# United States Patent [19]

**Neff et al.**

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[54] **COMPONENT REMOVAL TOOL**


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[52] **U.S. Cl.** ..... **29/235;** 29/259; 85/41

[51] **Int. Cl.²** ..... **B25B 27/02**

[58] **Field of Search** ..... 29/256, 258, 259, 263, 29/235, 282; 85/41, 42, 47



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[57] **ABSTRACT**

A tool for removing an annular oil seal assembly from an engine housing from which a crankshaft projects. The tool comprises a circular plate secured to the end face of the crankshaft by screws and a plurality of puller screws. Each puller screw has a feed section with machine threads and a nose section including a drill point and self-taping threads. The feed sections of the puller screws are threaded through the circular plate in line with the seal support element. Rotation of the puller screws advances the drill points to penetrate the seal support element permitting the self-taping threads to screw into it. Removal of the screws holding the plate to the crankshaft permits a center bolt to be threaded through the plate and against the crankshaft thereby pulling the seal assembly from the housing. The plate may also be used to install a seal element.


**9 Claims, 6 Drawing Figures**

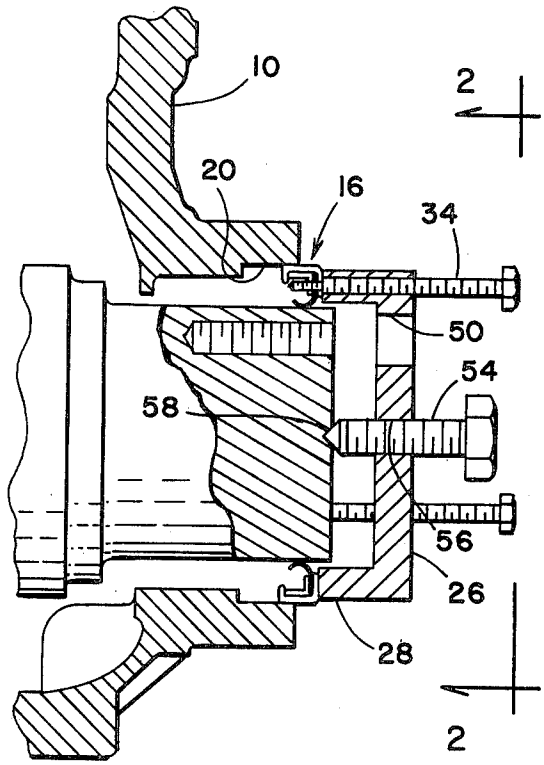


FIG 1

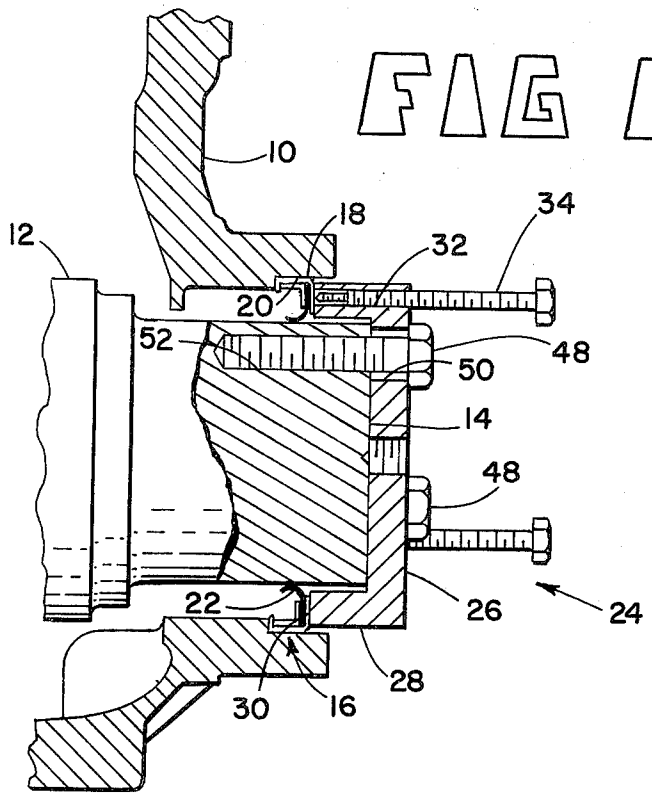



FIG 2

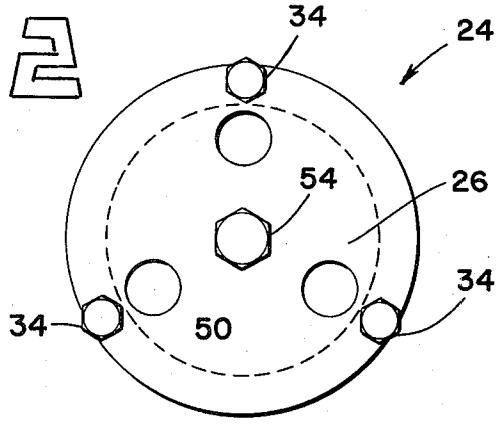



FIG 3

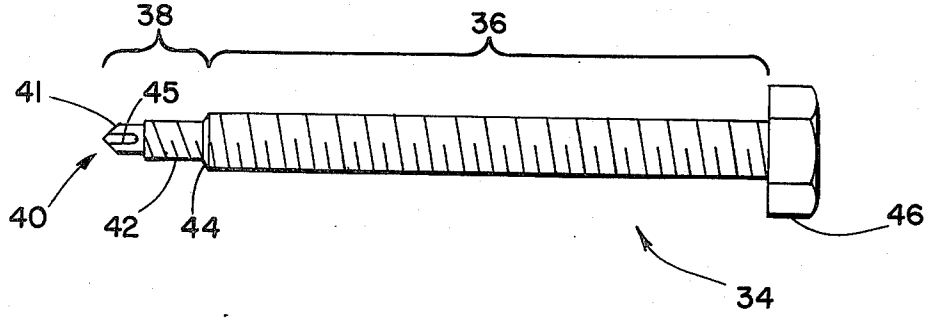


FIG 4

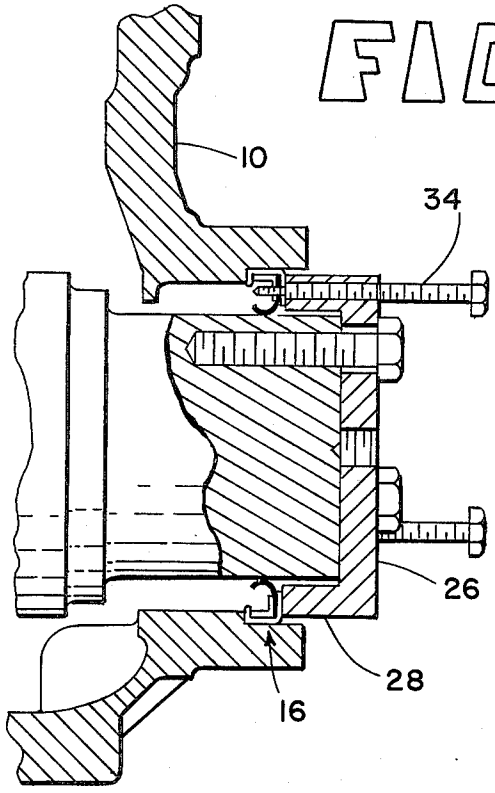
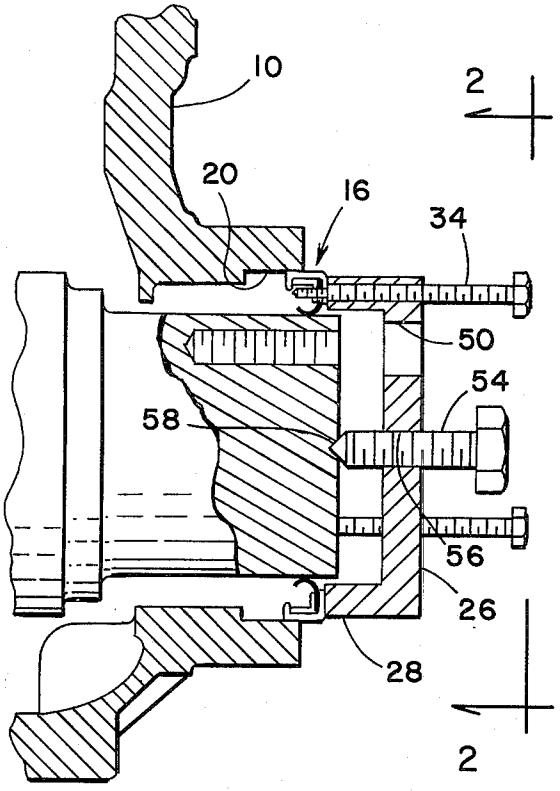



FIG 5



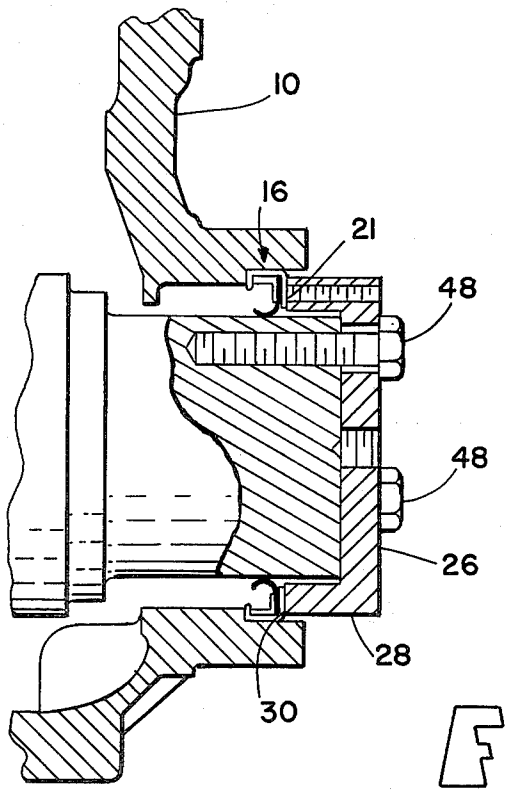




FIG 6

# COMPONENT REMOVAL TOOL

In internal combustion engines it is necessary to provide an annular oil seal assembly between a housing and a shaft projecting from it. This seal, which prevents leakage of lubricating oil from the engine, ultimately wears out and must be replaced. In the past, seals have been removed using any number of crude procedures. Typically a mechanic may attempt to pry the seal assembly from the housing with a screwdriver using the end of the crankshaft as a fulcrum. This practice frequently causes damage to the end of the crankshaft which must be repaired. In addition, this practice may result in damage to a vehicle radiator if the front seal of the engine is being removed.

Prior practice in installing seal assemblies has been to use a sleeve-like installation tool adapted to abut the end face of the seal assembly. A hammer is used to strike the installation tool thus driving the seal assembly into the housing. The problem with this approach is that it is difficult to prevent the seal assembly from "cocking" as it is driven into the housing resulting in damage to the seal assembly or the housing.

These problems are solved in accordance with the broad aspects of the present invention by a puller screw for removing a component from a housing. The screw comprises a feed section having machine threads and a nose section extending from one end of the feed section. The nose section includes a drill point and self-taping threads. The puller screw is adapted to be rotated so that the drill point and self-taping threads will penetrate the component as the shaft is advanced toward the component by threading the feed section through an element fixed relative to the housing thereby permitting removal of the component from the housing.

The above and other related features of the present invention will be apparent from a reading of the following description of the disclosure shown in the accompanying drawings and the novelty thereof pointed out in the appended claims.

In the drawings

FIG. 1 is a longitudinal section view of a seal assembly removal tool along with pertinent portions of an internal combustion engine with which the removal tool may be used.

FIG. 2 is an end view of the removal tool of FIG. 1 taken on line 2—2 of FIG. 5.

FIG. 3 is a greatly enlarged view of a puller screw used with the removal tool of FIG. 1.

FIGS. 4–5 are longitudinal section views of the removal tool in sequential stages of removing a seal from the engine housing of FIG. 1.

FIG. 6 illustrates the application of the removal tool of FIG. 1 for installing a seal.

FIG. 1 shows a portion of a housing 10 in which a shaft 12, such as a crankshaft, is journaled for rotation by suitable bearings (not shown). The bearings are commonly lubricated and when shaft 12 has an end face 14 projecting from housing 10, a seal assembly indicated at 16 is used to prevent leakage of lubricating oil. Seal assembly 16 comprises an annular thin wall seal support element 18 tightly received in an annular recess 20 in the housing 10 around shaft 12. A resilient seal element 22, such as Teflon or other material, projects inward from the seal support element 18 and



engages the periphery of shaft 12 to form an annular seal.

In time the seal element 22 will wear and deteriorate making it necessary to be replaced. In accordance with the present invention, the removal tool generally indicated at 24 is used.

As shown in FIGS. 1–2, the removal tool comprises a circular plate 26 having a diameter at least as great as the outer diameter of the seal support element 18. An axially projecting flange 28 terminates in an end face 30, which abuts an end face 21 of the seal support element 20. Plate 26 has a series of circumferentially spaced threaded through holes 32 in line with end face 21 of seal support element 18. Holes 32 receive puller screws indicated at 34.

As shown particularly in FIG. 3, the puller screws 34 comprise a feed section 36 having machine screw threads adapted to engage the threads in holes 32. A nose section 38 projects from one end of feed section 36 and includes a drill point 40 and self-taping threads 42. Drill point 40 is formed by a generally conical tip 41 with straight flutes 43 forming opposed cutting edges 45. Preferably the nominal diameter of the self-taping threads 42 is smaller than that for the threads on the feed section 36 to form a shoulder 44 intermediate the feed section 36 and the nose section 38. Also it is desireable that the diameter of the drill point 40 be equal to or less than the minor diameter of threads 42. In addition, it is desirable that the number of threads per unit length in the feed section 36 is greater than that for the self-taping threads 42 of the nose section 38. For example, feed section 36 may have 20 threads per inch while the self-taping threads 42 may have 16 threads per inch. A nut 46 positioned at the opposite end of the feed section 36 permits the application of torque through the use of a suitable wrench.

To remove the seal assembly 16, plate 26 is positioned against the end face 30 of crankshaft 12. A series of screws 48 extend through holes 50 in plate 26 and are threaded into bores 52 in the end face of crankshaft 12 to secure plate 26. If the shaft 12 is a crankshaft, bores 52 are normally used to mount a vibration damper (now shown).

With the plate 26 fixed in position, puller screws 34 are threaded through plate 26 so that the drill point 40 just contacts end face 21 of the seal assembly 16 as shown in FIG. 1. Each of the puller screws then is rotated by a tool applied to nut 46 so that end face 21 of the seal support element 18 is penetrated by the drill point 40. Continued turning causes the self-taping threads to be treaded into end face 21. This is continued until the end face 21 and the shoulder 44 abut one another.

It was pointed out above that there are more threads per unit length in the feed section 36 than that in the self-taping threads 42 of the nose section. The purpose of this is to counteract the axial force exerted on the seal support element 18 which tends to drive it into the housing 10. It also assures a positive threading action between the nose section 38 and the end face 21 of seal 16. Puller screws 34 are rotated until seal support element 18 bottoms against shoulders 44.

When all the puller screws are in the position shown in FIG. 4, the screws 48 are removed and a center screw 54 is threaded in to a central opening 56 in plate 26. This opening is substantially co-axial with shaft 12 and with the center of seal 16. As shown in FIG. 2, the

puller screws **34** are equally spaced around the periphery of plate **26.** If three puller screws as shown are used, they would be **120°** apart. The central placement of opening **56** with respect to the puller screws causes an uniform axial pulling force on seal **16** as screw **54** is turned. This causes the end face **58** of screw **54** to project from the end face of plate **26** as shown in FIG. **5** thus pulling seal assembly **16** from housing **10.** The screw **54** is turned until the seal assembly **16** is completely removed from annular recess **20.**

The above puller tool permits removal of the seal with uniform axial force. This minimizes, if not eliminates, damage to the housing or the crankshaft. Furthermore, the tool permits the use of tools requiring substantially minimal axial working clearance. This makes the tool particularly advantageous for use in removing a front crankshaft oil seal where there is minimum clearance between the engine housing and a vehicle radiator.

The removal tool may also be used to install the seal as illustrated in FIG. **6.** In this view, the puller screws **34** have been removed and the plate **25** positioned so that its end face **30** abuts the end face **21** of a seal assembly **16** to be installed. The screws **48** are uniformly threaded into the end face of crankshaft **12** a portion of a turn at a time thereby pushing seal **16** into place with a uniform axial force. When the seal is in position, the screws **48** are removed along with the plate **26.** The use of this tool to install the seal provides the same advantages as in removal. Uniform axial forces are exerted and there is a minimum axial working clearance required. This eliminates the need to remove a vehicle radiator that is required with most prior art installation tools.

While a preferred form of the present invention has been described, it should be apparent to those skilled in the art that it may be practiced in other forms without departing from its spirit and scope.

Having thus described the invention, what is claimed as novel and desired to be secured by Letters Patent of the United States is:

**1.** Apparatus for removing a component received in a recess in a housing, said apparatus comprising:

a base adapted to be releasably fixed relative to said housing:

at least one puller screw having a feed section with machine threads threadedly engaging said base in line with said component, said puller screw having a nose section including a drill point and self-taping threads for penetrating into said component as said puller screw is threaded into said base; and

an element removably connected to said base and having an end face displaceable therefrom for displacing said base away from said housing thereby removing said component from said recess.

**2.** Apparatus as in claim **1** wherein the number of threads per unit length is greater for said feed section than said nose section whereby said component is pulled against said base as said puller screw is threaded through said base.

**3.** Apparatus as in claim **1** wherein said component is annular in form and wherein:

said base extends at least as far as the perimeter of said annular component; and,

said apparatus has a plurality of puller screws positioned about said base in positions corresponding to circumferentially spaced points on said annular component.

**4.** Apparatus as in claim **3** wherein:

said puller screws are spaced from one another about said base in positions corresponding to equal circumferential positions around said annular component; and,

said element is positioned so that it is symmetrical with respect to said puller screws.

**5.** Apparatus for removing an annular component received in a recess in a housing, said apparatus comprising:

a base extending at least as far as the perimeter of said annular component and adapted to be releasably fixed relative to said housing;

a plurality of puller screws positioned about said base in positions corresponding to equal circumferential intervals around said annular component, said puller screws having a feed section with machine threads threadedly engaging said base in line with said component, said puller screw having a nose section including a drill point and self-taping threads for penetrating into said component as said puller screw is threaded into said base, the number of threads per unit length being greater for said feed section than said nose section whereby said component is pulled against said base as said puller screw is threaded through said base; and an element threadedly engaging said base at a position symmetrical with respect to said puller screws and adapted to be rotated so that said threaded element projects from said base to displace said base relative to said housing removing said component from said recess.

**6.** Apparatus as in claim **5** wherein said component is a seal including an annular relatively thin wall support for a seal element and said housing comprises a housing having a recess in which said seal is received and through which the end face of a shaft projects for engagement with said seal and wherein said apparatus has three puller screws spaced from one another about said base in positions corresponding to generally equal circumferential positions around said seal support and wherein said element is positioned substantially along the axis of said shaft thereby making it symmetrical with respect to said puller screws.

**7.** Apparatus as in claim **6** further comprising means for releasably securing said base to the end face of said shaft.

**8.** Apparatus as in claim **7** wherein said releasable securing means comprises a series of threaded elements extending through the base and threadedly engaging the end face of said shaft.

**9.** Apparatus as in claim **8** wherein said base is circular and has an annular face projecting from one face thereof whereby said circular base may be used to install a seal when said threaded elements pulls said base against the end face of said shaft.

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