ABSTRACT: A plier-type tool for removing and installing a snap ring and retainer on the Bendix drive shaft of an automobile starter. One jaw of the tool has an elongated open-ended slot formed therein to fit radially over the shaft and engage the snapring, and the other jaw has an elongated slot with means for engaging the end of the shaft to provide a reaction for applying axial pressure to the ring to force it out of the conventional retaining groove. Means is provided for supporting a snapring in axial alignment with the end of the shaft to facilitate telescoping the ring onto the end of the shaft to install the ring onto the retaining groove. During installation, the conventional retaining collar and thrust washer are snapped into place over the snapring by use of the slots in the opposed jaws of the tool.
3,571,894

TOOL FOR INSTALLING AND REMOVING SNAP RINGS

This invention relates to improvements in tools for assembling open-ended retaining, or snaprings onto grooved shafts and for removing the snaprings from such grooved shafts, and more particularly to an improved plier-type tool for use in installing and removing the retaining ring on the Bendix drive shaft of an automobile starter.

Although numerous devices have been developed for installing and/or removing snaprings on a grooved shaft, these devices have not been entirely satisfactory for use in removing or installing the snapring on the Bendix drive shaft of automobile starters of the type employed in numerous late model automobiles. For example, an electric starter manufactured by Delco-Remy which has been employed on most automobiles manufactured by General Motors Corporation for a number of years, employs a snapring which, when installed on the shaft, is surrounded by a retaining collar positively retaining the snapring against radial expansion. A thrust washer is pressed into the end of the retaining ring with the two forming, in effect, a cage for the snapring. Thus, to complete the installation of a snapring on such starter shafts, in addition to the usual step of spreading the snapring and telescoping it onto the shaft and into the groove, it is also necessary to force the snapring into the retaining collar and to press the thrust washer onto the end of the shaft. Therefore, a summary of the present invention provides a combination assembly-disassembly tool for use in installing or removing open-ended snaprings on grooved shafts.

Another object of the invention is to provide an improved plier-type tool for removing and installing a snapring in a groove on a shaft.

Another object of the invention is to provide an improved plier-type tool for removing and installing a snapring on the Bendix drive shaft of a Delco-Remy automobile starter.

In the attainment of the foregoing and other objects, an important feature of the invention resides in a combination plier-type tool having one jaw with an open-ended U-shaped slot formed therein dimensioned to fit radially over and closely engage the drive shaft of the starter. The other jaw of the tool is formed with an elongated slot which includes reaction means for engaging the end of the starter shaft to provide a reaction force for the tool to permit the first jaw to apply an axial load to force the snapring out of the groove on the shaft.

The tool also includes means for installing a snapring onto the end of the Bendix drive shaft. In one embodiment, an elongated, hollow, spool-shaped tool having an opening in one end of a diameter substantially equal to the diameter of the starter shaft is employed to press the snapring onto the end of the shaft and telescope the ring therealong. The sleeve has an internal, spring-pressed ball which projects outwardly through the opening in the end of the sleeve to act as a guide to position the snapring in alignment with the opening so that, as the sleeve is pressed over the end of the shaft, the ball will be depressed leaving the snapring aligned with the end of the shaft to be telescoped thereon as the sleeve passes over the shaft.

In an alternate embodiment, a groove is formed in the opposing faces of the U-shaped slot in position to receive and loosely support a snapring. To install the ring, the U-shaped slot is positioned over the end of the shaft with the snapring supported in the grooves in alignment with the end of the shaft. An axial force is then applied to the snapring to spread it within the grooves and telescope it onto the shaft.

When the snapring has been telescoped onto the shaft, the snapring retainer and thrust washer are then positioned on either side of the snapring and clamped together by slots in the opposing jaws of the plier-type tool.

Other objects and advantages of the invention will become apparent from the following description, taken with the drawings, in which:

FIG. 1 is a perspective view of the tool according to the present invention;
FIG. 2 is a sectional view, taken on line 2-2 of FIG. 1;
FIG. 3 is an elevational view of a Bendix drive shaft with a snapring and retainer installed thereon, and with portions broken away to more clearly illustrate other portions;
FIG. 4 is a view similar to FIG. 3, on a smaller scale, and illustrating the retaining collar and thrust washer disassembled from the snapring;
FIG. 5 is a fragmentary elevation view illustrating the use of the tool to remove a snapring from the groove in a shaft;
FIG. 6 is a view similar to FIG. 5 and illustrating the snapring partially removed from the shaft;
FIG. 7 is a fragmentary perspective view illustrating the initial step in replacing the snapring on the drive shaft employing the tool illustrated in FIG. 1;
FIG. 8 is a fragmentary elevation view illustrating a further step in the installation of a snapring on the drive shaft;
FIG. 9 is a view similar to FIG. 8 illustrating the completion of the installation of the snapring;
FIG. 10 is a sectional view taken on line 10-10 of FIG. 6;
FIG. 11 is a sectional view taken on line 11-11 of FIG. 9;
FIG. 12 is a view similar to FIG. 1 and illustrating an alternate embodiment of the invention;
FIG. 13 is a sectional view taken on line 13-13 of FIG. 12;
FIG. 14 is a side elevation view of the tool shown in FIG. 12 and illustrating the use of the tool to remove a snapring from the groove in a shaft;
FIG. 15 is a sectional view taken on line 15-15 of FIG. 14;
FIG. 16 is a fragmentary top plan view illustrating the use of the tool shown in FIG. 12 to install a snapring onto a shaft;
FIG. 17 is a sectional view taken on line 17-17 of FIG. 16;
FIG. 18 is a fragmentary side elevation view illustrating another method of using the tool to install a snapring, and FIG. 19 is a sectional view taken on line 19-19 of FIG. 18.

Referring first to the embodiment of the invention illustrated in FIGS. 1-11 of the drawings, a plier-type tool is designated generally by the reference numeral 10, and includes a pair of elongated bars pivoted together intermediate their ends by a pin 11 to define a pair of handles 12, 13 and a pair of jaws 14, 15. The clamping jaw 14 terminates in a substantially flat clamping plate 16 having an open-ended slot 17 formed therein, with the slot 17 being dimensioned to fit radially over and closely engage the Bendix drive shaft 18 of an automobile starter and engage the radial face of a snapring 19 positioned in a groove 40 in the shaft 18.

The jaw 15 terminates in an elongated, substantially flat clamping plate 20 normally disposed in opposed, substantially parallel relation to the plate 16. The plate 20 has an elongated, semicircular ended slot 21 formed therein providing a tracklike support for a cup-shaped hood 22. As most clearly seen in FIG. 10, the hood 22 comprises a generally cylindrical hollow body portion 23 having an inwardly directed flange 24 on one end and an outwardly directed flange 25 on its other end. A pair of grooves, or notches 26, 27 are formed in the outer surface of body 23 on opposed sides thereof adjacent the flange 24. The hood 22 mounted in the elongated slot 21 with the notches 26, 27 slidably receiving the opposed parallel side portion or rails 28, 29, respectively, on the plate 20 and with flange 25 being disposed between plates 20 and 16. Thus the hood 22 is slidable longitudinally of the slot 20, and the length of slot 20 is sufficiently great so that, when the hood is slid to the extreme position away from the pivot pin 11, as shown in FIGS. 8 and 9, the jaws of the tool may be closed to clamp the retaining collar 47 and thrust washer 48 between plates 16 and 20 without interference from flange 25.

In the other extreme position of the hood 22 illustrated in FIGS. 8 and 6, the inner bore 30 of the hood 22 is disposed above the slot 17. Preferably the notches 26, 27 are dimensioned to permit substantial pivotal movement of the hood 22 within slot 21 so that the flange 25 can be substantially parallel to the plate 16 throughout a substantial range of relative positions of the jaws 14, 15.

Rigidly mounted on the handle 12 is an elongated hollow spool assembly 34 including cylindrical sleeve 35 having a pair...
of inwardly concave beveled washers 36, 37 rigidly welded one on each end thereof with the central bore of sleeve 35. The openings 36, 37 have a diameter slightly larger than the diameter of the shaft 18, but substantially less than the internal diameter of the sleeve 35. A pair of spherical balls 40, 41, having a diameter substantially equal to the internal diameter of shaft 35, are entrapped within and urged toward opposite ends of sleeve 35 by a resilient coil spring 42 disposed therebetween. The relative diameters of the openings 36, 37 and the balls 40, 41 are such that a segment of the balls normally project outwardly through these openings to act as a guide for introducing a snapping 19 coaxially around the opening in one of the concave washers so that, when the shaft 18 is positioned against the ball 41 for example (FIG. 7), and pressed downward, the ball 41 will be pushed inward against the force of spring 42, leaving the snapping 19 aligned with the opening 39 in the washer 37. As the shaft 18 is pressed through the opening 55, the snapping 19 will be pressed onto the end of the shaft 18. Further movement of the shaft downward will force the snapping along the length of shaft 18 until the ring is positioned in the annular groove 45 in the shaft.

Referring now to FIG. 3, it is seen that the snapping retaining groove 46 on shaft 18 has a substantially radial shoulder on the inside that is closest to the starting point (180 degrees away), and is trapped toward the end of the shaft to facilitate axial removal of the snapping 19. To positively retain the snapping in the groove 45, the ring is normally disposed in a cage defined by an annular retaining collar 47 and a thrust washer 48. To remove the snapping 19, the thrust washer 48 is separated from the retaining ring 47 by a suitable instrument such as a knife blade, screwdriver, or the like, and then the collar 47 is forced off the snapping 19 in the direction of armature 46 by tapping the collar ring axially along the shaft by any suitable means such as a screwdriver, or the like. The hood 22 is then positioned over the shaft 18, and the plate 16 is positioned in contact with the snapping 19 as shown in FIG. 5. Handles 12 and 13 are then urged toward one another manually to force the snapping out of the groove 45 and move it axially along shaft 18 until the snapping is clamped between the flange 25 and the clamping plate 16 as shown in FIGS. 6 and 10. With the ring firmly clamped by the tool, it can then be easily lifted off the end of the shaft and retained, undamaged, for subsequent reinstallation.

To reinstall the snapping 19 on the shaft 18, the ring is first positioned over one of the spring pressed balls 40, 41, and thereby automatically aligned with an opening in the end of the mounting socket. The ball with the snapping positioned therearound is then positioned into engagement with the end of the shaft 18 and the shaft and tool pressed together against the resilient force of spring 42. As the spring 42 is depressed, shaft 18 will be telescoping received within the mounting spool, and snapping 19 will be slightly spread and telescoped onto the end of shaft 18. Further movement of the shaft 18 onto the spool 34 will result in the ring 19 being positioned in the annular groove 45. The retaining collar 47, is, of course, positioned on the shaft head ahead of the snapping 19.

To complete the assembly, the hood 22 is manually slid to the end of slot 21 farthest from pin 11 and, after the thrust washer 48 has been positioned on the end of shaft 18, the end of the shaft is inserted through the slot 21 and the open-ended slot 17 is positioned over the shaft below the retaining collar. Force is then applied to the handles 12 and 13 to manually force the retaining collar and retain the other force to force the snapping 19 into the annular groove 50 around the inner periphery of the retaining collar 47 and to press the axial lip 51 on washer 48 into frictional engagement with the inner bore of the collar.

While the mounting spool assembly 34 is illustrated in FIG. 2 being identical at opposed ends, it is believed apparent that the opening in one of the beveled washers could be larger than the other, thereby adapting the device for mounting

snappings onto shafts of different sizes. It is important, however, that the diameter of the opening in the concave ends walls of the spool be no greater than the mean diameter of the snapping to avoid any tendency of the ring to be pressed into the opening. When the opening in the end wall is greater than the mean diameter of the snap ring, excess force is required to spread the ring, and the ring may be damaged. At the same time, it is desired that the opening be as big as possible to facilitate the telescoping action between the spool and the shaft.

Turning now to FIGS. 12—19 of the drawings, an alternative embodiment of the invention is incorporated in a plier tool designated generally by the reference numeral 116 and including a pair of elongated bars pivoted together intermediate their ends by pin 111 to define a pair of handles 112, 113, and a pair of opposed clamping jaws 114, 115. The clamping jaw 114 terminates in a substantially flat clamping plate 116 having an open-ended slot 117 formed therein, with the slot 117 being dimensioned to fit radially over and closely engage the Bendix drive shaft 18 of an automobile starter and engage the radial face of a snapping 19 positioned in a groove 45 on the shaft 18. A pair of parallel grooves 52, 53 are formed, one in each of the internal, opposing faces of the slot 117, with the grooves 52, 53 being dimensioned to cooperatively receive and loosely support a snapping 19 positioned therein as illustrated in FIGS. 16 and 17.

The jaw 115 similarly terminates in a substantially flat clamping plate 120 normally disposed in opposed, substantially parallel relation to the plate 116. The plate 120 has an elongated, open-ended slot 121 formed therein in opposed relation to the slot 117, and a pair of reaction members, or tabs 54, 55 are formed one on the opposing, parallel faces of the elongated slot 121. The slot 121 is dimensioned to fit radially over and closely engage the Bendix drive shaft 18, with the tabs 54, 55 projecting inwardly from the opposed sides of the slot so that the respective tabs are spaced apart a distance less than the diameter of shaft 18. As indicated in FIG. 16, the tabs 54, 55 are spaced a substantial distance from the open end of the slot 121, and are preferably adjacent the end of the slot closest the pivot pin 111.

This alternate embodiment of the invention is employed to remove a snap ring from the Bendix drive shaft 18 in a manner quite similar to that described above with reference to the embodiment of the invention illustrated in FIGS. 1—11. For example, when the retaining collar 47 has been removed from the snapping in the manner described above, the snapping may be removed from the groove 45 by positioning the slot 117 over the shaft with the snapping 19 either disposed within the slots 52, 53 or engaging the flat surface of the plate 116. The tabs 54, 55 are then positioned into engagement with the end of the shaft 18 and the handles 112, 113 are manually urged one another to force the snapping axially out of the groove and along the shaft as illustrated in FIGS. 14 and 15.

To reinstall a snapping 19 onto a shaft using this alternate embodiment of the tool, the snapping is first positioned within the grooves 52, 53 and the slot 117 is positioned over the shaft adjacent the end thereof with the snapping in alignment with the end of the shaft. The snapping may then be forced onto the end of the shaft, either by applying manual force to the tool or by lightly tapping the tool with a hammer or the like to spread the ring and telescope it onto the shaft. The opposed faces of the groove 117 act as a guide to facilitate alignment of the snapping with the end of the shaft during this operation. Alternatively, the snapping may be telescoped onto the end of the shaft by positioning the tabs 54, 55 in the snapping groove 45 and manually urging the handles 112, 113 toward one another. As illustrated in FIGS. 18 and 19, the tool may also be embodied in this manner to slide the snapping along the shaft after it has been initially telescoped onto the end of the shaft.

After the snapping 19 is positioned in the groove 45, the retaining collar 47 and the thrust washer 48 are assembled onto the snapping by clamping the collar and thrust washer
between the opposed faces of the plates 116, 117 as described above with reference to the embodiment illustrated in FIGS. 1—11. It is pointed out that the reaction tabs 54, 55 are spaced from the end of the slot 121 a distance to permit this clamping action. In each embodiment of the invention, the opposed surfaces of the clamping jaws are substantially parallel during this clamping action to apply a clamping force on opposed sides of the shaft simultaneously, thereby eliminating any tendency of the thrust washer, snapping and retaining collar to shift or become misaligned during this assembly operation.

While I have disclosed and described the preferred embodiment of my invention, I wish it understood that I do not intend to be restricted solely thereto, but that I do intend to include all embodiments thereof which would be apparent to one skilled in the art and which come within the spirit and scope of my invention.

I claim:

1. A tool useful for removing a snapping from a groove in a shaft and for installing a snapping onto a shaft, said tool comprising, in combination, a pair of elongated members pivoted together intermediate their respective ends to define a pair of opposed relatively movable handles and a pair of opposed clamping jaws movable between a closed position and an open position by manipulation of said handles, a generally flat clamping surface on each of said jaws, said clamping surface being generally parallel when said jaws are in said closed position, an open-ended slot formed in one of said jaws and extending into the clamping surface thereof, said open-ended slot being dimensioned to closely receive the shaft from which a snapping is to be removed, an elongated slot formed in the other of said clamping jaws in generally opposed relation to said open-ended slot whereby an annular member disposed on a shaft may be clamped between said jaws when the shaft is disposed within said slots, and reaction means carried by said elongated slot on said other jaw positioned to engage the end of the shaft to provide a reaction force for said one jaw to axially force said snapping from the shaft.

2. The tool defined in claim 1 wherein said reaction means overlies at least a portion of said open-ended slot when said jaws are in said closed position.

3. The tool as defined in claim 2 wherein said reaction means comprises a pair of tabs projecting into said elongated slot in position to engage the end of a shaft on substantially opposite sides thereof.

4. The tool defined in claim 1 further comprising a pair of generally parallel grooves formed on each in the opposing surfaces of said open-ended slot, said grooves being positioned and dimensioned to slidably receive and support a snapping within said open-ended slot.

5. The tool defined in claim 1 wherein said reaction means in mounted on said other jaw for movement along said elongated slot.

6. The tool defined in claim 1 wherein said other jaw is substantially longer than said one jaw, said elongated slot extending generally parallel to and outwardly beyond said open-ended slot, and wherein said reaction means is movable between a ring moving position generally opposed to said open-ended slot when said jaws in said closed position to a retracted position spaced outwardly from said one jaw.

7. The tool defined in claim 6 wherein said elongated slot is closed at each end, and said reaction means is supported with said elongated slot for sliding movement therealong.

8. The tool defined in claim 7 wherein said reaction means comprises a generally cup-shaped hood having a central cavity therein for receiving the end of a shaft.

9. The tool defined in claim 7 wherein said elongated slot is dimensioned to telescopingly receive the end of a shaft when said reaction means is in said retracted position whereby said tool may be employed to apply a clamping force between a snapping disposed in a groove on a shaft and a retaining collar to telescope the collar onto the ring to retain the ring in the groove.