

TOOL AND METHOD FOR EXTRACTING A WEAR LINER

Technical Field

The present invention is related to a tool and method for extracting a wear liner, particularly to a tool and method for extracting a wear liner from a marine water jet shaft.

Background

Wear liners are used in the marine industry as a jacket for marine water jet shafts, to prevent wear on the otherwise exposed surface of the shaft. Over time, the liners become worn which necessitate replacement thereof.

To extract a wear liner from a shaft, the liner must be forcibly pulled off the shaft. Presently, removal of the liner is initiated by the seal between the lip of the liner and the shaft. Two screws are fixed to one end of the liner at opposed sides. A lever is then used to pry the liner along the shaft until the liner is freed from the lip seal. The liner is then extracted by pulling on the liner. This manner of extraction is difficult and time consuming.

US 5,349,736 describes a tool for removing a clutch from a washing-machine motor. This tool comprises a mounting plate with two guide screws which provide support for the central bolt, threaded through the mounting plate, and which is secured to the

mechanism to be removed. A nut is then threaded onto the protruding end of the central bolt above the mounting plate. Rotation of the nut causes the bolt, and thus the mechanism, to be lifted up, and the reaction force being provided by the guide screws.

US 4,771,528 describes a tool for removing out a spindle of a four-wheel drive vehicle during maintenance. The spindle puller tool comprises of a base plate, a pair of guide bolts, a puller bar, and a central bolt. The tool requires the two guide bolts to be secured through the puller bar to the base plate, and the central bolt. The puller bar has an internally threaded hole for receiving the central bolt, which is then screwed in to be engaged with the end of the shaft. The central bolt provides the axial thrust, and the puller bar pulls up the spindle in mention with the aid of the two guide bolts.

US 1,355,028 describes a tool for the removal of cones or gears from a shaft. This tool has a central adjusting screw which uses a plunger to form a connection between the adjusting screw and the shaft. The tool provides several clamping elements, set screws, which secure the device to the cone or gear in mention to be removed. These set screws are threaded through the tool body and are set near the end of the tool. The clamping elements allow for a quick and easy association of the tool to the cone and it eliminates the necessity of prying the cone out, which must be done with other tools.

US 4,174,558 describes a tool for removing a fan or a wheel from a drive shaft. This tool has a hollow housing with central adjusting screw at one end to form a connection with the shaft. The housing is fitted over the hub and via slots in the housing

screws are threaded into existing threaded holes in the hub. The central adjusting screw is then tightened to remove the hub.

Summary of invention

The object of the invention is to provide a tool for extracting a wear liner from a marine water jet shaft which overcomes or at least partly ameliorates some of the abovementioned disadvantages or which at least provides the public with a useful choice.

The tool further provides for removal of wear liners, from marine water jet shafts, having varying distances between the leading edge of the liner and the end of a shaft.

Brief description of the drawings

A device in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an exploded view of a first embodiment of a tool for extracting wear liners;

Figure 2 is a top view of a jacking member of a tool for extracting a wear liner;

Figure 3 is a bottom view of the jacking member;

Figure 4 is a top view of a puller member of a tool for extracting a wear liner;

Figure 5 is a bottom view of the puller member;

Figure 6A is a cross-section view of a skirt of the puller member fastened to a liner having a fully threaded fastener;

Figure 6B is a cross-section view of a skirt of the puller member fastened to a liner having a partially threaded fastener;

Figure 7 is an exploded view of a second embodiment of a tool, for extracting a wear liner, comprising a support member;

Figure 8 is a top view of a support member.

Figure 9A is a cross-section view of the puller member engaged with a shaft;

Figure 9B is a cross-section view of the puller member and the jacking member engaged with the shaft;

Figure 9C is a cross-section view of the first embodiment of the tool engaged with a shaft and a liner;

Figure 10 is an isometric view of a second embodiment of an assembled tool engaged with a shaft and a liner; and

Figure 11 is a side view of the second embodiment of the assembled tool engaged with the shaft and a liner.

Detailed description of the invention

The present invention will now be described with reference to the accompanying drawings.

With reference to figure 1, a tool 10 to pull or extract a wear liner 5 from a shaft 6 such as a marine water jet shaft. Tool 10 comprises a jacking member 12, a puller member 14 and coupling means 16.

Jacking member 12 has a cap-like structure to fit over an end 7 of a shaft 6. End 7 of shaft 6 comprises a portion of shaft 6 not covered by the liner 5. The jacking member 12 may be made from any suitable materials such as, but not limited to, steel.

With reference to figure 2, jacking member 12 comprises a body 18 of a generally uniform thickness. Body 18 is preferably circular and has planar surfaces on either side. Jacking member 12 further comprises a cylindrical flange 20 circumventing the body 18. On side 22 of jacking member 12, the flange 20 is level and integral with the body 18.

With reference to figure 3, at opposed side 24 of jacking member 12 the flange 20 extends beyond the body 18. The interior wall 26 of the flange 20 defines an aperture 28 for the jacking member 12 to receive and engage the end 7 of shaft 6. The base of aperture 28 is formed by body 18. When jacking member 12 is placed over end 7 of shaft 6, interior wall 26 engages the sidewall of the shaft 6 and the end 7 abuts the body 18.

Jacking member 12 may be suitably formed with the interior diameter of the aperture 28 being larger than the diameter of

the shaft. Preferably, jacking member 12 has an interior diameter that is slightly larger than the diameter of the shaft thereby allowing a close fit between jacking member 12 and shaft 6.

A driver member 30 provides a torque force required for the extraction of the liner by tool 10. Preferably the driver member is a jacking bolt. The body 18 has a central internally threaded driver hole 31 for receiving the bolt 30. Driver hole 31 may be located at the central axis of jacking member 12, such that the centre of driver hole 31 is coaxial with the central axis of jacking member 12. The bolt 30 has an externally threaded shank portion 32 and a polygonal head portion 34 connected at one end of the shank portion 32. Opposite end of shank portion 32 is a contact end 35 which is configured to contact shaft 6. Preferably, contact end 35 is pointed or rounded to correspond to a round indent on end 7 of shaft 6. In an assembled tool 10 bolt 30 extends axially through driver hole 31 generally transverse to the planar surfaces of body 18. Rotation of bolt 30 into driver hole 31 moves contact end 35 into aperture 28. Continued rotation of bolt 30, moves contact end 35 into abutting contact with shaft 6.

The cylindrical flange 20 has two bores 38 extending therethrough. Bores 38 extend radially and preferably parallel to the central axis of the jacking member 12. Each bore 38 has an opening 40 at the side 22 of jacking member 12 and an opposed opening 42 at side 24 of jacking member 12. Bores 38 are preferably positioned at diametrically opposite ends of the flange 20.

Coupling means 16 couple jacking member 12 to puller member 14. Preferably, coupling means are guide rods. Each guide rod 16 is externally threaded at both ends 36 and 37. Threaded ends 36 preferably have a length greater than the thickness of body 18. Threaded end 36 of each guide rod 16 has a suitable diameter to be slideably inserted through respective bore 38. When coupled to the jacking member 12 each threaded end 36 extends beyond side 22 of jacking member 12 and is exposed to receive a nut 44 to thereby secure the guide rod to the jacking member 12.

The distance between the leading edge of liner 5 from end 7 may vary from one shaft to another. Displacement of threaded ends 36 of guide rods 16 beyond side 22 of jacking member 12 may be varied to accommodate the distance between the leading edge of liner 5 from end 7. If leading edge of liner 5 is closer to end 7, in an assembled tool 10, greater displacement of threaded ends 36 is provided. Alternatively, if leading edge of liner 5 is further from end 7 less displacement is required. The fastening lengths of the guide rods 16 are thus adjusted according to the distance between leading edge of liner 5 end 7.

With reference to figure 4, puller member 14 has a generally tubular shape and can be made from any suitable materials such as, but not limited, to steel. Puller member 14 is configured to receive part of shaft 6 covered with a liner 5. Shaft 6 is inserted through puller member 14 till the puller member 14 abuts liner 5. In an assembled tool 10, puller member is fastened to liner 5 and has a central axis which is aligned to the central axis of the jacking member 12.

Puller member 14 comprises a collar 46 and a skirt 48, preferably collar 46 and a skirt 48 are integrally formed. The

collar 46 has an exterior wall 50 and an interior wall 52. Interior wall 52 defines a channel 53. Channel 53 has a diameter sufficient to receive shaft 6 but not liner 5. Collar 46 has a rim 54. In an assembled tool 10, rim 54 generally faces side 24 of jacking member 12. Rim 54 has threaded coupling holes 58 for receiving threaded ends 37 of guide rods 16 through openings 60. Coupling holes 58 partially project into collar 46. Preferably, rim 54 has at least two coupling holes. The width of rim 54 preferably corresponds to the thickness of flange 20. In an assembled tool 10, openings 60 of coupling holes 58 are aligned to openings 42 of bores 38. With reference to figure 5, collar 46 has an engagement surface 56 opposite to rim 54.

The skirt 48 extends radially from engagement surface 56, generally parallel to the central axis of the pulling member. Skirt 48 encircles the outer periphery of engagement surface 56. Skirt 48 has an exterior wall 62 which is contiguous with the exterior wall 50 of the collar 46 and an interior wall 64 which defines a vestibule 66 for receiving shaft 6 with liner 5. When shaft 6 is inserted through puller member 14 the interior wall 52 of collar 46 contacts the wall of the shaft 6 not covered by liner 5. Engagement surface 56 presents a surface for abutting contact with the leading edge of liner 5. Insertion of shaft 6 into puller member 14 is restricted by engagement surface 56. In an assembled tool 10, the interior wall 64 of the skirt 48 preferably is positioned over liner 5.

With reference to figure 6A, skirt 48 has an alignment hole 68 for a fastener 70 to be inserted therethrough. Fastener 70 secures skirt 48 to liner 5. Preferably fastener 70 is a screw. In an assembled tool 10, screw 70 projects from interior wall 64 of skirt 68 to engage with liner 5. Preferably, skirt 48 has

four alignment holes 68 arranged radially around the central axis of the pulling member 14. A pair of alignment holes 68 is, preferably, aligned perpendicular to the second pair of alignment holes 68. The alignment holes 68 may have threading. Preferably at least two holes are threaded.

Screws 70 may be threaded for insertion into corresponding threaded holes 68 in skirt 48. With reference to figure 6B, screws 70 may be modified in that screw 70 maybe partially threaded from the head 72 till partway on the shank 74. Such a screw 70 is used where a vacant slot 8 in the liner 5 has a damaged thread or is not threaded. The unthreaded portion of the shank 74 of screw 70 engages with the slot 8 and the threaded portion engages with threaded alignment hole 68.

With reference to figure 7, in a second embodiment, tool 10 further comprises a support member 80. Support member 80 may be made of any suitable material such as, but not limited to, aluminium. With reference to figure 8, support member 80 has a generally c-shaped structure for placement over shaft 6. Mounted to either end of the support member 80 are tubes 82. Preferably, support member 80 and the tubes 82 are integrally formed. Each tube 82 receives a guide rod 16. Support member 80 may further comprise an extension pad 83 for contact to shaft 6 not covered by liner 5. Support member 80 brace guide rods 16 during extraction of liner 5 from the shaft 6.

Prior to using tool 10 to extract a liner 5 all locking studs holding the liner 5 to shaft 6 are first removed leaving their slots 8 vacant. The end 7 of shaft 6 is inserted into vestibule 66 of puller member 14. Interior wall 52 of collar 46 contacts

and slides along the wall of shaft 6 till engagement surface 56 abuts the leading edge of liner 5. Interior wall 64 of skirt 48 will then be in position over liner 5. Pulling member 14 is positioned such that alignment holes 68 of skirt 48 are aligned to slots 8. With reference to figure 9A puller member 14 is secured to liner 5 by fasteners 70. Fasteners 70 are inserted through alignment holes 68 of skirt 48 into vacant slots 8 in the surface of liner 5.

With reference to figure 9B, jacking member 12 is placed onto the end 7 of the shaft 6. End 7 is received in aperture 28 of jacking member 12 and abuts body 18. Coupling members in the form of guide rods 16 are connected to jacking member 12. End 37 of each guide rod 16 is inserted into each bore 38 of jacking member 12 through opening 40 and exits through opening 42. Guide rods 16 are then connected to puller member 14. Each end 37 is inserted through opening 60 in rim 54 and screwed into coupling hole 58. Guide rods 16 may be screwed onto pulling member 14 prior to placing jacking member 12 over end 7. Threaded end 36 extends from side 22 of jacking member 12. A nut 44 is screwed onto each threaded end 36 of each guide rod 16 thereby coupling jacking member 12 to pulling member 14 and assembling the tool 10 to the shaft 6 and liner 5. Tool 10 can be assembled with the varying distances between jacking member 12 and puller member 14. This is achieved by way of the guide rods providing for varying fastening lengths.

With reference to figure 9C the liner 5 is extracted by rotating driver member 30. Upon rotation of driver member 30, contact end 35 moves into aperture 28 and abuts end 7 of shaft 6. Continued rotation of driver member 30 draws pulling member 14 towards jacking member 12. Simultaneously, rotation of driver member 30 pushes end 7 away from jacking member 12. Since pulling member 10 is fastened to liner 5, pulling member 14 and liner 5 move as a unit. Initial rotations of the driver member 30 breaks the seal between the liner 5 the shaft 6 and further rotation extracts the liner 5 along the shaft.

With reference to figures 10 and 11, to position support member 80 guide rods 16 are connected first connected to pulling member 14. Support member 80 is then coupled to guide rods 16 by inserting each guide rod 16 into the respective tube 82. Thereafter, jacking member 12 is connected to the guide rods 16.

Where in the foregoing description reference has been made to elements or integers having known equivalents, then such equivalents are included as if they were individually set forth.

Although the invention has been described by way of example and with reference to particular embodiments, it is to be understood that modifications and/or improvements may be made without departing from the scope or spirit of the invention.

Claims

1. A liner extracting tool for extracting a liner from a marine water jet shaft comprising:
 - a pulling member for fastening to the liner;
 - a jacking member for engaging an end of the shaft;
 - coupling means for coupling the pulling member to the jacking member; and
 - a driver member connected through the jacking member to abut the end of the shaft,wherein actuation of the driver member extracts the liner from the shaft.
2. A tool according to claim 1 further comprising a support member.
3. A tool according to claims 1 or 2 wherein the jacking member comprises an aperture for engaging the end of the shaft
4. A tool according to claims 1, 2 or 3 wherein the jacking member comprises a body and a flange, wherein the flange is level to the body on one side of the jacking member and at the opposite side extends beyond the plane surface of the body.
5. A tool according to claims 1, 2, 3 or 4 wherein the puller member comprises at least one hole, a fastener is inserted through the hole to secure the puller member to the liner.
6. A tool according to claim 5 wherein the puller member has four holes for receiving fasteners.

7. A tool according to claim 6 wherein the fasteners are screws.
8. A tool according to claim 7 wherein the screws are partially threaded from head to partway down the shank.
9. A tool according to any one of the preceding claims further comprising a support member connected to the coupling means between the jacking member and the pulling member.
10. A tool according to any one of the preceding claims wherein guide rods couple the jacking member to the puller member.
11. A tool according to claim 10 wherein the jacking member comprises bores and the puller member comprises corresponding coupling holes whereby guide rods are inserted through the bores to connect with the coupling holes.
12. A tool according to claims 10 or 11 wherein the ends of the guide rod are threaded.
13. A tool according to any one of the preceding claims wherein the driver member is a bolt.
14. A method of extracting a wear liner from a marine water jet shaft comprising the steps of:
 - securing a puller member to the liner;
 - mounting a jacking member to an end of the shaft, the jacking member carrying a driver member for abutting the shaft;
 - coupling the pulling member to the jacking member; and
 - rotating the driver member,

such that upon rotation the driver member abuts the shaft to thereby extracting the liner.

15. The method according to claim 14 further comprising a step of coupling a support member to the puller member prior to the step of coupling the jacking member.