

PATENT SPECIFICATION

(11) 1323 393

DRAWINGS ATTACHED

- (21) Application No. 4665/72 (22) Filed 1 Feb. 1972
 (44) Complete Specification published 11 July 1973
 (51) International Classification B25B 27/02
 (52) Index at acceptance
 B4W 6E



(54) A HAND-MANIPULABLE TOOL FOR ASSEMBLING SPRING RETAINING RINGS

(71) We, WALDES KOHINOOR, INC., of 47—16 Austel Place, Long Island City, New York 11101, United States of America, a corporation organized and existing under the laws of the State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a hand-manipulable tool for installing external spring retaining rings, of the type designed for radial insertion into a shaft groove.

Speaking generally, the assembly of retaining rings of the aforementioned type in the smaller sizes thereof designed for use with shafts or spindles of up to 5/16" diameter may be accomplished with relative ease by a conventional hand applicator tool. However, because of the relatively great thickness-to-diameter ratio which is necessary to provide the extra holding strength required of such rings, the assembly of retaining rings designed for 5/16" diameter shafts and larger by a conventional hand applicator requires undue effort on the part of the operator.

According to the present invention there is provided an applicator for installing external spring retaining rings of the type designed for radial insertion in to a shaft groove, the applicator comprising an applicator blade terminating at one end in co-planar resiliently interconnected grip jaws adapted to grip between them a ring to be installed, said jaws gripping the ring along an arcuate outer-edge portion thereof opposite its shaft-receiving opening, an elongated rigid member, pin-and-slot means securing said applicator blade and said rigid member in face engagement and providing also for guided translatory movement of said blade with respect to said rigid member from and to a normal retracted position thereon in which its grip jaws, upon gripping a ring, are adapted to maintain same in an "assembly-ready" position in which it is

disposed relatively rearwardly from the end of the rigid member corresponding to the grip-jaw end of said applicator blade, means provided on said end of the rigid member for engaging the shaft external surface during the course of the translatory movement of the applicator blade from its aforesaid retracted position through a ring-installing stroke, and hand-manipulable force-multiplying means operative between the rigid member and the end portion of the applicator blade remote from its said grip jaw end for translating said applicator blade from its aforesaid retracted position throughout its said ring-installing stroke, the arrangement being such that during the final part of said translatory movement the reaction on said rigid member of the force applied to the applicator blade to install the ring in its shaft groove is taken by said shaft-surfacing-engaging means.

Embodiments of the invention will now be more particularly described with reference to the accompanying drawings, in which:—

Fig. 1 shows a side elevational view of an applicator device with parts shown in section;

Fig. 2 shows an inverted plan view of the applicator device shown in Fig. 1;

Fig. 3 shows a sectional view taken along line 3—3 of Fig. 1;

Fig. 4 shows a fragmentary perspective view of the applicator device shown in Figs. 1 to 3 and illustrates both the action of the applicator-blade component or element thereof in applying a push force on a retaining ring in the plane of the groove in which it is to seat, and the action of the hook formation provided at the end of the bar member and which is shown as resting against the shaft, in engendering or setting up a force in opposition to the aforesaid push force acting on said ring;

Fig. 5 shows a plan view of a retaining ring, for the assembly of which in its groove the applicator device shown in the preceding views is suitable;

Fig. 6 shows a fragmentary plan view of a

modified form of applicator device as seen from its underside;

Fig. 7 shows a view corresponding to Fig. 4, illustrating the action of the modified applicator device shown in Fig. 6 in assembling a ring in its groove.

Referring to the drawings, reference numeral 10 (Fig. 5) illustrates a retaining ring for which a hand-manipulable applicator embodying the present invention is suitable. The ring 10 comprises two circumferentially spaced-apart and diametrically opposed segments or grip jaws 10a, 10b connected at their corresponding upper ends by a flexible bending arm 10c extending between the segments. The inner and outer edges of the opposed segments are concentric, and the inner edges extend along opposed arcs of a circle whose diameter is somewhat less than that of the circle of the bottom wall of the groove in which the ring is to be assembled. It is a further feature of the illustrated retaining ring that the free ends of its ring segments 10a, 10b are spaced apart by such an amount as defines a ring gap whose width is substantially less than the diameter of the circle of the shaft-groove bottom. Thus, to assemble the ring, the segments must be spread apart by an amount such that the spacing between the free ends at least equals the diameter of the circle of the groove bottoms. This requisite spreading of the ring segments is taken into account and provided for in the design and manner of connection of the flexible bending arms 10c to the ring segments 10a, 10b. The outer edge of the flexible bending arm extends along an arc of the same circle as that containing the arcuate outer edges of the ring segments 10a, 10b and hence the ring is basically one having a circular outer edge or perimeter.

As earlier stated herein retaining rings of the structural form thereof shown in Fig. 5 in the sizes thereof for assembly in the grooves of shafts of 5/16" diameter and larger, because of their relatively great thickness-to-diameter ratio required to endow them with the extra holding strength which they must possess because of their relatively small arcuate length, are difficult to assemble and in the case of the very large ring sizes, are almost impossible of assembly in their shaft grooves, by means of the known hand applicator of the type widely used to assemble the conventional rings in a shaft groove by applying a straight push force to said ring in the plane of the groove until the ring seats against and grips with spring pressure to the groove bottom. To minimize if not wholly solve this problem, the applicator combines (1) an applicator blade generally designated 12 mounted for translatable movement in the direction of its length; (2) an elongated rigid member 42 mounting said applicator blade for such movement and having at its one end towards which

the applicator blade is moved in assembling a retaining ring in its shaft groove, a hook formation designated 44 which opens through a side edge thereof, the mouth of the hook being somewhat greater than the diameter of the shaft and the area of the hook opening being also greater than that of the shaft, whereby the hook-ended member may be hooked to the shaft and rested against the arcuate side portion of the shaft which is diametrically opposed to that side portion of the shaft towards which the applicator blade is actuated when partaking of its working or ring-assembling stroke, thus engendering a force acting in opposition to that required to effect the ring-assembling stroke; and (3) hand-manipulable means generally designated 52 for actuating the applicator blade throughout its working stroke which incorporates a force-multiplying lever system effective to greatly reduce the hand effort required to be expended by the operator in assembling a ring in its groove.

More particularly, the applicator blade 12 comprises a shank portion 14, from one end of which extend two elongated arms 16a, 16b terminating in coplanar arcuate jaws 18a, 18b having forward working edges 20a, 20b which extend along an arc of a circle and are preferably counter-recessed as shown, whereby the edges provide both ring-gripping edge portions 22a, 22b and ring-edge backing flanges 24a, 24b.

It will be appreciated that by forming the gripping edges of the jaws 18a, 18b so that they extend along arcs of a common circle of somewhat lesser diameter than that of the outer-edge diameter of a ring to be assembled, taken with the fact that said arms 16a, 16b are slightly resilient, as provides for limited movement of the jaws away from and towards one another in their own plane, the jaws can be designed so as to be capable of exerting a resilient gripping action on a ring to be assembled of sufficient magnitude to hold it to the applicator during the course of each ring-assembling operation.

The applicator blade 12 is mounted in face engagement with the under face of the hook member 42, being operatively secured thereto by two shoulder screws 26a, 26b and flat washers 28a, 28b, but being also translatable in lengthwise direction relative to said hook member within the limits of an elongated slot 30 provided in the shank portion 14 of the blade and through which the shanks of said shoulder screws pass, by the afore-mentioned hand-manipulable means 52.

The hand-manipulable means 52 comprises a fixed handle arm 54 which is shown to be secured to the end of the hook member 42 opposite that provided with the aforesaid hook formation 44 illustratively by a screw 56, thus to extend in longitudinal continuation of the hook member, and a companion hand-

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depressible handle arm 58, which latter preferably comprises one arm of a bellcrank lever generally designated 60 mounted to pivot on a pin 62 supported in relatively raised position above said hook member in a U-shaped support member 64 (shown in part section in Fig. 3), which is secured against the relatively upper face of the hook member by the aforementioned shoulder screw 26b.

The other arm 66 of the bellcrank 60 which it will be observed has substantially short length as compared to that of the handle arm 58 thereof, extends relatively downwardly from the pivot pin 62 and mounts at its free end a fixed pin 68 which freely engages in an elongated slot (not shown) provided in an upwardly bent tab 32 formed integral with the end of the applicator blade 12 opposite the end thereof providing the aforementioned gripping jaws 18a, 18b the tab operating in a cut-out 48 provided in the rearward end of the hook member 42.

Depression of the depressible long handle arm 58 is resisted by a coil spring 70 extending between and operatively connected at its opposite ends to the shorter arm 66 of said the bellcrank and the fixed handle arm 54, generally as shown in Fig. 1. Said coil spring 70 also functions to return the handle arm 58 and thereby the applicator blade to their respective retracted or "at rest" positions upon completion of each ring-assembling operation.

When the applicator blade 12 is in its aforesaid retracted position in which it is generally shown in Fig. 2, its arcuate gripping jaws 18a, 18b are spaced relatively to the rear of the relatively rearward edge 46a of the hook opening 46 a distance as disposes a retaining ring then gripped by said gripping jaws and thus in the "assembly-ready" position also somewhat rearwardly of said rearward edge 46a of the hook opening. By such initial relationship of parts, the hook member 42 may be hookably engaged about a shaft without interference from (or interfering with) a ring to be assembled then held in the assembly-ready position by said applicator blade gripping jaws.

Now referring to Fig. 4 which generally indicates a retaining ring of the form thereof shown in Fig. 5 in the course of being assembled in the shaft groove Sg by movement of the applicator blade towards said shaft and in the plane of said groove, such movement occurring in response to the force F_1 applied in the direction of the arrow associated with said aforesaid designation, it will be observed that by engagement of its hook formation 44 against the opposite side portion of the shaft towards which the applicator blade 12 is moving, the hook member is also acting to engender a force F_2 in opposition to the aforesaid force F_1 .

It will be further observed that because

the effort which the operator applies to the handle arms 54 and 58 in assembling a ring in its groove is inherently directed to the outer end portions of said handle arms, and also because the handle arm 58 constitutes the long arm of a bellcrank lever whose short arm 66 acts directly on the applicator blade, the described arrangement provides the necessary leverage to greatly multiply the hand effort which the operator is required to exert to push the applicator blade throughout its working stroke.

While in Fig. 4 the retaining ring being assembled is shown as being gripped along the outer edge of only the flexible bending arm 10c which connects its ring segments 10a, 10b, as is desirable to keep the effective width of the applicator blade as small as possible and also to minimize the amount of spreading of its arcuate jaws 18a, 18b necessary to ring assembly, it is to be understood that the applicator blade may be formed with the greater width as in turn enables the jaws 18a, 18b to have the greater arcuate length required to effectively grip not only the large sizes of retaining rings but also conventional C rings, E rings and like open rings, thus extending the range of utility of an applicator as herein proposed.

Fig. 6 illustratively depicts the forward part of an applicator 80 whose applicator blade 82 is formed wider than the applicator blade 12 according to Fig. 2, for example, as in turn enables the arcuate gripping jaws 88a, 88b thereof to be designed with the arcuate length as together encompass and effectively grip a large-size retaining ring as shown in Fig. 5 throughout an approximately 180° arc of its effective outer edge (see Fig. 7), and in similar manner to grip the more conventional open rings, C-form and E-form rings throughout approximately 180° of their outer edges.

In the foregoing, brief mention is made of the fact that the applicator blade, when actuated throughout its relatively forward or working stroke, operates to assemble various sizes and types of retaining rings gripped by its arcuate jaws, without any statement in explanation of the manner and procedure required for these rings to reach the applicator so as to be gripped by the applicator blade jaws. The explanation is that, while conceivably said rings could be placed, one at a time, by hand in the applicator in position to be gripped by the arcuate blade, it is contemplated that an applicator as disclosed should be capable, when co-operated with a dispenser, of picking off rings to be assembled one at a time, from a supply thereof maintained in stack formation on a magazine rail forming a part of the dispenser and thereupon of transporting the so picked-off rings held in the applicator to the shaft or spindle in whose groove ring assembly is called for.



WHAT WE CLAIM IS:—

1. An applicator for installing external spring retaining rings of the type designed for radial insertion in to a shaft groove, the applicator comprising an applicator blade terminating at one end in co-planar resiliently interconnected grip jaws adapted to grip between them a ring to be installed, said jaws gripping the ring along an arcuate outer-edge portion thereof opposite its shaft-receiving opening, an elongated rigid member, pin-and-slot means securing said applicator blade and said rigid member in face engagement and providing also for guided translatory movement of said blade with respect to said rigid member from and to a normal retracted position thereon in which its grip jaws, upon gripping a ring, are adapted to maintain same in an "assembly-ready" position in which it is disposed relatively rearwardly from the end of the rigid member corresponding to the grip-jaw end of said applicator blade, means provided on said end of the rigid member for engaging the shaft external surface during the course of the translatory movement of the applicator blade from its aforesaid retracted position through a ring-installing stroke, and hand-manipulable force-multiplying means operative between the rigid member and the end portion of the applicator blade remote from its said grip jaw end for translating said applicator blade from its aforesaid retracted position throughout its said ring-installing stroke, the arrangement being such that during the final part of said translatory movement the reaction on said rigid member of the force applied to the applicator blade to install the ring in its shaft groove is taken by said shaft-surface-engaging means.
2. An applicator as claimed in Claim 1, wherein said hand-manipulable force-multiplying means comprises a bellcrank-lever system effective to greatly multiply the hand force which the operator applies to translate the applicator blade throughout its ring-installing stroke.

3. An applicator as claimed in either Claim 1 or Claim 2, wherein said hand-manipulable force-multiplying means comprises an elongate handle immovably affixed to the relatively rearward end of said rigid member and extending in longitudinal continuation thereof, and a depressible handle being the longer arm of a bellcrank lever mounted for bodily rotation about a pivot supported in relatively raised position from the rearward end of said rigid member and whose shorter arm extends to and is pin-and-slot connected to the relatively rearward end of said applicator blade, said handle construction and arrangement providing leverage advantage to substantially multiply the hand force which the operator applies in translating the applicator blade throughout its ring-installing stroke.
4. An applicator as claimed in Claim 3, and wherein spring means operative between said shorter arm of the bellcrank lever and said fixed handle effects return of the applicator blade to its normal retracted position upon release of hand pressure on said handle.
5. An applicator as claimed in any one of the preceding claims, wherein the means on the rigid member for taking positive hold on the shaft external surface comprises a relatively rearwardly facing edge in part defining the opening of a sidewardly opening hook formation in which said rigid member terminates.
6. An applicator for installing external spring retaining rings of the type designed for radial insertion in to their shaft groove, substantially as herein described with reference to the accompanying drawings.

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