April 11, 1950 R. M. NARDONE 2,503,350

OIL SEALING MEANS FOR STARTERS

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Fig. 1

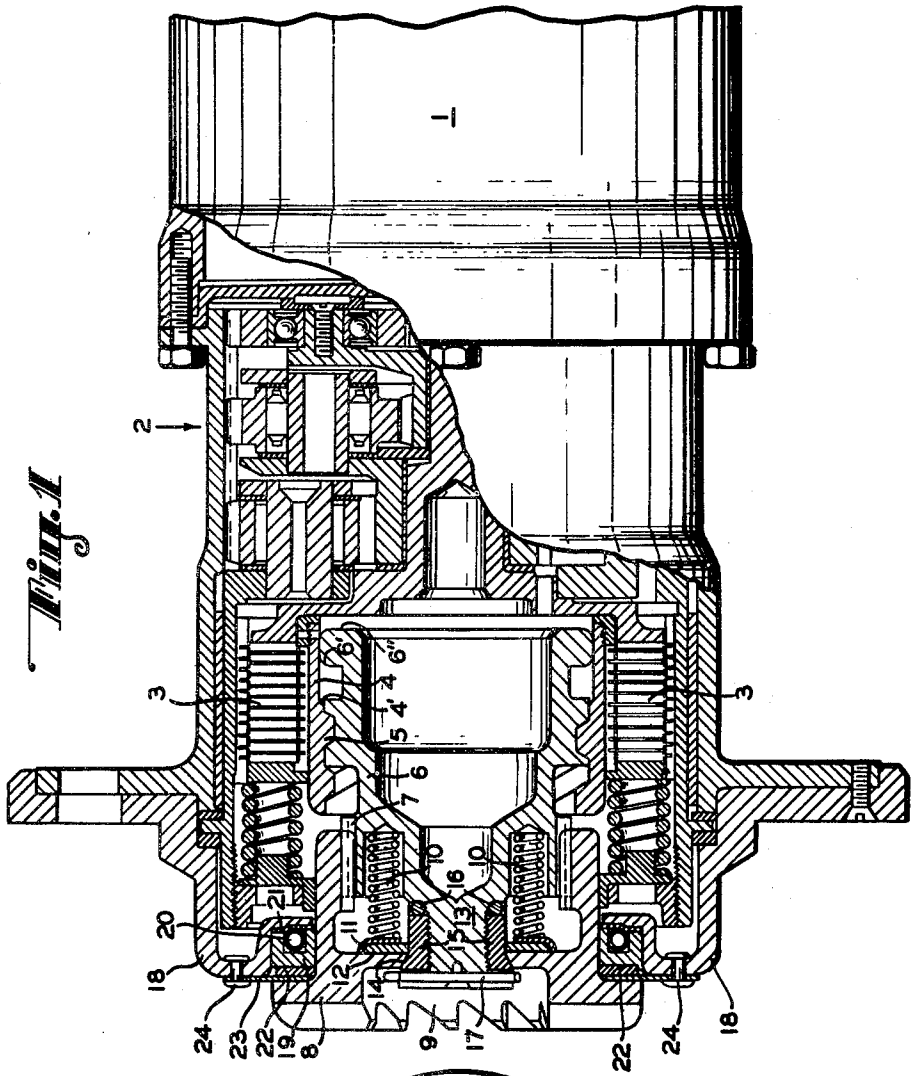
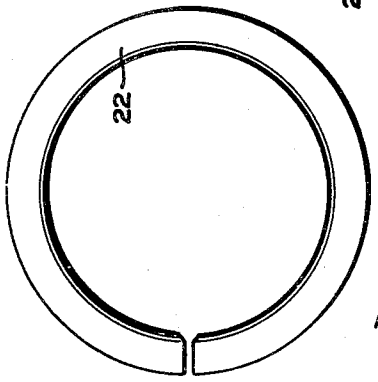


Fig. 2



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OIL SEALING MEANS FOR STARTERS

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2 Claims. (Cl. 192—94)

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The invention relates to starting mechanism for internal combustion engines, and particularly to engine starters of the type in which starting is effected by transmission of torque to the engine crankshaft or its equivalent by an axially movable jaw member. The invention is further applicable to driving mechanisms of general application outside the engine starting art, in which like problems exist. The invention particularly relates to provisions for sealing the jaw member against leakage and for retaining the jaw member in an inoperative position while the engine is running, without interfering with the operation of the starter when this turns the engine.

An object of the invention is to provide an improved means for keeping the jaw member from accidentally moving into engagement with the engine while the latter is running. A related object is to provide an improved simple assemblage of such means, which assemblage is readily accessible for maintenance and replacement purpose.

A further object is to provide means for sealing the engine end of the starter against leakage of oil which would tend to interfere with the intended functioning of parts of the starter. And still another object is to adapt such means to provide for the occasional start in which the outer end of the starter jaw initially abuts that of the engine instead of normally meshing immediately, to then permit the necessary relative axial movement of parts of the starter to prevent jamming while at the same time maintaining an adequate seal against oil leakage during the short interval in which the stated relative displacement exists.

These and other objects and features of the invention are pointed out in the following description in terms of the embodiment thereof which is shown in the accompanying drawings. It is to be understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a longitudinal sectional view of a starter embodying the invention; and

Fig. 2 is an end view of a detail, the C-ring for frictionally retaining the jaw member in its inoperative position while the engine is running.

Referring to the drawings, in which like reference characters indicate like parts throughout, and particularly to Fig. 1, the invention is shown embodied in a starter of the general type shown and described in U. S. Patents 1,962,397 and 2,347,788 respectively issued to Lansing and to the instant applicant.

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The starter shown herein by way of example includes an electric motor 1 connected by a planetary reduction gearing 2 and a torque limiting unit 3 with the sleeve 4 which is internally threaded at 5 and mounted to be rotatable about the axis of rotation of the starter jaw while it is constrained against axial movement. A mating externally threaded cup-shaped member 6 is externally splined at 7 to drive a mating internally splined jaw member 8 at whose outer end are the jaw teeth 9 which are adapted to engage the teeth of a complemental jaw, not shown, on the engine shaft. This arrangement permits the jaw member 8 to move axially with respect to the member 6 while these two members turn relatively, the outward movement of jaw member 8 being stopped when the collar surface 6' of member 6 strikes the end 4' of threads 5 of member 4 and the inward movement when collar surface 6'' of member 6 reaches its limit.

Springs 10 bias the members 6 and 8 away from each other, one end of each spring 10 abutting the member 6 and the other abutting a metal washer 11 which presses a sealing washer 12 against the inner surface of the jaw member 8 to provide a seal between members 6 and 8 in spite of the relative axial movement thereof which is necessary when the ends of the jaw teeth strike instead of meshing as they normally do.

Member 6 has a novel male threaded portion 13 extending toward the engine through a central hole in the jaw member 8, the outer edge of the hole being chamfered at 14 with, e. g., 70° included angle. A special nut 15 is provided with a cylindrical portion whose inner end abuts a toroidal seal ring 16 to prevent leakage between the nut and the stud 13. The outer end of nut 15 is radially slotted and provided with a cotter pin 17 to keep it tightly screwed up against the sealing ring 16. The head of the nut 15 is provided with a novel rim which normally seats as a valve against shoulder 14 to provide an oil-tight seal there.

Only rarely do the jaw teeth strike on their ends instead of meshing, the result being that this sealing action is only infrequently interrupted and then only very briefly. The centrifugal force due to the turning of the jaw member 8 tends to throw outwardly any oil which might otherwise tend to enter the hole. Also, the sealing washer 12 acts to keep such oil out.

The head of nut 15 keeps the jaw member 8 from extending too far toward the engine. Nut

15 of course permits ready disassembly of the jaw end of the unit since this nut is accessible from the end of the starter unit when this unit is detached from the engine. The novel form of nut 15 permits it to be mostly countersunk in the jaw member 8 so as to provide room for the projection on the end of the engine shaft commonly required to secure the mating jaw member thereto.

The housing 18 of the starter unit is provided with a novel oil seal consisting of the U-shaped flexible ring seal 19 containing the toroidal spring 20 which presses one lip of the seal 19 against the cylindrical portion of the jaw member 8 to prevent oil leakage between the jaw member 8 and the housing 18. This seal 19 lies between washer 21 and a novel C-ring 22 which is held in place by the outer flange 23 which is riveted to housing 18 by rivets 24. The C-ring 22 is of metal such as Phosphor bronze and is so shaped that, when free, its hole is of the order of one hundredth of an inch smaller in diameter than the cylindrical portion of the jaw member 8.

When this seal is assembled, the ring 19 effectively seals the opening between the jaw member 8 and the housing 18 against oil leakage and the C-ring 22 strongly tends to hold the jaw member 8 in its last-set position as long as the jaw member 8 is not turning. The friction provided by the novel C-ring 22 is readily made adequate to hold the jaw member 8 in a disengaged position while the engine is running and in spite of such large decelerations as occur during forced landings of aircraft. This friction also ensures the positive extension of the jaw member 8 during a start.

It is apparent that the several portions of the improved construction work together to provide a single unitary article of commerce, a starter jaw assemblage which is oil-tight and also proof against accidental engagement of the starter with the engine while the latter is running.

Although the present invention is only described and illustrated in detail for one embodiment thereof, it is to be expressly understood that the same is not limited thereto. Various changes may be made in design and arrangement of the embodiment illustrated, as will now be apparent to those skilled in the art. For a definition of the limits of the invention, reference should be had to the appended claims.

What is claimed is:

1. In an engine starter having a first female-threaded member which is mounted to be turned without axial displacement during starting, a second mating male-threaded member constructed to move axially of the first member upon relative rotation thereto, said second member having external splines upon its jaw end parallel with the axis of rotation, an annular jaw member having its inner end internally splined to mate with the splines on the second member and having a cylindrical outer surface co-axial with the axis of rotation, and means operatively connecting the second member with the jaw member to bias the latter outwardly, the improvement comprising the jaw member having a conical seat portion, a threaded portion of said second member extending through said jaw member and having a nut thereon to limit the outward movement of the jaw member, said nut having an inverted conical shoulder adapted to mate with said conical seat portion, means for sealing against leakage between said nut and said threaded portion of said second member, means for sealing against leakage around the cylindrical outer surface of the jaw member, and a metal C-ring biased toward the last-named surface for frictionally retaining the jaw member in a non-engaging position when the second member is in its innermost position and the jaw member is not turning.

2. In an engine starter having a first female-threaded member which is mounted to be turned without axial displacement during starting, a second mating male-threaded member constructed to move axially of the first member upon relative rotation thereto, said second member having external splines upon its jaw and parallel with the axis of rotation, an annular jaw member having its inner end internally splined to mate with the splines on the second member and having a cylindrical outer surface co-axial with the axis of rotation, and means operatively connecting the second member with the jaw member to bias the latter outwardly; the improvement comprising the jaw member having a conical seat portion, a threaded portion of said second member extending into said jaw member and having a nut thereon to limit the outward movement of said jaw member, said nut having a shoulder portion adapted to mate with said conical seat portion to form an oil seal therewith, means for providing an oil seal between said threaded portion and said nut, and means for providing an oil seal around the cylindrical outer surface of said jaw member.

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