May 26, 1964 H. ERDMANN 3,134,168

RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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Fig. 1.

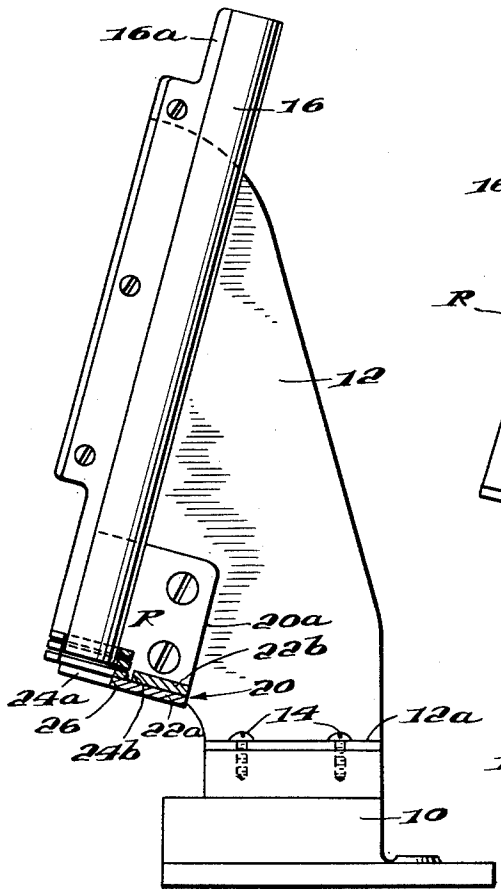


Fig. 2.

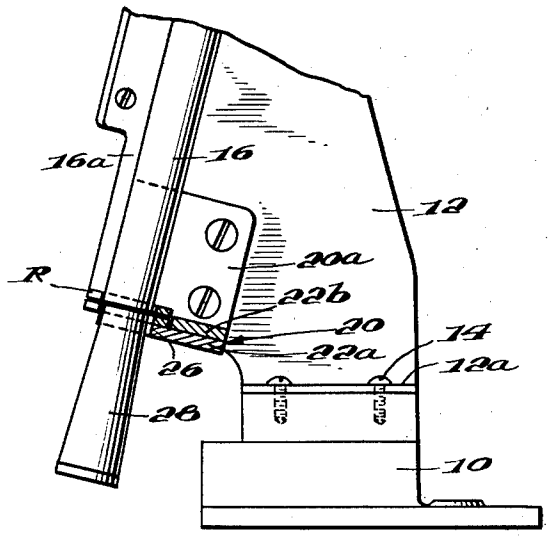


Fig. 3.

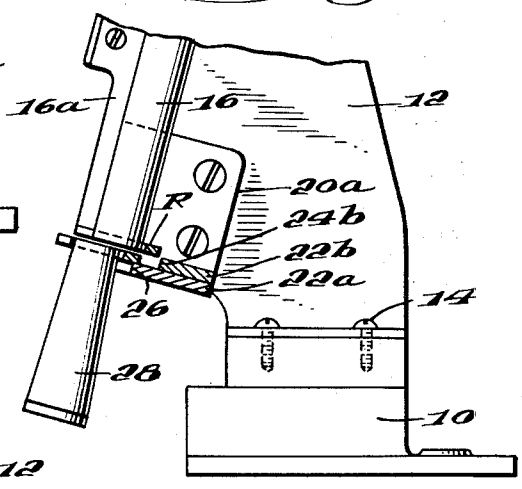
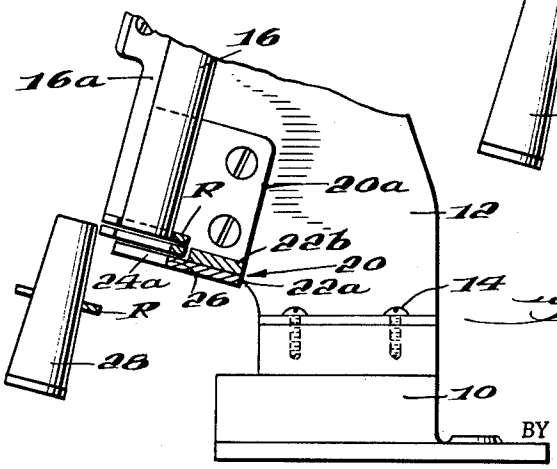


Fig. 4.



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RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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Fig. 6.

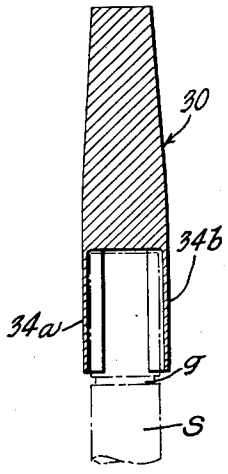


Fig. 5.

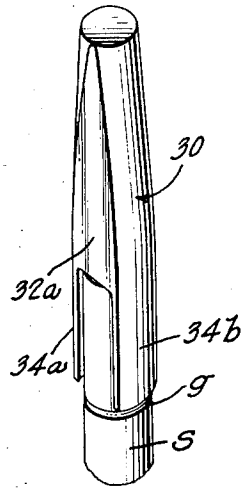


Fig. 9.

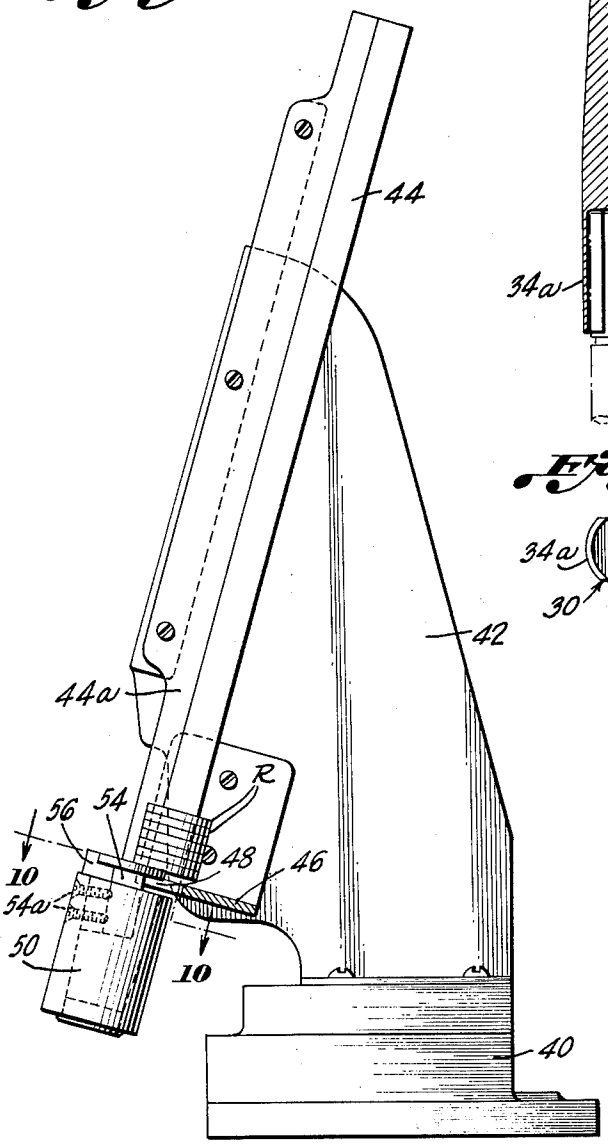


Fig. 7.

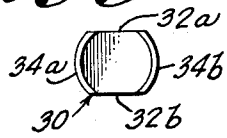


Fig. 8.

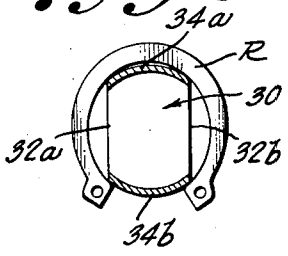
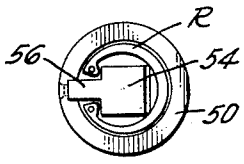


Fig. 10.



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RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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Fig. 11.

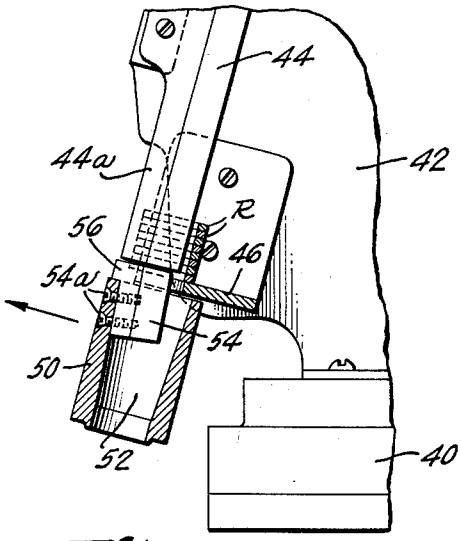


Fig. 12.

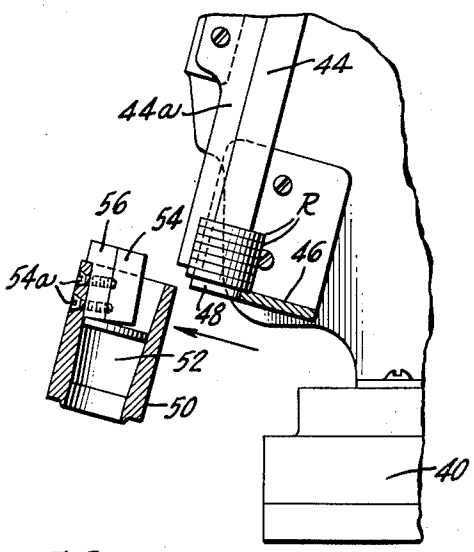


Fig. 13.

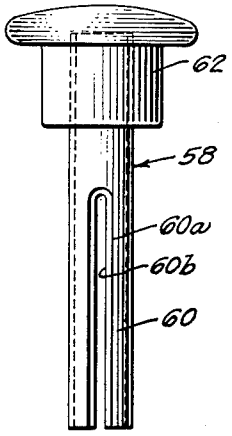


Fig. 14.

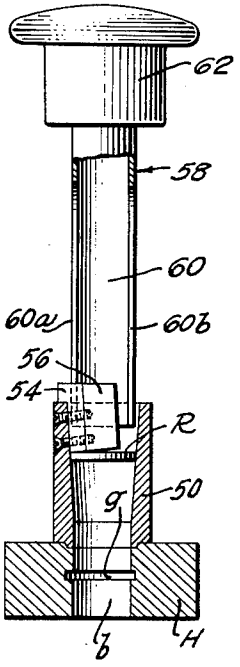


Fig. 15.

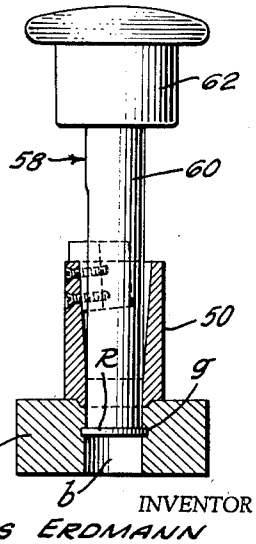
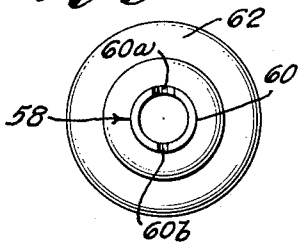


Fig. 13a.



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RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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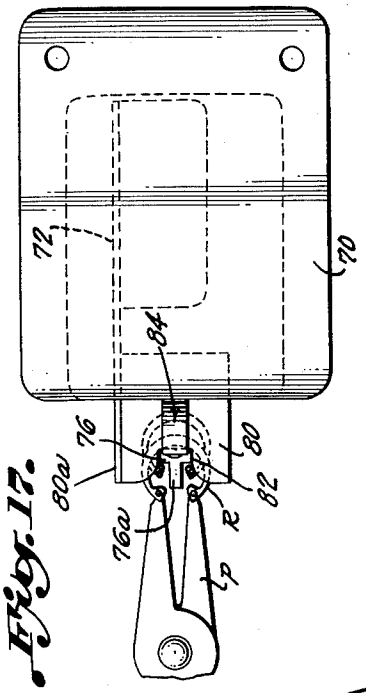


Fig. 17.

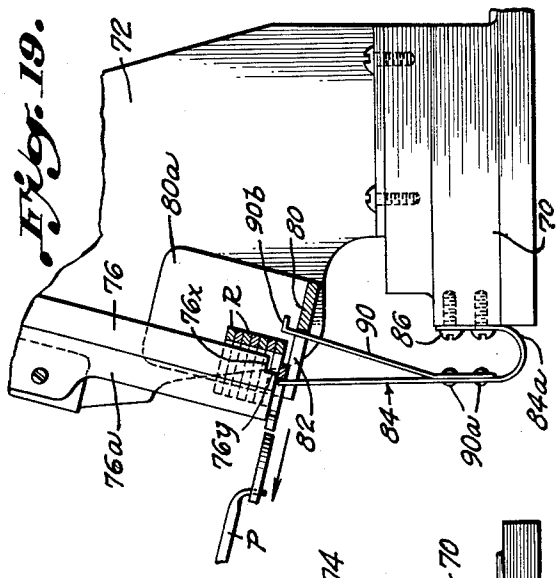


Fig. 19.

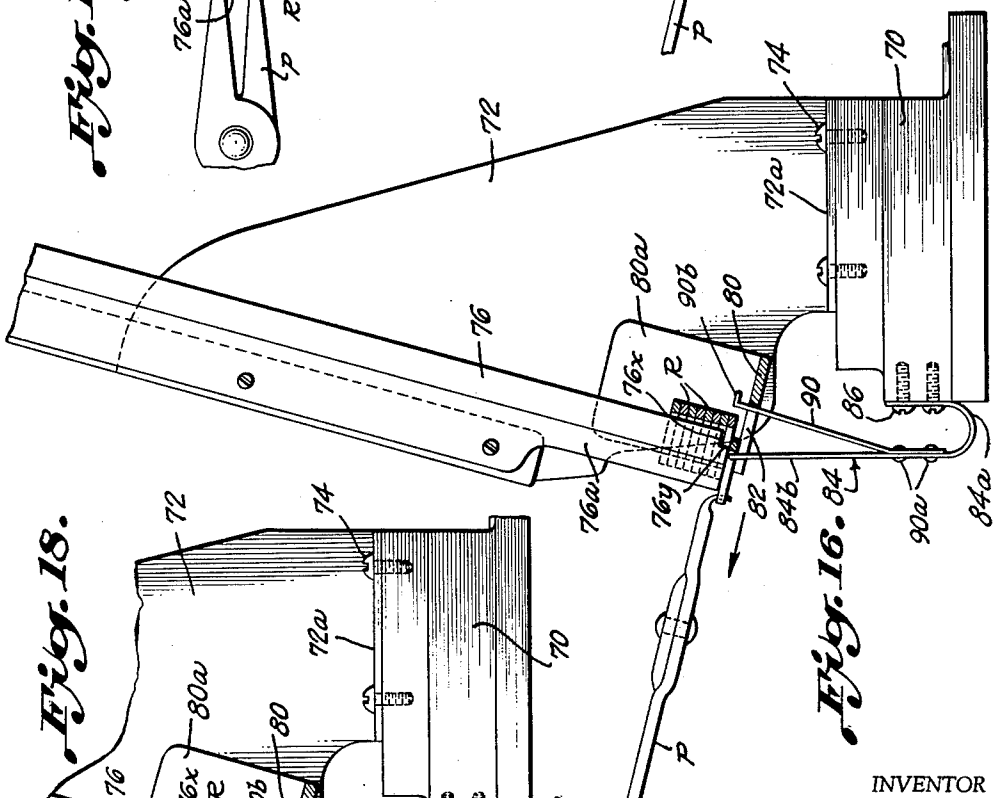


Fig. 16.

Fig. 18.

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RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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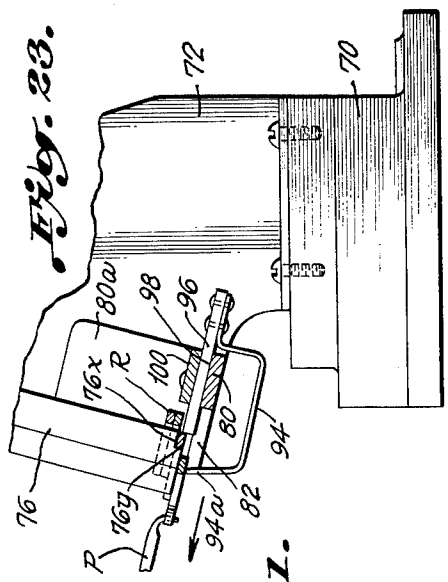


Fig. 23.

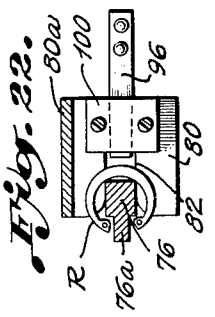


Fig. 22.

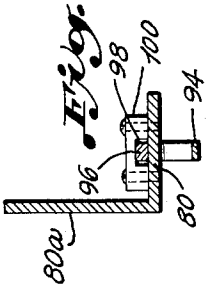


Fig. 21.

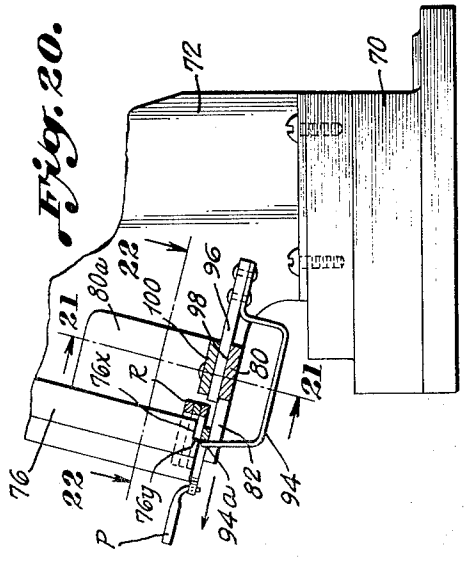


Fig. 20.

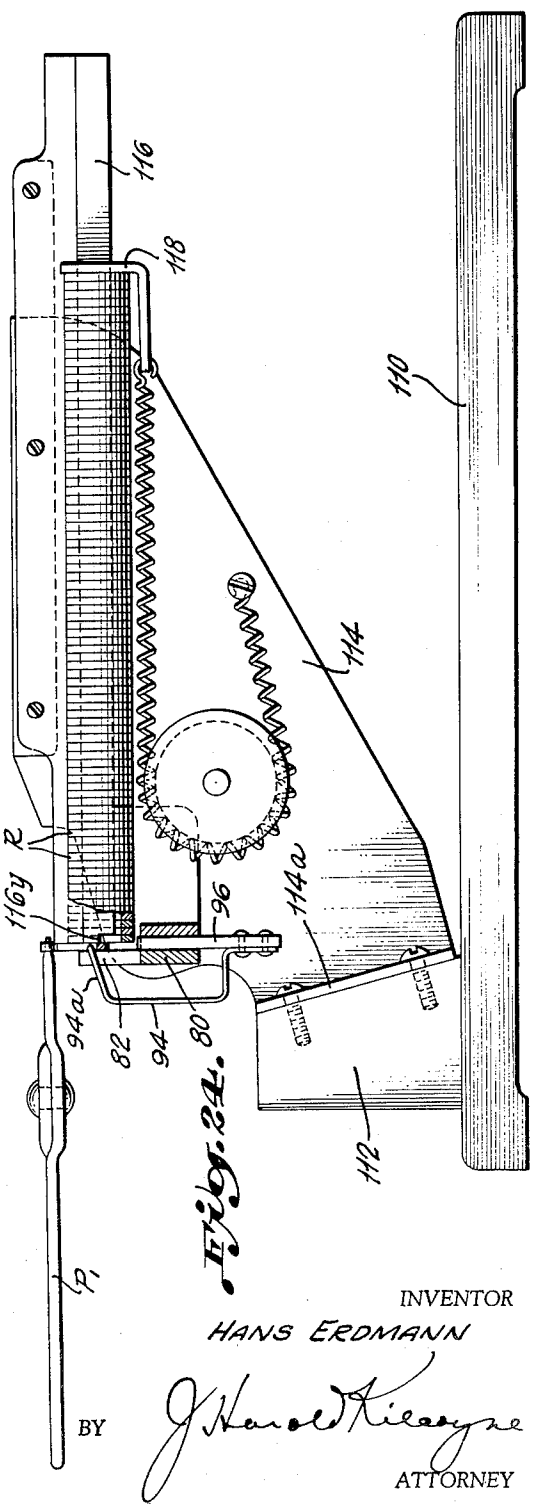


Fig. 24.

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United States Patent Office 3,134,168 Patented May 26, 1964

3,134,168
RETAINING-RING DISPENSING AND/OR APPLICATOR DEVICES

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Filed Feb. 27, 1963, Ser. No. 261,948
20 Claims. (Cl. 29—212)

This invention relates to improvements in retaining-ring dispensing and/or applicator devices and more particularly to improved magazine-type dispensers and/or applicators for so-called "split" or nearly closed spring retaining rings which are adapted, when spring-seated in grooves provided therefor in shafts or in the bores of housings and like carrier members, to form thereon or therein artificial shoulders for locating parts such as pinions, gears, bearing races, and the like. The present application for Letters Patent on such retaining-ring dispensing and/or applicator devices is a continuation-in-part of my earlier application Serial No. 69,475, filed November 15, 1960, now Patent No. 3,101,528, dated August 27, 1963.

Because of the greater arcuate length of split retaining rings, as compared to that of the so-called open retaining rings, the assembly of split rings on their shafts or in the bores of housings is usually effected either by means of a spreading mandrel- or contracting sleeve-type applicator tool capable of spreading or contracting the rings, depending on whether they are external or internal rings, from their normal unstressed diameter to the greater or lesser diameter required for their assembly responsively to said rings being pushed axially along or through said tool, or by means of a pliers-type applicator whose tips are provided with or formed as pin-like points which are adapted to be inserted into apertures for their reception in the free ends of the rings and which, when coupled by said points to the rings, is capable of spreading or contracting them as may be necessary for their assembly with proper manipulation of the plier handles.

Stated broadly, it is a primary object of the present invention to provide a magazine dispenser for dispensing split or nearly closed retaining rings of both the external and internal types, which is so constructed and arranged that it may be operated by the ring applying tool or tools (hereinafter referred to as "applicators") which are conventionally employed in assembling such rings to their shafts or in the bores of housings.

A more particular object of the invention is the provision of a dispenser and applicator combination for effecting the orderly, one-at-a-time dispensing and thereupon the assembly of split or nearly closed retaining rings as aforesaid, and which is characterized by simple, inexpensive and durable construction and is moreover thoroughly practical and dependable in its operation.

Still another object of the invention is the provision of an improved design of an applicator-type spreading mandrel for spreading split external rings as required in their assembly on shafts and the like and which may also be employed as a means for operating a dispenser for such rings; wherein the construction and configuration of the mandrel are such as to prevent overstressing of ring during the course of its being spread by forced axial movement along the mandrel.

Yet another object of the invention is the provision of an improved applicator-sleeve of the internal type for contracting split internal rings as required in their assembly in housing bores, and which is also highly effective as a means for operating a dispenser for such rings.

The above and other objects and features of advantage of split retaining ring dispensing and/or applicator devices of the invention will appear from the following

detailed description, in which reference is had to the accompanying drawings illustrating variant forms which both the dispensing and applicator devices of the invention may take, in which:

FIG. 1 is a side elevation, partly in section, of one form of retaining ring dispenser according to the present invention which operates to dispense split retaining rings of the external type;

FIG. 2 is a view similar to FIG. 1, illustrating the mandrel of a mandrel-type ring applicator for split external rings initially cooperated with and about to operate said dispenser;

FIGS. 3 and 4 are detail views which further illustrate the manner in which the applicator mandrel is actuated to in turn effect operation of the dispenser;

FIGS. 5–8 inclusive are a series of views illustrating the construction and new configuration of a spreading mandrel for external split rings designed to prevent overstressing thereof during the course of the rings being spread by forceful axial movement along the mandrel;

FIG. 9 is a view, partly in section, illustrating a modified dispenser according to the invention for use in dispensing split internal rings, the view also illustrating an applicator for such rings cooperated with the dispenser and in the process of withdrawing the lowermost ring of the ring column maintained by the dispenser;

FIG. 10 is a section taken along line **10—10** of FIG. 9;

FIGS. 11 and 12 are detail views corresponding generally to FIGS. 3 and 4, which illustrate a mandrel according to the FIG. 9 form operating the dispenser, i.e., withdrawing the endmost ring from the ring column;

FIGS. 13 and 13A are side elevation and underneath views respectively, of a push-tool for use with the sleeve-form applicator mandrel employed with the FIGS. 9, 11 and 12 form of dispenser;

FIGS. 14 and 15 are part-sectional views illustrating the manner in which the push-tool cooperates with such a sleeve-form mandrel;

FIG. 16 is a broken-away side elevational view, partly in section, of a modified form of dispenser designed for operation by a pliers-type ring applicator;

FIG. 17 is a bottom view of the FIG. 16 form of dispenser which illustrates the lowermost ring of the ring stack or column thereof provided by the dispenser in its advanced or "dispensing-ready" position in which it is readily accessible to the plier points;

FIGS. 18 and 19 are views similar to FIG. 16, which illustrate intermediate and final steps of each ring-dispensing operation characterizing the FIG. 16 form of dispenser;

FIG. 20 is a broken-away, part-sectional view similar to FIG. 16, which illustrates another form of pliers-operated ring-dispenser according to the invention;

FIGS. 21 and 22 are sectional views taken along lines **21—21** and **22—22** of FIG. 20, respectively;

FIG. 3 is a view similar to FIG. 20 but illustrating the dispenser in a more advanced stage of its operation; and

FIG. 24 is a view similar to FIG. 16 but illustrating a modified arrangement of dispenser suiting it to operation by pliers whose working points extend straightway from the tips thereof, rather than at right angles as with the pliers shown in FIGS. 16 and 20, for example.

Referring to the drawings in detail, a dispenser according to the FIGS. 1–4 form thereof illustratively comprises a generally rectangular supporting base **10** which mounts an upright standard member **12** affixed thereto as by screws **14** threaded into the base through a foot flange **12***a* provided on the standard; and affixed to and extending along the relatively forward edge of said standard **12**, which is preferably inclined from the vertical by a small angle as shown, a stackrod **16** of any appropriate section such as circular, and which is provided with a longitudinal,

forwardly projecting fin or blade 16*a*. The stackrod together with its forwardly projecting blade 16*a* is secured in sidewardly offset relation with respect to the standard 12 as by means of an angled connector bracket 18.

It is to be understood that the diameter (or sectional dimensions if non-circular) of the stackrod 16 is or are such as to permit a plurality of the split or nearly closed rings R prepared for assembly to be readily threaded thereon and when so mounted to slide more or less freely along the stackrod, and at the same time such as to preclude any substantial lateral displacement of the rings from their stack or column formation. Also to be observed is that the fin or blade 16*a* provided on the stackrod is sufficiently thin laterally as to enable it to extend into the gaps of the said rings, thus to position all rings of the column with their conventionally eared ends facing forwardly and hence uniformly oriented on the stackrod.

The standard 12 of the dispenser also mounts, through its upright attaching flange 20*a* which is secured flush against a side face of said standard, a laterally projecting shelf member 20 (illustratively of double-plate construction) which extends beneath the lower end of the stackrod 16. As seen in the drawing, the shelf is arranged so as to extend normal to the axis of the stackrod and it is further positioned at a level such that the upper surface of the underplate 22*a* thereof is spaced from the lower end of the stackrod a distance substantially equal to the axial thickness of one of the rings R to be dispensed. Thus, the shelf under-plate 22*a* provides support for the column of rings R disposed on the stackrod, while at the same time its spacing from the stackrod permits movement of the lowermost ring of the ring column in its own plane, as is essential to said lowermost ring being withdrawn from the ring column, the other rings of which are held by the stackrod 16.

If incorporated into the shelf structure, the upper-plate 22*b* thereof may be provided with a cut-out 24*b* disposed in axial alignment with the stackrod 16 and which opens through its forward edge and has size and configuration corresponding substantially to the outer-edge dimensions and configuration of the rings R mounted on the stackrod 16. Thus, said upper-plate 22*b* is capable of receiving in its cut-out 24*b* the lowermost ring of the ring column, thus preventing movement of said ring in its own plane in any direction except in forward direction. The under-plate 22*a* is also provided with a cut-out 24*a* opening through its front edge but the latter cut-out is disposed in forwardly-offset relation to the cut-out 24*b* of the upper-plate. Said under-plate cut-out 24*a* may have size and configuration generally similar to that of the upper-plate cut-out 24*b*, but in any case it has depth and width as enables the smaller-diameter end of the mandrel of a mandrel-type applicator for external rings to be inserted thereinto from below to a depth such that its end face engages the lower end face of the stackrod 16. As seen in FIG. 2, when the mandrel is so inserted, it also enters the central opening of the lowermost ring R of the ring column and hence is capable of withdrawing said lowermost ring from the ring column responsive to forward movement of the mandrel through the cut-out 24*a*.

It will also be seen that by virtue of the forward offsetting of the under-plate cut-out 24*a* with respect to the cut-out of the upper-plate 22*b*, the edge portion of the under-plate which surrounds and defines said cut-out 24*a* forms a ledge 26 which extends a small distance forward of the outer edge of the lowermost ring of the ring column and thus provides a generally annular supporting surface for the entire ring column. As will be seen in FIG. 3, however, the lowermost ring of the ring column can be readily freed from said supporting ledge simply by moving same forwardly an amount corresponding to the amount by which the under-plate cut-out 24*a* is offset forwardly from the upper-plate cut-out 24*b*.

From the above and by reference had to FIGS. 2–4 inclusive, it will be appreciated that the illustrated dispenser is capable of operation by the mandrel 28 of a mandrel-type ring-applying tool or applicator. More particularly, such a mandrel, which conventionally has frusto-conical configuration, and a smaller-diameter end of diameter somewhat less than the inner-edge diameter of the rings to be assembled and a larger-diameter end of diameter somewhat greater than the shafts on which the rings R to be assembled, is cooperated with the dispenser in the manner illustrated in FIG. 2, that is, with its smaller diameter end inserted through the cut-out 24*a* of the under-plate 22*a* from below same to a depth such that its end face engages against the end face of the stackrod 16, in which position it enters the central opening of the lowermost ring of the ring column maintained by the stackrod. Thereupon, said mandrel 28 may be shifted a small distance forwardly or to the left (FIG. 3) as results in the lowermost ring of the column being drawn forwardly therefrom. As this withdrawal movement continues, the ring is ultimately freed from the dispenser and drops on to the mandrel to an axially intermediate position therealong as indicated in FIG. 4. The mandrel 28 with ring thereon may now be transported by hand to and placed against the end of a grooved shaft in whose groove the ring is to be assembled, whereat the ring is spread to the diameter of the shaft by forcing it axially along the mandrel, as by a tool having a spreading head consisting of a longitudinally-split hollow cylinder adapted to be telescoped over the mandrel, for example. It will be understood that the mandrel 28 and the aforesaid ring-spreading head need not be formed as physically different parts as instead they may be combined into a unitary ring-spreading and applying tool of the general type disclosed and claimed in my patent No. 3,015,882, dated January 9, 1962.

Referring to FIGS. 5–8, such illustrate an improved ring-spreading mandrel whose construction and design are such as to prevent over-stressing of a ring as it is being spread by forceful movement therealong and thereby the possibility of the ring taking on a permanent set. In explanation, experience has shown that when an external split ring is spread on a conventional frusto-conical mandrel having full circular section, as has the mandrel 28 of the FIGS. 1–4 form of applicator, there is a tendency towards over-stressing of the ring to the degree that it takes on a permanent set, due apparently to the fact that when spread uniformly in radial direction, the more non-elastic portions of the ring, which are required to spread to about the same degree as the more elastic portions, tend to become over-stressed. To avoid this danger, the invention provides a ring-spreading mandrel which effects what may be termed a non-circular spreading action of the ring; that is, a spreading thereof in those portions of the ring which are the most elastic and accordingly well able to take the deformation which the ring must take in moving axially along the mandrel to its larger-diameter end.

Referring particularly to FIGS. 5 and 8, the improved mandrel 30 according to the invention is characterized by its larger-diameter end portion having flat sides 32*a*, 32*b*. In case of said larger-diameter end portion being formed hollow (as is the case with the mandrel shown in FIGS. 5 and 8) as enables it to be telescoped over the end of a grooved shaft S, in whose groove *g* the ring R being spread is to be assembled, said flat sides are provided by milling, grinding away or otherwise relieving opposite peripheral portions of its tubular wall, whereby the remaining opposite arcuate portions designated 34*a*, 34*b* form the larger-diameter spreading end of the mandrel. It is contemplated that the ring to be spread will drop or be pushed on to the smaller end of said mandrel with the necessary relative orientation that one arcuate portion 34*a* of the mandrel will be effective on the middle portion of the ring and the opposite arcuate portion 34*b* will be effective on the free end portion of the ring, as is illustrated in FIG. 8. The result of the aforesaid mandrel

construction and ring disposition is that the ring R is deformed non-circularly; that is, its more elastic sides or arms tend to elongate, whereas its less elastic middle-length portion and its usually lugged or eared free-end portions which are less sensitive to distortion are only slightly deformed, with the desirable result that over-stressing of the ring as a whole is not likely. Thus, by preventing overstressing, the ring will inevitably return to its original circular shape in moving into its groove, rather than being permanently set due to over-stressing, as can happen when the ring is spread on a conventional full or effectively full-circular mandrel.

Referring now to the dispenser and/or applicator devices according to FIGS. 9–15 inclusive, the dispenser therein illustrated, although designed to dispense split internal rings requiring contraction during their assembly in the bores of housings and the like, is generally similar to the applicator for the dispenser for external rings shown in FIGS. 1–4. That is to say, it comprises a base **40** and an upright standard **42** mounting a stackrod **44** having a ring-orienting rib or blade **44***a* provided along one side edge thereof and a ring-column supporting shelf **46** which extends laterally therefrom and beneath the stackrod **44**, from which it is spaced a distance corresponding to the axial thickness of one of the rings R mounted on the stackrod.

Said shelf **46**, which is preferably of single rather than double-plate construction as was the shelf means of the FIGS. 1–4 dispenser, is provided with a cut-out **48** which opens through its front edge and is moreover axially aligned with the stackrod. Said cut-out **48** provides for the movement of an applicator-carried part upwardly through the shelf into the opening of the lowermost ring of the ring column supported on the shelf, just as did the cut-outs in the shelf structure of the previously described form of dispenser.

By reference to FIGS. 11 and 12 taken with FIG. 10, said applicator is of the internal type and comprises a thick-walled sleeve member **50** having a bore **52** which tapers from its upper, larger-diameter end having diameter somewhat larger than the outer-edge diameter of the internal rings being dispensed in their unstressed condition to a lower-end diameter corresponding substantially to that of the bore *b* of a housing or similar machine part H (FIGS. 14 and 15) in whose groove *g* the internal rings are to be assembled.

To enable such a sleeve-form applicator to pick off the lowermost ring from the stackrod **44** (as constitutes a dispenser operation), it is provided with a generally upright pick-off finger **54** affixed to its upper end portion as by screws **54***a* at a level such that the upper end portion of the finger projects from the top edge of the sleeve a distance corresponding substantially to the total of the combined thickness of one ring R and of the shelf **46**. As best seen in FIG. 10, the section of the finger proper (which is shown to be square but which may be circular) is such that it may comfortably enter the center opening of the rings R mounted on the stackrod, and it is provided with an upright, forwardly directed rib **56** corresponding generally to the ring-orienting rib or blade **44***a* provided on the stackrod and is adapted to knife into the gap of the lowermost ring of the ring column. As seen in FIG. 10, the formation of the rib **56** on the finger **54** proper also provides outwardly facing corner recesses on the relatively forward side of the finger, which comfortably accommodate the radially inturned end ears characterizing the internal retaining ring. Thus, the ring pick-off tongue **54** and its rib **56** together provide an effective and reliable guide for the rings moving into the applicator sleeve **50**, following each ring dispensing operation.

Upon a dispensed ring dropping into the larger-diameter upper end of the applicator-sleeve bore **52**, it is forced axially downward therethrough by a ring-pushing tool **58** which may take the form of that shown in FIGS. 13–15 inclusive. More particularly, said tool comprises an elongated tubular shank **60**, the lower or working end of which is made contractible by providing therein diametrical slots **60***a*, **60***b* which extend axially-upwardly through said working end and the other end of which mounts a solid circular knob or handle **62**, by which the tool when held by the hand can be pushed downwardly. As seen in FIGS. 14 and 15, the tubular shank **60** normally has diameter intermediate that of the inner- and outer edge-diameters of the rings R, but as its working end is contractible, it may contract with the ring R as the latter is forced downwardly through the lower smaller-diameter end of said bore and into the housing bore *b*. As best seen in FIG. 13*a*, one of said slots **60***a* has greater width than the companion slot **60***b*, thus to accommodate the rib **56** of the pick-off finger **54**.

While the action of the applicator employed with the FIGS. 9, 11 and 12 form of dispenser will doubtless be clear to those skilled in the art, it is briefly summarized as follows: The applicator **50** is initially cooperated with the dispenser in the manner shown in FIG. 11; that is to say, it is moved upwardly by hand toward the ring-column supporting shelf **46** from a position below same to a position in which its ring pick-off finger **54** and its rib **56** extends upwardly through the shelf cutout **48**, enters the center opening of the lowermost ring R of the ring column supported on the shelf, and finally abuts the lower end of the stackrod **44**, which limits any further upward movement of the applicator. In this position, the rib **56** projects through the gap of the lowermost ring, the inwardly-directed end ears of which are accommodated in the outwardly facing corners provided between the finger proper and said rib, as best seen in FIG. 10.

Thereupon, the applicator is drawn forwardly, as in FIG. 12, this movement of course effecting withdrawal of the lowermost ring of the ring column and resulting in the column lowering the distance of one ring, whereupon the previously next-lowermost ring assumes the lowermost or dispensing-ready position. Upon moving beyond the forward edge of the shelf **46**, the so withdrawn ring lowers into the bore **52** of the applicator sleeve, whereupon the applicator and ring contained in its bore is moved by hand to the housing H in whose groove *g* said ring is to be assembled, and on which it is centered as shown in FIG. 14.

Thereupon, the contractible shank end of the push tool **58** is inserted into the larger upper end of the applicator-sleeve bore and is pushed downwardly therethrough, such action resulting in the ring being also forced downwardly through the bore and in being contracted during the course of such movement to a diameter such that it can readily be pushed into the housing bore *b* to the plane of its groove *g*, whereupon the push tool and applicator sleeve may be together backed-off from the housing and finally the push tool withdrawn from said sleeve.

Referring now to the further modified dispenser forms illustrated in FIGS. 16–24, and which as above generally stated are of the type adapted to be operated by a conventional pliers-type applicator, and first considering the FIGS. 16–19 form, the dispenser therein illustrated, like the two previously described forms, comprises a base **70** and an upright standard **72** affixed thereto, the standard mounting along one side edge thereof a generally vertically-disposed stackrod **76** provided with a forwardly projecting ring-orienting blade or rib **76***a* and affixed to a side face thereof a laterally projecting shelf **80** provided with a forwardly opening notch or cut-out **82**, said shelf-extending beneath and being spaced from the stackrod a distance substantially equal to the axial thickness of any one of the rings R disposed in vertical stack or column formation on the stackrod.

To enable a dispenser as so far described to be operated by means of a conventional retaining ring-assembly pliers (applicator) of the type having its pin-like working points disposed substantially at a right angle to the plier tips which carry the same, as is the case with the pliers

P shown in FIG. 16, for example, the invention provides means actuable by each lowermost ring of the ring column then in the dispensing-ready position as it is pulled in forward direction by the pliers, for effecting movement of the next higher (referred to hereinafter as the next lowermost) ring of said column to said dispensing-ready position. More particularly, the dispenser according to the FIGS. 16–19 form incorporates a U-bent leaf spring generally designed 84 whose fixed arm 84*a* may be secured to the forward face of the dispenser base 70 as by screws 86 as shown and whose other arm 84*b* (which is free to flex) extends substantially vertical and has length such that its free tip extends through the aforesaid forwardly opening shelf notch or cut-out 82 and terminates short of the lower end of the stackrod 76. Thus, the spring arm 84*b* may move in forward and rearward direction with respect to the stackrod without interference from same. By reference to FIG. 16, which illustrates the normal unstressed position of the spring 84, it will be seen that the free tip end of its arm 84*b* also projects into the center opening of the lowermost ring R of the ring column then in a more advanced position as compared to that of all other rings of the ring column, to be hereinafter referred to as the dispensing-ready position.

Secured at its lower end to the free arm 84*b* of the leaf spring adjacent its fixed U-bent end as by rivets 90*a* and inclining rearwardly therefrom is a finger 90 of length such that its free upper end, which may be angled rearwardly as at 90*b* for increased effectiveness and which also extends through the cut-out 82 in the column-supporting shelf 80, is normally disposed just to the rear of the next lowermost ring R of the ring column. Accordingly, by virtue of its connection to the movable arm 84*b* of the leaf spring 84 and its freedom to move within the cut-out 82 of the shelf, the finger 90 will move forwardly and rearwardly a limited amount with forward and rearward movement of the spring arm 84*b*. As will hereinafter be more fully explained, the forward movement of the finger 90 is utilized to push said next lowermost ring forwardly to the relatively forward position which it will assume when ultimately it becomes the lowermost ring R in the dispensing-ready position.

To allow this forward movement of the next lowermost ring, which would otherwise be prevented by engagement of its inner edge with the stackrod 76, and also to prevent excess forward ring movement, the lower face of said stackrod is provided with a rearwardly opening set-back or notch 76*x* of depth substantially equal to the radial thickness of the rings R at their middle section, said notch terminating in a rearwardly facing, abrupt shoulder 76*y* positioned to be abutted by the inner edge of the next lowermost ring as the latter is projected forwardly, as is illustrated in FIG. 18. When said ring abuts the shoulder 76*y*, its forward movement is positively stopped and its only further possible movement is a lowering movement, of which it will partake when the lowermost ring R is fully withdrawn by the pliers P as in FIG. 19. Since the finger 90 possesses some springiness, it will flex when the forward movement of its free end is stopped by engagement of said next lowermost ring with the shoulder 76*y* as aforesaid.

While it is believed that the manner in which such a dispenser is operated by a conventional ring-handling and assembling pliers will be clear from the above and an analysis of FIGS. 16–19, this operation is briefly detailed as follows:

Upon loading of the dispenser with a supply of the rings R to be dispensed arranged in column formation on the stackrod 76, the lowermost ring of the column will be projected by hand to the dispensing-ready position in which it is shown in FIG. 16. By reference to FIG. 17, it will be seen that in such position, the apertured ears of said lowermost rings extend forwardly beyond the forward edge of the shelf 80 and hence are freely accessible to the working points of the pliers which may thereupon be readily coupled to said ring as is shown in FIG. 16. When so positioned, the free or tip end of the spring arm 84*b* extends into the ring opening of said lowermost ring, and the free upper end of the finger 90 is disposed just to the rear of the next lowermost ring of the column.

When now the pliers are drawn forwardly to effect withdrawal of the lowermost ring from beneath the stackrod, the inner edge of said ring will engage the spring arm 84*b*, causing it to move forwardly and responsive to such flexing, the companion finger 90 is also actuated in forward direction, as results in the next lowermost ring of the ring column being projected forwardly into the under face notch 76*x* of the stackrod until it engages the rearwardly facing shoulder 76*y* thereof in which position (see FIG. 18) it is positioned directly above its ultimate dispensing-ready position. Thus, the shoulder 76*y* determines the forwardmost position to which each next lowermost ring R can be advanced. FIG. 19 also illustrates that continued withdrawal movement of the lowermost ring by the pliers disengages said lowermost ring from the spring arm 84*b*, which yields as may be necessary to permit such disengagement and when full disengagement occurs, spring arm 84*b* will retract rearwardly, carrying with it the finger 90. By proper design of the parts, the spring arm 84*b* will return to its normal unstressed position just prior to the previously next lowermost ring lowering by gravity into the dispensing-ready position in which it is shown in FIG. 19, whereupon the dispenser is now conditioned for the next dispensing operation.

In FIGS. 20–23 is illustrated a modified form of retaining ring dispenser in which the ring advancing and positioning means comprises a leaf spring 94 whose free end 94*a* normally extends into the central opening of the lowermost ring of the ring stack then disposed in the dispensing-ready position and thus is conditioned to be pulled bodily forwardly responsive to forward withdrawal movement of said ring, and whose other end is affixed to the rearward end of a rigid, forwardly extending slide 96 which is slidable forwardly and rearwardly in a confined slideway 98 defined by the upper surface of the shelf 80 and a slideway cover member 100 mounted on said shelf, it being observed that the forward edge of the slide is normally positioned just to the rear of the next lowermost ring R of the ring column. The spring and slide assembly is thus movable in forward and rearward direction as a unit and, while shown to be biased by gravity to its rearward position to which it will return following each ring-withdrawal operation, it will be understood that suitable spring means for effecting this return movement may be provided. In any case, as each lowermost ring of the column is withdrawn, the spring and slide assembly is moved forwardly responsive thereto, with the result that the forward edge of the slide 96 will engage and push the next lowermost ring forwardly (FIG. 23) until it engages the under-face shoulder 76*y* of the stackrod, whereupon it is positioned just above its ultimate dispensing-ready position, which it will assume when full withdrawal of the lowermost ring R of the column has been effected, which latter is permitted by the yieldability of the free end of the spring arm 94. When such occurs, said next lowermost ring drops to the dispensing-ready position and the spring and slide assembly will return to its normal retracted position in which it is shown in FIG. 20, thus conditioning the dispenser for the next dispensing operation.

As is well known, at least one type of retaining-ring assembly pliers in wide use has its ring-engaging and coupling points extending straightway from its tip portions, rather than being disposed at right angles thereto as in FIG. 16, for example. Since it would be impractical to operate a dispenser having its stackrod disposed vertically or approximately vertical with pliers P_1 having its working points extending straightway as aforesaid, the invention provides in FIG. 24 a modified dispenser arrangement suited to operation by such pliers.

According to such modified arrangement, a base member 110 is provided with an upright bracket 112, to one side edge of which is secured the attaching flange 114*a*

of a dispenser standard **114** corresponding in all substantial respects to the standard **72** of the FIGS. 16–25 forms, but which is turned approximately 90° so that its stackrod **116** is horizontally disposed. The rings R are successively projected to the dispensing-ready position by a spring and slide assembly corresponding to the spring and slide assembly **94–100** of the FIGS. 20–23 form of dispenser and are positively fed along the length of the stackrod by a spring-urged follower **118** as is usual in ring dispensers whose stackrod is disposed horizontally. Analysis of FIG. 24 shows that with this horizontal disposition of stackrod, the endmost ring R of the ring column which is then in the dispensing-ready position is at least as accessible to the pliers P_1 whose working points extend straightway thereof, as are the lowermost rings R occupying the dispensing-ready positions in the two forms of dispenser shown in FIGS. 16–19 and FIGS. 20–23, respectively, accessible to the pliers P whose working points are right-angularly disposed as in FIG. 16, by way of example.

It is to be understood that retaining ring dispensing and/or applicator devices as described and illustrated in the foregoing are equally adapted to the dispensing of both external and internal split rings, such in addition to achieving the primary objectives explained in the foregoing in simple yet highly effective manner. Moreover, as many changes in carrying out the above constructions without departing from the scope of the invention may be made and/or are possible, it is intended and to be understood also that all matter contained in the herein description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. The combination of a dispenser for split retaining rings adapted to form artificial locating shoulders on shafts or in housing bores and hand-actuable ring-applicator means for applying said rings to their shafts or housings, said dispenser comprising a base, stackrod supporting means mounted thereon, a stackrod affixed to said means and adapted to dispose a plurality of the rings to be dispensed in a column movable towards one end of the stackrod, shelf means mounted on said stackrod supporting means and extending transversely of the stackrod adjacent one end thereof and being spaced from said one end a distance substantially equal to the axial thickness of one of said rings, whereby to support the ring column while permitting the endmost ring thereof to be moved in its own plane from the column, said ring-applicator means incorporating provision for coupling itself to said endmost ring and being operative when so coupled to pull said ring in its own plane from the ring column preliminary to applying said ring to a shaft or housing.

2. The combination according to claim 1, wherein said applicator means includes a ring spreading mandrel of frusto-conical configuration whose smaller end has diameter less than that of the central opening of said rings, and wherein the shelf means is provided with a cut-out which opens through its front end and is dimensioned so as to permit said smaller end of the mandrel to be projected therethrough and into the center opening of said endmost ring from below same, as effects coupling of the applicator means thereto as aforesaid.

3. The combination according to claim 2, wherein said mandrel has two opposite peripheral portions which are flat and extend as chords between intermediate arcuate portions which provide the ring-spreading surface of the mandrel.

4. The combination according to claim 3, wherein the larger end of the mandrel is hollow and said flat sides are provided by cuts extending through the tubular wall of said hollow end on two opposite sides thereof.

5. The combination according to claim 1, wherein said applicator means includes a ring-contracting sleeve having a tapered bore whose diameter decreases from one slightly greater than that of the free outer edge diameter of said rings to be assembled to one substantially that of the bore of the housing in which said ring is to be assembled, and wherein said sleeve mounts a finger which projects a limited distance from its larger-diameter end and has dimension enabling it to be projected through the cut-out in the shelf means and into the center opening of said endmost ring, as effects coupling of said applicator means to said ring as aforesaid.

6. The combination according to claim 1, wherein the free ends of said rings are formed with apertured ears, and wherein said applicator means comprises a pliers having pin-like working points which are adapted to be inserted into the apertures of the ears of said endmost ring of the column and thereby coupled to said ring as aforesaid, upon said ring having first been moved in a relative forward direction in its plane by an amount as to make the apertured ears thereof accessible to said working points.

7. The combination according to claim 6, wherein said dispenser is further provided with means for automatically moving the next endmost ring of the column to a forward position in which its ears are accessible to the plier points responsive to the pliers pulling said endmost ring from the ring column.

8. A dispenser for split retaining rings adapted to form artificial locating shoulders on shafts and the like comprising, in combination, a base, stackrod supporting means mounted thereon, a generally upright stackrod affixed to said means and adapted to dispose a plurality of the rings to be dispensed in a column movable downwardly towards the lower end of the stackrod, shelf means mounted on said stackrod supporting means and extending transversely of the stackrod adjacent its lower end and being spaced below said end a distance substantially equal to the axial thickness of one of said rings, whereby to support the ring column while permitting sidewise movement of the lowermost ring of the column thereof, said shelf means having a ring drop-through opening therein which has size and configuration enabling said endmost ring to drop through the same but which is offset laterally from the normal position occupied by said lowermost ring, said opening providing for the insertion from below of means for actuating said lowermost ring to a position in which it is vertically aligned with said drop-through opening.

9. A dispenser for split retaining rings according to claim 8, wherein said shelf means comprises upper and lower plates disposed in face-engaging relation, said lower plate being provided with said drop-through opening, said upper plate having a similarly sized and configured opening but said latter opening being in axial alignment with the rings of the column and thereby adapted to receive the next lowermost ring thereof.

10. A dispenser for split retaining rings according to claim 8, wherein the opening of said shelf means is disposed to open through the forward edge thereof whereby the means insertible from below may move forwardly away from the shelf means.

11. In split retaining-ring applying means, a ring-spreading mandrel having effective diameter which increases from a diameter less than the free inner-edge diameter of a ring to be applied to a diameter corresponding substantially to that of the shaft on which said ring is to be applied, said mandrel having two opposite peripheral portions which are flat and which extend as chords between intermediate arcuate portions which provide the ring-spreading surface of the mandrel.

12. A ring-spreading mandrel as defined in claim 11, wherein the larger diameter end of the mandrel is hollow and said flat sides are provided by cuts extending through the tubular wall of said hollow end and on two opposite sides thereof.

13. In an applicator for split internal retaining rings, a ring contracting sleeve having a tapered bore whose larger end has diameter slightly greater than the free outer-edge diameter of said rings and whose smaller end has diameter substantially equal to the diameter of the bore of the housings in which said rings are to be assembled, said sleeve having a finger mounted in the larger

diameter end of its bore and which projects upwardly therefrom, said finger being dimensioned to enter the center opening of a ring mounted in a dispenser from below and to shift same laterally to a position in which it may drop into said bore.

14. An applicator according to claim 13, wherein said finger proper is connected to the sleeve by a narrow-width rib adapted to enter the gap of the ring with which the finger is cooperated, said rib cooperating with the finger in guiding said ring into the bore of the sleeve.

15. A pliers operated dispenser for split retaining rings comprising, in combination, a base, a stackrod supporting means mounted thereon, a stackrod affixed to said means and adapted to dispose a plurality of split retaining rings to be dispensed in a column movable towards one end of the stackrod, a ring-column supporting shelf extending transversely of said stackrod and being spaced from said one end thereof a distance substantially equal to the axial thickness of one of said rings whereby the endmost ring of the column may be withdrawn from said ring column by means of a pliers-type tool coupled to the end portions of said ring in the conventional manner, means on the stackrod enabling positioning of said endmost ring more forwardly on the shelf than are the remaining rings of the ring column, thereby making the end portions of the ring accessible to said tool, and means mounted on the stackrod supporting means for advancing the next endmost ring of the column to said more forward position as aforesaid responsive to the withdrawal movement of said endmost ring.

16. A pliers operated split-ring dispenser according to claim 15, wherein said ring advancing means comprises a leaf-spring arm whose free tip end extends into the central opening of said endmost ring so as to be actuable in relatively forward direction responsive to a ring withdrawal movement as aforesaid, and means connected to said arm for movement therewith and having a working end which is normally disposed just to the rear of said next lowermost ring and which is operative to impart advance movement to said latter ring when actuated forwardly by corresponding movement of said spring arm.

17. A pliers operated split-ring dispenser according to claim 16, wherein said last means comprises a spring finger affixed to said leaf-spring arm to move therewith and whose free tip end is normally disposed immediately to the rear of said next lowermost ring and provides said working end.

18. A pliers operated split-ring dispenser according to claim 16, wherein said last means comprises a rigid slide member mounted to slide forwardly and rearwardly on said shelf with movement of said spring arm and whose forward edge is disposed immediately to the rear of said next lowermost ring and provides said working end.

19. A pliers operated split-ring dispenser according to claim 15, wherein said ring-positioning means includes a rearwardly facing notch in said stackrod and which terminates forwardly in a transversely extending shoulder

adapted to be abutted by the inner edge of said next endmost ring as the latter partakes of advance movement as aforesaid, the construction and arrangement being such that said next endmost ring when in the forward position aforesaid may move axially from the stack-rod to the position of said endmost ring upon full withdrawal of said endmost ring by said pliers having been effected.

20. A pliers operated dispenser for split retaining rings comprising a base, a standard mounted on said base, a stackrod secured in generally vertical position along one side edge of the standard and having a longitudinal blade projecting forwardly therefrom, said stackrod serving to mount a plurality of retaining rings to be dispensed in generally vertical column formation thereon and said blade projecting through the gaps between the open end of said rings thereby to orient the rings so that their end portions face forwardly, a ring-column supporting shelf carried by said standard to extend transversely of said stackrod and at a level such that its upper surface is spaced below the lower end of the stackrod a distance substantially equal to the axial thickness of one said ring, said shelf having a slot opening through its front edge, means on the stackrod enabling positioning of the lowermost ring of the column in a forward dispensing-ready position with respect to the body of the rings on the stackrod in which the end portions of said ring overhang the forward edge of the shelf and thus are readily accessible to the working points of a pliers-type tool conventionally employed to assemble said ring, and means for actuating the next lowermost ring of the ring column while still on the stackrod to a forward position corresponding to that of said lowermost ring responsive to initiation of the operation of withdrawing said lowermost ring from the shelf, whereby said next lowermost ring will drop by gravity to the dispensing-ready position on said shelf upon completion of said withdrawal operation, said means including a rearwardly opening notch in the lower end of the stackrod providing for the accommodation of said next lowermost ring in its said forward position, a leaf-spring arm whose movable end extends through the shelf slot into the central opening of said lowermost ring and being movable forwardly through the slot by said ring responsively to ring withdrawal, and a push member normally disposed to the rearward side of said next lowermost ring and being coupled to the leaf-spring arm for forward movement therewith into engagement with said next lowermost ring as effects its forward movement as aforesaid.

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