Feb. 23, 1971 M. MILLHEISER 3,564,694

PLIER-TYPE TOOLS FOR ASSEMBLING AND DISASSEMBLING OPEN-ENDED SPRING RETAINING RINGS

Filed Oct. 1, 1968 2 Sheets-Sheet 1

Fig. 1.

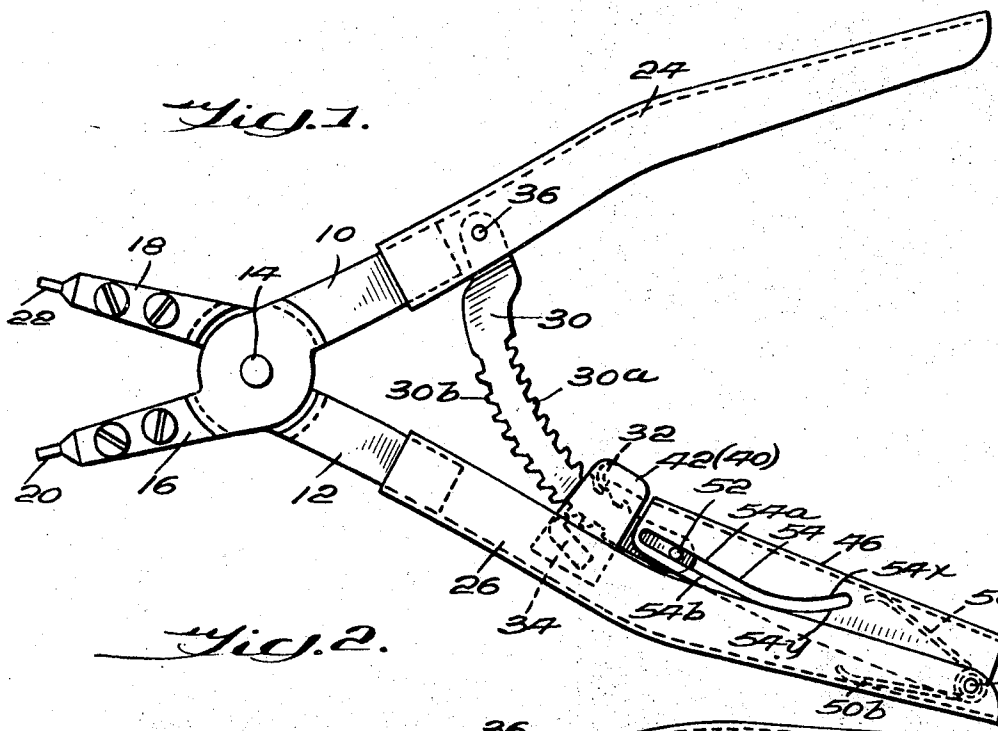


Fig. 2.

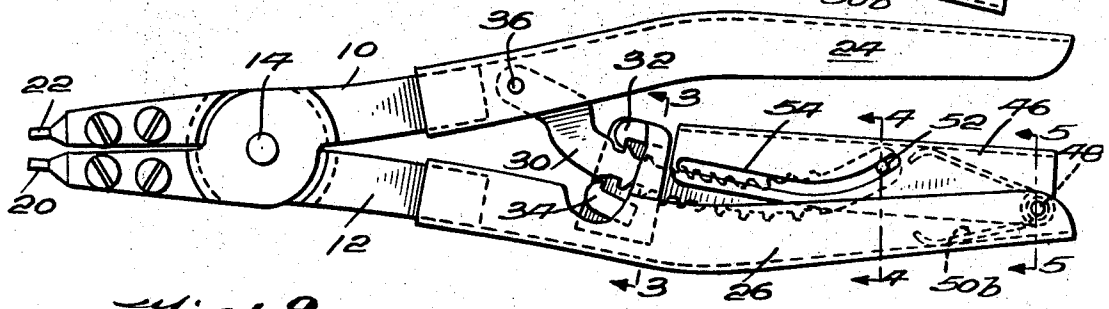


Fig. 8.

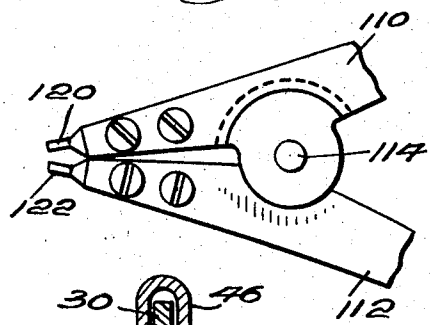


Fig. 3.

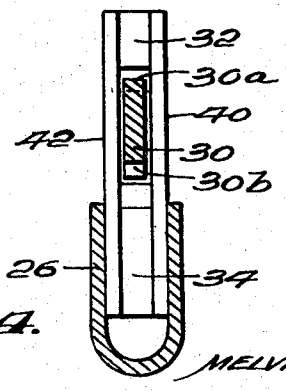


Fig. 5.

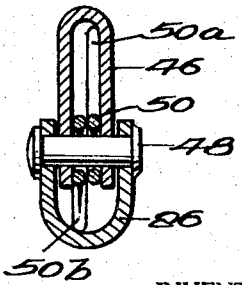
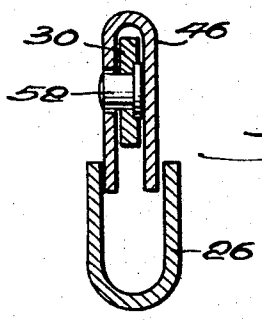


Fig. 4.



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PLIER-TYPE TOOLS FOR ASSEMBLING AND DISASSEMBLING OPEN-ENDED SPRING RETAINING RINGS

Filed Oct. 1, 1968 2 Sheets-Sheet 2

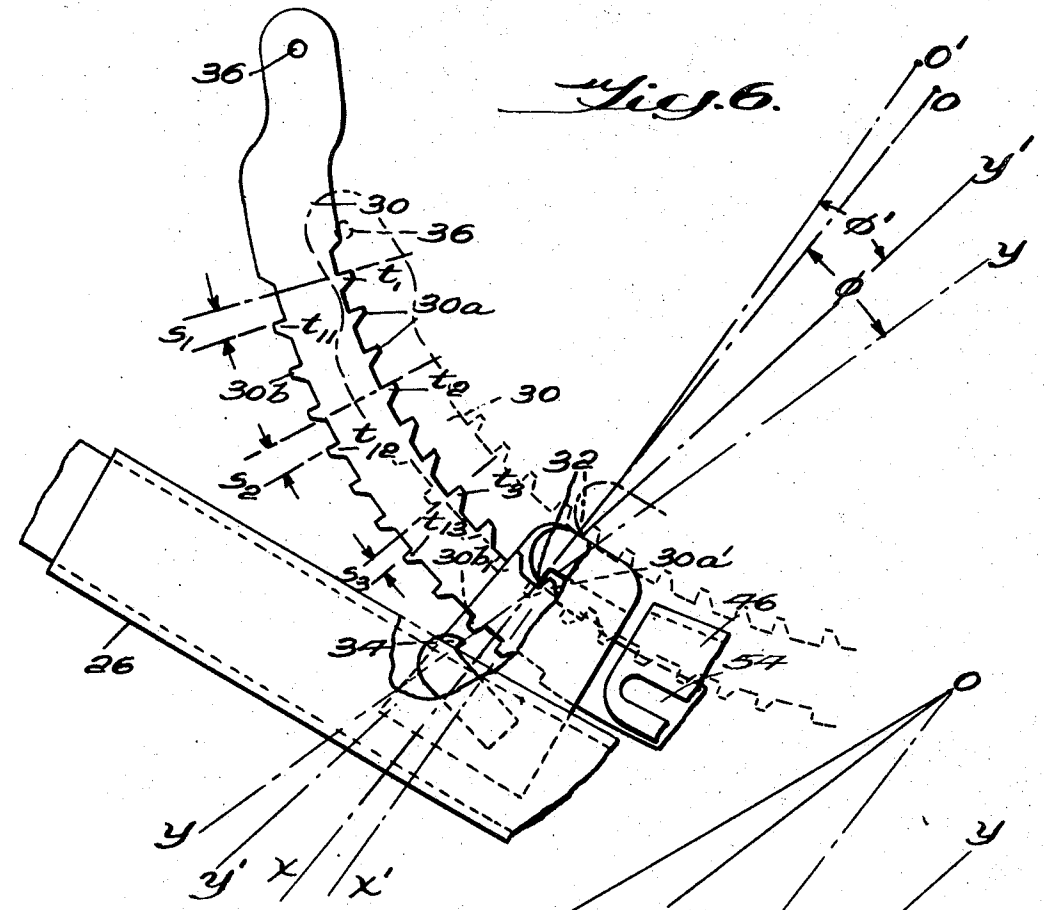

Fig. 6.

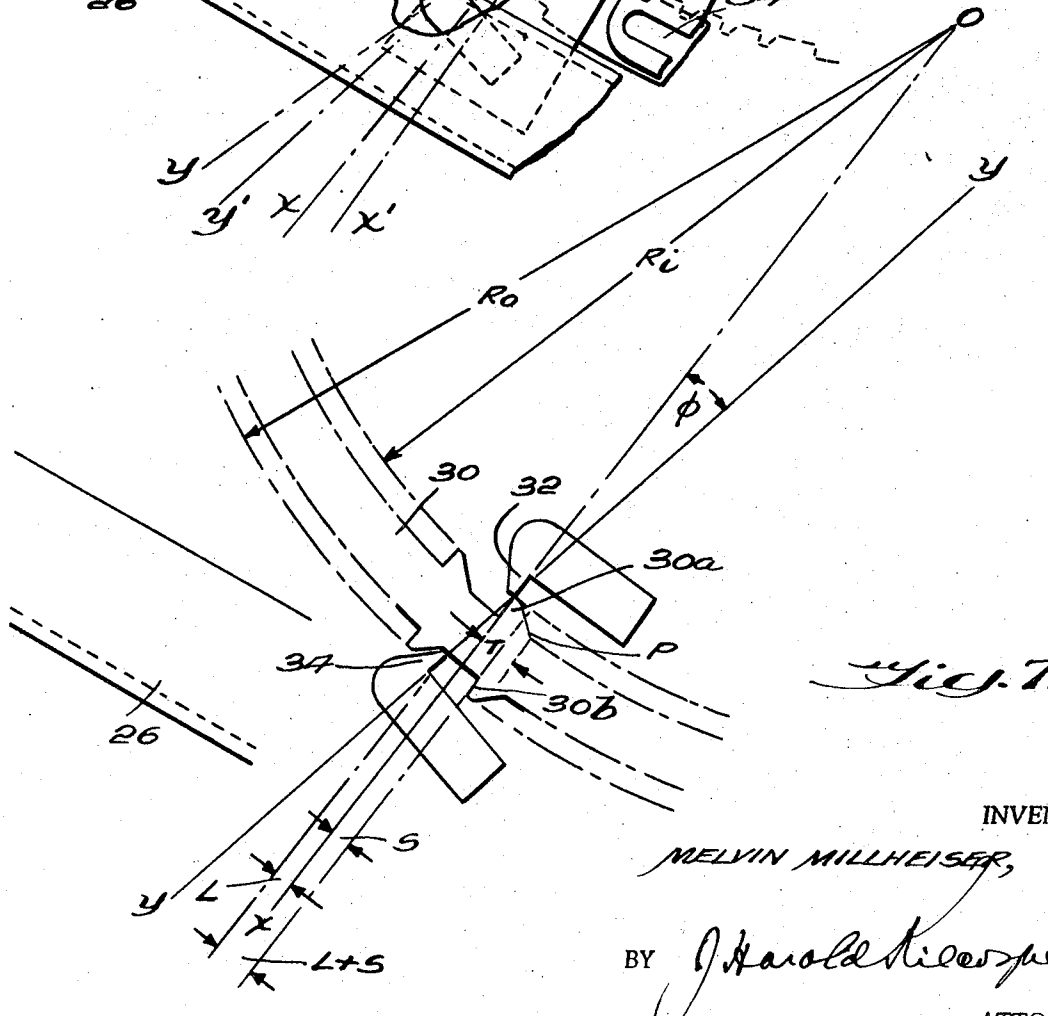

Fig. 7.

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3,564,694

PLIER-TYPE TOOLS FOR ASSEMBLING AND DISASSEMBLING OPEN-ENDED SPRING RETAINING RINGS

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Int. Cl. B23p 19/04; B25b 7/04
U.S. Cl. 29—229 6 Claims

ABSTRACT OF THE DISCLOSURE

An improved design of pliers of the type disclosed in U.S. Pat. No. 2,439,785 for use in assembling and disassembling split spring retaining rings. The double ratchet employed therein is in the form of the segment of a circle, but rather than the center thereof coinciding with the pliers' fulcrum as in the patented design, said center is disposed rearwardly of both said pliers fulcrum and the point of pivotal connection of said segment to one plier handle and is further disposed to one side of the plier center line. Such results in positioning of the ratchet segment so that its concave edge faces generally rearwardly and in its free end moving in a path which extends generally longitudinally along the inner edge of the other plier handle. The latter mounts a depressible stepper lever for actuating the ratchet segment between positions in which the teeth along its opposite edges engage oppositely disposed fixed pawls.

This invention relates to improvements in plier-type tools for assembling and disassembling open-ended spring retaining rings. More particularly, the invention contemplates an improved so-called double-ratchet pliers of the general type and which is to be used for the same general purpose as that shown in the Feitl Pat. No. 2,439,785, dated Apr. 13, 1948.

In a pliers according to the above patent, the ratchet which with the pawls associated therewith provides a means for locking the plier handles against self-opening and for effecting a controlled step-by-step opening of the plier handle against the tension of a spring retaining ring engaged by the plier working points is in the form of a part-circular segment whose center coincides with the plier fulcrum, i.e. the center about which the plier handles move in partaking of their opening and closing movements; and it is pivotally connected at its one end to one of the plier arms and disposed so that its other end projects through the other plier arm. Continuing experience with such pliers has established that, to be effective in the assembly and disassembly of split or open-ended retaining rings of the larger sizes, the ratchet segment must be of considerable arcuate length, as results in its free end projecting a substantial distance beyond the plier handle through which it passes when the pliers is in its closed position, i.e. when its handles are brought together. Such is an objectionable feature for two principal reasons: first, because any substantial projection of the ratchet segment beyond the line or contour of the plier handles can create a safety hazard, and, secondly, because any such projection makes necessary an appreciable amount of plier clearance space which is not always available.

Stated broadly, a major object of the present invention is the provision of an improved double-ratchet pliers for use in assembling and disassembling split retaining rings and which overcomes the above-noted objects to a pliers serving similar purpose according to the aforesaid Feitl et al., Pat. No. 2,439,785.

Another major object of the invention is the provision of a double-ratchet pliers for use in assembling and disassembling split spring retaining rings characterized by a ratchet segment which in all positions of the plier handles is accommodated in the space between said handles.

A more particular object of the invention is the provision of a double-ratchet pliers for assembling and disassembling split spring retaining rings, wherein the ratchet is in the form of a pivoted segment of a circle as heretofore but which is so mounted and arranged as to be capable of "folding" towards the inner side of the plier handle to which it is pivotally connected, to the end that it always remains within the plier contour as the plier handles move between their open and closed positions.

A further object of the invention is the provision of a double-ratchet pliers as last aforesaid, wherein the ratchet segment is struck from a center which is so located that the concave edge of said ratchet faces generally rearwardly and towards the handle to which it is pivoted as aforesaid, and wherein the teeth of the ratchet are so located along the edges thereof as to accommodate both for the change of position of said teeth with pivotal movement of said segment and the change of position of the pawls which engage said teeth which takes place as the plier handles move between their open and closed positions.

Yet another object of the invention is the provision of a double-ratchet type of pliers for use in assembling and disassembling split spring retaining rings, which is characterized by relatively simple yet durable and thoroughly dependable construction and operation.

The above and other objects of a pliers as herein contemplated will be obvious or hereinafter pointed out in the following detailed description thereof, taken with the accompanying illustrative drawings, wherein:

FIG. 1 is a plan view of a pliers according to the invention for use in assembling and disassembling split spring retaining rings of the internal type, i.e. rings which are adapted to be sprung into a groove in a housing bore and which thus require contraction in assembly and disassembly, the pliers being shown in the substantially open position;

FIG. 2 is a similar view but illustrating the pliers in its fully closed position;

FIGS. 3, 4 and 5 are sections taken along lines **3—3**, **4—4** and **5—5** of FIG. 2, respectively;

FIGS. 6 and 7 are broken-away diagrammatic views on an enlarged scale of portions of the pliers shown in FIGS. 1 and 2, of which FIG. 6 graphically illustrates the shift of ratchet-segment center and in the respective positions of the ratchet-segment teeth and pawls that engage said teeth which takes place during movement of the plier handles from their substantially open position shown in FIG. 1 to their closed position shown in FIG. 2, and FIG. 7 is offered to assist in explaining the equations involved in mathematically establishing the variation in the spacing between ratchet teeth on the convex edge of the ratchet segment found to be necessary because of the shift of ratchet center; and

FIG. 8 is a broken-away plan view of the ring-engage end of pliers of the invention for use with split retaining rings of the external type, that is to say, rings adapted to be assembled in a groove of a shaft or the like and which thus require spreading during assembly and disassembly.

Referring to the drawings in greater detail and more particularly to FIGS. 1 and 2, it will be seen that a pliers of the present invention in its basic construction is generally similar to that of the pliers of the aforesaid Feitl et al. Pat. No. 2,439,785 in that it comprises a pair of lever arms **10, 12** pivotally connected one to

the other intermediate their ends by a pivot **14**. The length portions of said arms **10, 12** disposed to the ring-engaging side of the pivot **14** provide tool tips **16, 18** which mount at their free ends a pair of working points **20, 22** of size as to be projected into the apertures conventionally provided for their reception in the ends of spring retaining rings. The length portions of said arms **10, 12** disposed to the opposite side of said pivot **14** provide means for the connection of elongate plier handles **24, 26** which are adapted to be brought together from their normally spread position. It will be understood that such handle movement brings the working points **20, 22** together, thereby to contract a split spring retaining ring into whose end apertures said points are projected if the plier arms **10, 12** cross one another (as in FIGS. 1 and 2), and spread said points to in turn spread a spring engaged by the points, if the plier arms extend in non-crossing relationship. As is conventional, said handles **24, 26** may be of channel section and are disposed so that the open sides of their channels face one another.

Like the pliers disclosed in the aforesaid Feitl Pat. No. 2,439,785, the pliers of the instant invention is also provided with a double-ratchet segment **30**, i.e. a ratchet in the form of the segment of a circle having teeth designated **30*a***, **30*b***, in predetermined staggered relation with respect to one another projecting in opposite directions from its longitudinal edges, and with fixed spaced-apart pawls **32, 34** adapted alternately to engage said teeth **30*a***, **30*b***, respectively. However, rather than said ratchet segment **30** being mounted so that it extends along an arc struck from the plier fulcrum, i.e. the pivot pin **14**, and is turned so that its concave edge faces said fulcrum, and further so that its free end projects through the lever arm (or its handle end) opposite that to which it is pivotally connected, as characterizes the segment mounting and disposition according to the Feitl Pat. No 2,439,785, the ratchet segment **30** of pliers according to the present invention is so mounted that its concave edge is disposed generally rearwardly when the plier handles are in their open position and generally upwardly (FIG. 2) when the plier handles are in their closed position, and further that it is always accommodated in the space between the plier handles as avoids any projection of one segment end through a handle.

More particularly, the ratchet segment **30** is pivotally connected at its one end to the plier handle **24** by a rivet or other connecting means **36**, preferably located just rearwardly of the point of connection of said handle with the plier arm **10** from which it extends, and it extends generally lengthwise along the inner edge of and parallel to the opposite plier handle **26**, rather than cross-wise between the handles **24, 26** as in the prior design. Such disposition of the ratchet segment results from the fact that its center O is disposed well to the rear of both the pliers fulcrum **14** and its own pivot **36** and is moreover disposed to the same side of the longitudinal center line of the pliers as is its pivot or swing point **36**, in all positions of said handles.

Referring to the aforesaid pawls **32, 34** which engage with the ratchet teeth **30*a***, **30*b***, respectively, such are mounted in spaced-apart, facing relation between two support plates **40, 42**, to which they are preferably welded and which are in turn welded to the inside faces of side walls of the channel-sectioned handle **26**. The free end of the ratchet segment passes through the space bounded by said plates **40, 42** and the pawls, the spacing between the plates being such that they guide the ratchet segment as it moves generally lengthwise along the handle **26**, and the spacing between the pawls **32, 34** being such as to allow limited swinging movement of the ratchet segment about its point of connection **36** with the handle **24**.

The free end of the ratchet segment **30** is also operatively related to a so-called stepper lever **46** which functions to actuate said ratchet segment out of engagement with the pawls **32, 34**. As seen in FIGS. 4 and 5, the lever has channel section and it is pivotally connected at its rearward end to the rearward end of the plier handle **26** by a rivet **48**, in position such that its channel faces that of the handle channel. A torsion spring **50** coiled about said rivet, and whose arms **50*a*** and **50*b*** are reactive against opposed inner surfaces of the stepper lever **46** and handle **26**, biases said lever in clockwise direction (and thereby the ratchet segment in counter-clockwise direction, as will be explained).

The length of the stepper lever **46** is such that it extends from approximately the outer end of the handle **26** to a point just short of the pawl-mounting plates **40, 42**, and thus it is disposed to receive in its channel the free end portion of the ratchet segment **30** as the latter moves generally lengthwise along the handle **26** with closing and opening of the plier handles. An operating, i.e. pin-and-slot, connection is provided between stepper lever **46** and ratchet segment **30** whereby depression of the free end of the lever against the bias of the torsion spring **50** effects limited swinging movement of the ratchet segment in clockwise direction, such illustratively comprising a pin **52** fixed on the free end of the ratchet segment and extending laterally from a side face thereof and an elongate slot **54** in the adjacent side wall of the stepper lever into which the pin ends. The side edges of the slot are spaced apart a distance substantially equaling the width (diameter) of the pin **52**, said edges thus functioning as pin-camming surfaces. For the greater portion of the length of the slot beginning at its forward end, the slot edges extend straight-way as at **54*a*** **54*b***, whereas, as best seen in FIG. 1 and for a purpose to be later explained, said edges curve inwardly or toward the tool handle **24** at their rearward ends, as indicated at **54*x***, **54*y***.

The arrangement is thus one in which the torsion spring **50**, being under stress in all positions of the tool handles **24, 26**, tends to rotate the stepper lever **46** inwardly (clockwise) relative to the handle **26**. Such causes the edge portions **54*b*** or **54*y*** to push against the pin **52** and thereby transmit the force of the spring **50** to the ratchet segment **30**. Accordingly, one of the teeth **30*a*** on the concave edge of the ratchet segment is normally in engagement with the relatively inner pawl **32**, and when any one tooth **30*a*** is so engaged, the pliers is prevented from springing open when in use and under the action of a stressed retaining ring with which the pliers is then coupled. However, when the stepper lever **46** is depressed as by hand or finger pressure applied to its free end, the pin **52** acted upon by slot edge portions **54*a***, **54*x***, effects corresponding depression, i.e. movement in the opposite or clockwise direction, of the ratchet segment as it disengages the particular tooth **30*a*** then in engagement with the inner pawl **32** from said pawl and brings a tooth **30*b*** on the opposite or convex edge of said segment in position to be engaged by the relatively outer pawl **34**. Thus, the provision of the ratchet segment, pawls and stepper lever arranged as described makes possible a controlled plier-handle movement effective not only during the closing of the handles to contract a retaining ring (this assumes that the pliers is of the crossed-handle type designed for use with internal rings), during the course of which the ring is increasingly stressed, but also during the release of the stressed ring when a controlled or step-by-step release of the ring is highly important in preventing rebound of a ring being assembled against the bottom of its housing-bore groove, for example.

For smoothness of operation of a pliers as aforesaid, the invention features a somewhat different disposition of the ratchet teeth **30*a***, **30*b*** than that characterizing the teeth of the ratchet segment employed in the aforesaid Pat. No. 2,439,785, wherein the teeth provided along both edges of the ratchet segment were equally spaced from one another and the teeth on the convex edge of the segment were displaced or offset from the teeth on the concave edge of said segment approximately one-half the

pitch distance thereof. Such stems from the fact that not only does the center O of the arc of the ratchet segment **30** of the instant pliers, rather than being fixed as in the prior design, move outwardly-forwardly and inwardly-rearwardly, respectively, with respect to the pliers fulcrum (pivot pin **14**) with closing and opening movement of the plier handles **24, 26** and, in so doing, shift its position in relation to the pawls **32, 34** but also the latter also shift position with handle-closing and opening movement.

The aforesaid change of position of the ratchet-segment center (and of pawls **32, 34** also) which takes place with closing of the plier handles is graphically illustrated in FIG. 6, wherein the segment and pawls are shown in full lines in the respective positions which they occupy when the plier handles are in the nearly open position and in broken lines in the respective positions which they occupy when the plier handles are in their nearly closed position. In said view, the lines O–X and O'–X' are lines drawn between the ratchet-segment center and the tip of the pawl **32** when said parts are in their different positions between which they move with plier handle closing as aforesaid; and similarly, the lines Y—Y and Y'—Y' are extended lines drawn between the tips of the pawls **32, 34** when the latter occupy their different positions aforesaid. Also in said view under discussion, the angles between the lines O–X and Y—Y and between the lines O'–X' and Y'–Y have been designated ϕ and ϕ', of which the angle ϕ' is the smaller. Thus, it will be further seen that, in addition to the ratchet center shifting with movement of the plier handles from open to closed position, the aforesaid angle ϕ changes considerably with closing of the pliers.

It is a feature of the present invention that, to compensate for the change in angle ϕ and thereby insure effective and smooth disengagement of any engaged tooth **30***a* from the pawl **32** with depression of the stepper lever **46**, the spacing between the teeth **30***b* on the convex edge of the ratchet segment is suitably varied, but without corresponding change in the spacing of the teeth **30***a* on the concave edge thereof which remains constant as heretofore. More particularly, and here again referring to FIG. 6, the variation in spacing between the teeth **30***b* is such that the individual spacings designated S_1, S_2 and S_3, etc. between lines drawn from the ratchet-segment center O through the faces of the equally spaced ratchet teeth t_1, t_2, t_3, etc. on the inner or concave edge of said ratchet segment and parallel lines passing through the faces of corresponding teeth t_{11}, t_{12}, t_{13}, etc. on the outer or convex edge of the segment progressively decrease towards the free end of the ratchet segment by an amount which is precalculated to compensate for the shift of position of the ratchet-segment center O.

The required variation in the spacing of the teeth on the outer or convex edge of the ratchet segment **30** with change in the angle ϕ can be mathematically determined according to the following series of equations based on the relationships shown in FIG. 7:

In said view, an inner-edge ratchet tooth **30***a* is shown at the point of disengagement from pawl **32**, such occurring as the stepper lever **46** is depressed and the ratchet segment **30** begins to rotate clockwise about its pivot **36**. In order that tooth **30***a* can disengage from pawl **32** and then clear same, it of course must be able to move leftwise of said pawl until its corner P just passes the line O–X, this movement being the distance T or the tooth dimension.

As said tooth **30***a* moves past or leftwise with respect to said pawl **32**, corresponding tooth **30***b* on the outer edge of the segment will move towards pawl **34** the distance $(L+S)$ where L is the distance between the tip point of pawl **34** on line Y—Y and a point on line O–X closest thereto, and S is the distance between the face of said tooth **30***b* and the face of corresponding tooth **30***a*. To permit such movement, $L+S$ must be greater than $T(R_o/R_i)$, with R_i being the radius of the inner arcuate edge of the ratchet segment **30** from the ratchet center O and R_o being the radius of the outer arcuate edge of said segment from said center.

Therefore it can be said:

$$L+S>T(R_o/R_i)$$

But, R_o and R_i are constant and tooth dimension T is also constant.

Further, $L=(R_o-R_i)\tan\phi$, where R_o-R_i is constant. We can therefore say:

$$K\tan\phi+S>K_1$$

and

$$S>K_1-K\tan\phi$$

where K and K_1 are constants.

As has been explained in connection with FIG. 6, the angle ϕ decreases as the plier handles move from their open to the closed positions. Therefore, as will be evident from the last of the above equations, S will increase as the plier closes. Thus, since S is the spacing of any tooth face on the outer convex edge of the ratchet from a tooth face of a corresponding tooth on its opposite or inner edge, it follows that such spacing will vary accordingly, i.e. increases as the angle ϕ decreases with handle closing movement.

A notable feature of the pliers of the invention is that of the protection which the stepper lever **46** provides to the operator. In explanation, with closing of the plier handles **24, 26** as effects stressing of a ring with which the plier points **20, 22** are engaged, the greater the amount of penetration of the toothed edges of the ratchet segment **30** into the enclosed space provided by the facing channels of said lever **46** and of the plier handle **26** to which it is mounted. Thus, the possibility of the operator's finger or fingers coming into contact with the teeth of the ratchet segment as it swings towards the handle **24** and moves longitudinally rearwardly along the handle **26** with closing of the handles is remote. Like protection is also afforded when a stressed ring held by the pliers is being released by opening of the plier handles from their closed position, which is accomplished by repeated depressions of the inner (free end) of the lever **46**, responsive to each of which the slot edge portions **54***x* or **54***a* of the lever acting through the pin **52** effect disengagement of any ratchet tooth **30***a* then in engagement therewith from the pawl **32**, as permits an increment of handle opening movement to take place under the urge of said ring to expand. It will be understood that each such increment terminates when the next opposite tooth of the series **30***b* thereof engages pawl **34**, following which release of the lever will permit the next tooth **30***a* following the previously disengaged tooth to engage the pawl **32**. In short, the stepper lever serves the dual function of a means to actuate the pliers in order to effect incremental ring release and as a safety housing for the heavily toothed ratchet segment **30**.

It will also be observed from FIG. 2 illustrating the positioning of plier parts at maximum ring stress condition that the distance from the pawl **32** to the pivot **36** which connects the ratchet segment **30** to the plier handle **24** is small compared to that from the lever-actuated pin **52** to said pivot **36**. A large mechanical advantage is therefore provided by the lever **46** for initiating and incrementally continuing ring release from a ring condition of maximum stress.

In connection with the slot **54** in which said pin **52** operates, it is explained that said pin and the shape of said slot, i.e. the curvature provided in the rearward edge portions **54***x*, **54***y* thereof as aforesaid serves the useful purpose of determining the position of the lever **46**. More particularly, as the plier handles are being brought together, the curved slot-edge portions acting on the pin **52** insure that the stepper lever **46** remain in essentially the same position which it had prior to initiation of handle-closing movement, rather than swinging

toward the handle **24** which it would do if the slot **54** extended straightway from its inner end. Thus, the free end of the lever **46** is always readily accessible to the operator for depression thereof when such is desired to be effected.

The length of said slot **54** is also such that when the plier handles are in their maximum permissible open position, the pin **52** will strike the forward end of the slot, thus preventing the ratchet segment **30** from moving completely out of engagement with the pawls **32, 34** should the handles be spread too far apart either by hand or by a retaining ring located on the plier points.

Referring to FIG. 8, such illustrates that the improved double ratchet mounting and actuating means of the invention as described in the foregoing is also applicable to external-ring pliers, i.e. pliers adapted for use with retaining rings which require spreading over a shaft end in their assembly and spreading to lift them out of their seating groove in said shaft in disassembly. In such a pliers, the levers designated **110, 112** are pivotally connected in non-crossing, generally parallel relation by a pivot **114** so that closing of the plier handles effects spreading of the working points **120, 122** and corresponding spreading of an external retaining ring to whose ends said points are coupled. With the above exception, the description of the pliers and its operation given in connection with FIGS. 1–7 applies equally to the pliers shown in FIG. 8, so that further detailed description of the FIG. 8 pliers appears unnecessary for its disclosure.

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 plier-type tool for assembling and disassembling open-ended spring retaining rings and the like comprising: a pair of lever arms and means pivotally connecting said arms one to the other intermediate their respective ends; the ends of the levers to one side of said pivot means mounting working points and the other ends mounting handles for effecting relative separating and approach movements of the working points and thereby stressing of a retaining ring engaged by said working points; and pawl and ratchet means for locking said handles against self-opening and for effecting controlled opening of said handles under the stress of a so-engaged retaining ring comprising: a ratchet segment pivotally connected to one of the handles at a point thereof near said lever-arm pivot means and extending therefrom into the space between said handles and positioned therein so that its free end portion extends generally parallel to and along the inner edge of the other of said handles, said segment having series of oppositely projecting ratchet teeth along both its longitudinal side edges, and oppositely disposed pawls fixedly secured to said other handle in spaced relation to one another and in position as to be engaged alternately by the oppositely disposed ratchet teeth of said ratchet segment responsive to pivotal movement of said segment in opposite directions; and means for imparting such pivotal movement in opposite directions to said ratchet segment, including a depressible lever pivotally connected at its one end to the relatively rearward end of said other handle and having its free end portion extending generally forwardly along the inner edge of said other handle and disposed relatively inwardly of said free end portion of said ratchet segment, spring means reactive between said other handle and said free end portion of said depressible lever for biasing the latter inwardly-away from said inner edge of the other handle, and means interconnecting the free end portions of said ratchet segment and depressible lever whereby depression of said lever effects pivotal movement of the ratchet segment in one direction and said spring means effects pivotal movement of the ratchet segment in the opposite direction.

2. A plier-type tool according to claim **1**, wherein said interconnecting means comprises a pin on the ratchet segment and a slot in the depressible lever into which said pin extends and whose opposite edges are engageable by said pin.

3. A plier-type tool according to claim **1**, wherein said depressible lever has channel section and the free end portion of the ratchet segment extends into and is housed within the channel of said lever.

4. A plier-type tool according to claim **1**, wherein the plier handles have channel section and said depressible lever is also of channel section and is disposed with its channel facing the channel of said other handle, and wherein the pivoted one end of said ratchet segment is housed in the channel of said one handle and its other free end portion extends into the channel of the depressible lever and is substantially housed thereby.

5. A plier-type tool according to claim **4**, wherein said spring means comprises a torsion spring whose central portion is coiled about the pivot connecting the depressible lever to said other handle and whose end portions extend into the channels of and are reactive against the opposite inside surfaces of said depressible lever and said other handle.

6. A plier-type tool for assembling and disassembling open-ended spring retaining rings and the like comprising: a pair of lever arms and means pivotally connecting said arms one to the other intermediate their respective ends; the ends of the levers to one side of said pivot means mounting working points and the other ends mounting handles for effecting relative separating and approach movements of the working points and thereby stressing of a retaining ring engaged by said working points; and pawl and ratchet means for locking said handles against self-opening and for effecting controlled opening of said handles under the stress of a so-engaged retaining ring comprising: a ratchet segment pivotally connected to one of the handles at a point thereof near said lever-arm pivot means and extending therefrom into the space between said handles and positioned therein so that its free end portion extends generally parallel to and along the inner edge of the other of said handles, said segment being in the form of the arc of a circle whose center is disposed rearwardly of the plier-arm pivot means and to one side of the longitudinal center line of the pliers and having series of oppositely projecting ratchet teeth along both its arcuate side edges, the ratchet teeth on the concave edge of the ratchet segment being equally spaced from one another and the teeth on the convex edge of said ratchet segment being staggered with relation to said ratchet teeth on the concave edge and having variable spacing with respect to one another, the variation of which is such as to compensate for shift of ratchet segment center which takes place as the plier handles move between their open and closed positions, and oppositely disposed pawls fixedly secured to said other handle in spaced relation to one another and in position as to be engaged alternately by the oppositely disposed ratchet teeth of said ratchet segment responsive to pivotal movement of said segment in opposite directions; and means for imparting such pivotal movement in opposite directions to said ratchet segment.

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