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2,978,802

COMBINATION RETAINING RING DISPENSING AND APPLYING TOOLS

Filed March 14, 1958

3 Sheets-Sheet 1

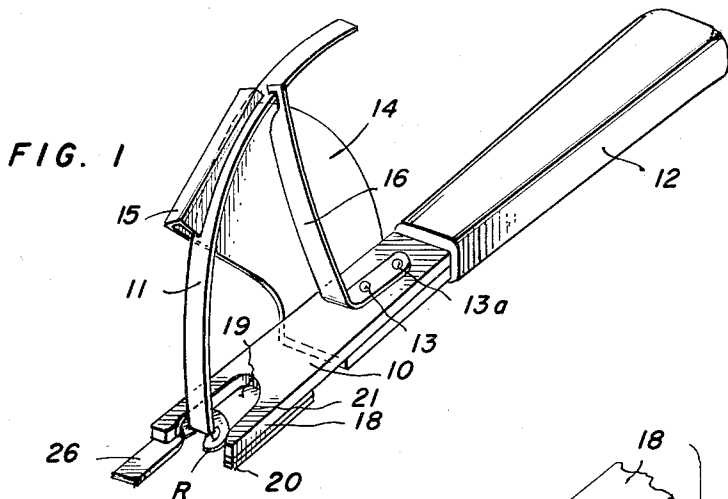


FIG. 3

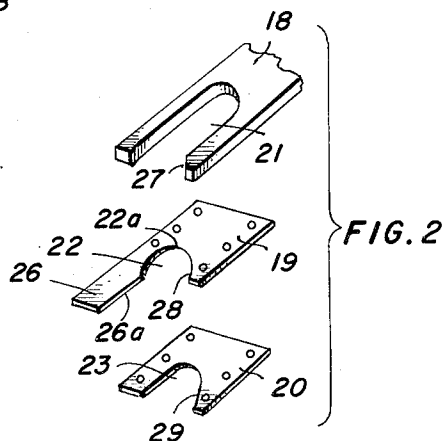
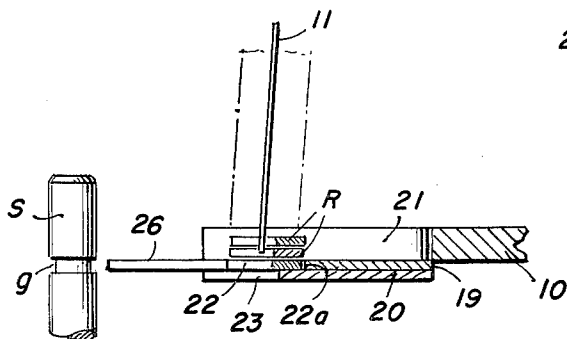
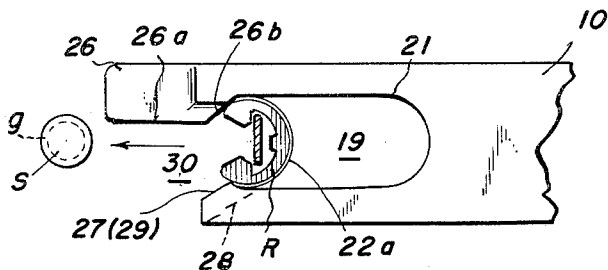


FIG. 4



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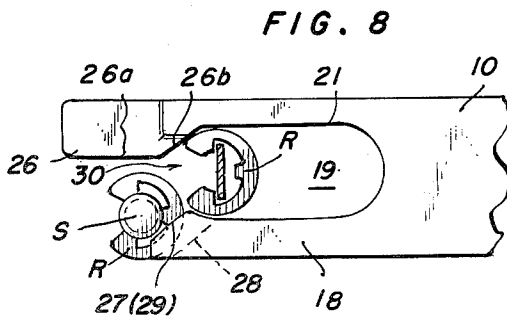
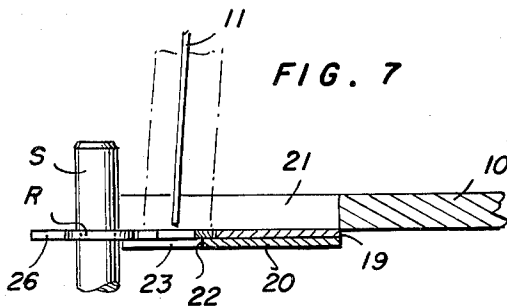
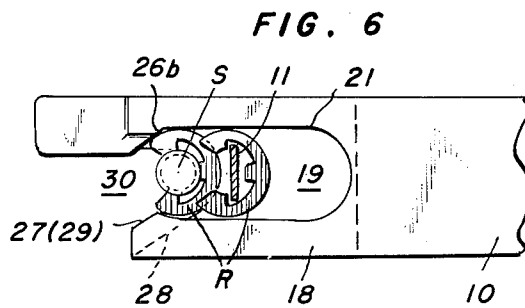
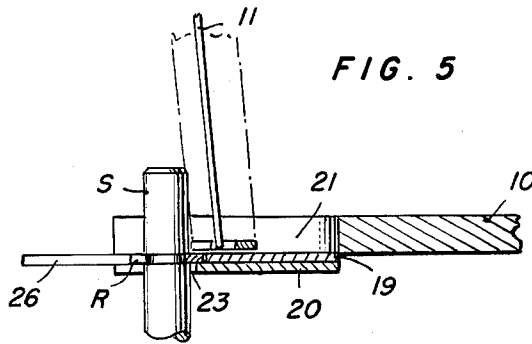
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COMBINATION RETAINING RING DISPENSING AND APPLYING TOOLS

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3 Sheets-Sheet 2



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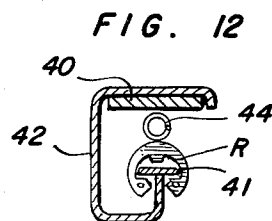
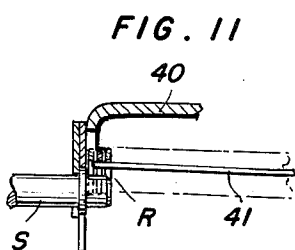
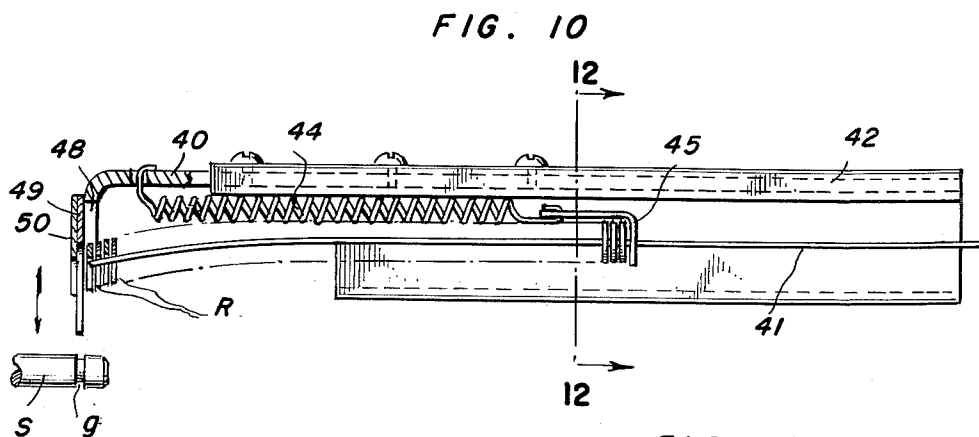
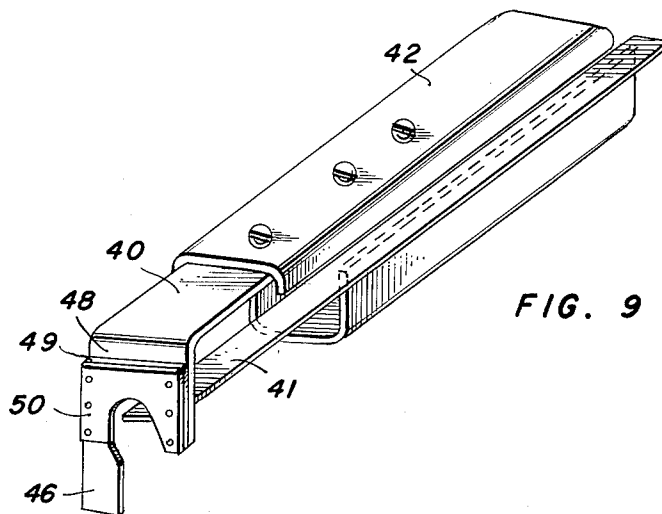
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COMBINATION RETAINING RING DISPENSING AND APPLYING TOOLS

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2,978,802

COMBINATION RETAINING RING DISPENSING AND APPLYING TOOLS

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11 Claims. (Cl. 29—229)

This invention relates to improvements in combination retaining ring dispensing and applying tools and more particularly to a improved hand tool which combines the operations of dispensing open retaining rings one-by-one from a stack thereof carried by the tool and of assembling the single rings as they are dispensed in the groove of a shaft, pin or like workpiece, responsive to a single relative movement of the tool toward and away from the workpiece.

In tools as aforesaid it has previously been suggested, i.e. in my applications Serial No. 485,785, filed February 2, 1955, and Serial No. 508,264, filed May 13, 1955 (the latter having been abandoned), which, with the present application, are commonly owned, to incorporate a guide finger extending forwardly from the free or working end of the applicator blade which is adapted, by entering the groove ahead of the ring, to correctly lead or pilot the ring into the groove without the tool being tilted or otherwise incorrectly positioned with respect to the plane of said groove. However, the prior guide fingers were open to the objection that they were not effective for the full travel of the ring being assembled as it moves from its recess in the applicator blade fully into the shaft groove. In explanation, the prior guide fingers were applied to the applicator blade of a tool which retracts from the shaft following ring assembly thereon in exactly the reverse of the direction in which it moved toward the shaft to effect ring assembly. Thus, a guide finger designed not only so that its inner edge enters the shaft groove and contacts the bottom thereof ahead of the ring, but also so that it provides ring guidance throughout its full movement as aforesaid, will obstruct the tool being pulled away (retracted) from the shaft consequent to the blocking effect exercised on the recess-end of the guide finger by the now seated ring.

While it is possible to build into the applicator blade of the resilient-jaw type of applicator tool sufficient resiliency that the jaws could, though with difficulty, be spread to a degree such as permits the guide finger to clear the assembled ring, such is quite impossible in the case of the rigid applicator blade which is the preferred blade for a number of uses.

Heretofore, the aforesaid objection could only be overcome (in the rigid blade tool) by so shaping the guide finger as to provide a gap or set-back in its inner-edge portion adjacent the applicator as gave sufficient space between the applicator recess and the guide finger proper as permits retraction of the tool without such movement being obstructed by engagement of the inner or recess end of the guide finger with the assembled ring. But this gapping or setting-back of the guide finger inner edge resulted in the finger losing its guiding function for the length of the set-back, since it can fully serve its intended purposes only when its guiding edge is continuous from its inner or applicator end to its outer free end.

Stated broadly, a major object of the present invention is the provision of a combination retaining-ring dis-

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pensing and applying tool having a guide finger for guiding the tool relative to the shaft or other workpiece during a ring applying or assembly operation as insures accurate and positive assembly of the ring in its groove, and which is further so constituted and arranged that the tool may be retracted from the workpiece without its retracting movement being impeded by engagement of the inner end of the guide finger and the assembled ring as was heretofore the case when the guiding edge of the finger extended substantially to the ring recess of the tool.

More particularly, an object of the invention is the provision of a retaining ring dispensing and applying tool having a guide finger serving to lead or pilot the ring being assembled into its shaft groove, which is so constructed and arranged that the guide finger exercises its ring-into-groove guiding function during the entire travel of the ring in moving from its recess in the tool to its full-assembled position in the groove, but which also insures unimpeded withdrawal movement of the tool following the assembly operation.

A more specific object of the invention is the provision of a retaining-ring dispensing and applying tool as aforesaid characterized in that the guide finger and tool are provided with complemental means for causing the tool when retracting from the workpiece following completion of a ring-assembly operation to move in a direction enabling the inner or ring-recess end of the guide finger to in effect detour the seated ring rather than being blocked thereby.

Still another object of the invention is the provision of a combination retaining ring dispensing and applying tool provided with a guide finger for leading the ring to be assembled in its groove, characterized in that the guide finger and the applicator-blade components of the tool are so constructed and related as to permit straight-ahead movement of the tool relative to the shaft or other workpiece in performing the assembly operation, but to cause the tool to retract from said workpiece at an angle which is sidewardly inclined to its straight-ahead motion as insures the inner end of the guide finger clearing the just assembled ring.

A further object of the invention is the provision of a combination retaining ring dispensing and assembly tool so constructed and arranged as to permit ring assembly responsively to movement of the tool towards a shaft or other workpiece on which a ring is to be assembled in direction normal to the longitudinal axis of the tool.

Still another object of the invention is the provision of a combination retaining ring dispensing and applying tool characterized by a unique design which makes for easier handling and greater compactness of the tool than with prior tools serving similar function.

Yet another object of the invention is the provision of a combination retaining ring dispensing and assembly tool as aforesaid whose design is further such that not only are the stack rod and applicator blade components thereof disposed in compact parallel relation but also that the stack rod is enclosed within and thereby effectively protected by the tool handle.

The above and other objects and advantages of a combination ring dispensing and applying tool of the invention will appear from the following detailed description taken with the accompanying drawings illustrating different forms which the improved tool may take, wherein—

Fig. 1 is a perspective view of one form of tool according to the invention which is designed to effect a ring-assembly operation with longitudinal movement of the tool toward the workpiece;

Fig. 2 is an exploded view of the parts making up the

working end of the applicator component of the tool shown in Fig. 1;

Figs. 3 and 4 are a broken-away longitudinal sectional view and a broken-away plan view, respectively, of the front or working end of the improved tool shown to be moving toward but in a position just before it makes contact with a shaft or like workpiece on which a ring is to be assembled;

Figs. 5 and 6 are views similar to Figs. 3 and 4, respectively, which illustrate the relation of parts under the condition of ring-assembly having just been completed;

Figs. 7 and 8 are similar views but illustrating the relation of parts following completion of a ring assembly operation and the inclined path of retracting movement of tool relative to workpiece;

Fig. 9 is a perspective view of a modified form of tool according to the invention whose design is such that it effects a ring-assembly operation with movement of the tool transversely of its longitudinal center line;

Fig. 10 is a part sectional side elevation of the tool seen in Fig. 9 shown to be moving towards its workpiece for a ring-assembly operation;

Fig. 11 is a detail view showing the relation of the working end of the tool and workpiece immediately upon completion of the ring assembly operation; and

Fig. 12 is a section taken along line 12-12 of Fig. 10.

Referring to the drawings, and more particularly to Figs. 1-8 thereof, reference numeral 10 generally indicates the applicator blade and reference numeral 11 the stack rod components of one form of combination retaining ring dispensing and applying tool provided with a guide finger, which embodies the improvements as herein proposed. As usual, the applicator blade 10 at its end removed from its so-called working end mounts a handle 12, and fixed to its intermediate body portion as by rivets 13, 13a is the angled foot flange of a bracket 14 whose inclined upper edge is bent back on itself to form a U-flange 15, to the free leg of which is secured the upper end of the stack rod 11. This arrangement is such that the free leg of the flange depends into the gap or opening between the ends of a plurality of the retaining rings R to be assembled, which are threaded on to the stack rod in the usual manner, and also that the lower end of the stack rod is free to flex. A strut 16 extending intermediate the blade and the upper end of the stack rod may also be provided as shown.

The working end of the applicator blade 10 is preferably composed of the three parts 18, 19 and 20 best shown in Fig. 2, which is an exploded view thereof. The aforesaid part 18 is a continuation of the applicator blade, and parts 19 and 20 are thin plate-like members secured in that order flat against the under side of the part 18.

As usual with the rigid blade-type applicator tool, the applicator-blade part 18 is provided in its end edge with a simple cut-out 21 as results in said part having forked or bifurcated configuration, the cut-out having width which is of slightly greater diameter than the rings R to be assembled so that they may move more or less freely therealong and extending deeply into the body of the blade, preferably terminating in a semi-circular end edge as shown. The plate 19, which is characterized by thickness corresponding substantially to the axial thickness of one of the rings R, is also provided in its end edge with a cut-out 22 of width and depth which is only slightly greater than the diameter of the rings R, said cut-out terminating inwardly in a semi-circular edge defining a rearward shoulder 22a for a ring disposed in said cut-out. It will be observed that the provision of the cut-out 22 imparts forked or bifurcated configuration to the end edge of said plate 19 also. The lower plate 20 is also provided in its end edge with a recess 23 having a semi-circular inner end, but such is set back from the plate end edge a distance which is less than the outer

diameter of a retaining ring R and somewhat greater than that of the shaft or other workpiece on which ring assembly is to be effected. Accordingly, the working end of the applicator blade composed as aforesaid when pushed against the workpiece may fork the same, as is illustrated in Fig. 6, for example.

The aforesaid arrangement is further such that, when the parts 18, 19 and 20 making up the working end of the applicator blade 10 are assembled to one another and disposed in proper position with respect to the stack rod 11, the lower end of the latter extends into the cut-out 21 of part 18 and more or less axially with respect to the cut-out 22 of the plate 19, but it terminates short of the upper face of said plate 19. Thus, the lowermost ring R of the stack thereof feeding downwardly on the stack rod normally seats in the relatively deeper ring recess defined by said cut-out 22 wherein it is supported from below in assembly-readiness position by the cut-out defining edge of the bottom plate 20 which serves as a ring-supporting ledge and it is backed from the rear (as in Fig. 3) by the shoulder 22a provided by the semi-circular end edge of the cut-out 22 as aforesaid. However, as will be seen from Fig. 5, when the working end of the applicator blade is moved against a workpiece such as the shaft S to effect assembly of the assembly-ready ring R in the shaft groove g, the aforesaid arrangement is such that the lower end of the stack rod 11 is free to flex rearwardly and thereby to shift the next higher ring R and the rings immediately above same into the rearward shallower recess which is bottomed by the upper face of the plate 19, as prevents the assembly operation being impeded by engagement of the rings immediately above the endmost ring R with the end of the shaft. Thus it will be seen that to the extent so far described the working end of the applicator blade 10 is functionally similar to the rigid applicator blade as disclosed in my prior application Serial No. 643,383, filed March 1, 1957.

The herein tool is further provided with a guide finger serving to lead the ring R disposed in assembly-readiness position in the cut-out 22 into its groove g during the performance of the ring-assembly operation. According to the invention, said guide finger designated 26 is formed integral with and extends forwardly from one bifurcation or fork of the plate 19 (Fig. 2) whereby it is disposed in the same plane as the ring to be assembled. By reference to Fig. 4, for example, it will also be seen that the inner guiding edge 26a of the guide finger, in addition to extending substantially as a tangent to the circle of the inner edge of the ring R seated in the cut-out 22 and which touches said circle at a point on the side thereof disposed towards the fork of the plate 19 from which the guide finger extends (as is usual), also extends inwardly substantially without interruption to said cut-out 22. Thus, in addition to serving as a guide finger whose inner edge is adapted to extend as a tangent to the circle of the groove of the shaft against which the tool as a whole is being moved corresponding generally to the guide fingers as disclosed in my prior applications Serial Nos. 485,785 and 508,264 (the latter now abandoned), the guide finger 26 of the present invention, by virtue of the continuity of its inner guiding edge 26a, is capable of serving as such throughout the entire travel of a ring R to be assembled in its movement from the cut-out 22 to its fully assembled position within the groove.

As will be seen from a consideration of Fig. 6, a guide finger 26 such as herein proposed, if incorporated into a ring-applying tool which retracts from the workpiece upon completion of a ring assembly operation in exactly the reverse of the direction in which it moved against the workpiece, tends to obstruct such retracting movement consequent to its inner-end edge portion abutting the just-assembled ring. To overcome this objection and at the same time to preserve the advantages of the guide finger whose inner guiding edge extends inwardly sub-

stantially to the ring cut-out 22, the invention provides for retracting movement of the tool from the workpiece in a direction which is inclined to that in which the tool moves against the workpiece by an angle which is such as enables said inner-end edge portion of the guide finger to clear the just-assembled ring.

More particularly, the end edge of the fork of the applicator blade part 18 opposite the fork from which the guide finger 26 extends, rather than extending inwardly-forwardly about a ring seated in the cut-out 22 as heretofore, is cut away at an angle of approximately 45° to the longitudinal center line of the working end of the applicator blade as indicated at 27; the corresponding end edge of the fork of the plate 19 opposite that from which the finger 26 extends is similarly cut away at an angle of approximately 45° as at 28; and the corresponding end edge of the fork of the plate 20 is also cut away at an angle of approximately 45° as at 29. Of the aforesaid inclined edges 27, 28 and 29, the inclined edges 27 and 29 preferably extend as tangents to a circle corresponding to the circle of the periphery of the shaft S assumed to be concentric with the ring cut-out 22 of the plate 19 and which touch said circle at the side thereof opposite the guide finger 26. On the other hand, the inclined edge 28 of the plate 19 extends as a tangent to the circle of the cut-out 22 or, more properly, of the outer edge of a ring R seated in said recess.

As will also be observed from Figs. 4, 6 and 8, the inner end of the guide edge 26a of the guide finger 26 merges into the inner edge of the fork of the plate 19 from which said guide finger extends via a sloped inner-end portion 26b which is also inclined as at a 45° angle so that it extends parallel to the aforesaid inclined end edge 28 of the opposite fork of the plate 19. Moreover, said inclined inner edge portion 26b is spaced from the opposite parallel inclined edge 28 a distance which corresponds to the external diameter of a ring R seated in said cut-out 22. Thus, without in any way disturbing the ability of the tool to move straightway on to the workpiece (shaft S) to initiate a ring-assembly operation, the effect of said inclined edging of the applicator blade-end parts is to provide an opening 30, through which a just-assembled ring may move relatively from the tool as said tool is retracted from the workpiece, which is inclined by an angle of approximately 45° to the longitudinal axis of the tool as a whole. It will also be noted that, rather than the inner-end edge portion 26b of the guide finger abutting the just-assembled ring in such a way as to obstruct retraction of the tool, said edge portion serves to cam the tool in direction as insures relative movement of the just-assembled ring through the inclined opening 30 responsive to a retracting force being applied to the tool.

The operation of the improved tool will, it is believed, be clear from Figs. 3-8. Referring to Figs. 3 and 4, such views illustrate the working end of the tool moving straightway towards a shaft S preparatory to assembling in its groove g a retaining ring R seated in assembly-readiness position in the cut-out 22 of the applicator blade part 19. It will be noted that the guide finger 26 is about to engage in the groove g, thereby to position the tool as to lead or pilot said ring R into the groove. Figs. 5 and 6 show the relation of the tool and workpiece parts at the instant of completion of a ring-assembly operation, it being observed that the stack rod 11 has shifted rearwardly so that neither it nor the rings next above the ring being assembled interferes in any way with completion of the assembly operation. Figs. 7 and 8, particularly the latter, illustrate the tool as having retracted from the just-assembled ring. More particularly, the tool, rather than backing off from the workpiece in the reverse direction in which it moved toward same, has instead moved or retracted in a direction which is inclined 45° to that at which it moved toward the tool, as insures the inner end

edge 26a of the guide finger clearing the just-assembled ring, despite the fact that its inner edge extends substantially to the ring cut-out. It will be understood that during this retracting movement, the stack rod has moved back to its normal position in which the previously next endmost ring has lowered to the assembly-readiness position in the cut-out 22 of the applicator part 19, thereby conditioning the tool for the next ring assembly operation.

Referring now to Figs. 9-12, such illustrate another form of retaining-ring dispensing and applying tool incorporating the guide finger and inclined tool retracting features as described above, according to which ring assembly is effected by movement of the tool transversely of its longitudinal axis, and which is further characterized by a novel design of overall tool which gives greater compactness and ease of handling than most if not all of the prior tools serving similar function.

First considering the new overall design features, it will be seen that the applicator blade and stack rod components 40, 41, respectively, of the tool under consideration are disposed in close parallel relation, with the stack rod being positioned relatively beneath the applicator blade, and that the tool handle 42 which is secured to the non-working end of the applicator blade, as heretofore, is continued beyond a side edge of said blade much as a wrapping and extends below the under face of the rearward end portion of the stack rod and thence upwardly to provide a longitudinal mounting edge, to which said rearward end of the stack rod is secured. Thus, the handle 42, in addition to serving as a tool handle, takes the place of the relatively awkward and cumbersome mounting bracket 14 and strut 16 characterizing the Fig. 1 form of tool, and it further serves much as an enclosing frame for a large portion of both the applicator blade and stack rod. The new design is also well suited to the incorporation of a substantially enclosed coil spring 44 mounted in the space between the applicator blade proper and the stack rod so as to be reactive between a forward point of the applicator and a follower 45 sliding on the stack rod for positively biasing the retaining rings stacked on the rods towards the working end of said applicator blade.

To provide the necessary substantially right-angular relationship between the stack rod and said working end, the latter is bent at a right angle to the plane of the blade proper in direction such that it extends just forwardly of the free (flexible) end of the stack rod as illustrated in Fig. 10. Said working end of the blade is moreover comprised of the parts 43, 49 and 50 corresponding in all substantial respects to the parts 18, 19 and 20 of the Fig. 1 form of tool. This arrangement requires, when assembling a retaining ring R of the stack thereof on the stack rod 41 in the groove g of a workpiece such as the shaft S (Figs. 10 and 11), that the tool be moved toward the shaft in a direction transverse to the longitudinal axis of the tool, which latter is of course considered to be the longitudinal center line of the blade 40 and its handle 42. During such assembly movement, the guide finger 46 corresponding to the prior described guide finger 26 functions similarly to the latter in positively leading or guiding the ring being assembled in its groove g. And when retracting the tool from the shaft upon completion of a ring assembly operation, the tool is caused to back off or retract from the work in a direction which is inclined to that in which it moved toward the shaft as provides for tool retraction unimpeded by abutment of the inner end of the guide finger 46 of the just-assembled ring characterizing the Figs. 1-8 form of ring dispensing and applying tool.

Without further analysis, it will be appreciated that the above described combination retaining-ring dispensing and applying tool in each of the forms disclosed above satisfies in simple yet effective and thoroughly dependable manner the objectives of the invention as

explained in the foregoing. However, as many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a device for dispensing open retaining rings and applying them to grooved shafts and the like comprising an applicator blade and a ring magazine operatively connected thereto in such manner as to render said device actuable solely by bodily movement of the blade together with said magazine relatively toward and away from the shaft to which a ring is to be assembled, said applicator blade having a bifurcated working end adapted to straddle said shaft and providing a recess for receiving a ring to be assembled in an assembly-readiness position and including ring abutment means for effecting transfer of such ring to the shaft groove when said blade is moved bodily relatively toward the shaft, said magazine including a stack rod operatively related to said recess for mounting a supply of the rings in position to move one at a time to said recess, and means responsive to applicator-blade movement relatively toward and away from the shaft in effecting a ring-assembly operation as aforesaid for also effecting automatic feed of a ring from the stack rod to said recess, the improvement comprising a guide finger extending forwardly from one bifurcation of said working end in the plane of the ring-receiving recess and having an inner guide edge adapted to be disposed substantially tangent to the circle of the bottom of the shaft groove for guiding the device throughout its final bodily movement towards the shaft in a path which insures transfer of a ring in said assembly-readiness position to the shaft groove as aforesaid, and cooperating means on the rearward end of said guide finger and the other bifurcation of said working end adapted by the engagement which said rearward end makes with the outer edge of the just-assembled ring when the device is being backed off from the shaft following completion of the ring-assembly operation to guide the device in a sidewardly inclined path as enables said rearward end of the guide finger to move past said just assembled ring without its movement being impeded by said ring.

2. The improvement substantially as set forth in claim 1, wherein said cooperating means comprises parallel inclined edges on the rearward end of said guide finger and on the forward end of said other bifurcation of said applicator-blade working end, respectively, which are spaced apart a distance corresponding substantially to the external diameter of the rings being assembled.

3. The improvement substantially as set forth in claim 2, wherein said parallel edges are inclined at an angle of approximately 45° to the longitudinal center line of the applicator blade.

4. The improvement substantially as set forth in claim 1, wherein said guide finger has a straight continuous inner guiding edge terminating at its rear end just forwardly of the ring-receiving recess and being disposed on a line of tangency to the circle of the effective inner edge of a ring in said assembly-readiness position.

5. The improvement substantially as set forth in claim 4, wherein said cooperating means comprises said rearward edge of the guide finger and the forward end edge of the other bifurcation of said working end, said end edges extending substantially parallel to one another and being spaced apart a distance corresponding substantially to the external diameter of a ring being assembled and being inclined by an angle of approximately 45° to the center line of the applicator blade.

6. The improvement substantially as set forth in claim 1, wherein the working end of the applicator blade is disposed at a right angle to the other end thereof, and said stack rod is rigidly connected at one end and extends substantially parallel to said other end of the applicator blade and terminates just short of and generally in alignment with said recess.

7. The improvement substantially as set forth in claim 6, wherein said other end of the applicator blade mounts a combined tool handle and partial enclosure for the stack rod.

8. In a combination retaining-ring dispensing and applying tool for assembling open retaining rings on grooved shafts, pins and the like and being actuable solely by bodily movement of the tool toward and away from the shaft, the combination of an applicator blade having a handle end and a working end, said working end being disposed at a right angle to the handle end, the end edge of the working end having a cut-out giving said working end a forked configuration whereby it may fork a shaft on which a retaining ring is to be assembled and a retaining-ring recess extending about said cut-out for seating a retaining ring to be assembled in assembly-readiness position, a stack rod for mounting a plurality of retaining rings in stack formation, and a tool handle rigidly affixed to the handle end of the applicator blade and to one end of the stack rod and securing the stack rod in substantially parallel relation to said handle end and in substantial alignment with the ring recess, the other end of the stack rod terminating just short of said recess and being flexible whereby it is free to flex with bodily movement of the working end of the applicator blade toward and away from the shaft, means operative on the stack of rings mounted on said stack rod for biasing same towards the recess, and means including the flexible end of the stack rod and said ring-stack biasing means for effecting feed of the ring of the stack nearest the recess into assembly-readiness position in said recess responsively to bodily movement of the applicator blade away from the shaft following completion of each ring-assembly operation.

9. A combination retaining-ring dispensing and applying tool substantially as set forth in claim 8, wherein said handle is extended and secured to the face of the stack rod remote from the applicator blade whereby it partially encloses the stack rod.

10. A combination retaining-ring dispensing and applying tool substantially as set forth in claim 8, wherein said handle extends substantially as a wrapping about opposite faces of the handle end of the blade and the stack rod and terminates in a longitudinal edge to which the stack rod is affixed.

11. A combination retaining-ring dispensing and applying tool substantially as set forth in claim 8, wherein the ring-stack biasing means comprises a tension spring contained in the space between the parallel handle end of the applicator blade and the stack rod.

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