conventional manner.

An output shaft 10 has splines 11 adapted to mate with splines 12 on starter jaw 13. The output shaft 10 is connected to the reduction

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gearing (not shown) by splines or in any other conventional manner. The shaft 10 has a counterbore portion 14 adapted to receive a spring 15. The spring 15 biases the jaw 13 outward. The jaw 13 is held in operative engagement with the shaft 10 by retaining bolt 16.

An engine jaw member 17, having teeth 17a adapted to mesh with teeth 13 of starter jaw 13, has a splined portion 19 mating with splines 20 on an extension 21 of engine shaft 22. The extension 21 may be secured to the shaft 22 by a bolt 23 or may be integral therewith. A spring 24 is interposed between the splined portion 19 and a spring retaining member 25. The retaining member 25 is secured to the extension 21 by the bolt 23.

The jaw 17 has a ramp portion 26 on the end opposite the teeth 17a. A member 27 having a mating ramp portion 28 is also splined to the extension 21. A snap ring 29 holds the member 27 in position. Wedge members 30 are positioned in the opening formed by the ramp portions 26 and 28. The wedge members 30 have a groove 31 therein to receive a garter spring 32. A flange 33 on the member 27 limits the outward travel of the wedge members 30.

The jaw 13 pilots in the housing 7 by means of a bearing 34. An oil seal 35 surrounds the jaw 13 and is positioned in the housing 7 by a snap ring 36.

In operation, the garter spring 32 biases the wedge members inward with a wedging action on the ramp surfaces 26 and 28. Inasmuch as the member 27 is fixed, axial force is imparted to the jaw 17 to move it against the bias of the spring 24 into engagement with the starter jaw 13. Should the teeth of the jaws abut, the spring 15 permits the jaw 13 to be retracted. Upon initial rotary movement of the jaw 13 the teeth will mesh due to the force of the spring 15.

Upon the engine shaft exceeding a predetermined speed, the wedges 30 are moved outward against the bias of the garter spring 32. The return spring 24 moves the jaw 16 out of engagement with the starter jaw 13.

As long as the engine shaft exceeds the predetermined speed, the centrifugal force overcomes the bias of the garter spring 32 and the spring 24 biases the jaw 16 in the disengaged position. At a shut-down, the speed decreases, the centrifugal force decreases and the garter spring 32 forces the wedges 30 inward to move the jaw 16 towards the engaged position. The spring 15 permits the jaws to ratchet until the engine comes to a stop. The jaws remain meshed and are ready

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for the next start. Should the cranking speed exceed the predetermined speed, the friction between the teeth will hold the jaws in mesh until the starter ceases putting out torque.

Figure 3 illustrates a modification of the centrifugal means and comprises a ball retainer 40 of spring stock material relieved in a plurality of places 41 for true circle expansion. Balls 42 are secured in openings 43 in the retainer 40 and are adapted to be moved outward by centrifugal force. The retainer 40 has a split 44 to permit changes in diameter. The retainer 40 and balls 42 may replace the wedges 30 and garter spring 32 of Figure 1. The operation is similar to that set forth for Figure 1.

Although only two embodiments of the invention have been illustrated and described, various changes in the form and relative arrangements of the parts may be made to suit requirements.

What is claimed is:

1. A starting device comprising, in combination, an engine jaw member slidably splined to an engine shaft, a fixed member on said engine shaft, means including a resilient member for biasing said engine jaw away from said fixed member, said last means also including a mass responsive to centrifugal force to overcome said bias upon said centrifugal force exceeding a predetermined value, and spring means for urging said engine jaw towards said fixed member.

2. A starting device comprising, in combination, an engine jaw member movable from a position engaging a starter jaw to a disengaged position, first spring means for biasing said engine jaw in a disengaged position, and means including second spring means for overcoming the bias of said first spring means to urge said engine jaw member into an engaging position and centrifugal means for overcoming the bias of said second spring means upon said engine jaw exceeding a predetermined speed.

3. A starting device comprising, in combination, an engine shaft, an engine jaw member splined for axial movement relative to and rotation with said engine shaft, said engine jaw member being movable from a position engag-

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ing a starter jaw to a disengaged position, means for normally biasing said engine jaw member to a disengaged position, a ramp portion on said engine jaw member, a fixed member having an opposite ramp portion, and wedging means interposed between said ramp portions for overcoming said biasing means to urge said engine jaw member into an engaged position, said wedging means being responsive to centrifugal force to remove the wedging action upon the speed of said engine jaw member exceeding a predetermined amount.

4. In a starting device, the combination comprising an engine shaft, an engine jaw member splined for axial movement relative to and rotation with said engine shaft, spring means for normally biasing said engine jaw member to a disengaged position, and a wedging member having a normal diameter and adapted to expand upon the action of centrifugal force, said wedging member having biasing means sufficient to overcome the bias of said spring means to urge said engine jaw to an extended position when in said normal condition and adapted to expand to remove said biasing means upon said engine jaw member exceeding a predetermined speed.

5. In a starting device, the combination comprising an engine shaft, an engine jaw member splined for axial movement relative to and rotation with said engine shaft, said jaw member being adapted for axial movement from a retracted position to an extended position, spring means for normally biasing said jaw member to the retracted position, said jaw member having a ramp portion, and a resilient member having a normal diameter and adapted to expand upon the action of centrifugal force, said resilient member coacting with said ramp portion to overcome said spring biasing means to urge said jaw member to an extended position when in said normal condition and to permit said spring biasing means to return said jaw to a retracted position upon expansion of said resilient member.

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No references cited.