Jan. 15, 1963 H. ERDMANN 3,073,014

RETAINING RING ASSEMBLY TOOLS

Filed April 1, 1960 3 Sheets-Sheet 1

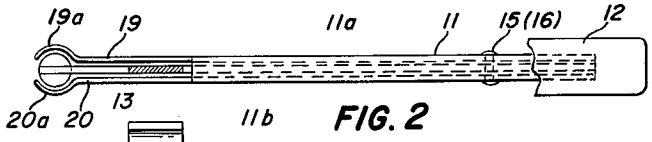


FIG. 2

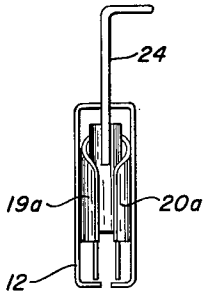


FIG. 3

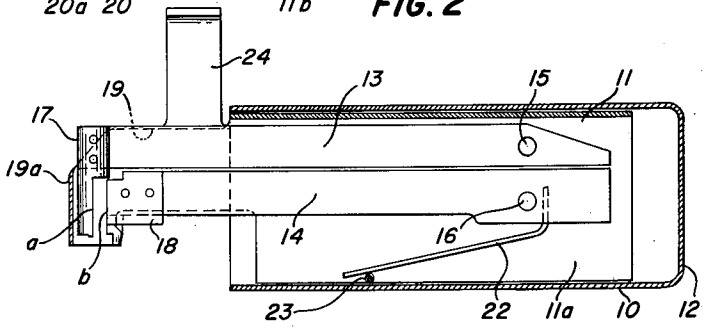


FIG. 1

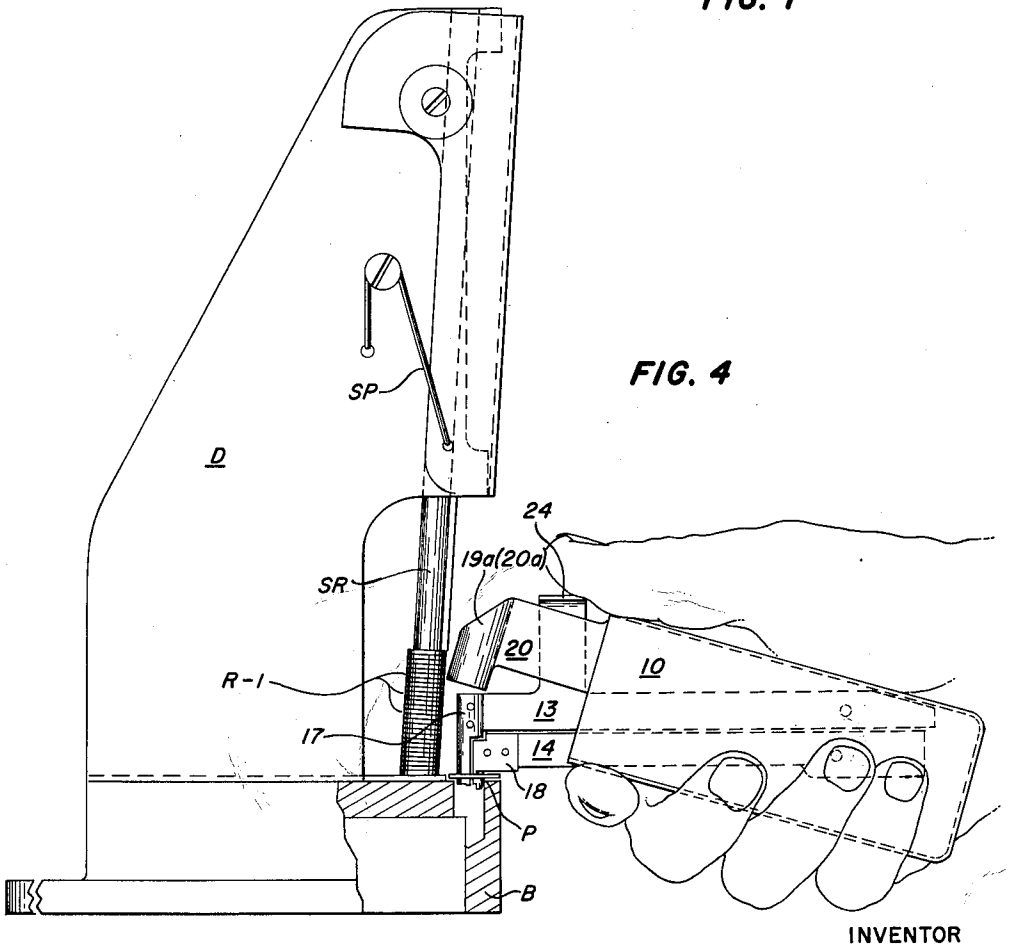


FIG. 4

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RETAINING RING ASSEMBLY TOOLS

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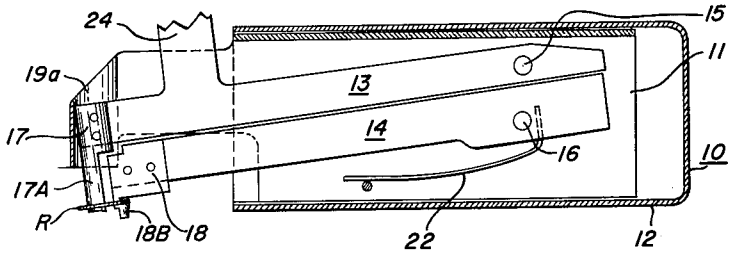


FIG. 5

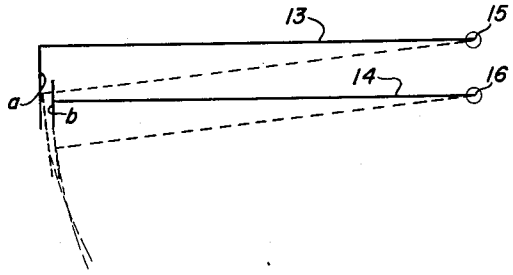


FIG. 8

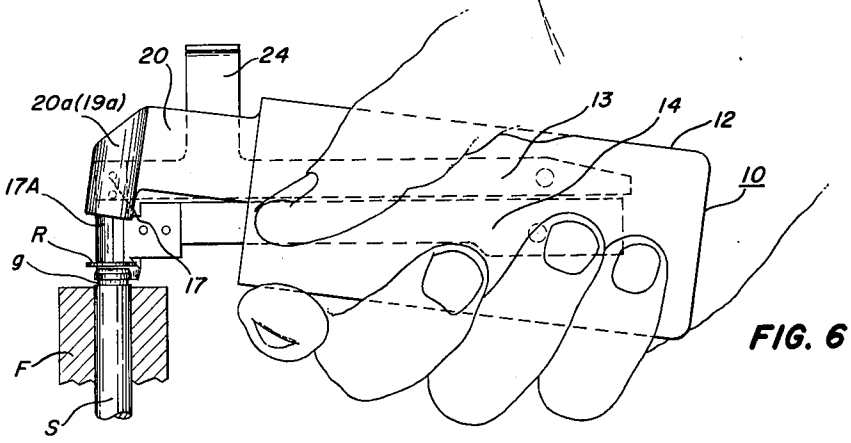


FIG. 6

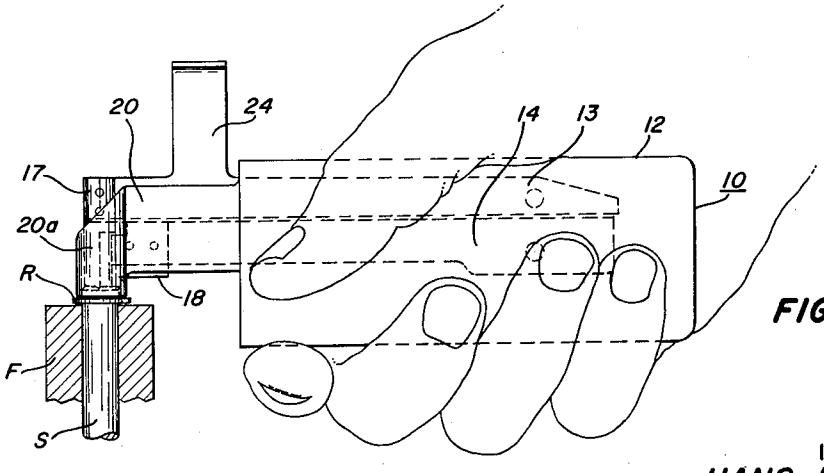


FIG. 7

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RETAINING RING ASSEMBLY TOOLS

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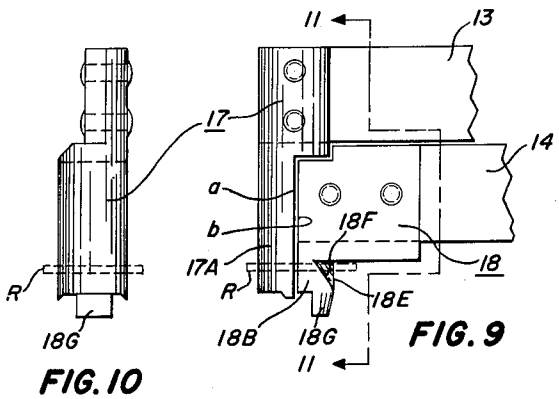


FIG. 9

FIG. 10

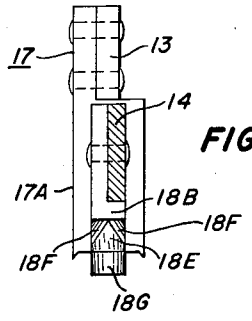


FIG. 11

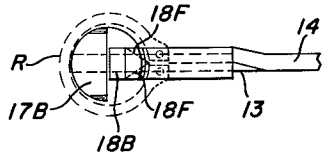


FIG. 12

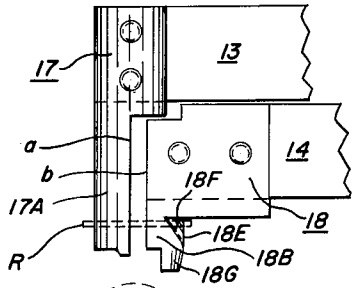


FIG. 13

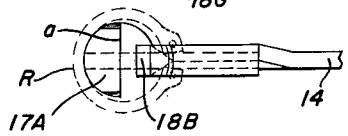


FIG. 14

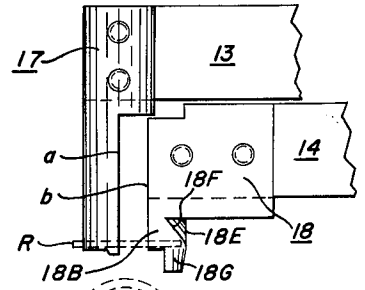


FIG. 15

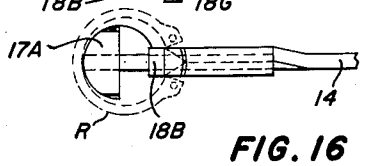


FIG. 16

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3,073,014

RETAINING RING ASSEMBLY TOOLS

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Filed Apr. 1, 1960, Ser. No. 19,207
16 Claims. (Cl. 29—229)

This invention relates to improvements in retaining-ring assembly tools and is more particularly directed to an improved hand tool of the type generally disclosed and claimed in my prior applications Serial No. 817,668, filed June 2, 1959, now Pat. No. 3,015,882, and Serial No. 835,222, filed August 21, 1959, now Pat. No. 3,012,313, for assembling so-called split spring retaining rings on grooved shafts, pins and like cylindrical workpieces.

While effective for their intended purpose, the tools of my prior applications aforesaid are relatively complicated both as to their structure and respective modes of operation. In explanation, the prior tools operate on the principle of spreading a split ring to be assembled from its free or unstressed diameter to one slightly exceeding the diameter of the shaft in whose groove it is to be assembled by pushing the ring axially along a tapered spreading mandrel by force exerted against a face thereof, such axial movement of course being in addition to the further movement required to move the spread ring axially along the shaft to the plane of its groove, with the result that the prior tools are required to have not only an accurately configured and dimensioned spreading mandrel or head but also their design must be such as to provide a substantial length of working stroke of the spreading head and/or the related push head.

A tool according to my earlier filed application Serial No. 817,668, now Pat. No. 3,015,882, has also been found to be somewhat slow and awkward in its operation, since to be capable of picking up a ring to be assembled from the conventional dispenser therefor and thereupon of assembling the ring on its usually upright shaft from above, it was necessary to first invert and then upright the tool, all preliminary to the actual ring assembly operation. Although the assembly tool of my aforesaid later filed application Serial No. 835,222, now Pat. No. 3,012,313, overcame this requirement of preliminary tool inversion and uprighting, the later devised tool was still open to the criticism sometimes leveled at the basic tool which it sought to improve that the rings to be assembled could be picked up by said tool only if and when physically positioned between the so-called push and spreading head of said tool, thus necessitating room both above and below the dispenser table or shelf to accommodate said heads in their spaced ring pick-up position.

Stated broadly, a major object of the present invention is the provision of a hand tool for assembling split spring retaining rings on shafts and similar cylindrical workpieces, which is simpler and less expensive to manufacture than the tools serving similar function according to my prior applications Serial Nos. 817,668 and 835,222, now Patent Nos. 3,015,882 and 3,012,313 respectively, and which further has the advantage that it may be more easily operated as well as being capable of assembling rings in grooves which are spaced a greater distance from the ends of said workpieces than the tools of my applications aforesaid.

Another important object of this invention is the provision of an effective hand tool for assembling split spring retaining rings on shafts and similar cylindrical workpieces which does away not only with the tapered

spreading head but also with the requirement of substantially shifting the ring in axial direction as a condition to its being spread, as characterizes the tools of my aforesaid prior applications, thus simplifying both the operation and the mechanical design of the tool, the latter in part by substantially lessening the working stroke of tool parts.

Another practical object of the invention is the provision of an improved hand tool as aforesaid which is capable of simply and effectively assembling split spring retaining rings in the grooves of upright shafts and similar grooved cylindrical workpieces, without any requirement on the part of the operator to perform the cumbersome steps of first inverting the tool to grasp each ring to be assembled and thereupon of uprighting it to apply the ring to the upper end of said workpieces, as characterizes a tool according to my prior application Serial No. 817,668 aforesaid.

Yet another object of the invention is the provision of an improved hand tool for assembling split open retaining rings in the grooves of shafts and similar grooved cylindrical workpieces which operates on the principle of the rings to be assembled being spread from within by effective diametrical separating movement of two relatively separable mandrel parts whose separating and coming-together movements are subject to positive control by the tool operator.

A more detailed object of the invention is the provision of an effective hand tool for assembling split spring retaining rings as aforesaid by the spreading action of complemental, spreadable mandrel parts mounted for swinging movement in unison along arcuate paths which mutually intersect and whose ring spreading and non-spreading positions thus depend on simple swinging movement imparted to said mandrel parts along such paths.

Yet another object of the invention is the provision of an improved tool as last aforesaid, wherein said mandrel parts and their mounting means are so constructed and arranged that when swung relatively downwardly in unison throughout a predetermined arc the mandrel parts are closely related to a degree that they may readily enter the ring opening and secure to said ring and that when they are swung upwardly or in the return direction they separate from one another and in so doing exert radial outward spreading force on the ring as effects controlled spreading thereof.

A still further object of the invention is the provision of an improved hand tool for spreading split retaining rings employing spreadable parts operative to spread the ring from within by their relative radial outward movement, and wherein one of said parts is constructed and arranged so as to be capable of knifing into the gap between the split or open ends of the ring with a wedging action when partaking of its relative radial outward movement.

Another object of the invention is the provision of an improved pliers-type hand tool of the last above character wherein said one part is movable into the ring gap in successive stages, thus providing a multi-stage ring spreading action.

Yet another object of the invention is the provision of an improved hand tool as last aforesaid, wherein the first stage of ring spreading is effectively utilized in enabling the tool to pick up the ring with which it is cooperated and the later stage or stages of such spreading effects spreading of the ring the amount permitting it to be readily shifted over the end of its shaft.

Still another object of the invention is the provision of a hand tool for assembling split spring retaining rings on shafts and like cylindrical workpieces incorporating an effectively radially-spreadable mandrel capable in its

non-spread relation of being readily insertable into the opening of a ring to be assembled and in its spread relation of spreading the ring from within, combined with a push means effective to exert push on the face of such a spread ring as provides for its axial movement over and thence along the end of the shaft on which it is being assembled to the plane of its groove.

A further more specific object of the invention is the provision of a pliers-type hand tool as last aforesaid, wherein the mandrel is biased by the design of the tool towards its spread relation thereby to relieve the operator to some degree of applying spreading force to the ring.

Still another object of the invention is the provision of a hand tool for assembling split spring retaining rings in the grooves of shafts and similar cylindrical workpieces whose construction and arrangement is such that it incorporates tool-to-ring guiding means, ring pick-up means and ring spreading means combined in a simple mandrel-type tool head.

A final object of the present invention is the provision of a hand tool for assembling split spring retaining rings on grooved shafts and the like which is economical to manufacture, simple and efficient to use, and yet performs its ring pick-up, spreading and assembling functions in more highly satisfactory manner than heretofore achieved.

The above and other objects and advantages of the improved hand tool for assembling split spring retaining rings according to the present invention will appear from the following detailed description thereof, taken with the following illustrative drawings showing preferred but not necessarily the only forms which such a tool may take, wherein:

FIG. 1 is a side elevational view, partly in section, of the pliers-type tool of this invention in the normal or rest position in which the complemental tip members constituting the spreading mandrel or head are in a fully spread condition;

FIG. 2 is a top plan view thereof, also partly in section;

FIG. 3 is a front end elevational view thereof;

FIG. 4 is a side elevational view of the herein tool associated with a conventional ring dispenser which illustrates the manner of operating the aforesaid tool in picking up a ring to be assembled seated in the nest or pocket of the dispenser;

FIG. 5 is a view generally similar to FIG. 4 which illustrates the action of the tool and relation assumed by the tool parts in gripping the ring following its being picked up as in FIG. 4;

FIG. 6 illustrates the tool preliminarily engaged with the workpiece preparatory to the ring applying operation;

FIG. 7 shows the tool as having just completed the ring applying or assembling operation;

FIG. 8 is a motion diagram which graphically depicts the principle of the separating and receding motion of the complemental tip members constituting the spreading mandrel;

FIG. 9 is an enlarged side elevational framentary view of the ring spreading mandrel, with the complemental parts thereof shown in their fully closed position corresponding to that of FIG. 4; with FIG. 10 being a front end view and FIG. 11 a vertical section taken on line 11 of FIG. 9;

FIG. 12 is a bottom view of the closed mandrel as shown in FIG. 9, which illustrates its ready insertability in the opening of a split retaining ring being picked up thereby, which ring is shown in broken lines;

FIGS. 13 and 14 are views corresponding to the aforesaid FIGS. 9 and 12, which illustrate the complemental mandrel parts partially spread as in FIG. 5; and

FIGS. 15 and 16 are further views corresponding to FIGS. 9 and 12, which illustrate the complemental mandrel parts in the fully spread relation.

Referring to the drawings in detail, a tool according to the present invention basically comprises a grip handle **10** preferably consisting of an elongated, rectangular hollow frame **11** made of sheet metal shaped to inverted U-section and thus having spaced side walls **11***a*, **11***b* (FIG. 2) and which is encased in an open-front cover or sheath **12**; upper and lower parallel forwardly extending lever arms **13**, **14** operative in the space between said frame side walls whose rearward ends **13***a*, **14***a* are pivoted to said frame by vertically spaced pins **15**, **16** and whose forward working ends extend well beyond the forward end of the handle and terminate in right-angularly disposed and complemental depending tip members generally designated **17**, **18**, later described in detail; and ring-push-means comprising forwardly reaching springy arms **19**, **20** integral with the frame side walls **11***a*, **11***b* and terminating in depending semi-cylindrical extensions **19***a*, **20***a* together forming a generally tubular push head, the diameter of which is slightly larger than the inner diameter of the ring to be assembled and approximately equal to the diameter of the shaft in whose groove the ring is to be seated, thus being operative to push a ring with which it has face engagement axially along said shaft.

As best seen in FIGS. 1 and 5, the upper and lower arms **13**, **14** which have bar section and preferably extend in close edge-to-edge relation so as to be mutually operable one by the other are normally urged to a position in which they are "square" with the handle **10** (as in FIG. 1), i.e. their longitudinal center lines extend parallel with that of the horizontal center line of the handle and hence at right angles to the vertical line of their pivots **15**, **16**, by a spring **22** shown to be reactive between a fixed frame-mounted pin **23** and the end of the lower lever arm **14** which extends to the rear of its pivoting pin **16**. However, the lever arms are swingable in unison against the force of said spring to a position in which their forward working ends incline downwardly from the handle (as in FIG. 5), as by means of a finger piece **24** shown to project upwardly from the forward end of the upper lever arm **13**. During the course of their movement from and to their FIG. 1 position, the lever arms move in a common plane which is intermediate that of the fixed arms **19**, **20** carrying the aforesaid push head.

According to the invention, the aforementioned ring spreading mandrel constituted by the complemental tip members **17**, **18** is specially constructed so as to be capable of performing the manifold functions of guiding the tool to a ring to be assembled seated in the ring nest or pocket of a ring dispenser, for example, thereupon of gripping the ring along its inner and gap edges so that it can be lifted from the dispenser and transported by the tool to the shaft in whose groove it is to be assembled, and finally of spreading the ring to the diameter of said shaft as permits its ready application to the shaft by the push head. More in detail, the tip member **17** provided on the upper lever arm **13**, which has predetermined greater length than the lower companion arm **14**, may be formed initially cylindrical throughout its length, either as an integral part of the forward end of said arm **13** or as a separate part affixed to said end by welding or riveting, and has diameter slightly less than that of the inner circle of the rings being assembled. However, its lower end portion which is disposed forwardly of the forward free end of the related lever arm is cut away or relieved so as to have semi-cylindrical formation as at **17**A and is disposed so as to present its transversely extending plane face *a* to the end of said related lever arm.

As is best shown in FIGS. 9 and 11, for example, the complemental tip member **18** carried by the other lever arm **14** preferably has modified square plate configuration and section, being so arranged that its forward vertical edge face *b* aligns with and is adapted to enter the cut-out of the aforesaid tip member **17** and, for a reason to be explained, to move toward and away from said cut-out face *a* with relatively downward and upward swinging movement of the lever arms with respect to the tool handle **10**. Illustratively, the tip member **18** further in-

cludes a combination spreader and guide blade **18B** which depends downwardly from its front lower corner, said blade having generally the same thickness as that of the tip member proper except as hereinafter noted.

As is seen in FIGS. 9, 13 and 15, the upper section or portion of said blade **18B** (which constitutes the spreader blade proper) is disposed at the same level as the lower end of the tip member **17**, and its rearward working edge **18E** which preferably has curvature corresponding to that of tip end **17A** of the complemental tip member **17** is further provided in its side corners with a pair of upwardly converging notches which deepen as they extend upwardly, thus to define double-wedge surfaces **18F** which incline oppositely toward one another and have progressively greater lateral extent towards the upper line of said blade. In contrast, the rearward edge of the lower section or half of said blade **18B** (hereinafter designated **18G**) which has generaly similar curvature is sloped forwardly or towards the tip member **17** by a small angle.

In a properly designed tool as aforesaid, the mandrel constituted by said complemental tip members **17, 18** will have as its greatest effective diameter, i.e. a front-to-rear diameter extending to and terminating rearwardly at said rearward edge **18E**, one such diameter which provides the desired maximum spreading of the ring to be assembled and will have as its minimum diameter one such diameter which is slightly less than that of the inner circle of the rings to be assembled. Thus, as the mandrel-forming tip members **17** and **18** are brought together so that their adjacent faces *a* and *b* abut or substantially abut one another, the lower end of the mandrel can be readily inserted into the opening of a ring positioned to receive same (as in a dispenser, FIG. 4), being guided in such movement by the guide portion **18G** of the spreader blade **18B** whose formation is such as to provide effective tool-to-ring guidance. Conversely, as the tip members are spread apart their maximum amount (as in FIGS. 1, 7 and 15, 16), the ring being operated on by said tip members will be spread to a diameter slightly larger than that of the grooved shaft on which it is to be assembled.

The requisite translatory movement providing for closing and separating motion of the mandrel-forming tip members **17** and **18** is simply achieved in the herein tool by the aforesaid mounting and disposition of the lever arms **13, 14** and tip members as well. That is to say, consequent to the vertical spacing of the pivots **15, 16**, the greater length of the upper lever arm **13** as compared to that of the lower lever arm **14**, and the depending right-angular disposition of the tip members with respect to said arms, the normally spaced, adjacent faces *a, b* of the tip members will approach and finally abut one another as said lever arms are swung downwardly relative to the handle **10** from their FIG. 1 to their FIG. 4 positions, for example, consequent to said faces moving in arcuate, mutually intersecting paths as is graphically illustrated in FIG. 8. It follows, of course, that two diametrically opposed points on the front-to-rear diameter of said mandrel, i.e. the diameter of the circle of the tip member **17** continuing through the working edge **18E** of the complemental tip members **18**, will move together, thus in effect decreasing said diameter an amount permitting the insertion of the lower free end of the mandrel into the opening of a ring to be assembled. Conversely, as said lever arms **13, 14** swing or are swung back to their initial or FIG. 1 position with respect to the handle **10**, the faces *a, b* recede from one another, as effects spreading of the ring positioned thereon to substantially the diameter of the shaft on which it is to be applied.

While the operation of the above described and illustrated tool will be obvious to those skilled in the art, it will be briefly explained as follows: Assuming the tool is in its normal position shown in FIG. 1, in which the lever arms **13, 14** are horizontal with the handle **10** and the mandrel-forming tip members **17, 18** are spread the maximum permissible amount, the operator, upon picking up the tool and bringing its forward working or mandrel end directly over a ring R disposed in the assembly-ready position in the nest or pocket P of a dispenser D as generally illustrated in FIG. 4, depresses the finger piece **24** thereby swinging said lever arms **13, 14** downwardly with respect to the handle until the tip-member faces *a* and *b* abut or substantially abut one another. In such extreme arm position, the mandrel is disposed fully below the part tubular push head **19***a*, **20***a* and, equally important, it is in effect closed to its smallest possible diameter, which as above explained is such as to enable ready insertion of its lower end into the opening of ring R, which inserting movement is facilitated by the tapered guide extension **18G** of the spreader blade **18B**.

The operator then proceeds to insert the free or lower end of the closed mandrel to the maximum possible depth (see FIGS. 9 and 13) into the ring opening, of course being careful to orient the tool with respect to the ring so that working edge **18E** is aligned with the narrow-width gap characterizing split or nearly closed spring retaining rings, such being best illustrated in FIG. 12. Thereupon the operator releases the finger piece **24**, such resulting in the lever arms **13, 14** tending to and in fact partially returning to their initial or FIG. 1 position under bias of spring **22** as effects partial spreading of the tip members **17, 18**. Consequent thereto, the spreader blade **18B** knifes into the gap a limited distance but one which is nonetheless sufficient to insure the mandrel firmly gripping or grasping the ring R at diametrically spaced points along its inner and gap edges, and further to effect a first-stage spreading of said ring. The degree of such ring gripping and spreading will of course depend on the force exertable by the spring **24**, but preferably this is not sufficient as of itself to effect maximum ring spreading. FIGS. 5, 13 and 14 generally illustrate the relationship assumed by the tool parts following release of the finger piece **24** as aforesaid.

With the ring now firmly held by the tool, the latter may be used to carry it to the grooved shaft or other cylindrical workpiece on which it is to be assembled, such as the shaft S held in upright position in a fixture F (FIGS. 6 and 7). To finally assemble the ring, the tool is engaged with the shaft as shown in FIG. 6 and at this point it is noted that the forward vertical edge of the guide portion **18G** of the spreading blade **18B** is cut back so as not to interfere with the mandrel aligning with said shaft and at the same time to aid in tool-to-shaft engagement. Upon proper tool-on-shaft engagement having been obtained, the operator then exerts firm downward pressure on the handle which just previously has assumed an upwardly-forwardly inclined attitude (FIG. 6). As the result thereof, the handle is brought back into horizontal parallelism with the lever arms **13, 14**, the mandrel is spread the maximum permissible amount as effects second- or final-stage spreading of the ring (see FIGS. 15 and 16) during the course of which the ring first tends to hug the spreader blade **18B** because of the upward inclination of the double-wedge faces **18F**, and, finally, the push head **19***a*, **20***a*, which upon arms **13, 14** and handle **12** being brought into parallelism as aforesaid is coaxial with the now fully spread mandrel, progressively engages on the upper face of the ring, "skins" it from the mandrel, and in its final movement pushes the ring over and along the shaft end to the plane of the groove *g*. Upon arriving at the groove, the ring snaps into the groove and the tool is now withdrawn from the shaft, fully conditioned for the next ring assembly operation.

In connection with the aforementioned ring dispenser D, such illustratively comprises a base B mounting a pivotally hung stack rod SR biased by a spring SP to a position in which it normally disposes the supply of rings R–1 mounted thereon above and in substantially vertical alignment with said ring nest or pocket P. However, due to its aforesaid mounting, the stack rod is free to swing

rearwardly when its stack of rings is engaged by the tool push head **19***a*, **20***a* moving against same (as in FIG. 4), thus to make the tool mandrel and ring R seated in the pocket P mutually accessible to one another. It is observed that the tool-to-ring guide blade **18**G also serves to align the tool with the ring pocket by its ability to engage the wall thereof and thereby find its proper position above the pocket.

Without further analysis, it will be appreciated that the herein hand tool as described and illustrated achieves the stated objectives therefor, i.e. a tool of simple, inexpensive construction which is easy to operate, has a short working stroke, requires no inversion, etc. 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 drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A hand tool for gripping split spring retaining rings from within the opening thereof and thereupon assembling said rings on grooved shafts and like cylindrical workpieces comprising, in combination, an elongated handle member, complemental and diametrically translatable members together forming a ring gripping and spreading mandrel, parallel arm means pivotally connected to said handle member adjacent their rearward ends and extending forwardly from said handle and mounting said tip members at their relatively forward ends in generally right-angular and mandrel-forming relationship with respect to said handle member, the pivotal connections of said arm means to handle member permitting limited relative rotational movement of the handle member with respect to said arm means, the length of said arm means and the locations of their pivotal connections to the handle member being such that rotational movement of the arm means in unison with respect to the handle member in one direction effects swinging movement of the tip members in mutually intersecting arcs as effects translatory movement of said mandrel-forming tip members towards one another by an amount such that the mandrel has effective diameter slightly less than that of the opening of a ring to be assembled and that subsequent rotational movement of the handle member in the opposite direction effects swinging movement of the tip members in mutually diverging paths as effects translatory movement of said mandrel-forming tip members away from one another by an amount such that the mandrel has effective diameter corresponding substantially to that of the shaft on which said ring is to be assembled, and mandrel-telescoping means fixedly mounted on a forward extension of said handle member in general axial alignment with said mandrel and being adapted to telescope over said mandrel responsive to rotational movement of said handle with respect to the arm means as aforesaid, thereby to push a ring which has been gripped and spread by said mandrel axially therefrom and thence over an end of the shaft to the plane of the ring-seating groove thereof.

2. A hand tool according to claim 1, wherein one of said tip members has double-wedge section defining a narrowing edge which is adapted in the movement of the tip members to their relative positions of maximum separation to knife into the gap of a ring which said mandrel has grippingly engaged.

3. A hand tool according to claim 1, wherein one tip member has substantially semi-cylindrical section and diameter slightly less than that of said ring opening.

4. A hand tool according to claim 1, wherein one tip member has substantially semi-circular section and diameter slightly less than that of said ring opening and the complemental tip member has double-wedge section defining a narrowing edge which is adapted during the course of movement of the tip members to their relative positions of maximum separation to knife into the gap of a ring which said mandrel has grippingly engaged.

5. A hand tool according to claim 1, wherein said handle mounts means for biasing said complemental tip members toward their relative positions of maximum separation.

6. A hand tool according to claim 5, wherein said last means includes a spring capable of providing a biasing force sufficient to effect a first-stage movement of said tip members from their relative positions of minimum spacing toward their relative positions of maximum spacing as aforesaid.

7. A hand tool according to claim 1, wherein one of said tip members incorporates tool-to-ring guide means depending relatively downwardly therefrom and being shaped to facilitate initial engagement of the mandrel with the ring to be assembled.

8. A hand tool according to claim 1, wherein said arm means mounts a finger piece projecting therefrom forwardly of the handle member for imparting rotational movement of said arm means in said one direction with respect to the handle member.

9. A hand tool for gripping split retaining rings from within the opening thereof and thereupon assembling said rings on grooved shafts and like cylindrical workpieces comprising, in combination, a handle member, a pair of parallel lever arms disposed in overlying relation with their working ends extending forwardly from the handle and being pivotally connected at their corresponding rearward ends to the rearward end of the handle member at relatively vertically spaced points thereof for limited rotational movement with respect to said handle member, the working ends of the said lever arms carrying depending complemental tip members disposed at substantially right angles to said arms and which together form a two-part closable and spreadable ring gripping and spreading mandrel having, when the tip members are in their closed position, an effective diameter which is slightly less than that of the ring opening and, when the tip members are spread a predetermined permissible amount, an effective diameter which is slightly greater than that of said shaft, the length of said arms and the points of their pivotal connection to the handle member being so located that rotational movement of the arms in unison and in one direction relatively to the handle member effects translatory movement of said tip members to their closed position in which the mandrel has minimum effective diameter which is slightly less than that of the opening of the ring to be assembled and that subsequent rotational movement of the handle member in the opposite direction effects translatory motion of said tip members to their open position wherein the mandrel has maximum effective diameter corresponding to that of the shaft on which said ring is to be assembled, and mandrel-telescoping means affixed to a forward extension of said handle member and in generally axial alignment therewith, said telescoping means being adapted to telescope over the mandrel responsive to said opposite rotational movement of the handle member with respect to said arms and being operative during such movement to push a ring which has been gripped and spread by said mandrel axially therefrom and thence over the end of the shaft to the plane of the ring-seating groove thereof.

10. A hand tool according to claim 9, wherein one of said tip members has semi-cylindrical formation and the other tip member is formed as a double-face wedge terminating in a narrowing edge which extends on a diameter of said semi-cylindrical tip member.

11. A hand tool according to claim 9, including spring means reactive between the handle member and the arms and being operative normally to bias the tip members to their spread relationship.

12. A hand tool according to claim 9, wherein one of

said tip members has its working edge formed as an inclined wedge adapted when said one tip member is being spread to knife into the gap of a ring with which the mandrel is engaged, and wherein spring means are provided which is normally effective to bias the tip members to their spread relationship and which is further effective following closing of the tip members and engagement of the mandrel with said ring to cause a first-stage spreading of the ring by forcing the working edge a limited distance into the ring gap.

13. A hand tool according to claim 9, wherein the relatively upper one of said pair of parallel lever arms mounts a finger piece projecting therefrom forwardly of the handle member for actuating said lever arms in unison in said one direction with respect to the handle member.

14. A hand tool for picking up split spring retaining rings individually from a supply thereof and assembling them on grooved shafts and like cylindrical workpieces comprising, in combination, a handle, complemental closable and spreadable tip members disposed forwardly and in generally right-angular disposition with respect to the handle and being together operative to form a ring gripping and spreading mandrel having effective diameter slightly less than that of the opening in said rings when said tip members are in their relatively closed position and effective diameter corresponding to that of the shaft on which ring assembly is to be effected when said tip members are in their relatively spread-apart position, substantially parallel arm means extending between said tip members and the handle and being pivotally connected to the latter for limited swinging movement in unison with respect thereto, the length of said arm means and the locations of their points of pivotal connection with the handle being such that when said arm means are moved in unison with respect to the handle in one direction said tip members are positively actuated from their spread-apart to their closed position, and when they are similarly moved but in the opposite direction said tip members are positively actuated from their closed to their spread-apart position, and a push head carried by said handle member which is coaxial with the mandrel when the tip members thereof are in their spread-apart position and being operative to push a spread ring from the mandrel and over the end of said shaft.

15. A hand tool according to claim 14, wherein said arm means comprises parallel arms pivotally connected to the handle means adjacent their relatively rearward ends for swinging movement in unison with respect to said handle member, the free ends of said arms extending forwardly from the forward end of said handle member, said tip member being mounted in depending front and rear relationship on the free ends of said arm, the construction and arrangement being such that when said arms are swung in unison with respect to the handle member in one direction said tip members move in a mutually intersecting arcuate path as effects closing of the tip members and when said arms are similarly swung but in the opposite direction said tip members move in diverging arcuate paths as effects opening of said tip members.

16. A hand tool according to claim 14, wherein the relatively upper one of said parallel arm means mounts a finger piece projecting therefrom forwardly of the handle for actuating said arm means in said one direction and in unison with respect to the handle.

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