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Rigsby et al.

[11] **3,813,756**

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[54] **METHOD OF REMOVING AND REPLACING SPLIT RING SHAFT LOCKS**

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[52] **U.S. Cl.** **29/427**, 29/229, 29/267, 29/401, 72/412, 72/450

[51] **Int. Cl.** **B23p 19/02**

[58] **Field of Search** ..... 29/427, 229, 255, 244, 29/267, 282, 401, 453, DIG. 96; 72/412, 416, 450

[56] **References Cited**

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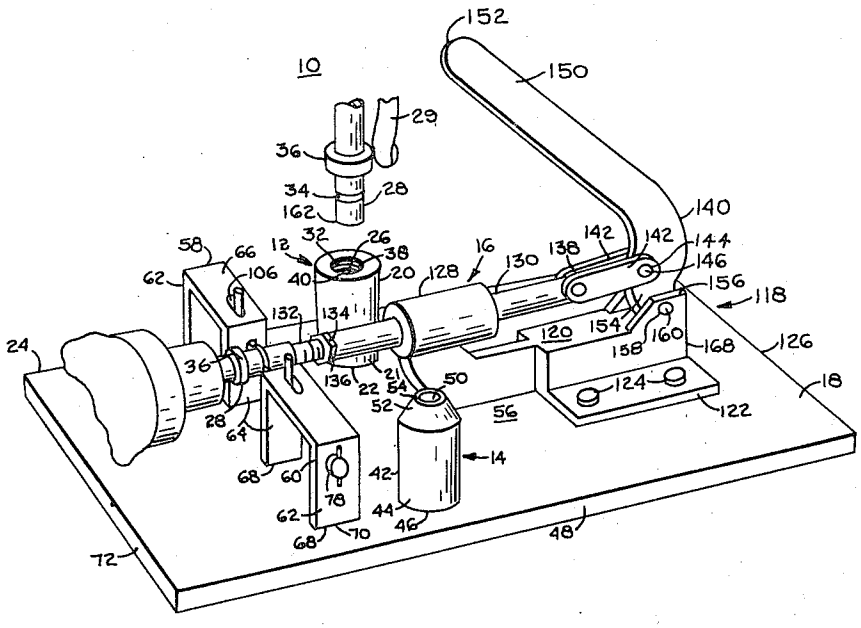
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Primary Examiner—Charles W. Lanham
Assistant Examiner—James R. Duzan

[57] **ABSTRACT**

The method and apparatus for the removal and installation of split ring type shaft locks wherein, one, a tubular die is employed to receive a shaft and enable the separation of the collar portion of the shaft lock from the split ring portion, two, a die and press assembly is employed to remove the split ring from the shaft, three, the split ring is reinstalled by placing the split ring in the tubular die and pressing on the shaft, and four, a second tubular die is employed which receives the now-in-place split ring and enables the collar to be placed over it by applying pressure to the collar.

1 Claim, 5 Drawing Figures



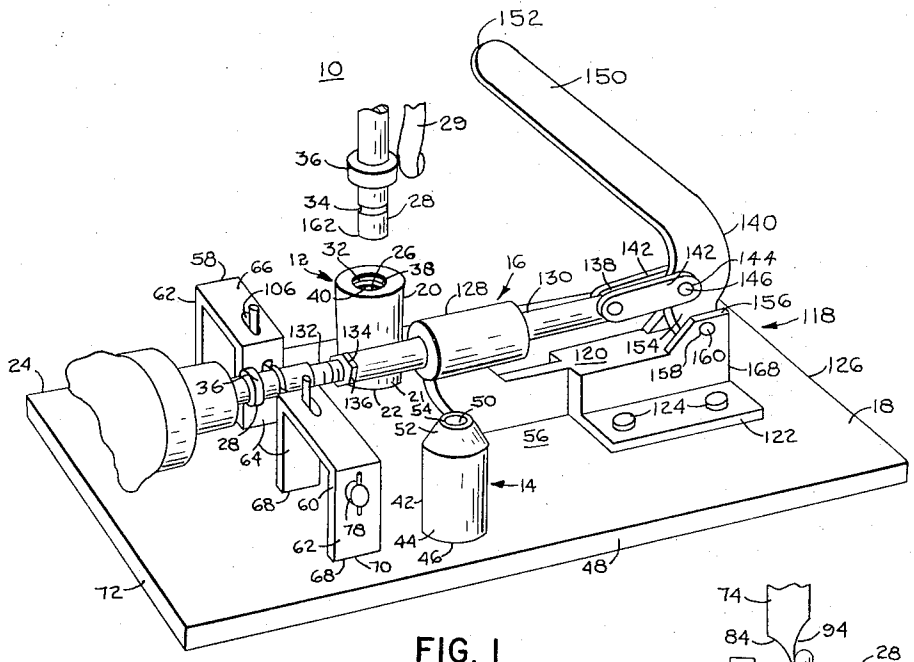


FIG. 1

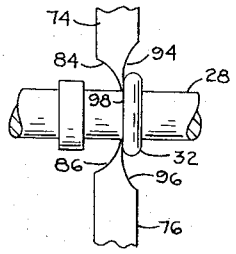


FIG. 3

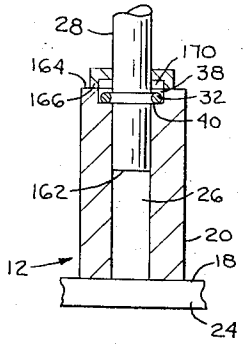


FIG. 4

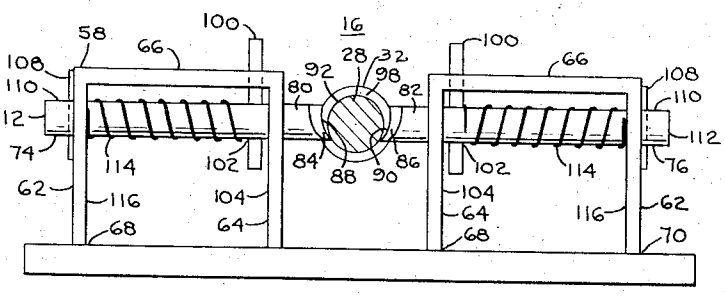


FIG. 2

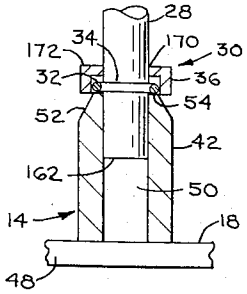


FIG. 5

METHOD OF REMOVING AND REPLACING SPLIT RING SHAFT LOCKS

BACKGROUND OF THE INVENTION

This invention relates to a method and means for the removal and installation of split ring type shaft locks.

Split ring type shaft locks, which include a split locking ring and a collar which fits over it when the split ring is in place in a groove on a shaft, are widely used to position rotary elements on a shaft. Such shaft locks are extensively used on certain make automobile starter shafts. There is a substantial volume of starter overhaul work, usually performed in small shops and the chore of removal and installation of split ring shaft locks usually requires several minutes of labor because of the lack of a tool assembly to enable this work to be performed more expeditiously. It is to be noted that each time that one of these starters is disassembled it is necessary to remove the split ring shaft lock and upon reassembly to reinstall it on the shaft. With conventional hand tools the operation is not easy to perform and requires a significant portion of the total time required for starter overhaul. This is in turn, of course, reflected in the cost of the work.

It is, accordingly, the object of the present invention to provide an improved method and apparatus assembly for the performance of each of the steps involved in this the removal and reinstallation of such shaft locks, thus enabling a significant reduction in the time required for such operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a tool assembly as contemplated by the present invention.

FIG. 2 is an end view of the die assembly shown in FIG. 1.

FIG. 3 is a top view of assembly **16** shown in FIG. **2.**

FIG. 4 is a vertical section of tubular die **20** shown in FIG. **1.**

FIG. 5 is a vertical section of tubular die **42** shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, there is shown in FIG. **1** a perspective view of tool or tool assembly **10,** constructed in accordance with the invention. Tool assembly **10** includes three related assemblies, collar removal and ring insertion assembly **12,** collar installation assembly **14,** and split ring removal assembly **16,** all secured upon a rectangular base **18.** Collar removal and ring insertion assembly **12** comprises vertically disposed tubular die **20,** having lower end **21** secured to base **18** at a point **22** near rear side **24** and forward of center. Tubular die **20** has central longitudinal opening dimensioned to slidably accept an armature or other shaft **28,** equipped with split ring type shaft lock **30.** Split ring lock **30** (FIG. **5**) consists of split ring **32,** positioned on shaft **28** by peripheral groove **34** and locked in position by circular collar **36.** Annular ring insertion recess **38** formed about upper extremity **40** of central opening **26** is adapted to receive split ring **32** to be assembled to shaft **28.**

Collar installation assembly **14** comprises a second vertically disposed tubular die **42** having lower end **44**

firmly secured to base **18** at a point **46** opposite die **20** and similarly spaced from near side **48** of base **18.** Die **42** has central opening **50** dimensioned to slidably accept shaft **28** and has conically configured upper section **52** terminating in planar surface **54,** adapted to mate with and support split ring **32.**

Split ring removal assembly **16,** a particularly sigificant aspect and portion of the invention, generally occupies central region **56** of mounting base **18.** It includes a pair of U-shaped pedestals **58** and **60** preferably formed of lengths of rectangular bar, having parallel vertically dipsosed end elements **62** and **64** interconnected by horizontal section **66.** Spaced pedestals **58** and **60,** being transversely disposed, have free ends **68** secured to base **18,** in lateral alignment, on a line **70** near front end **72** of base **18.** Transverse axially aligned guide rods **74** and **76** (FIG. **2**), are slidably supported by similarly aligned holes **78,** drilled in end elements **62** and **64** of pedestals **58** and **60,** immediately below horizontal section **66.** Inwardly dipsosed end regions **80** and **82** of guide rods **74** and **76,** respectively, are configured to provide ring extracting jaws **84** and **86** having opposed knife-edge end surfaces **88** and **90,** respectively, contoured to mate with peripheral surface **92** of shaft **28,** and provided with planar rear surfaces **94** and **96,** respectively, occupying a common plane, being adapted to engage forward side **98** of split ring **32.** Each of guide rods **74** and **76** is radially supported by guide pin **100** frictionally retained within lateral holes **102** drilled through rods **74** and **76** adjacent inner surface **104** of vertical end elements **64.** Guide pins **100** are slidably supported within elongate slot **106** (FIG. **1**), milled in horizontal element **66** of pedestals **58** and **60.** Desired inward travel of rods **74** and **76** is limited by roll pin **108** frictionally retained within lateral holes **110** formed near outer ends **112** of rods **74** and **76.** Extracting jaws **84** and **86** are urged into spring biased engagement with shaft **28** and split ring **32** by compression springs **114,** retained about rods **74** and **76,** being supported by guide pins **100,** and inner surface **116** of end elements **62.** Split ring **32** is removed from shaft **28** by lever actuated toggle action press **118** in cooperation with extracting jaws **84** and **86.** Press **118** has integrally formed frame assembly **120** provided with mounting brackets, only one, **122,** of which is shown, being centrally secured by bolts **124** near rear end **126** of mounting base **18.** Press frame **120** includes linear bearing **128** adapted to slidably journal plunger shaft **130** in an essentially axial alignment with armature or other shaft **28** when supported by extracting jaws **84** and **86** as shown in FIG. **1.** Shaft contacting tip **132,** preferably of tool steel, is threadably secured to outer end **134** of plunger shaft **130,** being locked in position by locking nut **136.** Opposite end **138** of shaft **130** is pivotally interconnected to operating lever **140** by spaced coupling links **142,** secured through aligned holes **144** by rivets **146.** S-shaped operating lever **140** is configured into hand grip **150** at upper end **152** and is pivotally supported at lower end **154** by spaced support arms **156,** provided with aligned holes **158,** adapted to accept rivet **160** attached through hole, not shown, drilled near lower end **154** of lever **140.**

OPERATION

To remove split ring type shaft lock **30** from shaft **28,** first insert end **162** (FIG. **4**) of shaft **28,** to which lock **30** is assembled, into central opening **26** of tubular die

20, causing upper surface 164 of die 20 to engage lower rim 166 of collar 36 (FIG. 4). Apply a downward force to shaft 28 to separate collar 36 from ring 32. To remove split ring 32 from shaft 28, first push operating lever 140 toward rear end 168 of press 118 so that plunger tip 132 clears inward end 162 of shaft 28. Shaft 28 is positioned as shown in FIG. 1, with shaft 28 and ring 32 being fully engaged with end surfaces 88 and 90 (FIG. 2) and rear surfaces 94 and 96, respectively of extracting jaws 84 and 86. While maintaining shaft 28 in an essentially horizontal position, pull operating lever 140 forward. Plunger tip 132 engages inner end 162 of shaft 28 urging shaft 28 forward to transfer split ring 32 from shaft 28 to plunger tip 132. Collar 36 may now be easily removed from shaft 28 thus completing the removal procedure.

To reassemble shaft lock 30 to shaft 28, first slide collar 36 over shaft 28 such that inner recess 170 of collar 36 faces outward end 162 of shaft 28, then proceed as follows:

Insert split ring 32 into upper recess 38 of die 20 (FIG. 1) and while manually retaining collar 36 on shaft 28 with forefinger 29 orient shaft 28 to vertical position and push end 162 of shaft 28 through split ring 32, until split ring 32 engages ring receptacle 34 of shaft 28. Remove shaft 28 from die 20 and slide end 162 of shaft 28 into central opening 50 of tubular die 42, allowing split ring 32 to rest on upper surface 54 of die 42. While so positioned, gently tap exposed upper surface 172 of collar 36 with mallet, or other suitable tool, not shown, to again engage collar 36 over split ring 32, and thus split ring lock is replaced on shaft 28.

What is claimed is:

1. A mechanical shop process for the removal and assembly of a split ring shaft lock wherein said shaft lock comprises a split ring and a collar for enclosing and holding said split ring in a groove on a shaft comprising the steps:

placing a shaft, with installed said shaft lock, in a tubular die of a dimension wherein a shoulder of the tubular die engages said collar and then passing on the shaft whereby the collar is moved from over said split ring;

placing the shaft between the spring biased jaws of a split ring removal assembly having additionally and extensible arm operated by a lever and wherein the end of said arm is pressed against the end of said shaft when said lever is operated enabling the split ring to be removed from said shaft;

reinstalling said split ring by placing it in a split ring holding groove in an end of said tubular die and pressing the shaft through the split ring until the split ring is positioned in the groove on the shaft; and

placing the end of said shaft in a second tubular die having a shoulder adapted to support said split ring and then pressing said collar back over said split ring.

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