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### (54) RAILROAD SPIKE REMOVER

(57) A portable railroad spike remover (500) comprises a housing (502), a drive shaft and a claw assembly extractor (540) that is shaped to engage and secure a railroad spike previously installed into a rail tie. The claw assembly extractor (540) includes a pair of jaw members that are pivotally connected to each other by a pivoting pin and a rotating pin, wherein the claw assembly extractor (540) is connected to a mounting flange. Each jaw member may include a lower end configured to contact and secure a railroad spike and a pair of upper members interlocked with each other and pivotally connected to a clevis fastener connected with the rotating pin. When the drive shaft is rotated, the claw assembly extractor (540) and the mounting flange may move inside the main housing (502) in a vertical direction to extract the railroad spike from the rail tie.

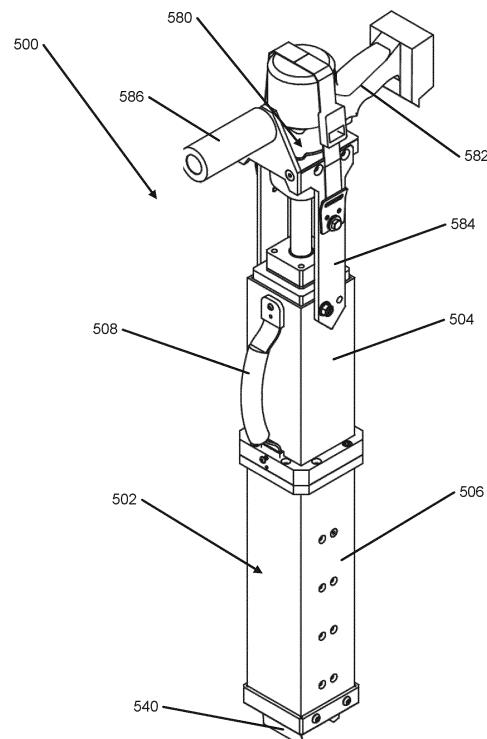


FIG. 16B

## Description

**[0001]** This application claims priority to U.S. Non-Provisional Application No. 16/734,125, filed January 3, 2020; and U.S. Provisional Application No. 62/788,925, filed January 6, 2019 which is a continuation-in-part application of U.S. Non-Provisional Application No. 15/175,900, filed June 7, 2016. All of these applications are herein incorporated by reference in their entirety.

## FIELD OF INVENTION

**[0002]** The field of invention for this disclosure relates to a portable railroad spike remover.

## BACKGROUND

**[0003]** Removing railroad spikes from a rail tie has not changed much over time. Railroad spikes are often removed from a rail tie manually using a crowbar. A railroad spike may need as much as 5,000 pounds of vertical force to remove a spike embedded in a rail tie. A portable device to easily remove the railroad spikes would be a great improvement.

## SUMMARY

**[0004]** The following presents a general summary of aspects of the invention in order to provide a basic understanding of the invention and various features of it. This summary is not intended to limit the scope of the invention in any way, but it simply provides a general overview and context for the more detailed description that follows.

**[0005]** The present disclosure provides an apparatus for removing railroad spikes from a rail tie that is portable and easy to use.

**[0006]** According to one aspect of the disclosure, an apparatus for removing a railroad spike from a rail tie comprises: a main housing that includes an upper housing and a lower housing, wherein the upper housing includes a bearing housing that contains one or more bearings; a drive shaft connected to the main housing and a mounting flange, the drive shaft extending through the one or more bearings and an opening in the bearing housing; and a plurality of standoffs with a first end and a second end, with the first end of the plurality of standoffs connected to the mounting flange and the second end of the plurality of standoffs connected to a clevis pivot plate with a clevis fastener that is connected to a claw assembly extractor. The claw assembly extractor may include a pair of jaw members that are pivotally connected to each other by a pivoting pin and a rotating pin. Each jaw member may include a lower end and a pair of upper members interlocked with each other. The lower end may be configured to contact and secure a railroad spike and the pair of upper members may be pivotally connected to the clevis fastener with the rotating pin. When the drive

shaft is rotated, the claw assembly extractor and the mounting flange may move inside the main housing in a vertical direction to extract the railroad spike from the rail tie.

**[0007]** According to another aspect of the disclosure, an apparatus for removing a railroad spike from a rail tie comprises: a main housing that includes an upper housing and a lower housing, wherein the upper housing includes a bearing housing that contains one or more bearings; a drive shaft connected to the main housing and a mounting flange, the drive shaft extending through the one or more bearings and an opening in the bearing housing; a T-handle assembly to hold a battery-operated drill-type tool that connects to the drive shaft, wherein the T-handle assembly includes one or more fastening straps and one or more side plates to connect the T-handle assembly to the main housing; and a plurality of standoffs with a first end and a second end, with the first end of the plurality of standoffs connected to the mounting flange and the second end of the plurality of standoffs connected to a clevis pivot plate with a clevis fastener that is connected to a claw assembly extractor. The claw assembly extractor may include a pair of jaw members that are pivotally connected to each other by a pivoting pin and a rotating pin. Each jaw member may include a lower end and a pair of upper members interlocked with each other. The lower ends may be configured to contact and secure a railroad spike and the pair of upper members may be pivotally connected to the clevis fastener with the rotating pin. The claw assembly extractor may include a friction assembly that includes a spring and one or more friction caps to keep the jaws in an open position as the jaws are moved from an up position to a home position after a railroad spike has been pulled. When the drive shaft is rotated, the claw assembly extractor and the mounting flange moves inside the main housing in a vertical direction to extract the railroad spike from the rail tie.

**[0008]** According to another aspect of the disclosure, the rail spike remover may include a rail spike driver for driving the railroad spike into the rail tie. The rail spike driver may be interchangeable with the claw assembly extractor by removing the clevis pivot plate and attaching the rail spike driver to the plurality of standoffs.

**[0009]** According to yet another aspect of the disclosure the rail spike remover may include a rectangular leveling block located on a side of a bottom footer of the lower housing of the main housing, wherein the leveling block is utilized to level the main housing and the rail spike remover when removing railroad spike.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** The present invention is illustrated by way of example and not limited in the accompanying figures in which like reference numerals indicate similar elements and in which:

FIG. 1 illustrates a top front perspective view of an example embodiment of a rail spike remover according to one or more aspects described herein;

FIG. 2 illustrates a front view of the example embodiment of the rail spike remover of FIG. 1;

FIG. 3 illustrates a top view of the example embodiment of the rail spike remover of FIG. 1;

FIG. 4 illustrates a cross-sectional view of the example embodiment of the rail spike remover of FIG. 1;

FIG. 5 illustrates a perspective view of an extractor from the example embodiment of the rail spike remover of FIG. 1 with other components removed;

FIG. 6 illustrates a top view of the extractor of FIG. 5;

FIG. 7 illustrates a top view of an alternate embodiment of the extractor of the rail spike remover of FIG. 1;

FIG. 8 illustrates a front view of an extractor tooth from the extractor of FIG. 7;

FIG. 9 illustrates a cross-sectional view of the extractor tooth of FIG. 7;

FIG. 10 illustrates a side perspective view of an alternate embodiment of the extractor of the rail spike remover of FIG. 1;

FIG. 11 illustrates an internal side perspective view of the extractor and rail spike remover of FIG. 10;

FIG. 12 illustrates a close-up view of a bottom portion of the extractor and rail spike remover of FIG. 10;

FIG. 13 illustrates a close-up view of the extractor and rail spike remover of FIG. 10;

FIG. 14 illustrates a side perspective view of the extractor of the rail spike remover of FIG. 10;

FIGS. 15A-15D illustrate the interchangeability of the extractors 140 and 340 for the railroad spike remover 100;

FIGS. 16A and 16B illustrate perspective views of an alternate embodiment of the rail spike remover of FIGS. 1 and 10;

FIG. 17A illustrates a cross-sectional view along A-A of the rail spike remover of FIGS. 16A and 16B;

FIG. 17B illustrates a cross-sectional view of detail B of the rail spike remover of FIGS. 16A and 16B;

FIG. 17C illustrates a cross-sectional view of detail C of the rail spike remover of FIGS. 16A and 16B;

FIG. 17D illustrates a cross-sectional view of detail D of the rail spike remover of FIGS. 16A and 16B;

FIGS. 18A-18C illustrate perspective views of an upper housing of the rail spike remover of FIGS. 16A and 16B;

FIGS. 19A and 19B illustrate perspective views of a lower housing assembly of the rail spike remover of FIGS. 16A and 16B;

FIGS. 20A-20C illustrate perspective views of a T-handle assembly of the rail spike remover of FIGS. 16A and 16B;

FIGS. 21A and 21B illustrate perspective views of a drill guard assembly for the T-handle assembly of FIGS. 20A-20C;

FIG. 22 illustrates a schematic view illustrating the interchangeability of a rail spike driver with the extractor or claw assembly extractor of the rail spike remover of FIGS. 1, 10, 16A, and 16B; and

FIG. 23 illustrates a schematic view of a leveling block for use with the rail spike remover of FIGS. 1, 10, 16A, and 16B.

**[0011]** Further, it is to be understood that the drawings may represent the scale of different components of one single embodiment; however, the disclosed embodiments are not limited to that particular scale.

## DETAILED DESCRIPTION

**[0012]** In the following description of various example structures according to the invention, reference is made to the accompanying drawings, which form a part hereof, and in which are shown by way of illustration various example devices, systems, and environments in which aspects of the invention may be practiced. It is to be understood that other specific arrangements of parts, example devices, systems, and environments may be utilized and structural and functional modifications may be made without departing from the scope of the present invention. Also, while the terms "top," "bottom," "front," "back," "side," "rear," and the like may be used in this specification to describe various example features and elements of the invention, these terms are used herein as a matter of convenience, e.g., based on the example orientations shown in the figures or the orientation during typical use. Nothing in this specification should be construed as requiring a specific three-dimensional orientation of structures in order to fall within the scope of this invention. Also, the reader is advised that the attached

drawings are not necessarily drawn to scale.

**[0013]** The following terms are used in this specification, and unless otherwise noted or clear from the context, these terms have the meanings provided below.

**[0014]** "Plurality," as used herein, indicates any number greater than one, either disjunctively or conjunctively, as necessary, up to an infinite number.

**[0015]** "Connected," as used herein, indicates that components may be connected directly being physically contacting each other or connected indirectly where the components are connected indirectly where the components do not physically contact, but have one or more intermediate components positioned between them.

**[0016]** "Integral joining technique" or means a technique for joining two pieces so that the two pieces effectively become a single, integral piece, including, but not limited to, irreversible joining techniques, such as adhesively joining, cementing, welding, brazing, soldering, or the like, where separation of the joined pieces cannot be accomplished without structural damage thereto. Pieces joined with such a technique are described as "integrally joined."

**[0017]** In the following description of the various embodiments, reference is made to the accompanying drawings, which form a part hereof, and in which is shown, by way of illustration, various embodiments in which aspects of the disclosure may be practiced. It is to be understood that other embodiments may be utilized and structural and functional modifications may be made without departing from the scope and spirit of the present disclosure.

**[0018]** In general, as described above, aspects of this invention relate to an apparatus to remove railroad spikes from a rail tie comprising a main column, a drive shaft and an extractor. More detailed descriptions of aspects of this invention follow.

**[0019]** One aspect of this invention relates to a portable railroad spike remover 100, as shown in FIGS. 1-4. Specifically, FIG. 1 illustrates a top front perspective view of an example embodiment of a railroad spike remover 100. FIG. 2 illustrates a front view of the railroad spike remover 100. FIG. 3 illustrates a top view of the railroad spike remover 100. FIG. 4 illustrates a cross-sectional view of the railroad spike remover 100. The railroad spike remover 100 may comprise a main column 102, a bearing housing 110, a plurality of standoffs 170, a mounting flange 134, an extractor 140, and a drive shaft 120. The main column 102 may have a first end 104, a second end 106 opposite the first end 104, and a center section 108 positioned between the two ends. The bearing housing 110 may be connected to the first end 104 of the main column 102 and have an opening 112 for inserting the drive shaft 120. The drive shaft 120 may also extend through a bearing 114 secured in the bearing housing 110 by a cap plate 116.

**[0020]** As illustrated in FIG. 4, the drive shaft 120 may have a first end 122 and a second end 124 opposite the first end 122. Near the first end 122, the drive shaft 120

may extend through an opening in the bearing 114, through an opening 112 in the bearing housing 110, and through an opening in the cap plate 116. Near the second end 124, the drive shaft 120 may connect to the mounting flange 134. The drive shaft 120 may be secured to the mounting flange 134 using a nut 137.

**[0021]** The plurality of standoffs 170 may connect to the mounting flange 134 at one end and to the extractor 140 at the opposite end. Alternatively, the drive shaft 120 may connect directly to the extractor 140 without the need for the mounting flange 134 and the plurality of standoffs 170. The extractor 140 may engage and grip the railroad spike 10 to secure it. Once the extractor 140 secures the railroad spike 10, a user may engage the first end 122 of the drive shaft 120 with a tool to provide torque to the drive shaft 120. As the drive shaft 120 is rotated, the mounting flange 134 and the extractor 140 may move inside the column in a vertical direction to extract the railroad spike 10 from a rail tie. As the extractor 140 moves up within the main column 102, the railroad spike 10 is removed from the rail tie.

**[0022]** The main column 102 may have a plurality of substantially vertical side walls that are open at both ends 104, 106. The main column may have a height of approximately 32 inches or within a range of 24 to 40 inches or any height. As shown in the exemplary embodiment shown in FIGS. 1-9, the main column 102 may generally have a square cross-sectional shape. However, the main column may have any geometric cross-sectional shape, such as circular, triangular, such that the main column 102 may have any number of side walls. For example as shown in FIGS. 1 and 3, the main column 102 may have four side walls, but may have 3 side walls, 5 side walls, 6 side walls or any number of side walls. The side walls may have a thickness of approximately 0.188 inches or within a range of 0.125 inches to 0.25 inches, or within a range of 0.06 inches to .375 inches. Each side wall may have a width of approximately 4 inches or within a range of 3 inches to 5 inches, or within a range of 2 inches to 6 inches.

**[0023]** As shown in FIG. 2, at least one side wall of the main column 102 may have an aperture 109 that extends from the second end 106 to a portion of the height of the main column 102. For example, the aperture 109 may have a height of approximately 20 percent of the height of the main column 102 or the aperture 109 may have a height that is within a range of 12 percent to 37 percent of the height of the main column. The aperture 109 may have an elongated shape and may have a height of approximately 7 inches or may be within a range of 5 inches to 9 inches. In addition, the aperture 109 may have a width of approximately 1.5 inches or within a range of 1.0 inch to 2.5 inches. The aperture 109 may align with the opening 147 of the extractor 140 to allow the railroad spike remover 100 to slide into position to engage the railroad spike 10 with the extractor 140.

**[0024]** The bearing housing 110 may be integrally joined to the first end 104 of the main column 102. Alter-

natively, the bearing housing 110 and main column 102 may be formed as a single piece. As previously discussed, the bearing housing 110 may have an opening 112. The opening 112 may be located in the geometric center of the bearing housing 110 and may have a cylindrical shape to allow the drive shaft 120 to extend through the bearing housing 110. The opening 112 may be through both ends of the bearing housing 110. In addition, the bearing housing 110 may have a cavity 113 that is concentric with the opening 112. The cavity 113 may be sized to contain the bearing 114 and have a cylindrical shape that is open at one end with a surface at the opposite end to engage one end of the bearing 114. The bearing housing 110 may also have a plurality of holes around the perimeter of the housing. The plurality of holes may be threaded to releasably connect the cap plate 116. The bearing 114 may be a roller bearing or bushing that enables the drive shaft 120 to rotate freely when the bearing 114 is installed onto the drive shaft 120 and into the bearing housing 110.

**[0025]** The drive shaft 120 may have a first end 122 and a second end 124 and may be partially threaded. As shown in FIG. 4, the drive shaft 120 may have a plurality of distinct diameter regions. For example, the drive shaft 120 may have a first region 128 with a first diameter 129 corresponding to the threaded region, a second region 130 having a second diameter 131 with a smooth surface, and a third region 132 which may have a third diameter 133. The first diameter 129 may be greater than both the second diameter 131 and the third diameter 133. The first diameter 129 may be approximately 1 inch or within a range of 0.75 inches and 1.5 inches or within a range of 0.5 inches to 2.0 inches. The threaded portion (first region 128) may be ACME threads or other similar threads. Alternatively, the drive shaft 120 may have two distinct diameter regions or four distinct diameter regions.

**[0026]** The first end 122 may have a drive element 127 to allow a user to engage the drive shaft 120 with a rotating tool, such as a torque wrench 20 or similar device to rotate the drive shaft 120. As shown in FIG. 3, the drive element 127 may have a hexagonal shape to be engaged by a standard hexagonal socket. The standard hexagonal socket may be a 0.5 inches or larger. Preferably, the torque wrench 20 has a length of 18 inches or longer. A battery-operated drill-type apparatus or an air hammer attached to a pneumatic supply could be utilized as the rotating tool in lieu of the torque wrench 20, thereby engaging the drive shaft 120 and rotating the drive shaft 120 to move the drive shaft 120 up and down.

**[0027]** As discussed the drive shaft 120 may connect to the mounting flange 134. The mounting flange 134 may have a centrally located aperture 136 to connect the drive shaft 120. The mounting flange 134 may be connected to the drive shaft in a plurality of ways. For example, the aperture 136 may be threaded to directly engage the drive shaft 120, or alternatively as shown in FIG. 4, a nut 137 may be connected to the aperture 136 of the mounting flange 134 where the drive shaft 120 may con-

nnect to the mounting flange 134 with the nut 137 positioned between the mounting flange 134 and the drive shaft 120. The nut 137 may be integrally joined to the mounting flange 134 or some may be connected using an anti-rotation element to prevent the nut 137 from rotating in relation to the mounting flange 134 when the drive shaft 120 is rotated, such as a set screw. The mounting flange 134 may also have a plurality of mounting holes positioned around the perimeter to allow for easy connection to the plurality of standoffs 170. The mounting flange 134 may be releasably connected to the standoffs 170 or the drive shaft 120 to allow any repairs that may be required.

**[0028]** The plurality of standoffs 170 may be hollow tubes that connect at a first end to a mounting flange 134 and a second end of connected to an extractor 140. Each standoff 170 may have internal threads such that they may be releasably connected using a threaded fastener. Alternatively, the plurality of standoffs 170 may be integrally joined to the either the mounting flange 134 or extractor 140 or both.

**[0029]** Each standoff 170 may be approximately 7 inches long or within a range of 5 inches to 9 inches or within a range of 3 inches to 12 inches. Each of the standoffs 170 may be the same length, but depending on the shape of the either the mounting flange 134 or extractor 140, each of the standoffs 170 may have different lengths.

**[0030]** As discussed above, the plurality of standoffs 170 connect to an extractor 140. As shown in FIGS. 5 and 6, the extractor 140 may comprise a metallic plate with a top surface 141, a bottom surface 142, and a plurality of side surfaces 143, 144, 145, 146. The extractor 140 may further comprise an opening 147 through the top and bottom surface and extending through at least one side surface. The opening may further include an upper portion 148 and a lower portion 149. The lower portion 149 of the opening may have a plurality of tapered side walls 150, 151 and a first rounded rear wall 152. The plurality of tapered side walls 150, 151 may be vertically oriented and taper toward one another. The upper portion 148 of the opening may have vertically oriented side walls 153, 154, and a second rounded rear wall 155, wherein the width of the upper portion 148 is larger than the width of the lower portion 149. The first rounded rear wall 152 and the second rounded rear wall 155 may be concentric.

The extractor 140 may have a plurality of holes 158 to releasably connect the extractor 140 to the plurality of standoffs 170. The plurality of holes 158 may be positioned near the side surfaces 143, 144, 145, 146 of the extractor 140 and extend through the top surface 141 and bottom surface 142. The plurality of holes 158 may be threaded or clearance holes for a threaded fastener. Alternatively, as discussed above, the extractor 140 may be integrally joined to the standoffs 170. Additionally, as discussed above, the extractor 140 may be connected directly to the drive shaft 120.

**[0031]** FIGS. 7-9 show an alternate embodiment for the embodiment of FIGS. 7-9, the

features of the extractor 240 are referred to using similar reference numerals under the "2XX" series of reference numerals, rather than "1XX" as used in the embodiment of FIGS. 5 and 6. Accordingly, certain features of the extractor 240 that were already described above with respect to the extractor 140 of FIGS. 5-6 may be described in lesser detail, or may not be described at all.

**[0032]** The extractor 240 may have the similar exterior shape as extractor 140 to fit within the main column 102 with a top surface 241, a bottom surface 242, and a plurality of side surfaces 243, 244, 245, 246. An opening 247 may extend through at least two side surfaces and the bottom surface 242. The opening 247 may include a first guide rail 248, a second guide rail 249, a first side wall 250 adjacent the first guide rail, a second side wall 251 adjacent the second guide rail, and an upper surface 252 connecting the first guide rail 248 to the second guide rail 249. The upper surface 252 of the opening may be rounded and exposed to the exterior. The opening 247 may have a first end 253 and a second end 254, wherein a first height 255 at the first end 253 may be defined as a distance perpendicular from the bottom surface 242 of the extractor 240 to the furthest extent of the upper surface 252 and the second end 254 may have a second height 256 defined from the bottom surface 242 to the furthest extent of the second end 254 of the upper surface 252. The bottom surface 242 may further include an angled region 257, such that the angled region 257 angles upward toward the first end 253 of the opening 247.

**[0033]** Additionally, the top surfaces of the first guide rail 248 and the second guide rail 249 may be coplanar surfaces. The first guide rail 248 may have a height at the first end 253 of the opening 247 defined as a perpendicular distance from the bottom surface 242 of the extractor 240 to the furthest extent of the first end 253 of the first guide rail 248. Similarly, the second end 254 may have a second height defined as a perpendicular distance from the bottom surface 242 to the furthest extent of the second end 254 of the first guide rail 248, wherein the first height is smaller than the second height. The guide rails 248, 249 may be linear surfaces and angle in a direction away from the bottom surface 242. Thus, the opening 247 may be larger at the first end 253 than at the second end 254.

**[0034]** The first side wall 250 adjacent the first guide rail 248 and the second side wall 251 adjacent the second guide rail 249 are parallel. Alternatively, the first side wall 250 adjacent the first guide rail 248 and the second side wall 251 adjacent the second guide rail 249 are angled toward one another. Also, similar to the extractor 140, the extractor 240 may have a plurality of holes 258 to connect the extractor 240 to the plurality of standoffs 170.

**[0035]** The various components for the railroad spike remover 100, such as the main column 102, the bearing housing 110, the drive shaft 120, the mounting flange 134, the plurality of standoffs 170, and the extractor 140, 240 may be made of a metallic material, preferably a steel alloy. Alternatively, the components may be made

of other metallic materials such as iron, aluminum, an aluminum alloy, titanium, or a titanium alloy.

**[0036]** The railroad spike remover 100 may be portable for a single user to move and operate. Thus, the railroad spike remover 100 may have a weight of less than 50 pounds. In other embodiments of this invention, the railroad spike remover 100 and 500 may have a weight of less than 30 pounds.

**[0037]** To operate the railroad spike remover 100, a user may position the railroad spike remover 100 near a railroad spike 10 and then slide the opening 147 of the extractor 140 onto the top of the railroad spike 10 such that the railroad spike 10 is secured in extractor 140. The user may then position the railroad spike remover 100 over the railroad spike 10. The user then engages the drive element 127 with the torque wrench 20 and rotates the drive shaft 120 to raise the mounting flange 134 and the extractor 140. As the drive shaft 120 is turned, the extractor 140, along with the railroad spike 10, raises into the main column 102 until the railroad spike 10 is released from the rail tie. Then, the user may reverse the drive shaft 120 to lower the mounting flange 134 and the extractor 140 to allow the railroad spike remover 100 to be ready to remove another railroad spike 10. As was discussed above, a battery-operated drill-type apparatus or an air hammer attached to a pneumatic supply could be utilized in lieu of the torque wrench, thereby engaging the drive shaft 120 and rotating the drive shaft to move the drive shaft 120 up and down.

**[0038]** FIGS. 10-14 show an alternate embodiment for the extractor 140, 240. For the embodiment of FIGS. 10-14, in the place of the extractor 140, 240, the railroad spike remover 100 may include an extractor 340 with moving jaws 342 that are frictionally delayed. The features of the extractor 340 are referred to using similar reference numerals under the "3XX" series of reference numerals, rather than "1XX" as used in the embodiment of FIGS. 5 and 6. Accordingly, certain features of the extractor 340 that were already described above with respect to the extractor 140 of FIGS. 5-6 may be described in lesser detail, or may not be described at all. The extractor 340 may be used with similar features of the railroad spike remover 100 already described above.

7 FIG. 10 illustrates a side perspective view of an alternate embodiment of the extractor of the rail spike remover of FIG. 1. FIG. 11 illustrates an internal side perspective view of the extractor and rail spike remover of FIG. 10. FIG. 12 illustrates a close-up view of a bottom portion of the extractor and rail spike remover of FIG. 10. FIG. 13 illustrates a close-up view of the extractor and rail spike remover of FIG. 10. FIG. 14 illustrates a side perspective view of the extractor of the rail spike remover of FIG. 10.

**[0039]** As discussed above, the plurality of standoffs 170 connect to an extractor 340. As shown in FIGS. 10-14, the extractor 340 may comprise a claw assembly extractor. Generally, the claw assembly extractor 340 may be designed to open, close, and grab with the drive shaft 120 movement the railroad spike at a force as high

as 19,000 pounds. The claw assembly extractor 340 may include a pair of jaws 342 that are pivotally connected to each other by a pivoting pin 344 and a rotating pin 346. The lower ends 348 of the jaws 342 are configured to contact and grab the railroad spike 10. The upper members 350 of the jaws 342 are pivotally connected to the mounting flange 134 with the rotating pin 346 or the pivoting pin 344 as illustrated in FIG. 15A. When the drive shaft 120 is pulled upward, the jaws 342 move towards a grabbing position to grab onto the railroad spike 10.

**[0040]** The extractor 340 and claw assembly extractor includes the two jaws 342, a pivoting pin 344, the two upper members 350, spacer caps, a rotating pin 346, and a friction assembly. The friction assembly generally includes a spring and friction caps. The jaws 342 and upper members 350 form a moveable parallelogram assembly. The jaws 342 each have a pivot hole 352 which the pivot pin 344 is located in. The jaws 342 also each have a rotating section 354 which the rotating pin 346 is located in. The upper members 350 of the jaws 342 are pivotally connected to the jaws 342 by their rotating sections 354 and the rotating pins 346. The upper members 350 of the jaws 342 may be also pivotally connected to the mounting flange 134 and drive shaft 120 by the pivoting pin 346.

**[0041]** The friction assembly functions for keeping the jaws 342 in an open position as the jaws 342 are moved from the up position to the home position after a spike 10 has been pulled. Initially, a user places the railroad spike remover 100 over the spike 10 with the jaws 342 in the open position. When the user begins movement of the railroad spike remover 100, the drive shaft 120 is moved upward, pulling the upper members 350 upward and rotated pulling the upper members 350 of the jaws 342 towards each other. The friction assembly keeps the centers of the jaws 342 fixed relative to the main column 102 such that the jaws 342 only initially rotate and do not translate relative to the main column 102. Thus, the lower ends 348 of the jaws 342 are able to rotate under the head of the spike 10. Then the jaws 342 are stopped by the spike 10 from further rotation, the upward movement of the drive shaft 120 overcomes the frictional forces of the friction assembly and the jaws 342 translate upward along the interior of the main column 102 pulling the spike 10 with it. When the user releases the movement of the railroad spike remover 100, the drive shaft 120 is moved downward back towards its home position. The friction assembly initially holds the center of the jaws 342 fixed relative to the main column 102 such that the jaws 342 only initially rotate and translate to move the jaws 342 to an open position. As the jaws 342 are opened, the spike 10 is able to be released. The jaws 342 stop rotating and start translating down the main column 102 when the back surfaces of the jaws 342 lower ends contact the opposite interior sides of the main column 102. The lower ends 348 of the jaws 342 substantially block an area between the main column 102 and the back surfaces to prevent the spike 10 from entering this area. After the

jaws 342 open the downward movement of the drive shaft moves the jaws 342 downward back to their home position while maintaining the jaws 342 in their open position along this home returning movement.

**5** **[0042]** The claw assembly extractor and the jaws 342 includes a frictionally-delayed movement that includes pivoting claws 348 with arms or upper members 350 that frictionally contact each other and/or the main column 102 when opening and closing the jaws 342. The frictionally-delayed moving jaws functions as a means for keeping the jaws in an open position as the jaws 342 are moved from the up position to the home positions after a spike 10 has been pulled.

**[0043]** Additionally, FIGS. 15A-15D illustrate the interchangeability of the extractors 140 and 340 for the railroad spike remover 100. FIG. 15A illustrates fastening the mounting flange 134 to the top end of the main column 104 and the bearing housing 110 with the bolts and the standoffs 170. FIG. 15B illustrates sliding the standoffs

**10** 170 (or long bolts) into the extractor 140 (or claw) and then sliding the sleeves onto the standoffs 170 (or long bolts). FIG. 15C illustrates the use of spacers installed onto the extractor 140 (or claw) as needed, which will adjust the stroke of the railroad spike remover 100 from 4.5 to 6.5 inches. FIG. 15D illustrates sliding the extractor assembly (or claw assembly) into the main column 102 and tightening the four standoffs 170 (or long bolts) into the mounting flange 134.

**[0044]** FIGS. 16A-20C show an alternate embodiment **15** for a rail spike remover 500. The features of the rail spike remover 500 are referred to using similar reference numerals under the "5XX" series of reference numerals, rather than "1XX" or "3XX" as used in the embodiments of FIG. 1 and 10. Accordingly, certain features of the rail spike remover 500 that were already described above **20** with respect to the rail spike remover 100 of FIGS. 1-9 or the rail spike remover 300 of FIGS. 10-15D may be described in lesser detail, or may not be described at all. The rail spike remover 500 may be used with similar features of the railroad spike remover 100, 300 already described above. FIGS. 16A and 16B illustrate perspective views of an alternate embodiment of the rail spike remover of FIGS. 1 and 10. FIG. 17A illustrates a cross-sectional view along A-A of the rail spike remover of FIGS.

**25** 16A and 16B. FIG. 17B illustrates a cross-sectional view of detail B of the rail spike remover of FIGS. 16A and 16B. FIG. 17C illustrates a cross-sectional view of detail C of the rail spike remover of FIGS. 16A and 16B. FIG. 17D illustrates a cross-sectional view of detail D of the rail spike remover of FIGS. 16A and 16B. FIGS. 18A-18C **30** illustrate perspective views of an upper housing of the rail spike remover of FIGS. 16A and 16B. FIGS. 19A and 19B illustrate perspective views of a lower housing assembly of the rail spike remover of FIGS. 16A and 16B. FIGS. 20A-20C illustrate perspective views of a T-handle assembly of the rail spike remover of FIGS. 16A and 16B.

**35** **[0045]** The railroad spike remover 500 may comprise a main housing 502, a bearing housing 510, a plurality of standoffs 512, a main column 514, a drive shaft 516, a bearing housing 518, a bearing 520, a bearing housing 522, a bearing 524, a bearing housing 526, a bearing 528, a bearing housing 530, a bearing 532, a bearing housing 534, a bearing 536, a bearing housing 538, a bearing 540, a bearing housing 542, a bearing 544, a bearing housing 546, a bearing 548, a bearing housing 550, a bearing 552, a bearing housing 554, a bearing 556, a bearing housing 558, a bearing 560, a bearing housing 562, a bearing 564, a bearing housing 566, a bearing 568, a bearing housing 570, a bearing 572, a bearing housing 574, a bearing 576, a bearing housing 578, a bearing 580, a bearing housing 582, a bearing 584, a bearing housing 586, a bearing 588, a bearing housing 590, a bearing 592, a bearing housing 594, a bearing 596, a bearing housing 598, a bearing 600, a bearing housing 602, a bearing 604, a bearing housing 606, a bearing 608, a bearing housing 610, a bearing 612, a bearing housing 614, a bearing 616, a bearing housing 618, a bearing 620, a bearing housing 622, a bearing 624, a bearing housing 626, a bearing 628, a bearing housing 630, a bearing 632, a bearing housing 634, a bearing 636, a bearing housing 638, a bearing 640, a bearing housing 642, a bearing 644, a bearing housing 646, a bearing 648, a bearing housing 650, a bearing 652, a bearing housing 654, a bearing 656, a bearing housing 658, a bearing 660, a bearing housing 662, a bearing 664, a bearing housing 666, a bearing 668, a bearing housing 670, a bearing 672, a bearing housing 674, a bearing 676, a bearing housing 678, a bearing 680, a bearing housing 682, a bearing 684, a bearing housing 686, a bearing 688, a bearing housing 690, a bearing 692, a bearing housing 694, a bearing 696, a bearing housing 698, a bearing 700, a bearing housing 702, a bearing 704, a bearing housing 706, a bearing 708, a bearing housing 710, a bearing 712, a bearing housing 714, a bearing 716, a bearing housing 718, a bearing 720, a bearing housing 722, a bearing 724, a bearing housing 726, a bearing 728, a bearing housing 730, a bearing 732, a bearing housing 734, a bearing 736, a bearing housing 738, a bearing 740, a bearing housing 742, a bearing 744, a bearing housing 746, a bearing 748, a bearing housing 750, a bearing 752, a bearing housing 754, a bearing 756, a bearing housing 758, a bearing 760, a bearing housing 762, a bearing 764, a bearing housing 766, a bearing 768, a bearing housing 770, a bearing 772, a bearing housing 774, a bearing 776, a bearing housing 778, a bearing 780, a bearing housing 782, a bearing 784, a bearing housing 786, a bearing 788, a bearing housing 790, a bearing 792, a bearing housing 794, a bearing 796, a bearing housing 798, a bearing 800, a bearing housing 802, a bearing 804, a bearing housing 806, a bearing 808, a bearing housing 810, a bearing 812, a bearing housing 814, a bearing 816, a bearing housing 818, a bearing 820, a bearing housing 822, a bearing 824, a bearing housing 826, a bearing 828, a bearing housing 830, a bearing 832, a bearing housing 834, a bearing 836, a bearing housing 838, a bearing 840, a bearing housing 842, a bearing 844, a bearing housing 846, a bearing 848, a bearing housing 850, a bearing 852, a bearing housing 854, a bearing 856, a bearing housing 858, a bearing 860, a bearing housing 862, a bearing 864, a bearing housing 866, a bearing 868, a bearing housing 870, a bearing 872, a bearing housing 874, a bearing 876, a bearing housing 878, a bearing 880, a bearing housing 882, a bearing 884, a bearing housing 886, a bearing 888, a bearing housing 890, a bearing 892, a bearing housing 894, a bearing 896, a bearing housing 898, a bearing 900, a bearing housing 902, a bearing 904, a bearing housing 906, a bearing 908, a bearing housing 910, a bearing 912, a bearing housing 914, a bearing 916, a bearing housing 918, a bearing 920, a bearing housing 922, a bearing 924, a bearing housing 926, a bearing 928, a bearing housing 930, a bearing 932, a bearing housing 934, a bearing 936, a bearing housing 938, a bearing 940, a bearing housing 942, a bearing 944, a bearing housing 946, a bearing 948, a bearing housing 950, a bearing 952, a bearing housing 954, a bearing 956, a bearing housing 958, a bearing 960, a bearing housing 962, a bearing 964, a bearing housing 966, a bearing 968, a bearing housing 970, a bearing 972, a bearing housing 974, a bearing 976, a bearing housing 978, a bearing 980, a bearing housing 982, a bearing 984, a bearing housing 986, a bearing 988, a bearing housing 990, a bearing 992, a bearing housing 994, a bearing 996, a bearing housing 998, a bearing 1000, a bearing housing 1002, a bearing 1004, a bearing housing 1006, a bearing 1008, a bearing housing 1010, a bearing 1012, a bearing housing 1014, a bearing 1016, a bearing housing 1018, a bearing 1020, a bearing housing 1022, a bearing 1024, a bearing housing 1026, a bearing 1028, a bearing housing 1030, a bearing 1032, a bearing housing 1034, a bearing 1036, a bearing housing 1038, a bearing 1040, a bearing housing 1042, a bearing 1044, a bearing housing 1046, a bearing 1048, a bearing housing 1050, a bearing 1052, a bearing housing 1054, a bearing 1056, a bearing housing 1058, a bearing 1060, a bearing housing 1062, a bearing 1064, a bearing housing 1066, a bearing 1068, a bearing housing 1070, a bearing 1072, a bearing housing 1074, a bearing 1076, a bearing housing 1078, a bearing 1080, a bearing housing 1082, a bearing 1084, a bearing housing 1086, a bearing 1088, a bearing housing 1090, a bearing 1092, a bearing housing 1094, a bearing 1096, a bearing housing 1098, a bearing 1100, a bearing housing 1102, a bearing 1104, a bearing housing 1106, a bearing 1108, a bearing housing 1110, a bearing 1112, a bearing housing 1114, a bearing 1116, a bearing housing 1118, a bearing 1120, a bearing housing 1122, a bearing 1124, a bearing housing 1126, a bearing 1128, a bearing housing 1130, a bearing 1132, a bearing housing 1134, a bearing 1136, a bearing housing 1138, a bearing 1140, a bearing housing 1142, a bearing 1144, a bearing housing 1146, a bearing 1148, a bearing housing 1150, a bearing 1152, a bearing housing 1154, a bearing 1156, a bearing housing 1158, a bearing 1160, a bearing housing 1162, a bearing 1164, a bearing housing 1166, a bearing 1168, a bearing housing 1170, a bearing 1172, a bearing housing 1174, a bearing 1176, a bearing housing 1178, a bearing 1180, a bearing housing 1182, a bearing 1184, a bearing housing 1186, a bearing 1188, a bearing housing 1190, a bearing 1192, a bearing housing 1194, a bearing 1196, a bearing housing 1198, a bearing 1200, a bearing housing 1202, a bearing 1204, a bearing housing 1206, a bearing 1208, a bearing housing 1210, a bearing 1212, a bearing housing 1214, a bearing 1216, a bearing housing 1218, a bearing 1220, a bearing housing 1222, a bearing 1224, a bearing housing 1226, a bearing 1228, a bearing housing 1230, a bearing 1232, a bearing housing 1234, a bearing 1236, a bearing housing 1238, a bearing 1240, a bearing housing 1242, a bearing 1244, a bearing housing 1246, a bearing 1248, a bearing housing 1250, a bearing 1252, a bearing housing 1254, a bearing 1256, a bearing housing 1258, a bearing 1260, a bearing housing 1262, a bearing 1264, a bearing housing 1266, a bearing 1268, a bearing housing 1270, a bearing 1272, a bearing housing 1274, a bearing 1276, a bearing housing 1278, a bearing 1280, a bearing housing 1282, a bearing 1284, a bearing housing 1286, a bearing 1288, a bearing housing 1290, a bearing 1292, a bearing housing 1294, a bearing 1296, a bearing housing 1298, a bearing 1300, a bearing housing 1302, a bearing 1304, a bearing housing 1306, a bearing 1308, a bearing housing 1310, a bearing 1312, a bearing housing 1314, a bearing 1316, a bearing housing 1318, a bearing 1320, a bearing housing 1322, a bearing 1324, a bearing housing 1326, a bearing 1328, a bearing housing 1330, a bearing 1332, a bearing housing 1334, a bearing 1336, a bearing housing 1338, a bearing 1340, a bearing housing 1342, a bearing 1344, a bearing housing 1346, a bearing 1348, a bearing housing 1350, a bearing 1352, a bearing housing 1354, a bearing 1356, a bearing housing 1358, a bearing 1360, a bearing housing 1362, a bearing 1364, a bearing housing 1366, a bearing 1368, a bearing housing 1370, a bearing 1372, a bearing housing 1374, a bearing 1376, a bearing housing 1378, a bearing 1380, a bearing housing 1382, a bearing 1384, a bearing housing 1386, a bearing 1388, a bearing housing 1390, a bearing 1392, a bearing housing 1394, a bearing 1396, a bearing housing 1398, a bearing 1400, a bearing housing 1402, a bearing 1404, a bearing housing 1406, a bearing 1408, a bearing housing 1410, a bearing 1412, a bearing housing 1414, a bearing 1416, a bearing housing 1418, a bearing 1420, a bearing housing 1422, a bearing 1424, a bearing housing 1426, a bearing 1428, a bearing housing 1430, a bearing 1432, a bearing housing 1434, a bearing 1436, a bearing housing 1438, a bearing 1440, a bearing housing 1442, a bearing 1444, a bearing housing 1446, a bearing 1448, a bearing housing 1450, a bearing 1452, a bearing housing 1454, a bearing 1456, a bearing housing 1458, a bearing 1460, a bearing housing 1462, a bearing 1464, a bearing housing 1466, a bearing 1468, a bearing housing 1470, a bearing 1472, a bearing housing 1474, a bearing 1476, a bearing housing 1478, a bearing 1480, a bearing housing 1482, a bearing 1484, a bearing housing 1486, a bearing 1488, a bearing housing 1490, a bearing 1492, a bearing housing 1494, a bearing 1496, a bearing housing 1498, a bearing 1500, a bearing housing 1502, a bearing 1504, a bearing housing 1506, a bearing 1508, a bearing housing 1510, a bearing 1512, a bearing housing 1514, a bearing 1516, a bearing housing 1518, a bearing 1520, a bearing housing 1522, a bearing 1524, a bearing housing 1526, a bearing 1528, a bearing housing 1530, a bearing 1532, a bearing housing 1534, a bearing 1536, a bearing housing 1538, a bearing 1540, a bearing housing 1542, a bearing 1544, a bearing housing 1546, a bearing 1548, a bearing housing 1550, a bearing 1552, a bearing housing 1554, a bearing 1556, a bearing housing 1558, a bearing 1560, a bearing housing 1562, a bearing 1564, a bearing housing 1566, a bearing 1568, a bearing housing 1570, a bearing 1572, a bearing housing 1574, a bearing 1576, a bearing housing 1578, a bearing 1580, a bearing housing 1582, a bearing 1584, a bearing housing 1586, a bearing 1588, a bearing housing 1590, a bearing 1592, a bearing housing 1594, a bearing 1596, a bearing housing 1598, a bearing 1600, a bearing housing 1602, a bearing 1604, a bearing housing 1606, a bearing 1608, a bearing housing 1610, a bearing 1612, a bearing housing 1614, a bearing 1616, a bearing housing 1618, a bearing 1620, a bearing housing 1622, a bearing 1624, a bearing housing 1626, a bearing 1628, a bearing housing 1630, a bearing 1632, a bearing housing 1634, a bearing 1636, a bearing housing 1638, a bearing 1640, a bearing housing 1642, a bearing 1644, a bearing housing 1646, a bearing 1648, a bearing housing 1650, a bearing 1652, a bearing housing 1654, a bearing 1656, a bearing housing 1658, a bearing 1660, a bearing housing 1662, a bearing 1664, a bearing housing 1666, a bearing 1668, a bearing housing 1670, a bearing 1672, a bearing housing 1674, a bearing 1676, a bearing housing 1678, a bearing 1680, a bearing housing 1682, a bearing 1684, a bearing housing 1686, a bearing 1688, a bearing housing 1690, a bearing 1692, a bearing housing 1694, a bearing 1696, a bearing housing 1698, a bearing 1700, a bearing housing 1702, a bearing 1704, a bearing housing 1706, a bearing 1708, a bearing housing 1710, a bearing 1712, a bearing housing 1714, a bearing 1716, a bearing housing 1718, a bearing 1720, a bearing housing 1722, a bearing 1724, a bearing housing 1726, a bearing 1728, a bearing housing 1730, a bearing 1732, a bearing housing 1734, a bearing 1736, a bearing housing 1738, a bearing 1740, a bearing housing 1742, a bearing 1744, a bearing housing 1746, a bearing 1748, a bearing housing 1750, a bearing 1752, a bearing housing 1754, a bearing 1756, a bearing housing 1758, a bearing 1760, a bearing housing 1762, a bearing 1764, a bearing housing 1766, a bearing 1768, a bearing housing 1770, a bearing 1772, a bearing housing 1774, a bearing 1776, a bearing housing 1778, a bearing 1780, a bearing housing 1782, a bearing 1784, a bearing housing 1786, a bearing 1788, a bearing housing 1790, a bearing 1792, a bearing housing 1794, a bearing 1796, a bearing housing 1798, a bearing 1800, a bearing housing 1802, a bearing 1804, a bearing housing 1806, a bearing 1808, a bearing housing 1810, a bearing 1812, a bearing housing 1814, a bearing 1816, a bearing housing 1818, a bearing 1820, a bearing housing 1822, a bearing 1824, a bearing housing 1826, a bearing 1828, a bearing housing 1830, a bearing 1832, a bearing housing 1834, a bearing 1836, a bearing housing 1838, a bearing 1840, a bearing housing 1842, a bearing 1844, a bearing housing 1846, a bearing 1848, a bearing housing 1850, a bearing 1852, a bearing housing 1854, a bearing 1856, a bearing housing 1858, a bearing 1860, a bearing housing 1862, a bearing 1864, a bearing housing 1866, a bearing 1868, a bearing housing 1870, a bearing 1872, a bearing housing 1874, a bearing 1876, a bearing housing 1878, a bearing 1880, a bearing housing 1882, a bearing 1884, a bearing housing 1886, a bearing 1888, a bearing housing 1890, a bearing 1892, a bearing housing 1894, a bearing 1896, a bearing housing 1898, a bearing 1900, a bearing housing 1902, a bearing 1904, a bearing housing 1906, a bearing 1908, a bearing housing 1910, a bearing 1912, a bearing housing 1914, a bearing 1916, a bearing housing 1918, a bearing 1920, a bearing housing 1922, a bearing 1924, a bearing housing 1926, a bearing 1928, a bearing housing 1930, a bearing 1932, a bearing housing 1934, a bearing 1936, a bearing housing 1938, a bearing 1940, a bearing housing 1942, a bearing 1944, a bearing housing 1946, a bearing 1948, a bearing housing 1950, a bearing 1952, a bearing housing 1954, a bearing 1956, a bearing housing 1958, a bearing 1960, a bearing housing 1962, a bearing 1964, a bearing housing 1966, a bearing 1968, a bearing housing 1970, a bearing 1972, a bearing housing 1974, a bearing 1976, a bearing housing 1978, a bearing 1980, a bearing housing 1982, a bearing 1984, a bearing housing 1986, a bearing 1988, a bearing housing 1990, a bearing 1992, a bearing housing 1994, a bearing 1996, a bearing housing 1998, a bearing 2000, a bearing housing 2002, a bearing 2004, a bearing housing 2006, a bearing 2008, a bearing housing 2010, a bearing 2012, a bearing housing 2014, a bearing 2016, a bearing housing 2018, a bearing 2020, a bearing housing 2022, a bearing 2024, a bearing housing 2026, a bearing 2028, a bearing housing 2030, a bearing 2032, a bearing housing 2034, a bearing 2036, a bearing housing 2038, a bearing 2040, a bearing housing 2042, a bearing 2044, a bearing housing 2046, a bearing 2048, a bearing housing 2050, a bearing 2052, a bearing housing 2054, a bearing 2056, a bearing housing 2058, a bearing 2060, a bearing housing 2062, a bearing 2064, a bearing housing 2066, a bearing 2068, a bearing housing 2070, a bearing 2072, a bearing housing 2074, a bearing 2076, a bearing housing 2078, a bearing 2080, a bearing housing 2082, a bearing 2084, a bearing housing 2086, a bearing 2088, a bearing housing 2090, a bearing 2092, a bearing housing 2094, a bearing 2096, a bearing housing 2098, a bearing 2100, a bearing housing 2102, a bearing 2104, a bearing housing 2106, a bearing 2108, a bearing housing 2110, a bearing 2112, a bearing housing 2114, a bearing 2116, a bearing housing 2118, a bearing 2120, a bearing housing 2122, a bearing 2124, a bearing housing 2126, a bearing 2128, a bearing housing 2130, a bearing 2132, a bearing housing 2134, a bearing 2136, a bearing housing 2138, a bearing 2140, a bearing housing 2142, a bearing 2144, a bearing housing 2146, a bearing 2148, a bearing housing 2150, a bearing 2152, a bearing housing 2154, a bearing 2156, a bearing housing 2158, a bearing 2160, a bearing housing 2162, a bearing 2164, a bearing housing 2166, a bearing 2168, a bearing housing 2170, a bearing 2172, a bearing housing 2174, a bearing 2176, a bearing housing 2178, a bearing 2180, a bearing housing 2182, a bearing 2184, a bearing housing 2186, a bearing 2188, a bearing housing 2190, a bearing 2192, a bearing housing 2194, a bearing 2196, a bearing housing 2198, a bearing 2200, a bearing housing 2202, a bearing 2204, a bearing housing 2206, a bearing 2208, a bearing housing 2210, a bearing 2212, a bearing housing 2214, a bearing 2216, a bearing housing 2218, a bearing 2220, a bearing housing 2222, a bearing 2224, a bearing housing 2226, a bearing 2228, a bearing housing 2230, a bearing 2232, a bearing housing 2234, a bearing 2236, a bearing housing 2238, a bearing 2240, a bearing housing 2242, a bearing 2244, a bearing housing 2246, a bearing 2248, a bearing housing 2250, a bearing 2252, a bearing housing 2254, a bearing 2256, a bearing housing 2258, a bearing 2260, a bearing housing 2262, a bearing 2264, a bearing housing 2266, a bearing 2268, a bearing housing 2270, a bearing 2272, a bearing housing 2274, a bearing 2276, a bearing housing 2278, a bearing 2280, a bearing housing 2282, a bearing 2284, a bearing housing 2286, a bearing 2288, a bearing housing 2290, a bearing 2292, a bearing housing 2294, a bearing 2296, a bearing housing 2298, a bearing 2300, a bearing housing 2302, a bearing 2304, a bearing housing 2306, a bearing 2308, a bearing housing 2310, a bearing 2312, a bearing housing 2314, a bearing 2316, a bearing housing 2318, a bearing 2320, a bearing housing 2322, a bearing 2324, a bearing housing 2326, a bearing 2328, a bearing housing 2330, a bearing 2332, a bearing housing 2334, a bearing 2336, a bearing housing 2338, a bearing 2340, a bearing housing 2342, a bearing 2344, a bearing housing 2346, a bearing 2348, a bearing housing 2350, a bearing 2352, a bearing housing 2354, a bearing 2356, a bearing housing 2358, a bearing 2360, a bearing housing 2362, a bearing 2364, a bearing housing 2366, a bearing 2368, a bearing housing 2370, a bearing 2372, a bearing housing 2374, a bearing 2376, a bearing housing 2378, a bearing 2380, a bearing housing 2382, a bearing 2384, a bearing housing 2386, a bearing 2388, a bearing housing 2390, a bearing 2392, a bearing housing 2394, a bearing 2396, a bearing housing 2398, a bearing 2400, a bearing housing 2402, a bearing 2404, a bearing housing 2406, a bearing 2408, a bearing housing 2410, a bearing 2412, a bearing housing 2414, a bearing 2416, a bearing housing 2418, a bearing 2420, a bearing housing 2422, a bearing 2424, a bearing housing 2426, a bearing 2428, a bearing housing 2430, a bearing 2432, a bearing housing 2434, a bearing 2436, a bearing housing 2438, a bearing 2440, a bearing housing 2442, a bearing 2444, a bearing housing 2446, a bearing 2448, a bearing housing 2450, a bearing 2452, a bearing housing 2454, a bearing 2456, a bearing housing 2458, a bearing 2460, a bearing housing 2462, a bearing 2464, a bearing housing 2466, a bearing 2468, a bearing housing 2470, a bearing 2472, a bearing housing 2474, a bearing 2476, a bearing housing 2478, a bearing 2480, a bearing housing 2482, a bearing 2484, a bearing housing 2486, a bearing 2488, a bearing housing 2490, a bearing 2492, a bearing housing 2494, a bearing 2496, a bearing housing 2498, a bearing 2500, a bearing housing 2502, a bearing 2504, a bearing housing 2506, a bearing 2508, a bearing housing 2510, a bearing 2512, a bearing housing 2514, a bearing 2516, a bearing housing 2518, a bearing 2520, a bearing housing 2522, a bearing 2524, a bearing housing 2526, a bearing 2528, a bearing housing 2530, a bearing 2532, a bearing housing 2534, a bearing 2536, a bearing housing 2538, a bearing 2540, a bearing housing 2542, a bearing 2544, a bearing housing 2546, a bearing 2548, a bearing housing 2550, a bearing 2552, a bearing housing 2554, a bearing 2556, a bearing housing 2558, a bearing 2560, a bearing housing 2562, a bearing 2564, a bearing housing 2566, a bearing 2568, a bearing housing 2570, a bearing 2572, a bearing housing 2574, a bearing 2576, a bearing housing 2578, a bearing 2580, a bearing housing 2582, a bearing 2584, a bearing housing 2586, a bearing 2588, a bearing housing 2590, a bearing 2592, a bearing housing 2594, a bearing 2596, a bearing housing 2598, a bearing 2600, a bearing housing 2602, a bearing 2604, a bearing housing 2606, a bearing 2608, a bearing housing 2610, a bearing 2612, a bearing housing 2614, a bearing 2616, a bearing housing 2618, a bearing 2620, a bearing housing 2622, a bearing 2624, a bearing housing 2626, a bearing 2628, a bearing housing 2630, a bearing 2632, a bearing housing 2634, a bearing 2636, a bearing housing 2638, a bearing 2640, a bearing housing 2642, a bearing 2644, a bearing housing 2646, a bearing 2648, a bearing housing 2650, a bearing 2652, a bearing housing 2654, a bearing 2656, a bearing housing 2658, a bearing 26

of standoffs 570, a mounting flange 534, an extractor 540, and a drive shaft 520 attached to a T-handle assembly 580 with a battery-operated drill-type tool 582. The main housing 502 may have an upper housing 504 and a lower assembly housing 506. The bearing housing 510 may be connected to the upper housing 504 and have an opening 512 for inserting the drive shaft 520. The drive shaft 520 may also extend through one or more bearings 514 secured in the bearing housing 510 by a cap plate 516.

**[0046]** As illustrated in FIG. 17A, the drive shaft 520 may have a first end 522 and a second end 524 opposite the first end 522. Near the first end 522, the drive shaft 520 may extend through an opening in the bearing 514, through an opening 512 in the bearing housing 510, and through an opening in the cap plate 516. As further illustrated in FIG. 17C, near the second end 524, the drive shaft 520 may connect to the mounting flange 534. The drive shaft 520 may be secured to the mounting flange 534 using a nut 537.

**[0047]** As illustrated in FIGS. 17C and 17D, the plurality of standoffs 570 may connect to the mounting flange 534 at one end and to a clevis pivot plate 572 on the other end. The clevis pivot plate 572 may be attached to a clevis fastener 574 which may then be connected to the extractor 540 or the claw assembly extractor 540.

**[0048]** As further illustrated in FIG. 17D, the extractor 540 comprises a claw assembly extractor 540. Generally, the claw assembly extractor 540 may be designed to open, close, and grab with the drive shaft 520 movement the railroad spike at a force as high as 19,000 pounds. As described above and illustrated for the extractor 340 and FIGS. 10-14, the claw assembly extractor 540 may include a pair of jaws 542 that are pivotally connected to each other by a pivoting pin 544 and a rotating pin 546. The lower ends 548 of the jaws 542 are configured to contact and grab the railroad spike 10. The upper members 550 of the jaws 542 are pivotally connected to the clevis fastener 574 with the rotating pin 546 or the pivoting pin 544 as illustrated in FIG. 17D. When the drive shaft 520 is pulled upward, the jaws 542 move towards a grabbing position to grab onto the railroad spike 10.

**[0049]** The claw assembly extractor 540 includes the two jaws 542, a pivoting pin 544, the two upper members 550, spacer caps, a rotating pin 546, and a friction assembly. The friction assembly generally includes a spring and friction caps. The jaws 542 and upper members 550 form a moveable parallelogram assembly. The jaws 542 each have a pivot hole 552 which the pivot pin 544 is located in. The jaws 542 also each have a rotating section 554 which the rotating pin 546 is located in. The upper members 550 of the jaws 542 are pivotally connected to the jaws 542 by their rotating sections 554 and the rotating pins 546. The upper members 550 of the jaws 542 may be also pivotally connected to the clevis fastener 574 and the clevis pivot plate 572 by the pivoting pin 544.

**[0050]** The friction assembly functions for keeping the jaws 542 in an open position as the jaws 342 are moved

from the up position to the home position after a spike 10 has been pulled. Initially, a user places the railroad spike remover 100 over the spike 10 with the jaws 542 in an open position. When the user begins rotation of the drive shaft 520 of the railroad spike remover 500, the drive shaft 520 is moved upward, pulling the upper members 550 upward and rotated pulling the upper members 550 of the jaws 542 towards each other. The friction assembly keeps the centers of the jaws 542 fixed relative to the main housing 502 such that the jaws 542 only initially rotate and do not translate relative to the main housing 502. Thus, the lower ends 548 of the jaws 542 are able to rotate under the head of the spike 10. Then the jaws 542 are stopped by the spike 10 from further rotation and the upward movement of the drive shaft 520 overcomes the frictional forces of the friction assembly and the jaws 542 translate upward along the interior of the main housing 502 pulling the spike 10 with it. When the user releases the movement of the railroad spike remover 100 and rotates the drive shaft 520 downward, the drive shaft 520 is moved downward back towards its home position. The friction assembly initially holds the center of the jaws 542 fixed relative to the main housing 502 such that the jaws 542 only initially rotate and translate to move the jaws 542 to an open position. As the jaws 542 are opened, the spike 10 is able to be released. The jaws 542 stop rotating and start translating down the main housing 502 when the back surfaces of the jaws 542 lower ends contact the opposite interior sides of the main housing 502. The lower ends 548 of the jaws 542 substantially block an area between the main housing 502 and the back surfaces to prevent the spike 10 from entering this area. After the jaws 542 open the downward movement of the drive shaft 520 moves the jaws 542 downward back to their home position while maintaining the jaws 542 in their open position along this home returning movement.

**[0051]** The claw assembly extractor 540 and the jaws 542 includes a frictionally-delayed movement that includes pivoting claws 548 with arms or upper members 550 that frictionally contact each other and/or the main housing 502 when opening and closing the jaws 542. The frictionally-delayed moving jaws 542 function as a means for keeping the jaws 542 in an open position as the jaws 542 are moved from the up position to the home positions after a spike 10 has been pulled.

**[0052]** The main housing 502 may include both an upper housing 504 and a lower assembly housing 506. As illustrated in FIGS. 18A, 18B, 18C, 19A, and 19B, the upper housing 504 and the lower assembly housing 506 may include a plurality of substantially vertical side walls. The main housing 502 may have a height of approximately 24 inches or within a range of 16 to 40 inches or any height. The upper housing 504 may have a height of approximately 10 inches or within a range of 6 to 18 inches or any height. The lower assembly housing 506 may have a height of approximately 14 inches or with a range of 10 to 22 inches or any height. As shown in the

exemplary embodiment shown in FIGS. 16A-20C, the main housing 502, the upper housing 504, and the lower assembly housing 506 may generally have a square cross-sectional shape. For example as shown in FIGS. 16A-20C, the main housing 502, the upper housing 504, and the lower assembly housing 506 may have four side walls. Each side wall may have a width of approximately 3.5 inches or within a range of 3 inches to 4 inches, or within a range of 2 inches to 6 inches. Additionally, the upper housing 504 may include a housing handle 508 attached to the upper housing 504. The lower housing assembly 506 may also include a housing handle without departing from the invention.

**[0053]** As shown in FIGS. 16A, 16B, 20A, 20B, and 20C, a T-handle assembly 580 with a battery-operated drill-type tool 582 may be connected to the drive shaft 520 to rotate the drive shaft 520. The first end 522 of the drive shaft 520 may have a drive element 527 to allow a user to engage the drive shaft 520 with the T-handle assembly 580 and the battery-operated drill-type tool 582, such as a high-impact torque wrench or similar device to rotate the drive shaft 520. The battery-operated drill-type tool 582 may include a rechargeable battery pack 583. The drive element 527 may have a hexagonal shape to be engaged by a standard hexagonal high impact socket 592 on the T-handle assembly 580. The standard hexagonal socket may be 0.5 inches or larger. A battery-operated drill-type apparatus or an air hammer attached to a pneumatic supply could be utilized as the rotating tool, thereby engaging the drive shaft 520 and rotating the drive shaft 520 to move the drive shaft 520 up and down. The T-handle assembly 580 may also allow the battery-operated drill-type tool 582 to be easily removed by a user and removed for storage.

**[0054]** As illustrated in FIGS. 20A, 20B, and 20C, the T-handle assembly 580 may include a drill face plate 596 to hold the battery-operated drill-type tool 582. The drill face plate 596 may be connected to a handle plate 594 extending perpendicular to the drill face plate 596. A handle 586 may be extend perpendicular and be connected to the handle plate 594. A handle grip 588 may surround the handle 586 and may be made of a foam material. One or more fastening straps 590 and one or more side plates 584 may be utilized to connect the T-handle assembly 580 to the main housing 502 and specifically to the upper housing 504. The one or more fastening strips 590 may be designed to be quick-connect straps to quickly disconnect the battery-operated drill-type tool 582 from the main housing 502 and upper housing 504 of the railroad spike remover 500. The one or more side plates may extend from and connect to the drill face plate 596. The one or more straps 590 may surround and secure the battery-operated drill-type tool 582 to the drill face plate 596, thereby securing the T-handle assembly 580 to the main housing 502. Additionally, the battery-operated drill-type tool 582 may be attached to an impact socket 592 which then connects to the drive element 527 of the drive shaft 520. The battery-operated drill-type tool

582 may be other similar tools, such as electronic, pneumatic, or other such drill-type tools that will perform similar functionality as a battery-operated drill-type tool 582.

**[0055]** In another embodiment of the present invention, as illustrated in FIGS. 21A and 21B, the T-handle assembly 580 may include a drill guard structure 598. The drill guard structure 598 may be connected to the T-handle assembly 580 and provide a guard for the battery-operated drill-type tool 582. The drill guard structure 598 may include a case over the battery-operated drill-type tool 582 while allowing the user to hold the battery-operated drill-type tool 582. The drill guard structure 598 may include side panels that extend the length of the battery-operated drill-type tool 582 and a back panel that covers the battery area. The drill guard structure 598 may also include front panels that cover the rotating section of the battery-operated drill-type tool 582.

**[0056]** The plurality of standoffs 570 may be hollow tubes that connect at a first end to a mounting flange 534 and a second end of connected to a clevis pivot plate 572. The clevis pivot plate 572 may be attached to a clevis fastener 574 which is then connected to the claw assembly extractor 540. Each standoff 570 may have internal threads such that they may be releasably connected using a threaded fastener on the clevis pivot plate 572. Alternatively, the plurality of standoffs 570 may be integrally joined to the either the mounting flange 534 or the clevis pivot plate 572 or both. Each standoff 570 may be approximately 7 inches long or within a range of 5 inches to 9 inches or within a range of 3 inches to 12 inches. Each of the standoffs 570 may be the same length, but depending on the shape of the either the mounting flange 534, the clevis pivot plate 572, or the extractor 540, each of the standoffs 570 may have different lengths.

**[0057]** The various components for the railroad spike remover 500, such as the main housing 502, the bearing housing 510, the drive shaft 520, the mounting flange 534, the plurality of standoffs 570, the T-handle assembly 580, and the claw assembly extractor 540 may be made of a metallic material, preferably a steel alloy. Alternatively, the components may be made of other metallic materials such as iron, aluminum, an aluminum alloy, titanium, or a titanium alloy.

**[0058]** In another embodiment of the present invention, as illustrated in FIG. 22, the rail spike remover 100, 500 may include a quick attachment that allows the rail spike remover to be either a spike puller or a spike driver. The rail spike remover 100, 500 may also include rail spike driver 180 that can be interchangeable with any of the extractor 140, extractor 340, or the claw assembly extractor 540. For example, the rail spike driver 180 may be quickly interchanged with the claw assembly extractor 540 by removing the clevis pivot plate 572 and attaching the rail spike driver 180 to the plurality of standoffs 570. Additionally, and similarly, the rail spike driver 180 may be interchanged with extractor 140 and the extractor 340. The rail spike driver 180 may be utilized

**[0059]** In another embodiment of the present invention, as illustrated in FIG. 23, the rail spike remover 100, 500 may include a leveling block 190 for use with the rail spike remover of FIGS. 1, 10, 16A, and 16B. The leveling block 190 may be located on one side of the bottom footer of the second end 106 of the main column 102 or the lower assembly housing 506 of the main housing 502 of the rail spike remover 100, 500. As illustrated in FIG. 23, the leveling block 190 may be rectangular in shape. The leveling block 190 may be utilized to help level the rail spike remover 100, 500 when removing railroad spikes. Additionally, the leveling block 190 may be utilized to help remove the rails flanged angle when pulling railroad spikes.

## CONCLUSION

**[0060]** While the invention has been described in detail in terms of specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and methods.

## Claims

1. A portable apparatus for removing a railroad spike from a rail tie, the apparatus comprising:

a main housing that includes an upper housing and a lower housing, wherein the upper housing includes a bearing housing that contains one or more bearings; a drive shaft connected to the main housing and a mounting flange, the drive shaft extending through the one or more bearings and an opening in the bearing housing; and a plurality of standoffs with a first end and a second end, with the first end of the plurality of standoffs connected to the mounting flange and the second end of the plurality of standoffs connected to a clevis pivot plate with a clevis fastener that is connected to a claw assembly extractor, wherein the claw assembly extractor includes a pair of jaw members that are pivotally connected to each other by a pivoting pin and a rotating pin, and further wherein each jaw member includes a lower end and a pair of upper members interlocked with each other, the lower end configured to contact and secure a railroad spike and the pair of upper members pivotally connected to the clevis fastener with the rotating pin, wherein when the drive shaft is rotated, the claw assembly extractor and the mounting flange moves inside the main housing in a vertical direction to extract the railroad spike from the rail

tie.

- 2. The apparatus of claim 1, wherein the claw assembly extractor includes a friction assembly that includes a spring and one or more friction caps to keep the jaws in an open position as the jaws are moved from an up position to a home position after a railroad spike has been pulled.
- 3. The apparatus of claim 1 or claim 2, further including a T-handle assembly to hold a battery-operated drill-type tool that connects to the drive shaft.
- 4. The apparatus of claim 3, wherein the T-handle assembly includes one or more fastening straps and one or more side plates to connect the T-handle assembly to the main housing.
- 5. A portable apparatus for removing a railroad spike from a rail tie, the apparatus comprising:

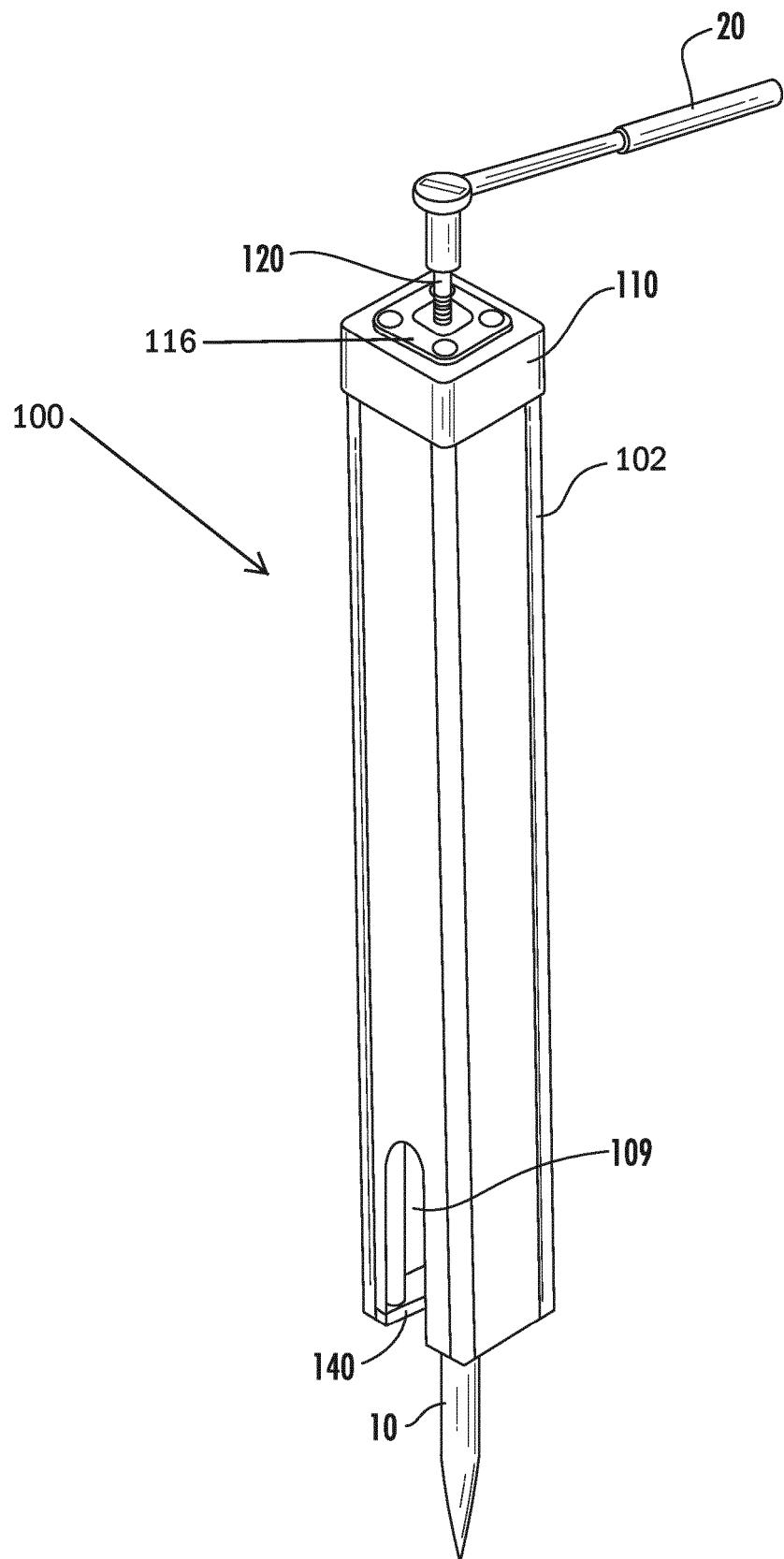
a main housing that includes an upper housing and a lower housing, wherein the upper housing includes a bearing housing that contains one or more bearings; a drive shaft connected to the main housing and a mounting flange, the drive shaft extending through the one or more bearings and an opening in the bearing housing; a T-handle assembly to hold a battery-operated drill-type tool that connects to the drive shaft, wherein the T-handle assembly includes one or more fastening straps and one or more side plates to connect the T-handle assembly to the main housing; and a plurality of standoffs with a first end and a second end, with the first end of the plurality of standoffs connected to the mounting flange and the second end of the plurality of standoffs connected to a clevis pivot plate with a clevis fastener that is connected to a claw assembly extractor, wherein the claw assembly extractor includes a pair of jaw members that are pivotally connected to each other by a pivoting pin and a rotating pin, and further wherein each jaw member includes a lower end and a pair of upper members interlocked with each other, the lower ends configured to contact and secure a railroad spike and the pair of upper members pivotally connected to the clevis fastener with the rotating pin, and further wherein the claw assembly extractor includes a friction assembly that includes a spring and one or more friction caps to keep the jaws in an open position as the jaws are moved from an up position to a home position after a railroad spike has been pulled, wherein when the drive shaft is rotated, the claw

assembly extractor and the mounting flange moves inside the main housing in a vertical direction to extract the railroad spike from the rail tie.

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6. The apparatus of any preceding claim, wherein the drive shaft has a first end, and a second end, wherein the first end includes a drive element and the second end includes threaded portion. 10
7. The apparatus of any preceding claim, wherein the plurality of standoffs are hollow tubes with a length of between 7.5 cm and 30 cm (3 and 12 inches).
8. The apparatus of any preceding claim, wherein the bearing housing is integrally joined to the main housing. 15
9. The apparatus of any preceding claim, wherein when the drive shaft is pulled upward, the pair of jaws move towards a grabbing position to grab onto the railroad spike. 20
10. The apparatus of any preceding claim, wherein each of the interlocked upper members include a rotating section in which the rotating pin is located. 25
11. The apparatus of any of claims 3 to 10, wherein the battery-operated drill-type tool includes an impact socket that connects to a drive element of the drive shaft. 30
12. The apparatus of any of claims 3 to 11, wherein the T-handle assembly includes a handle plate with a handle and a handle grip that surrounds the handle. 35
13. The apparatus of any preceding claim, wherein the portable apparatus weighs less than 30 pounds.
14. The apparatus of any preceding claim, further including a rail spike driver for driving the railroad spike into the rail tie, wherein the rail spike driver is interchangeable with the claw assembly extractor by removing the clevis pivot plate and attaching the rail spike driver to the plurality of standoffs. 40 45
15. The apparatus of any preceding claim, further including a rectangular leveling block located on a side of a bottom footer of the lower housing of the main housing, wherein the leveling block is utilized to level the main housing and the rail spike remover when removing railroad spike. 50

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**FIG. 1**

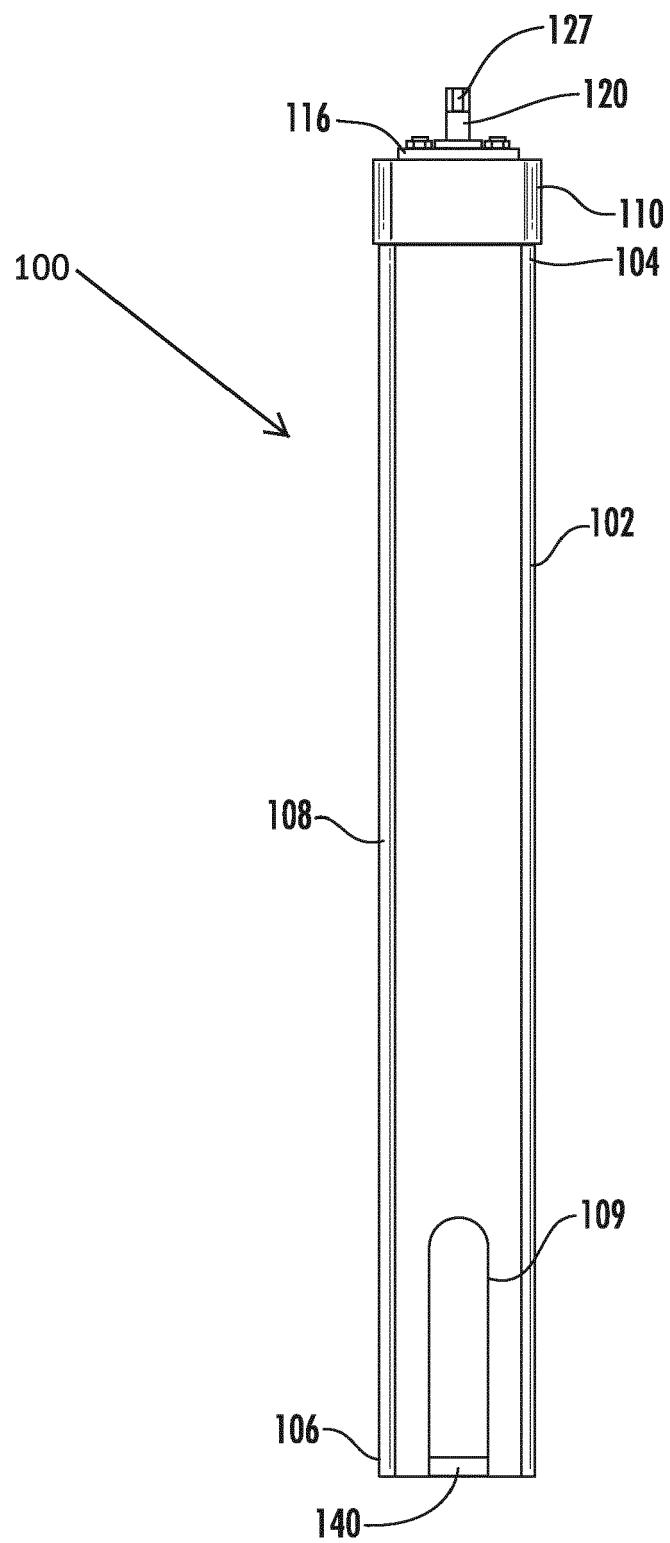


FIG. 2

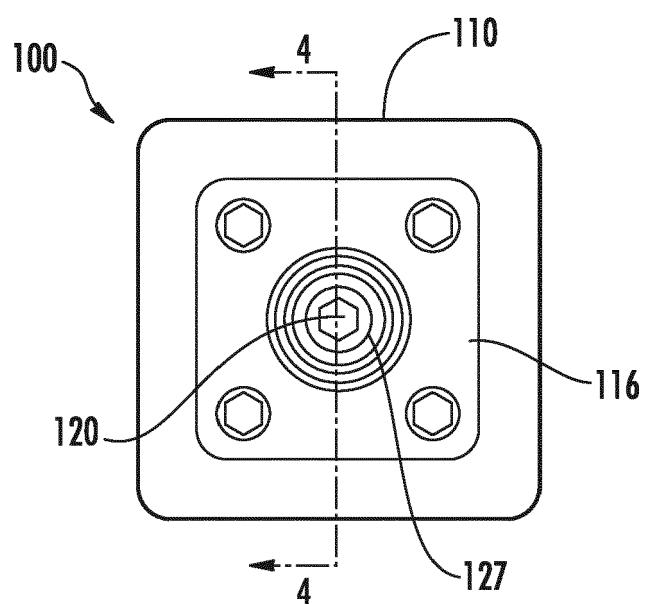


FIG. 3

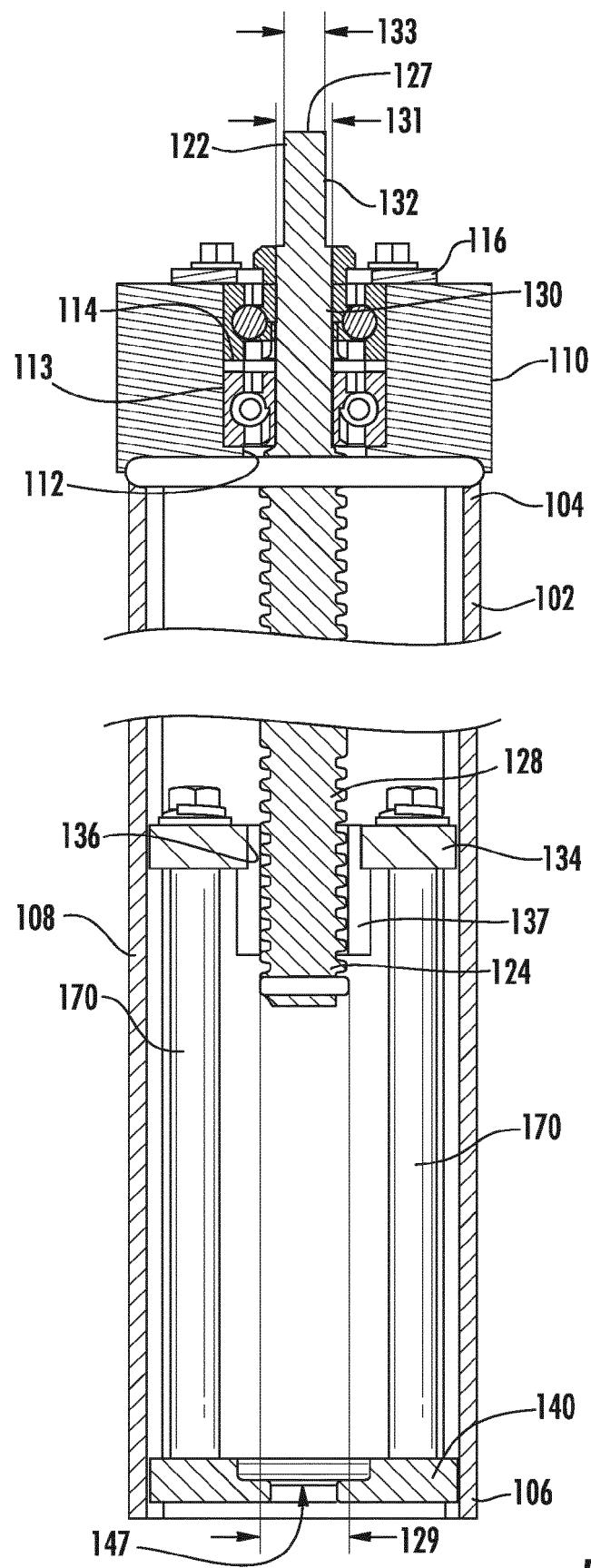
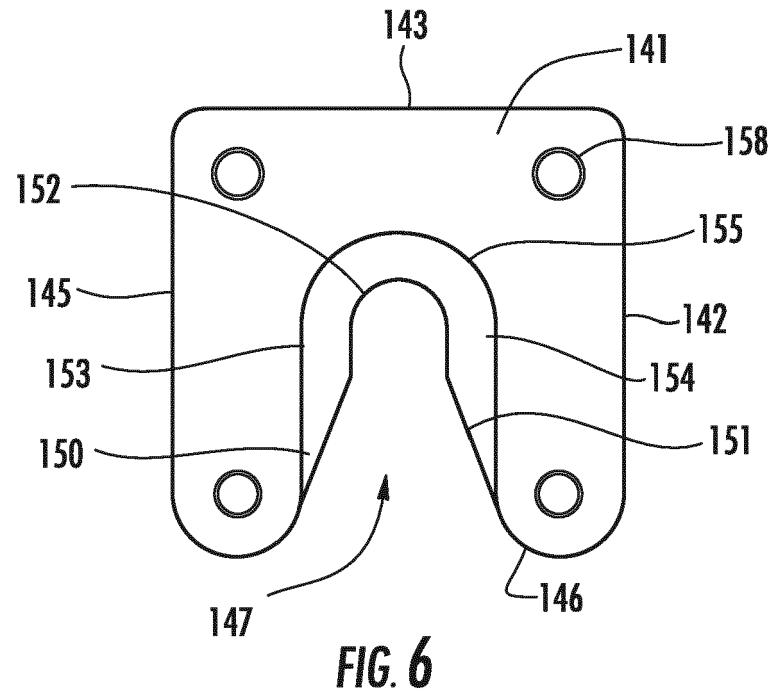
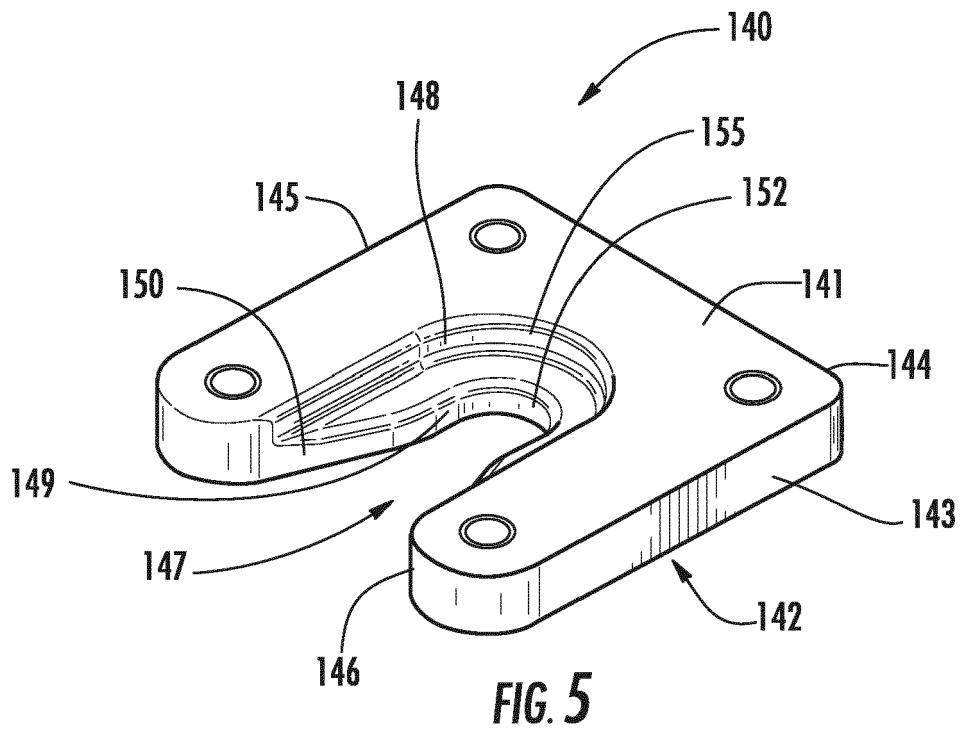
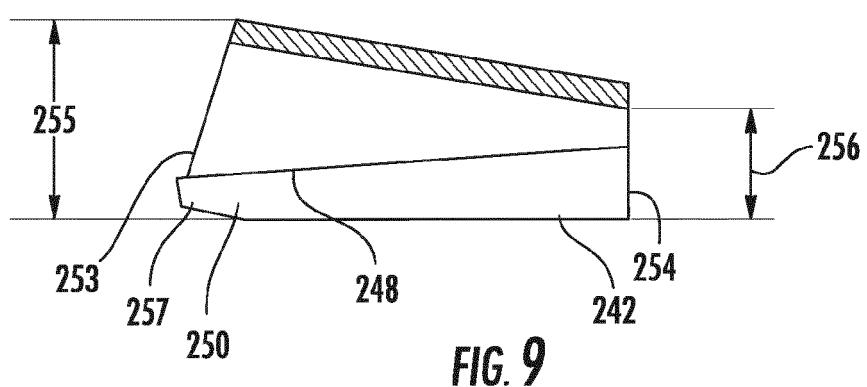
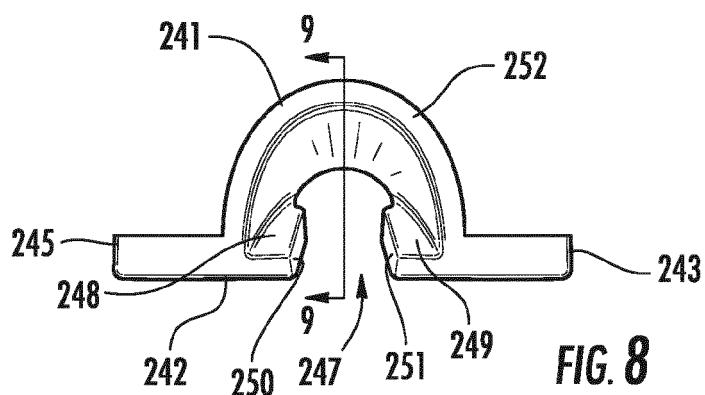
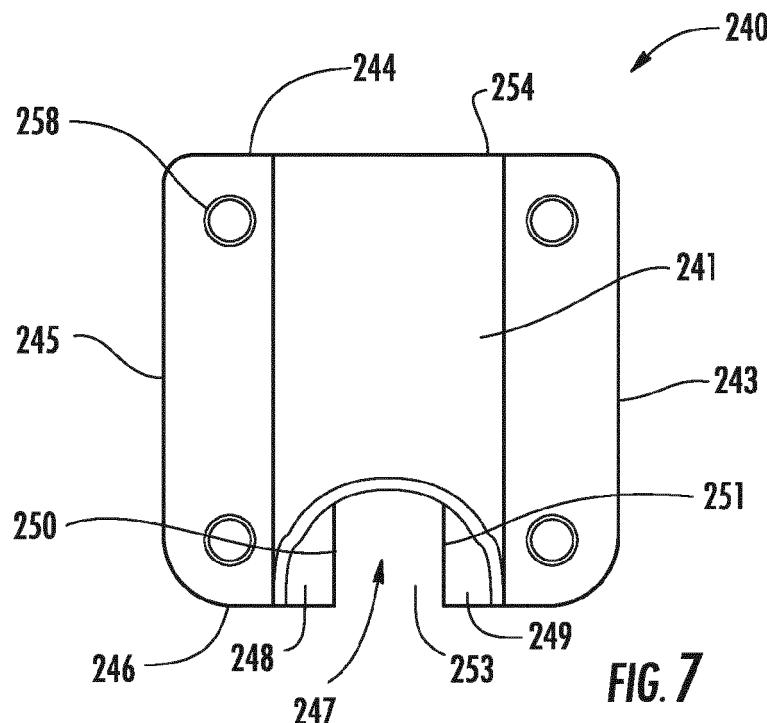
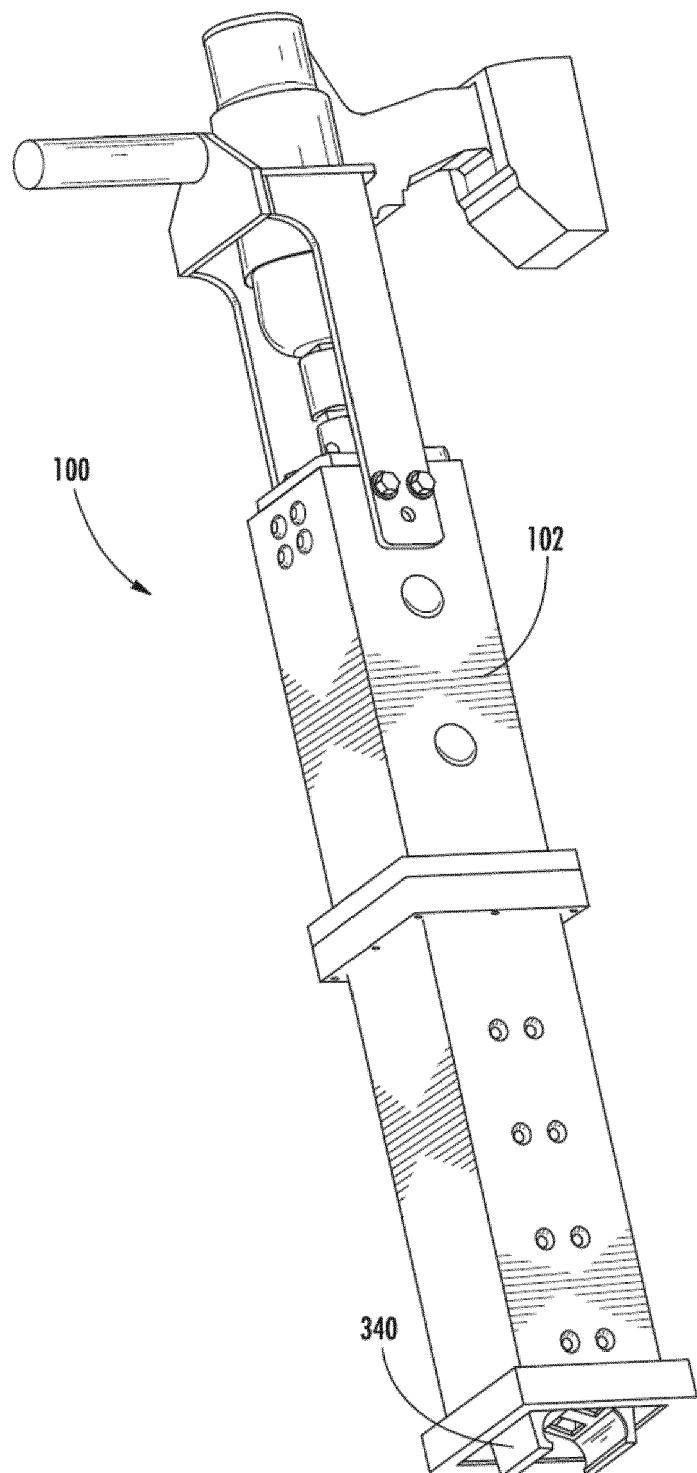


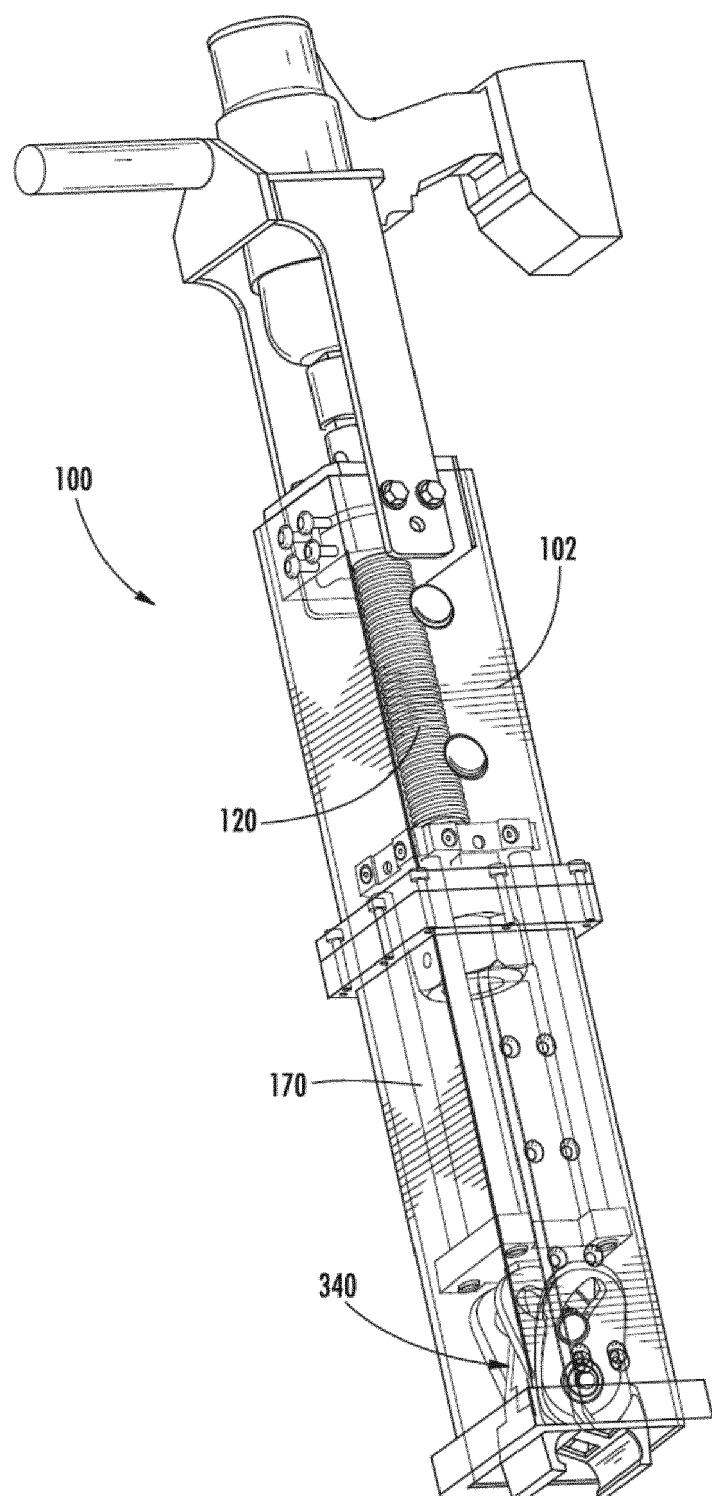
FIG. 4



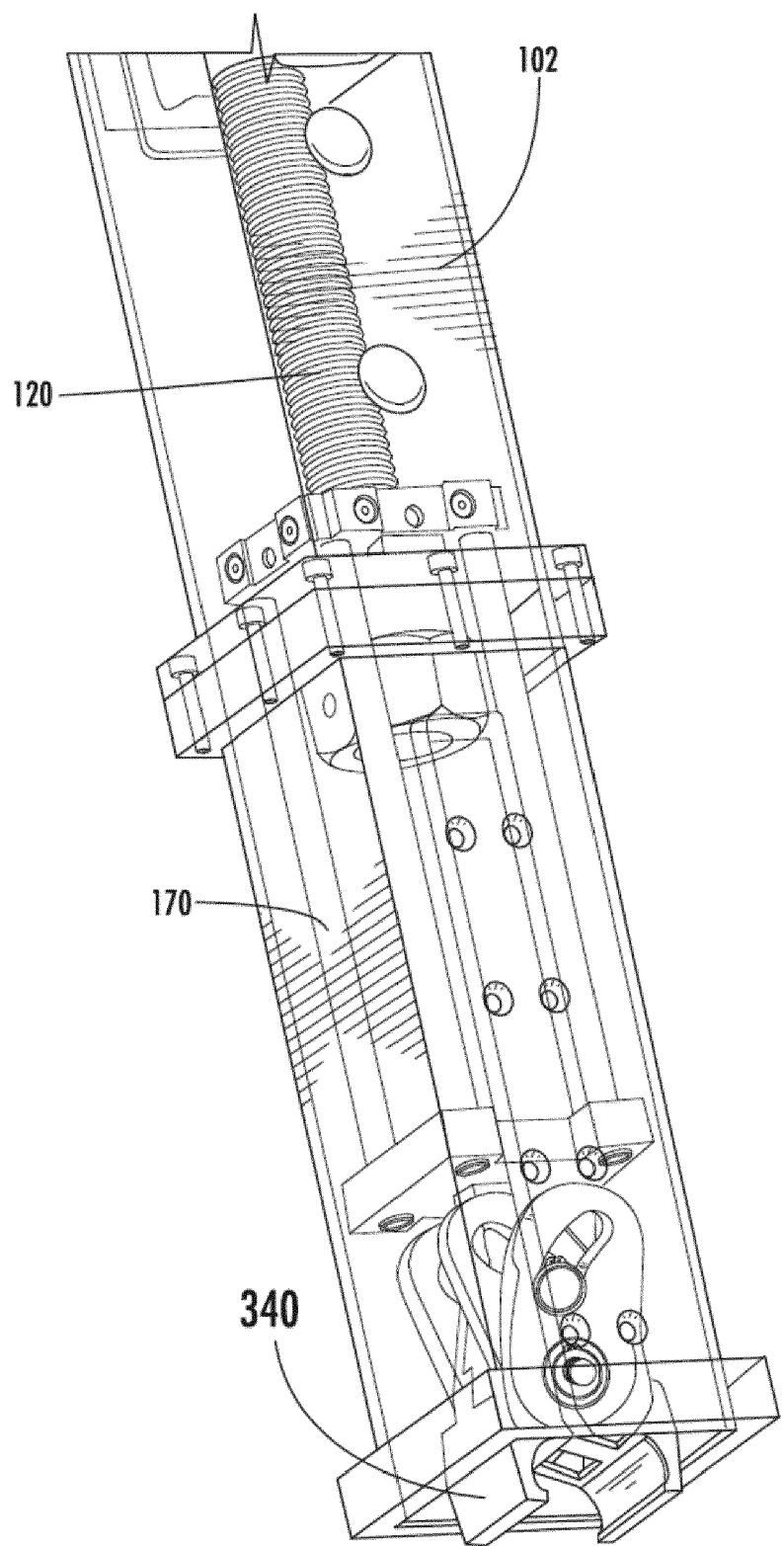




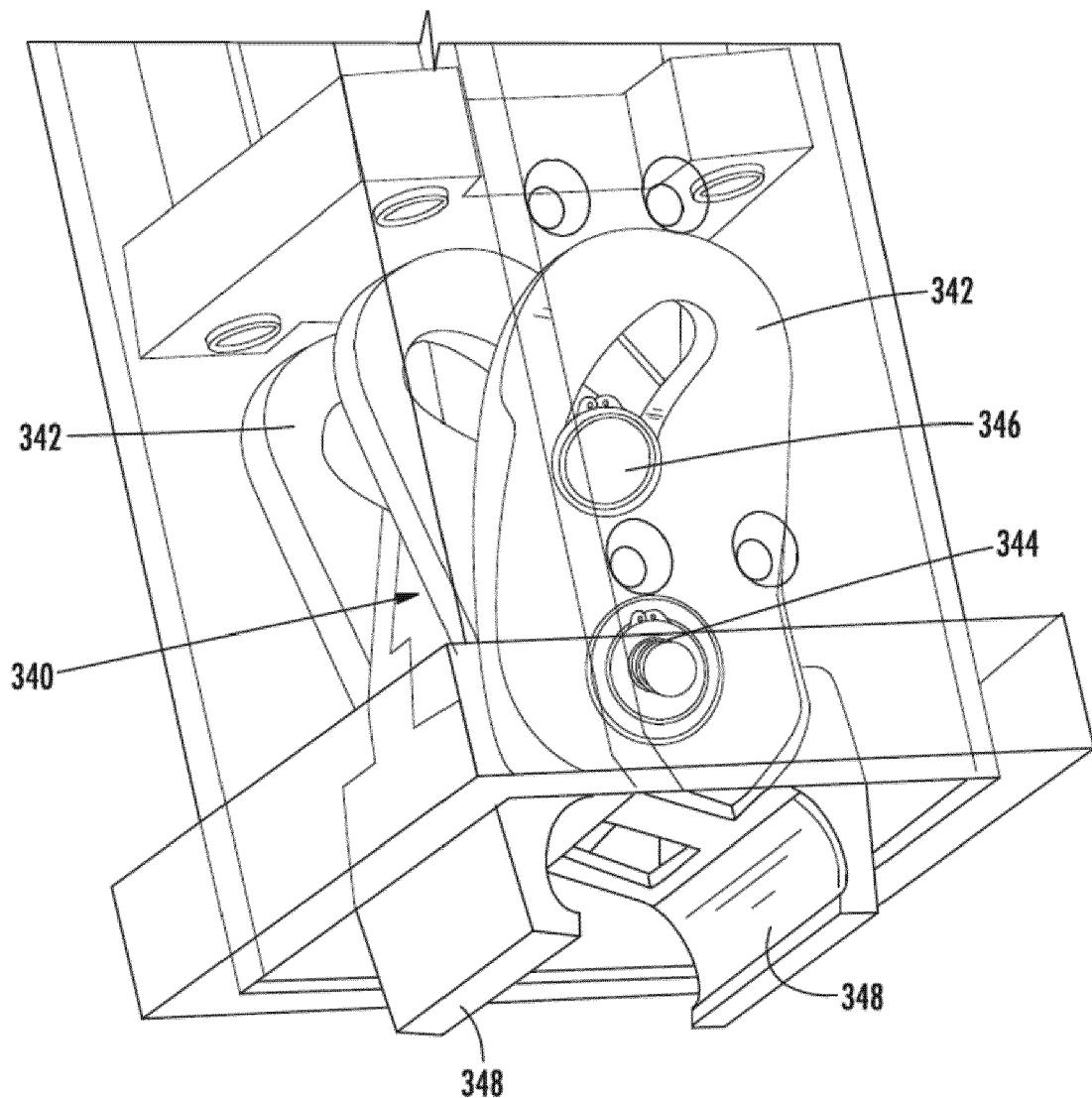
**FIG. 10**



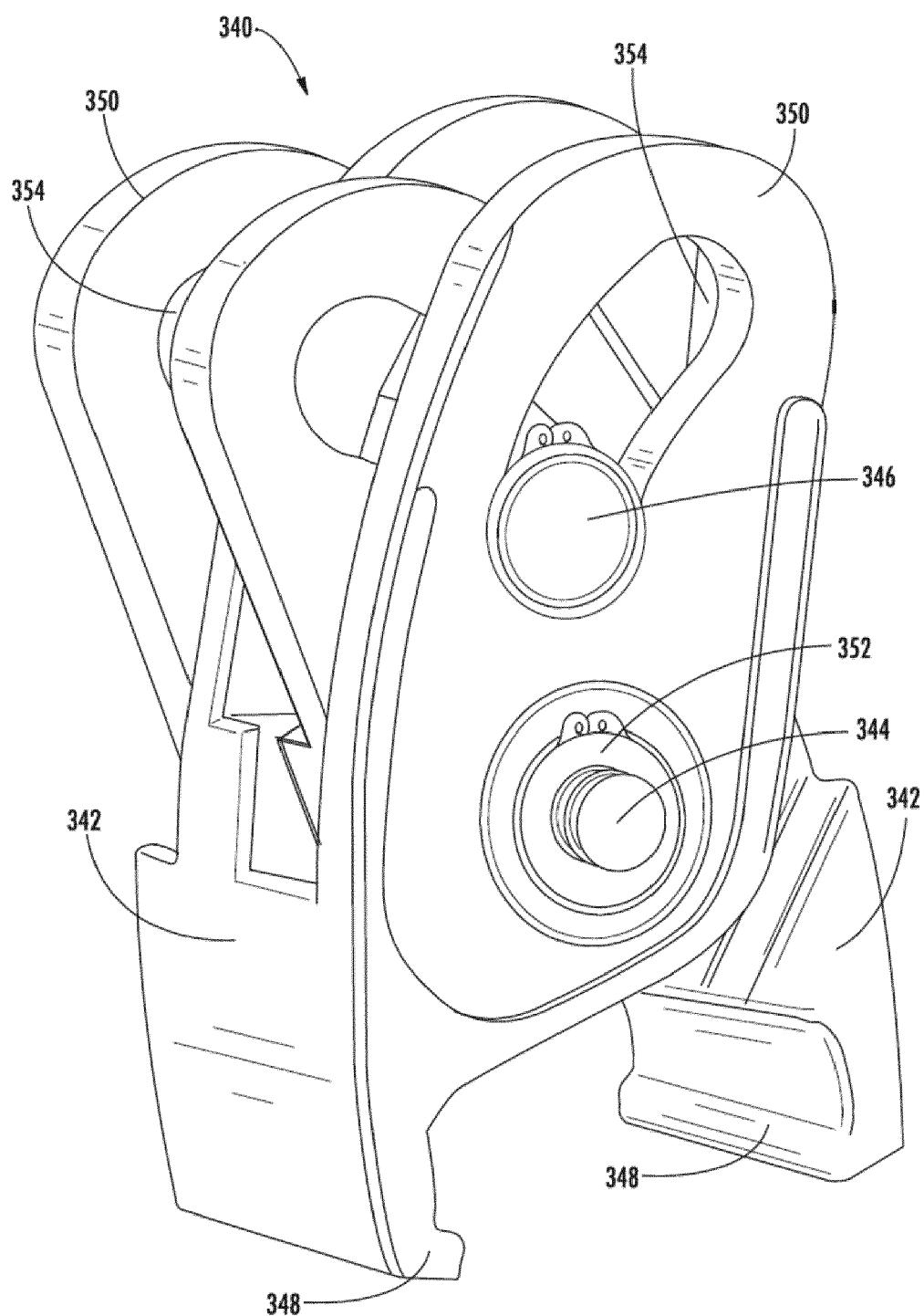
**FIG. 11**



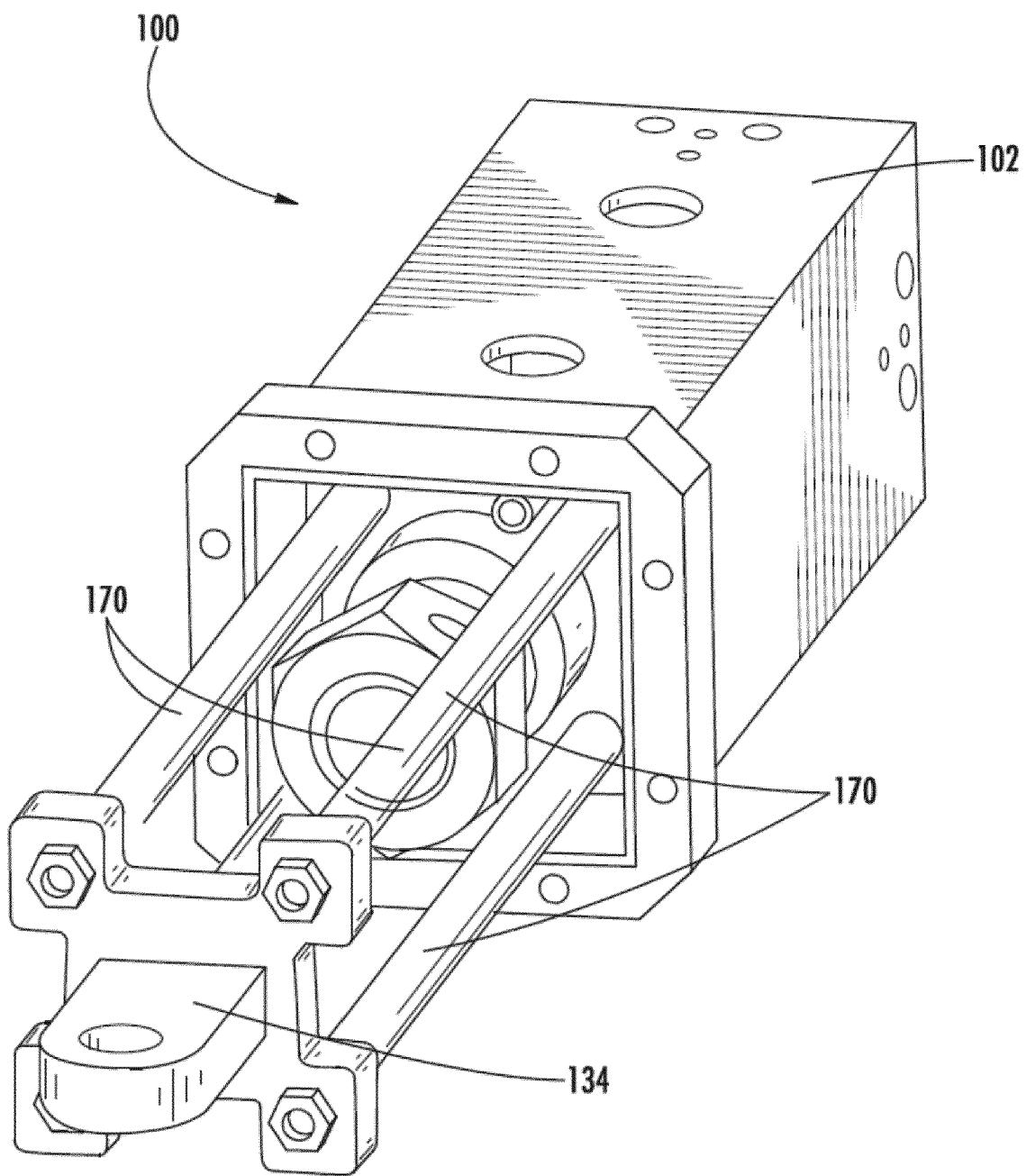
**FIG. 12**



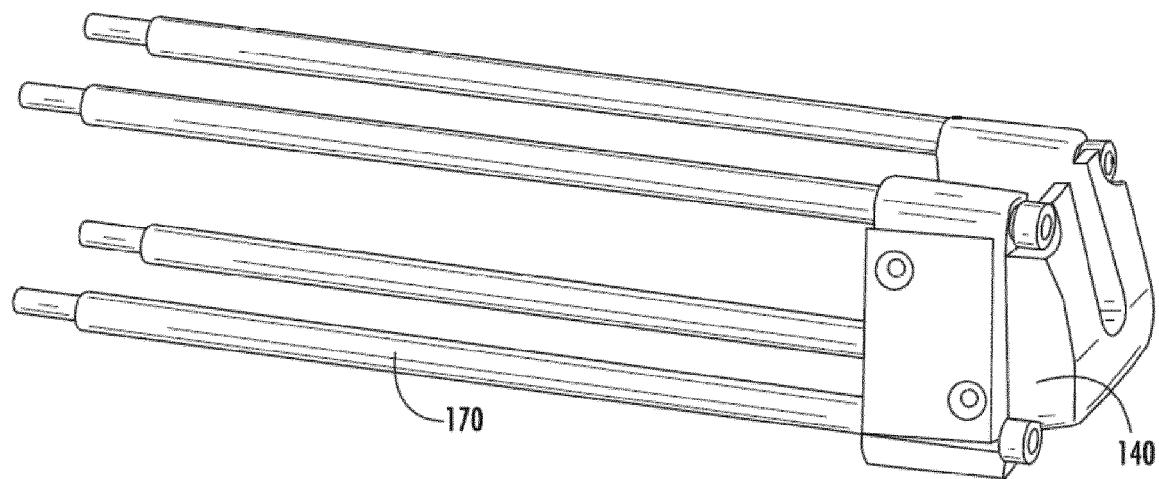
**FIG. 13**



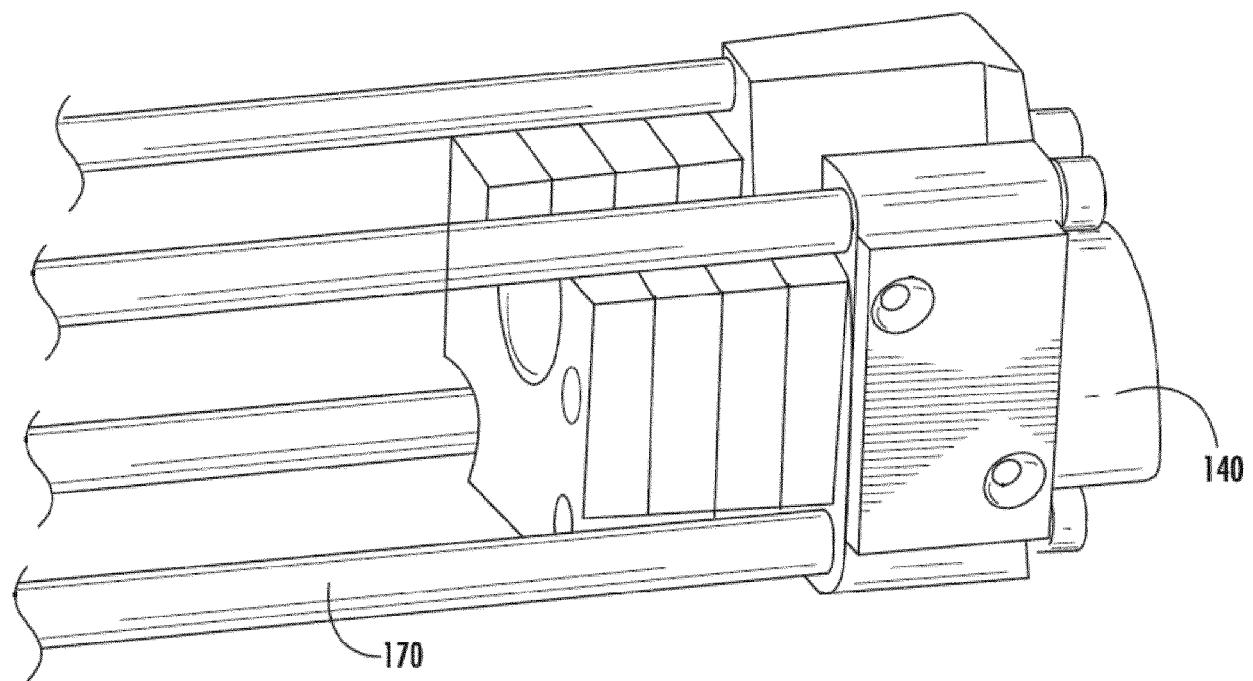
**FIG. 14**



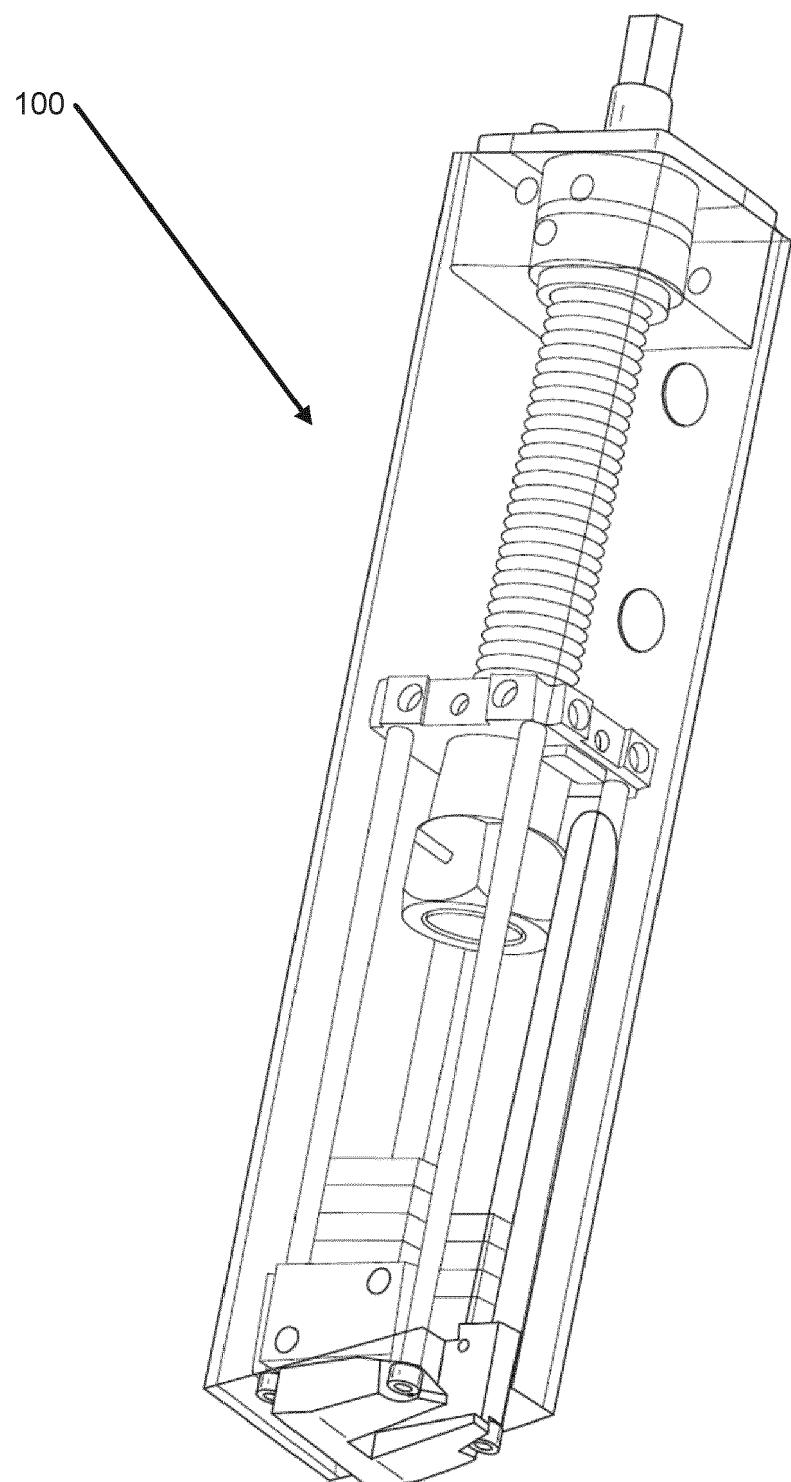
**FIG. 15A**



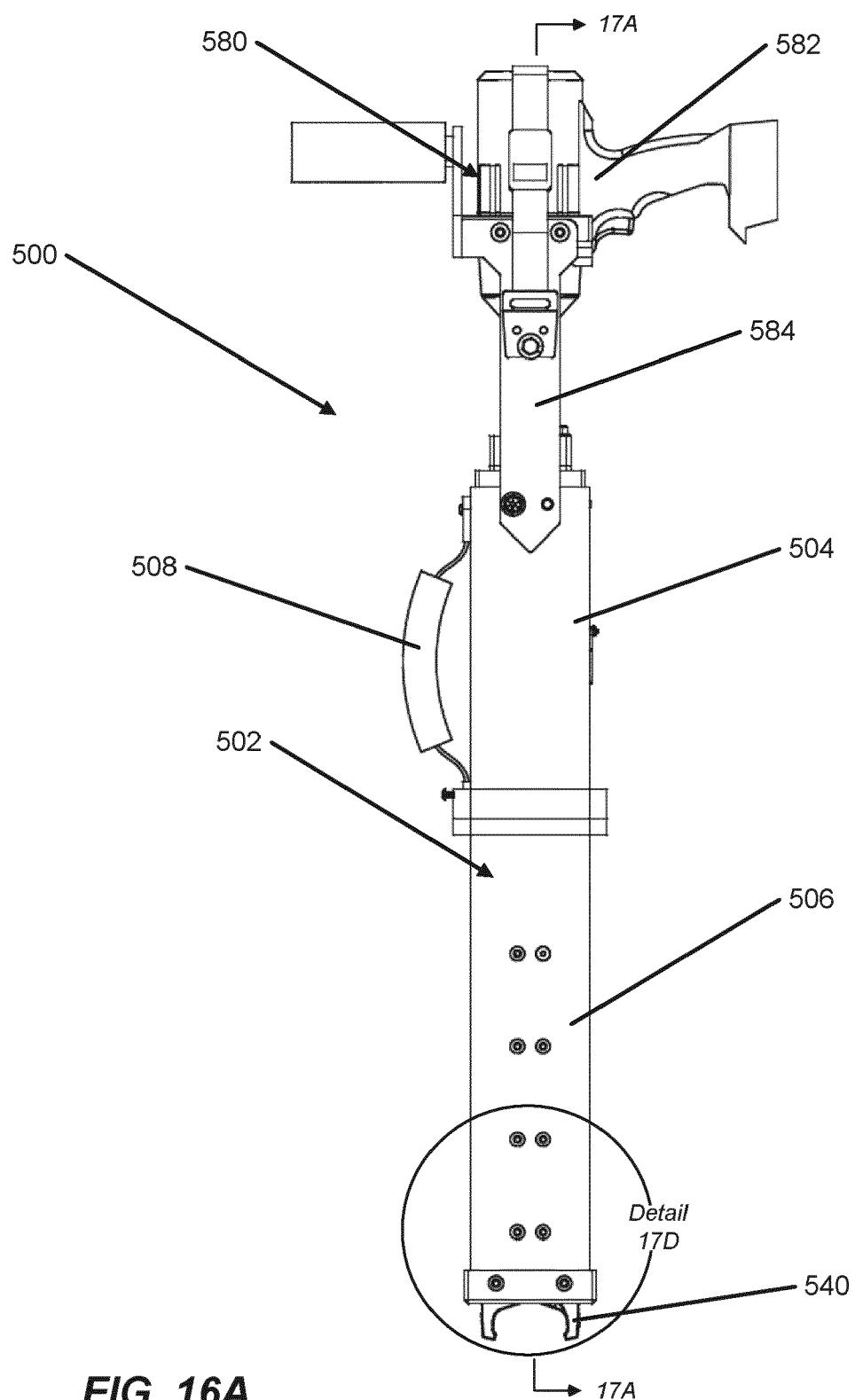
**FIG. 15B**



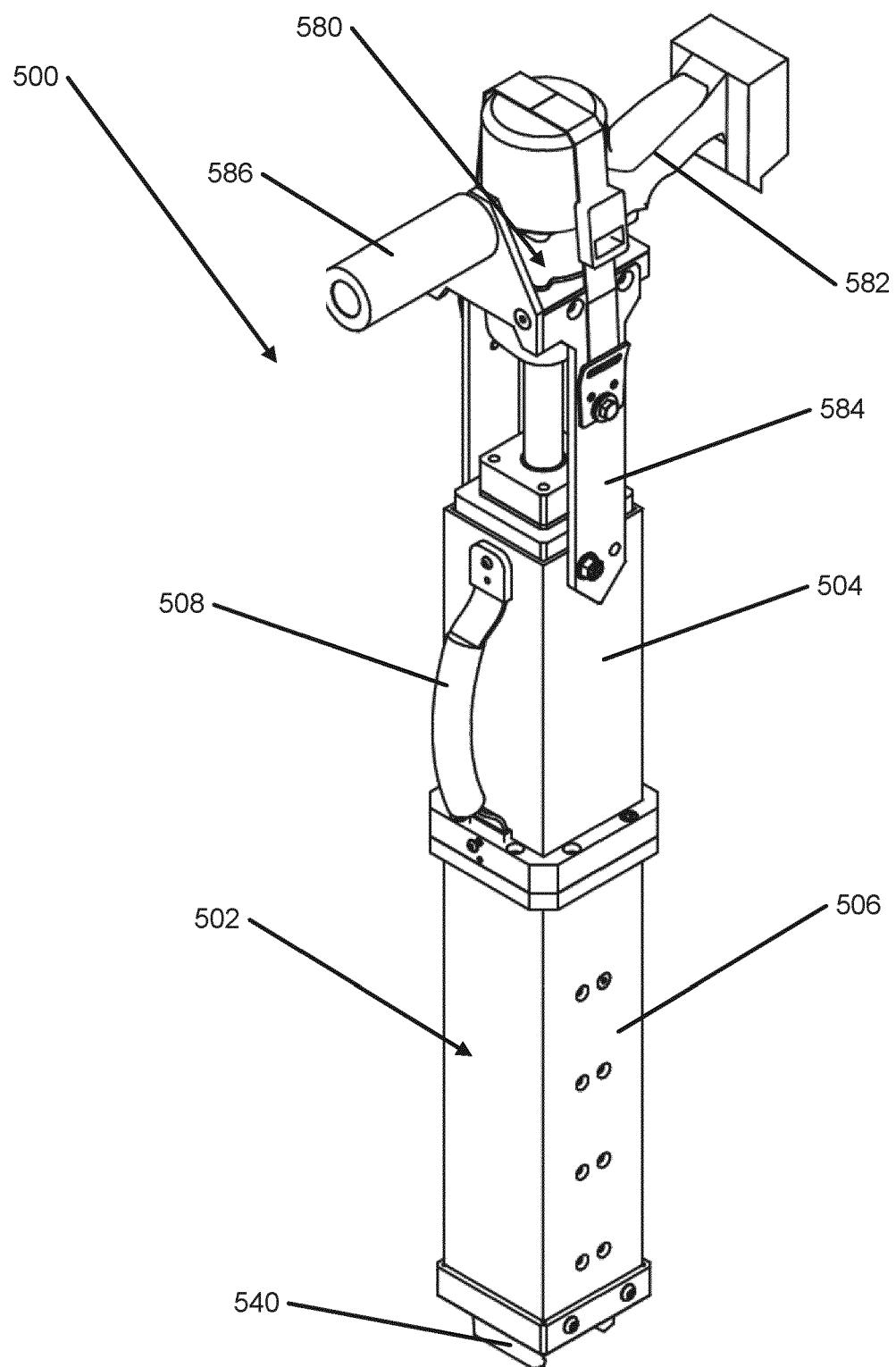
**FIG. 15C**



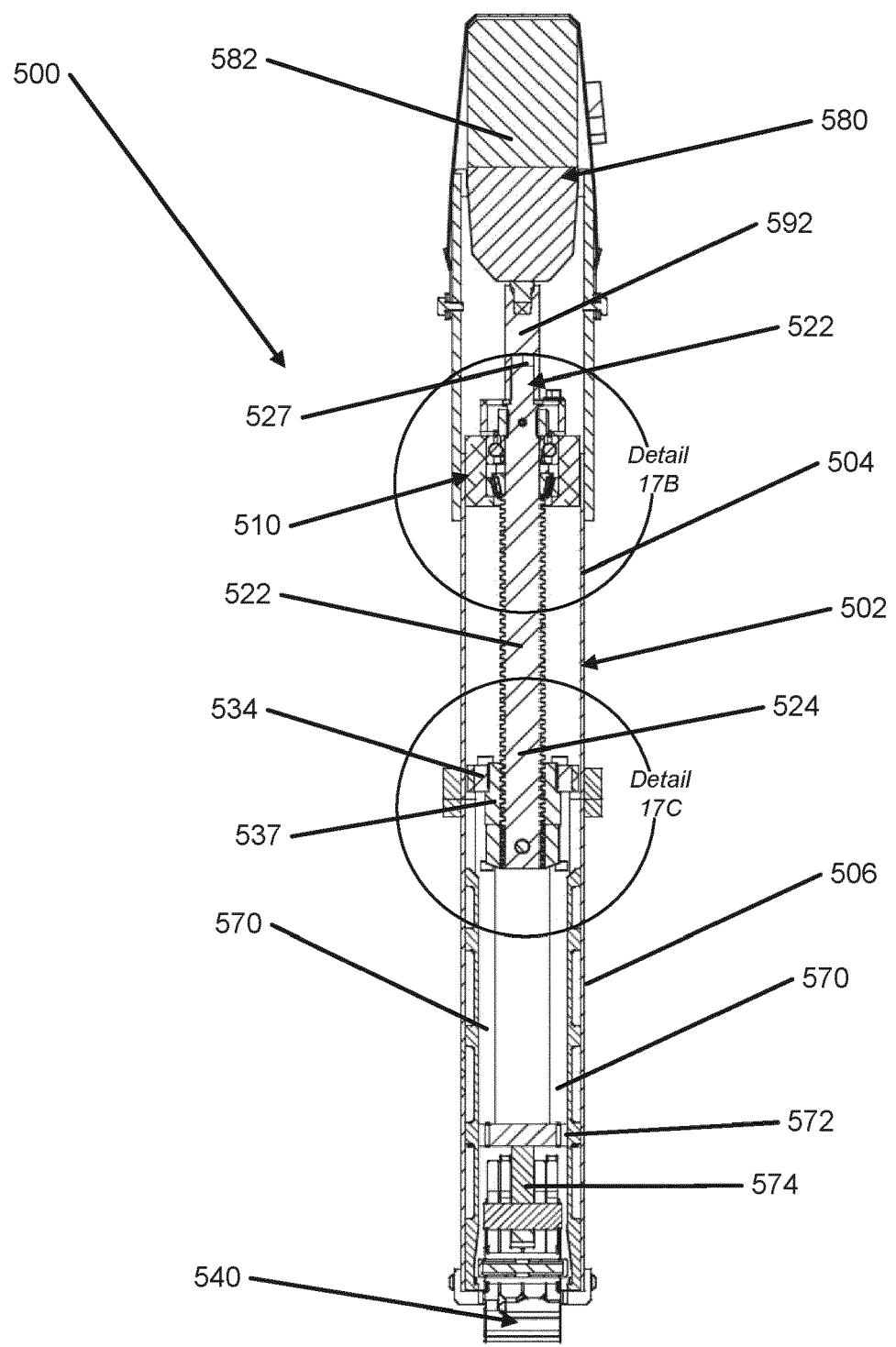
**FIG. 15D**



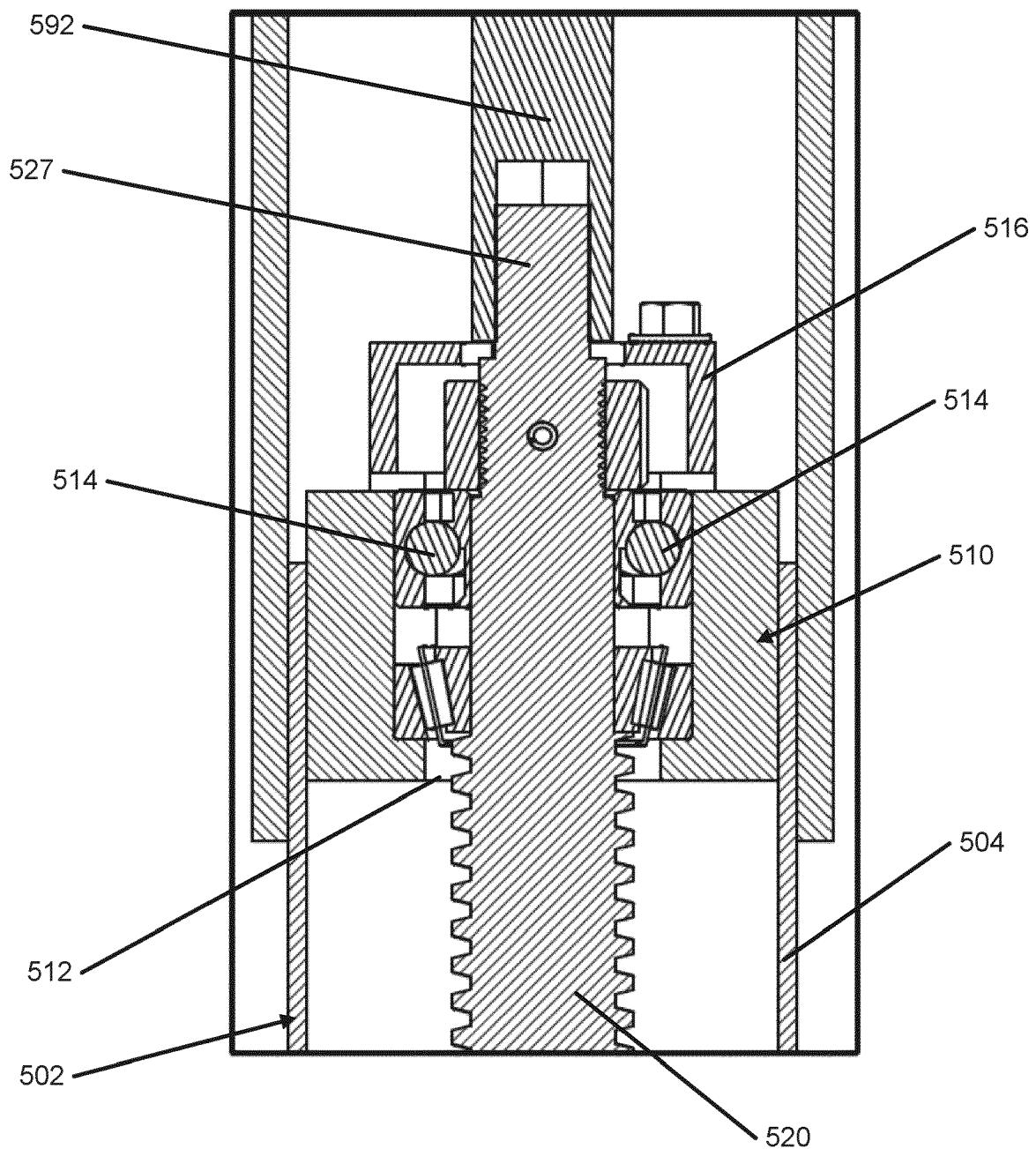
**FIG. 16A**



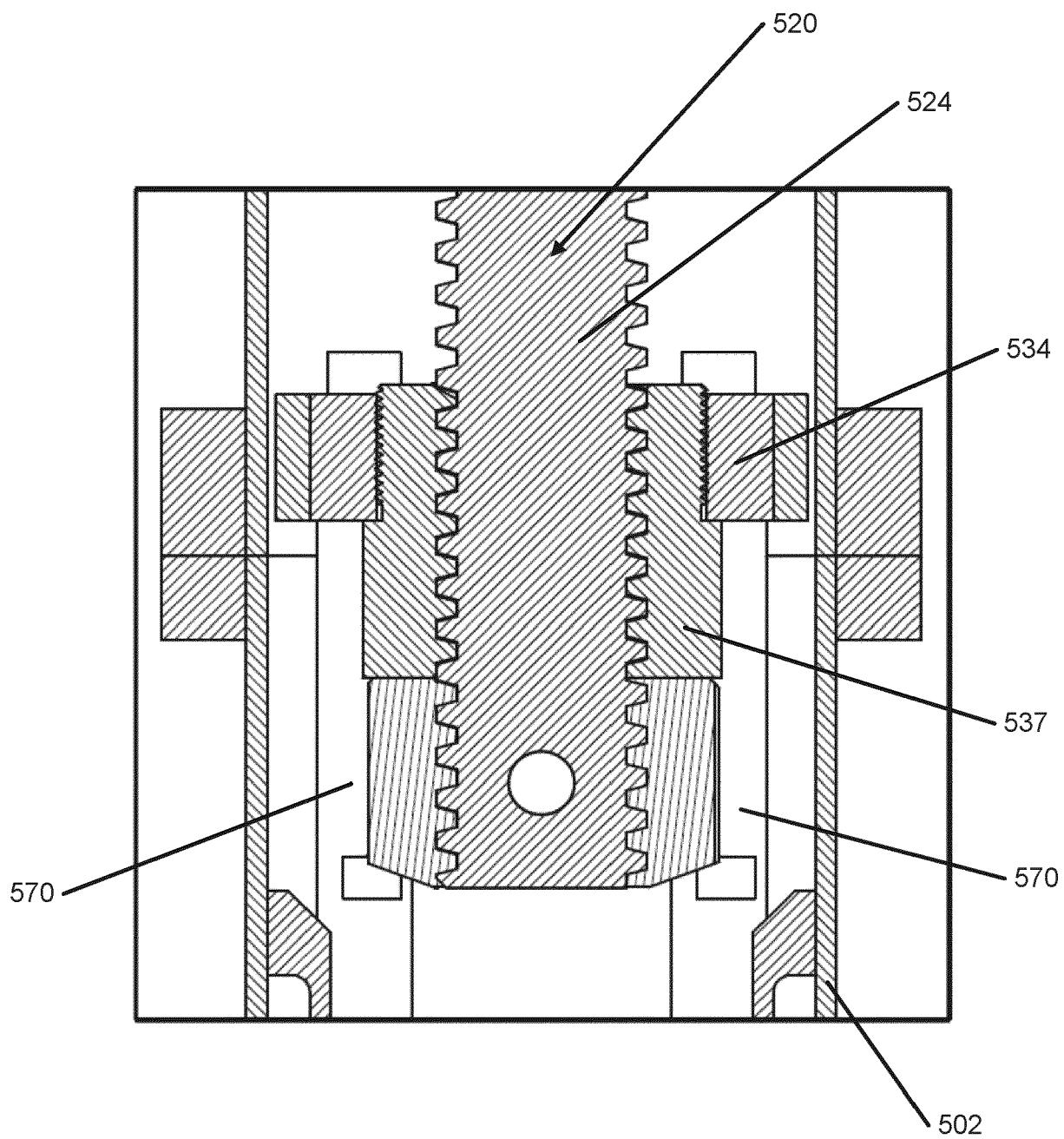
**FIG. 16B**



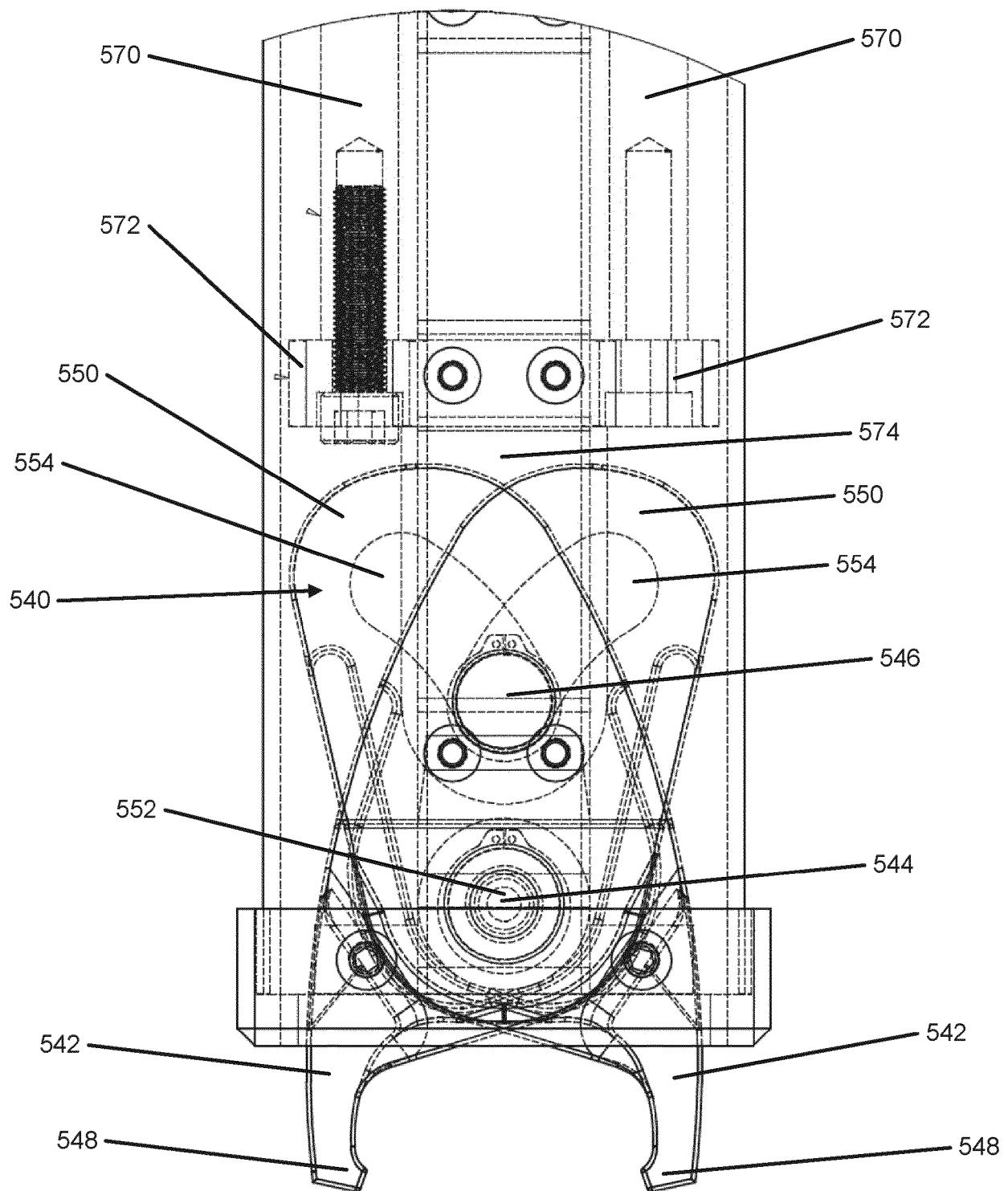
**FIG. 17A**



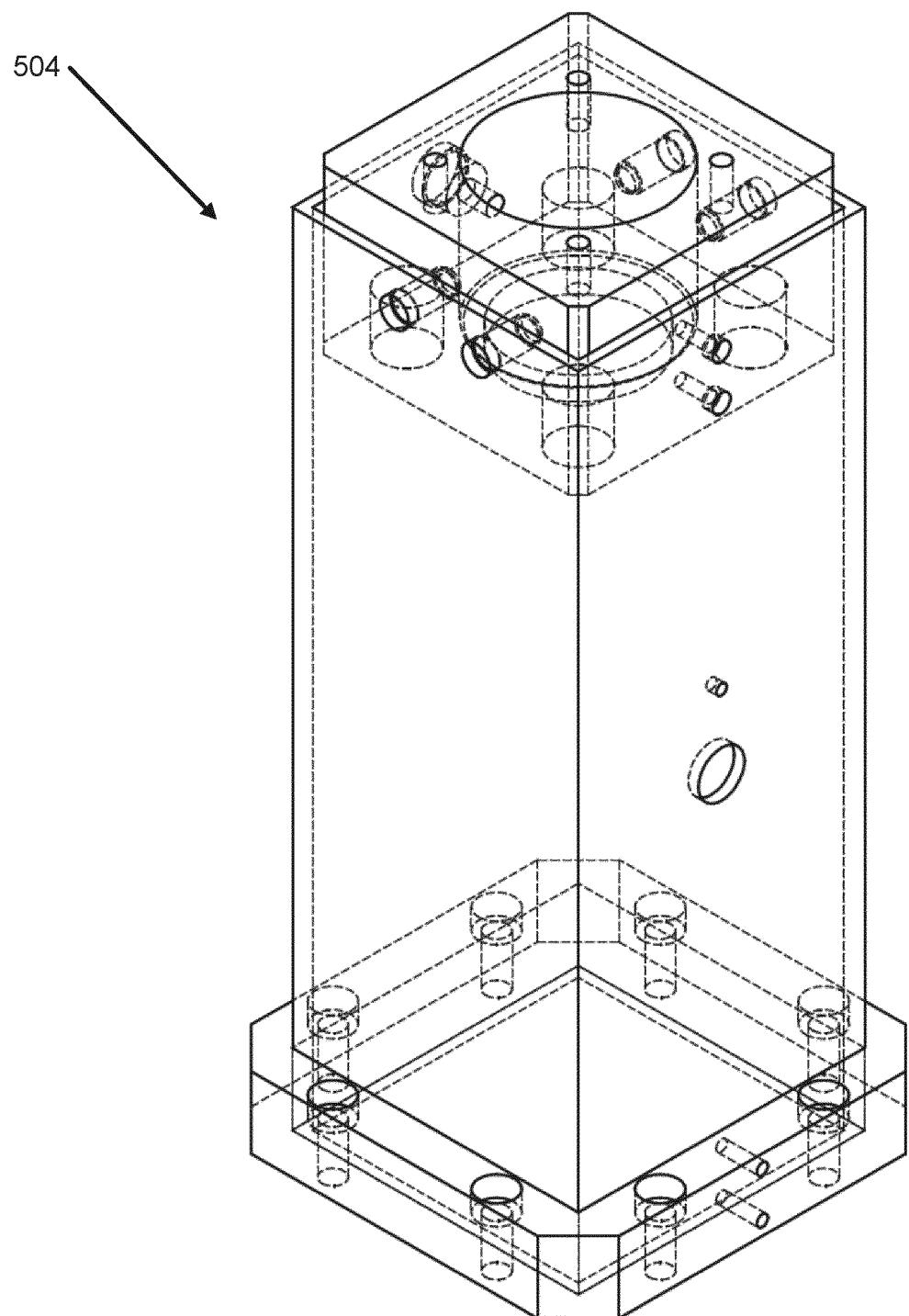
**FIG. 17B**



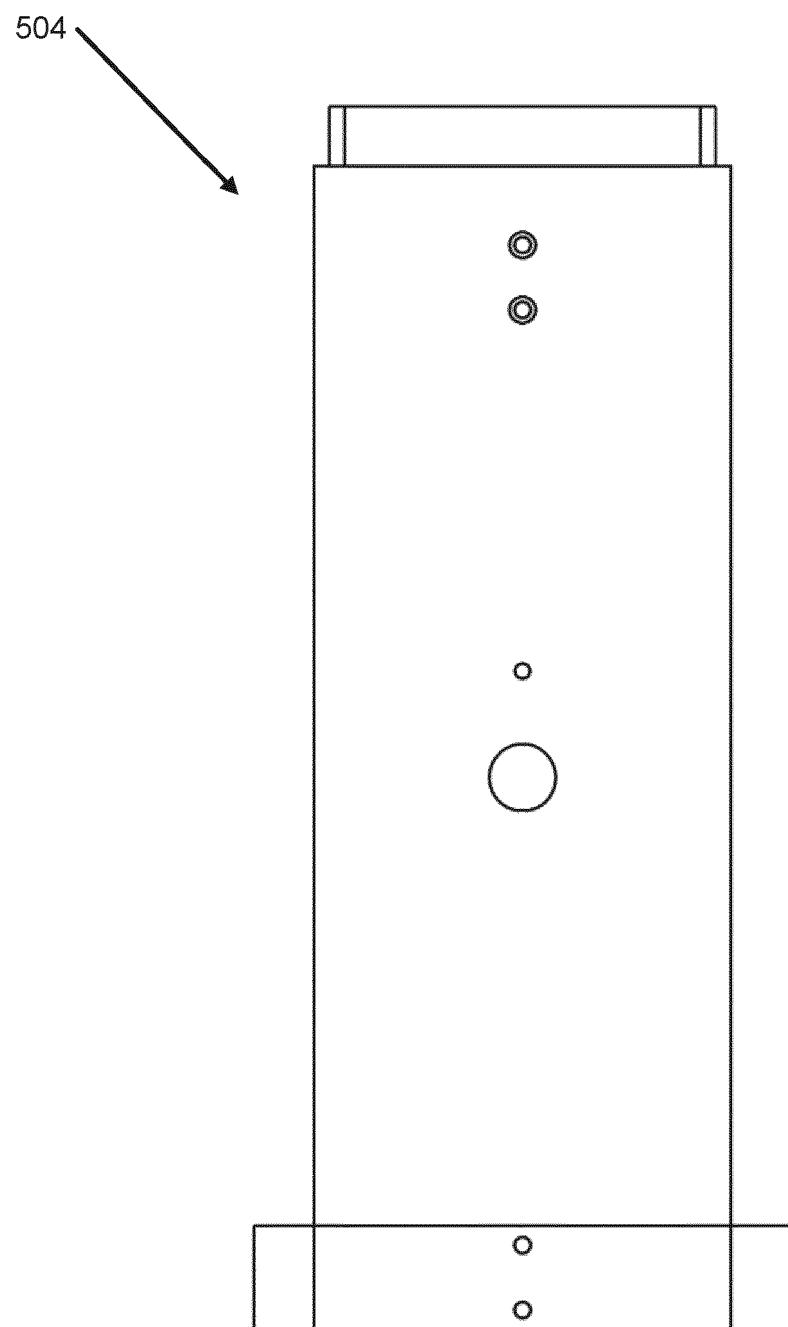
**FIG. 17C**



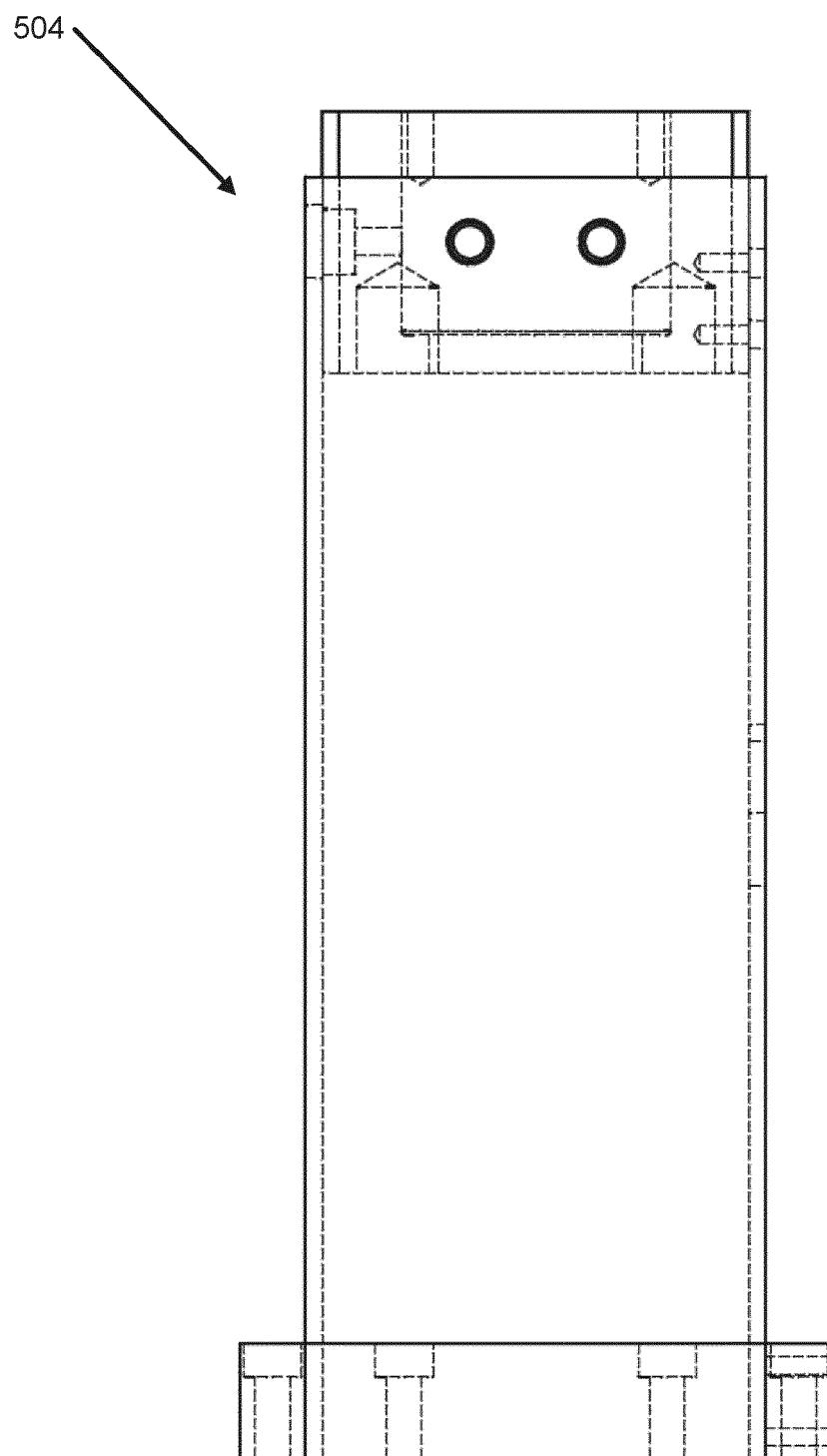
**FIG. 17D**



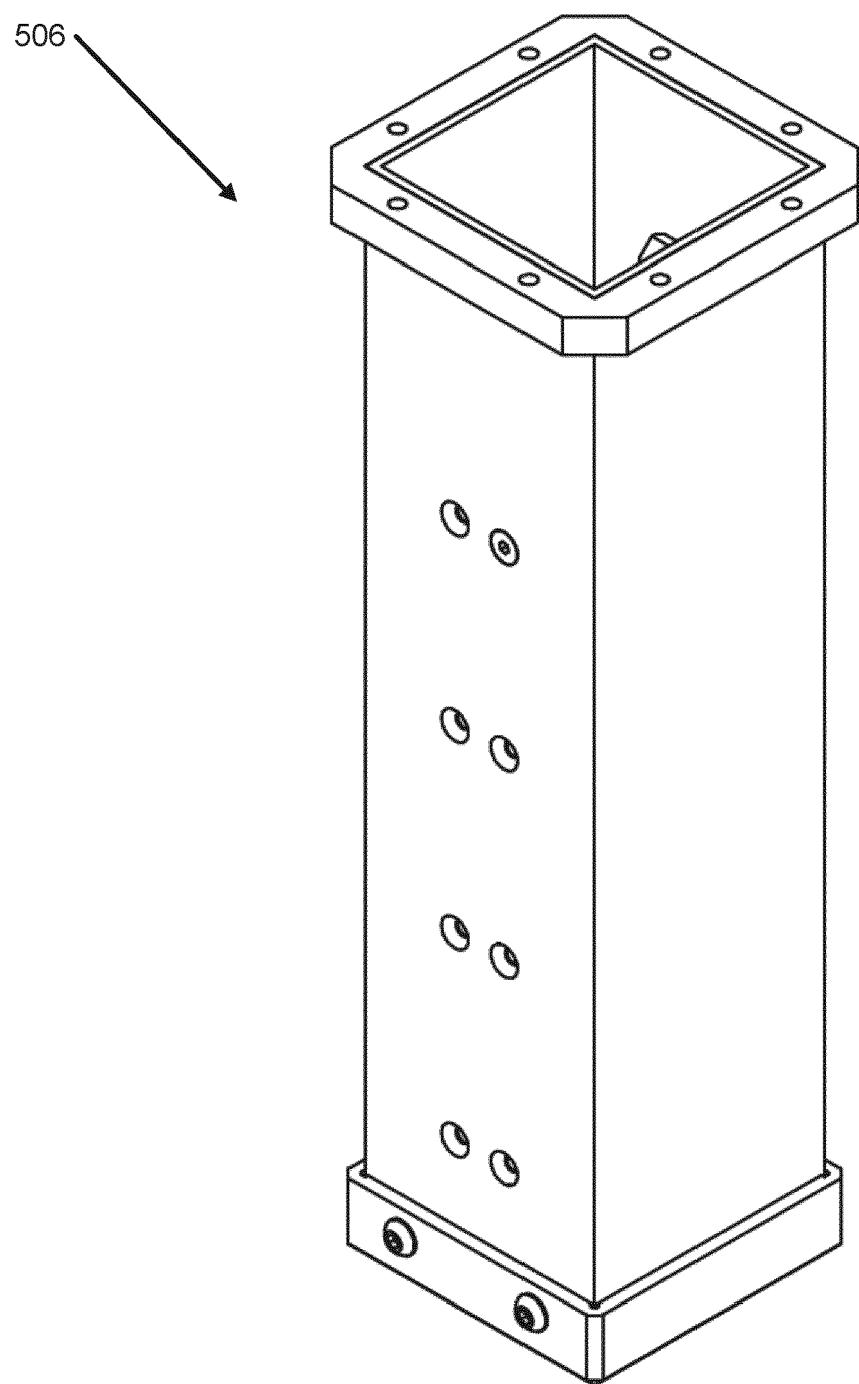
**FIG. 18A**



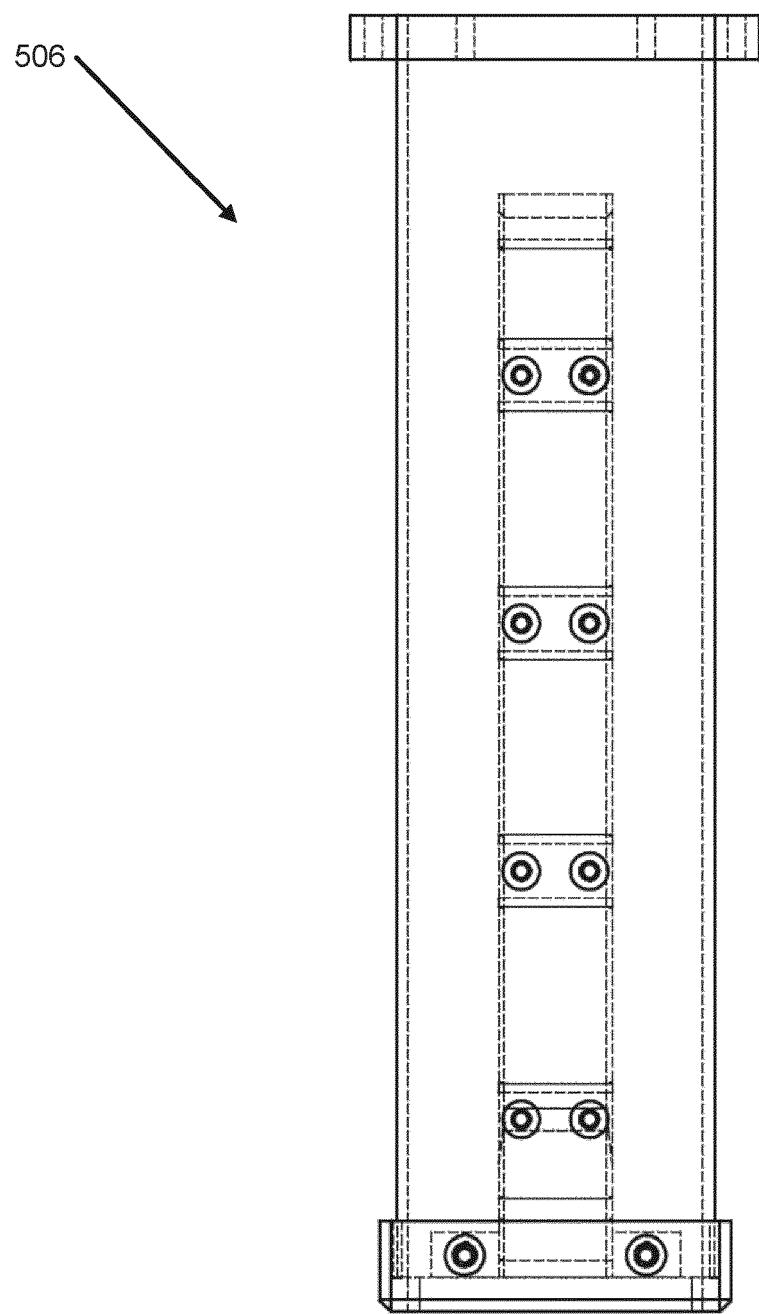
***FIG. 18B***



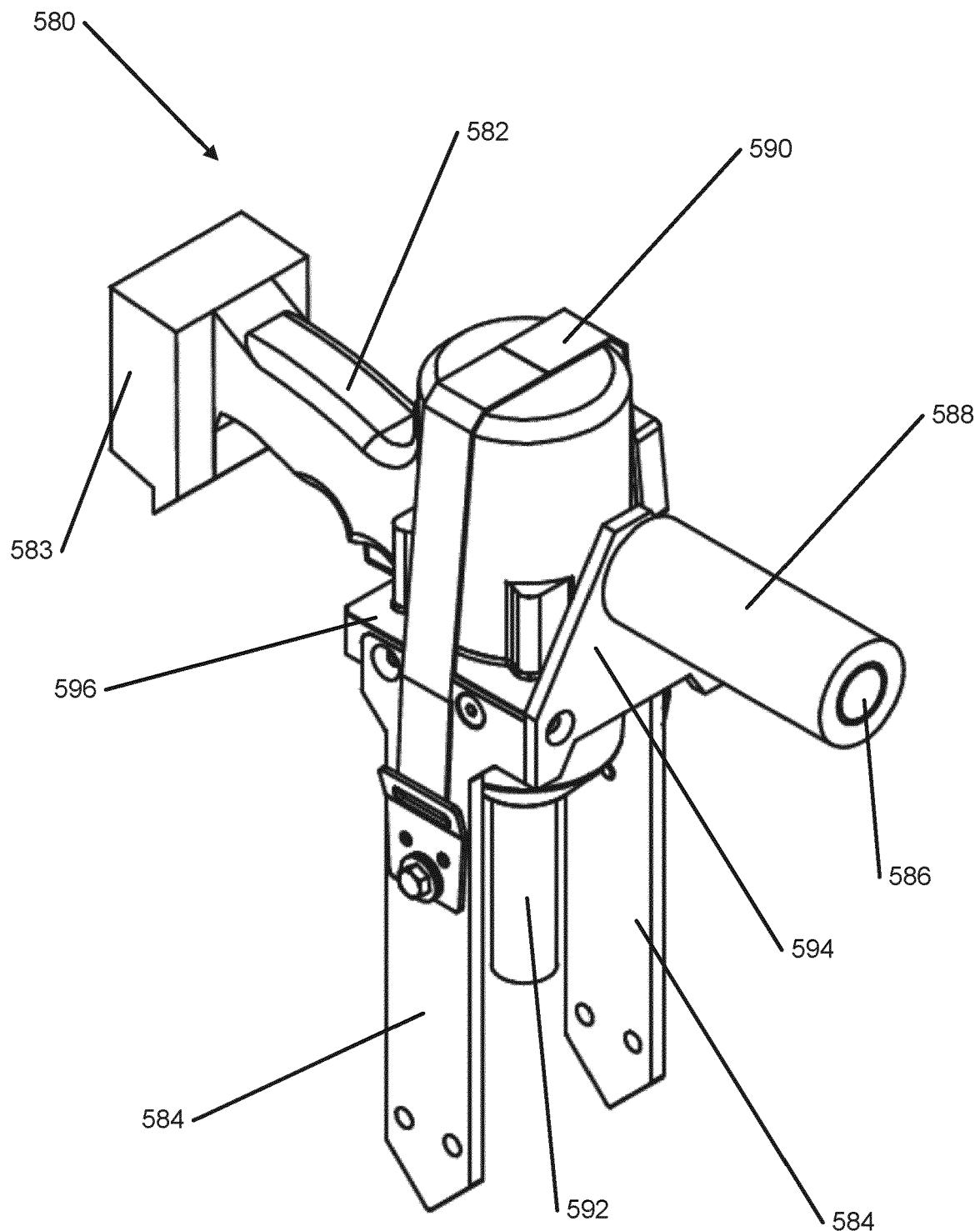
*FIG. 18C*



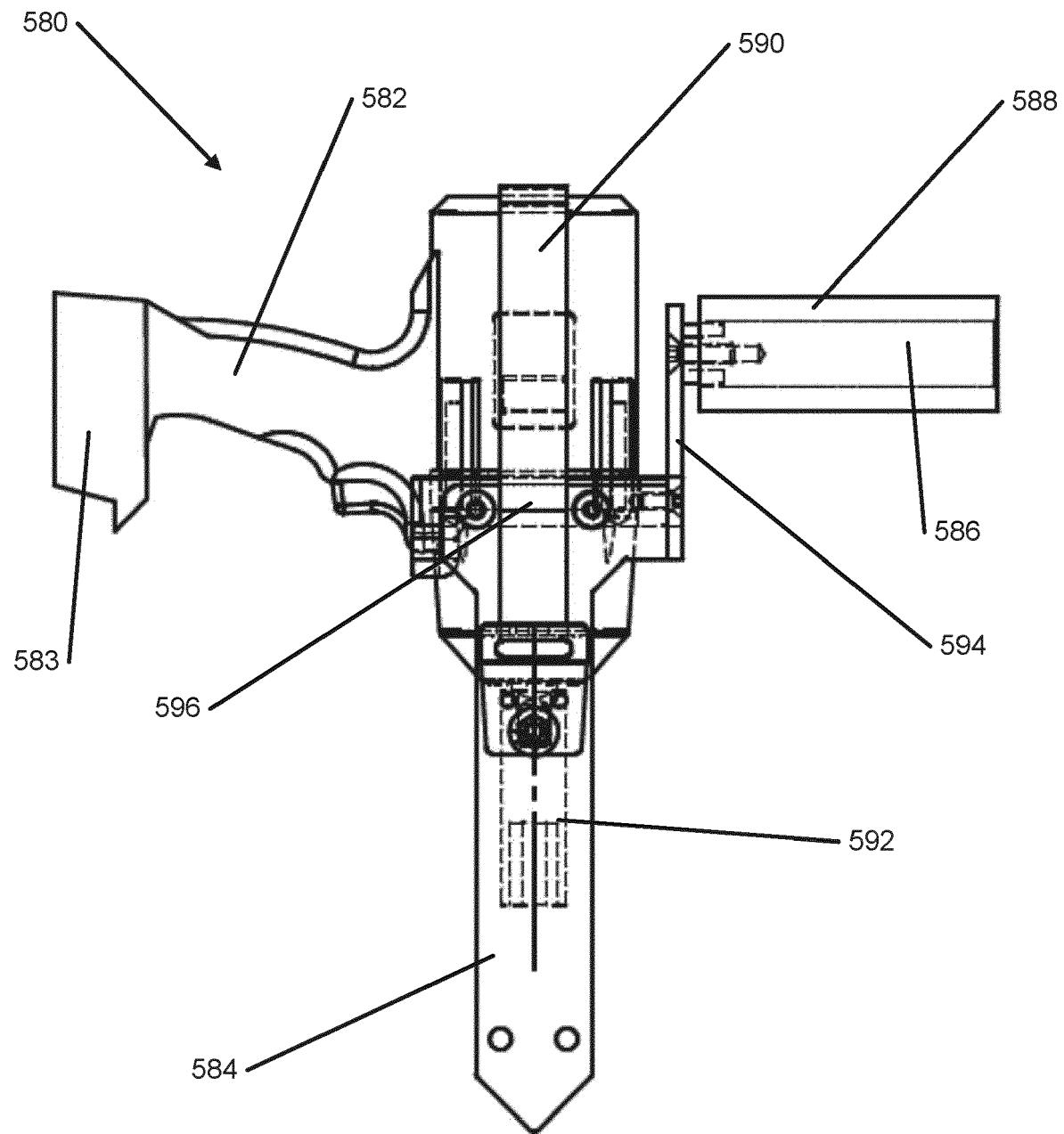
**FIG. 19A**



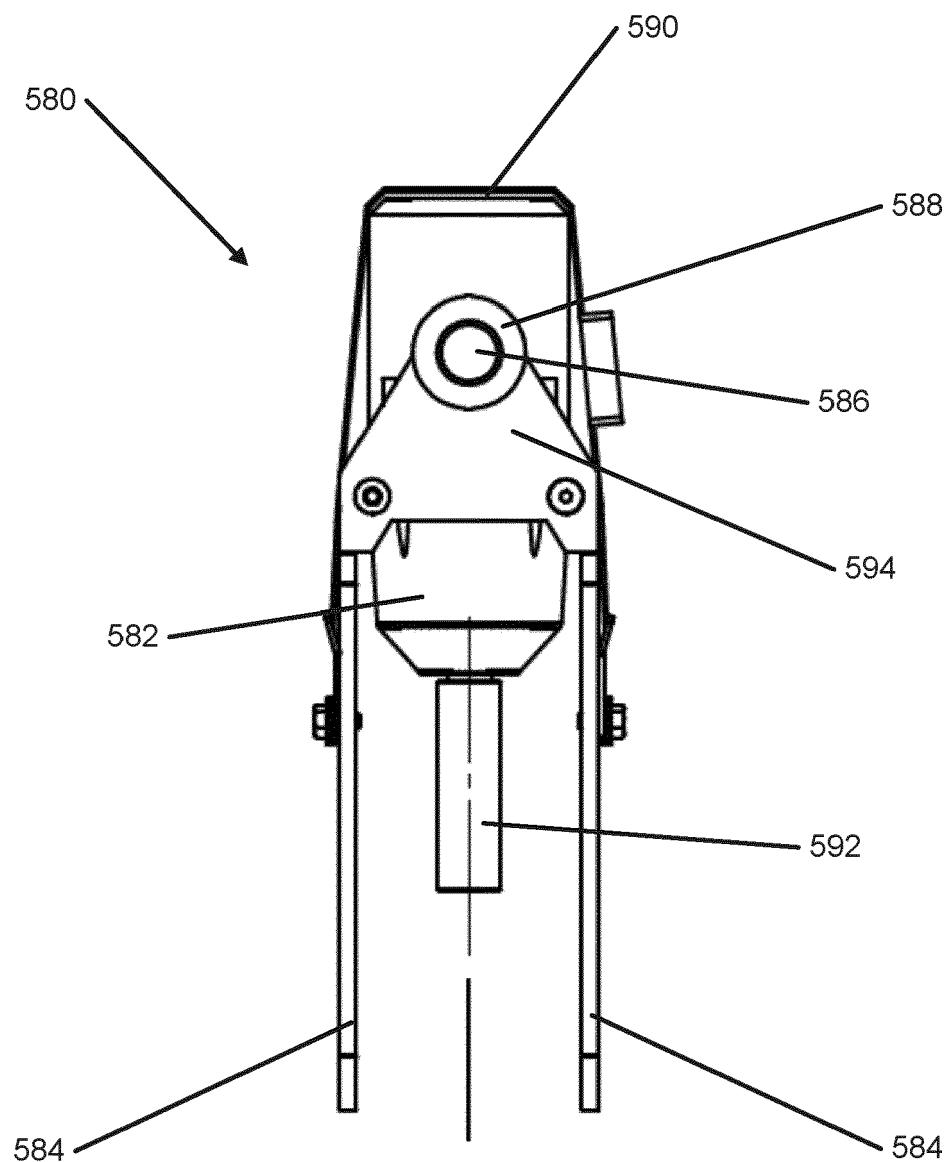
**FIG. 19B**



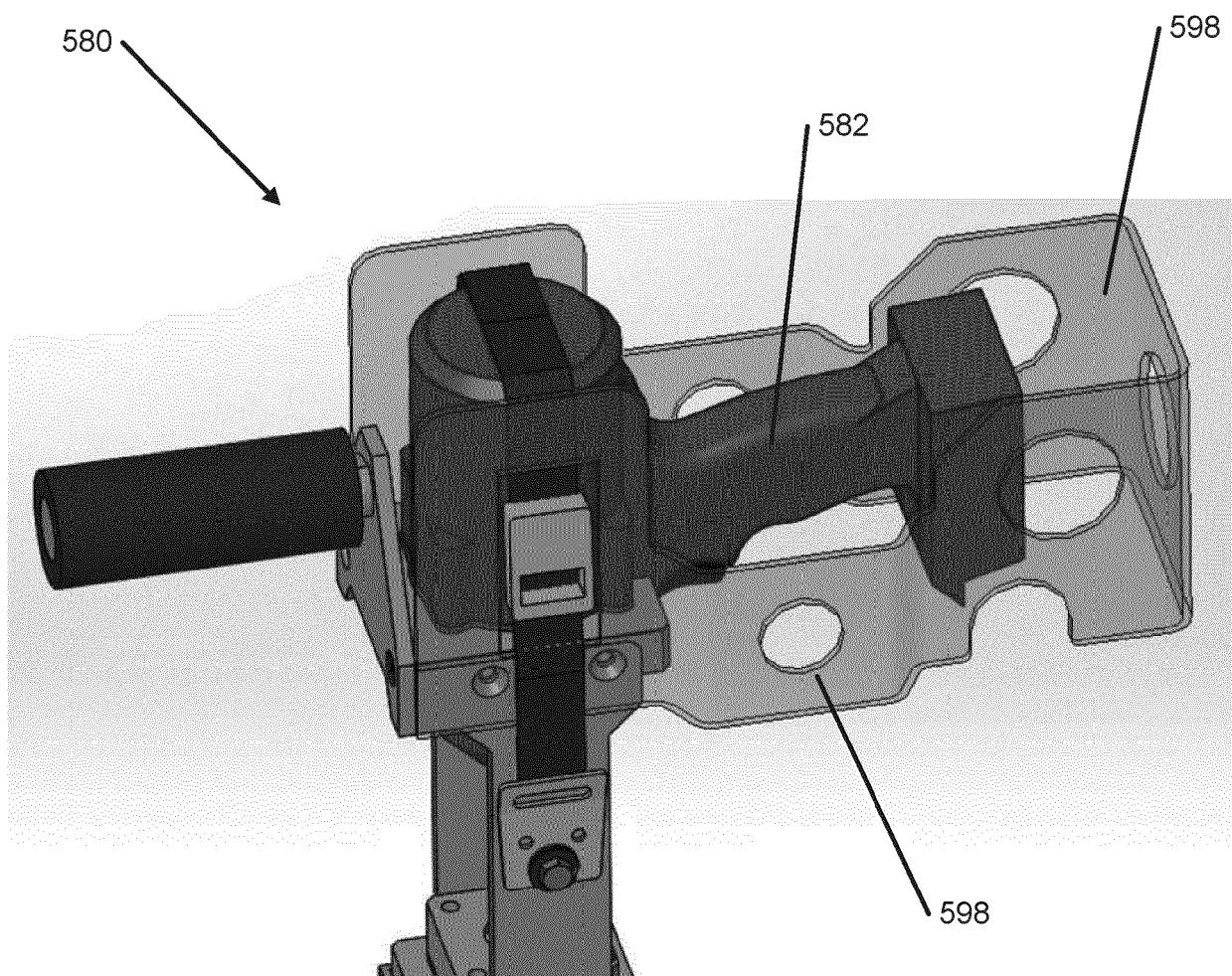
**FIG. 20A**



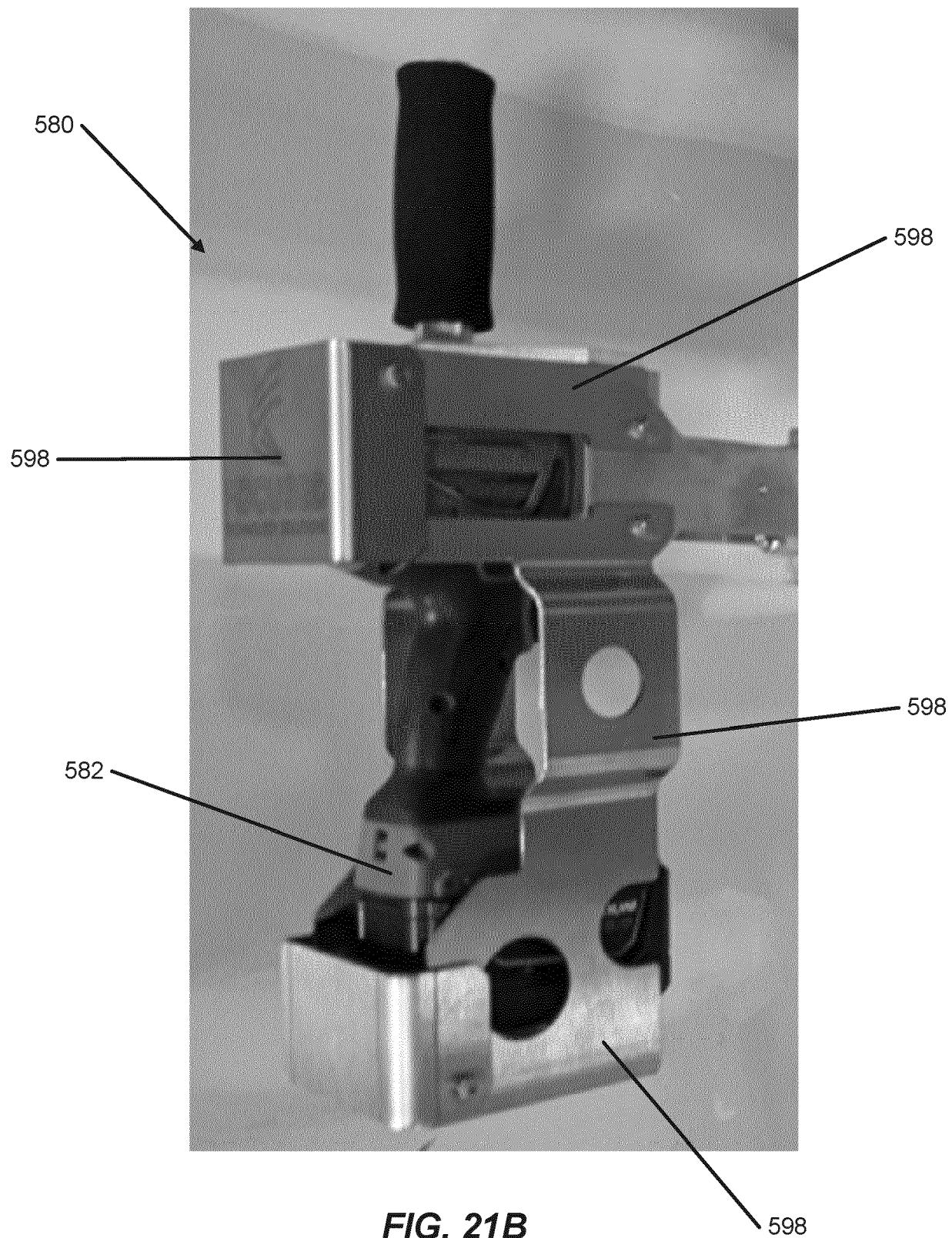
**FIG. 20B**

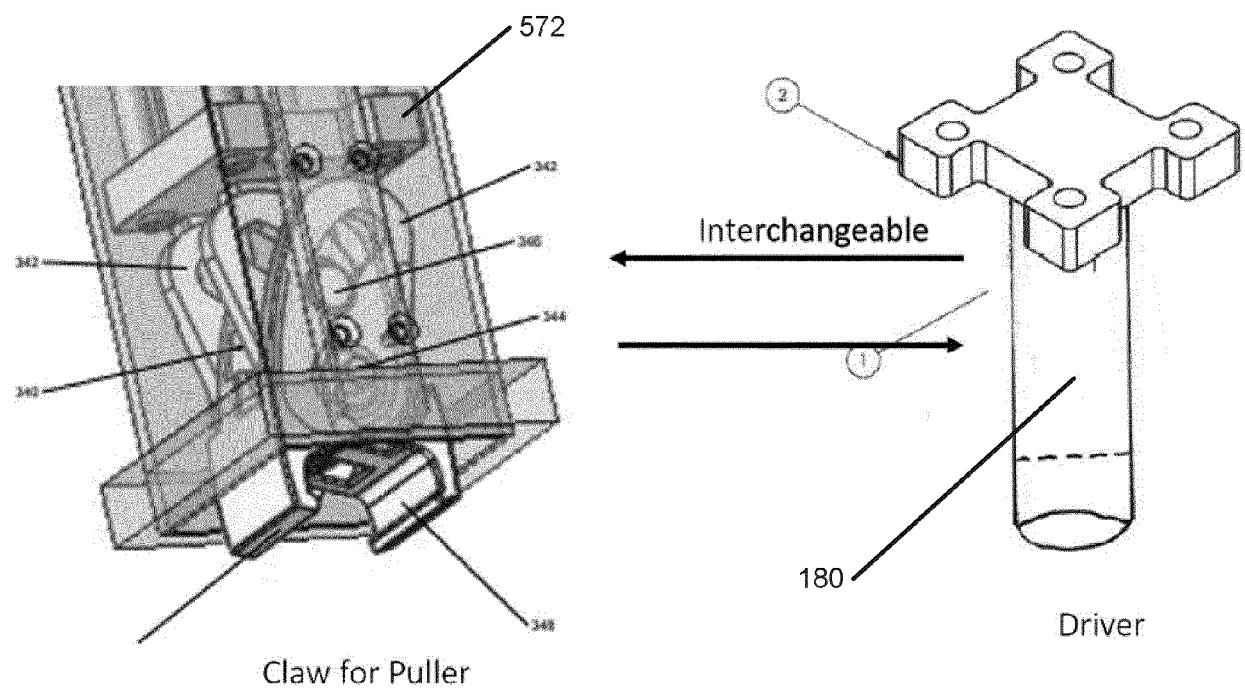


**FIG. 20C**

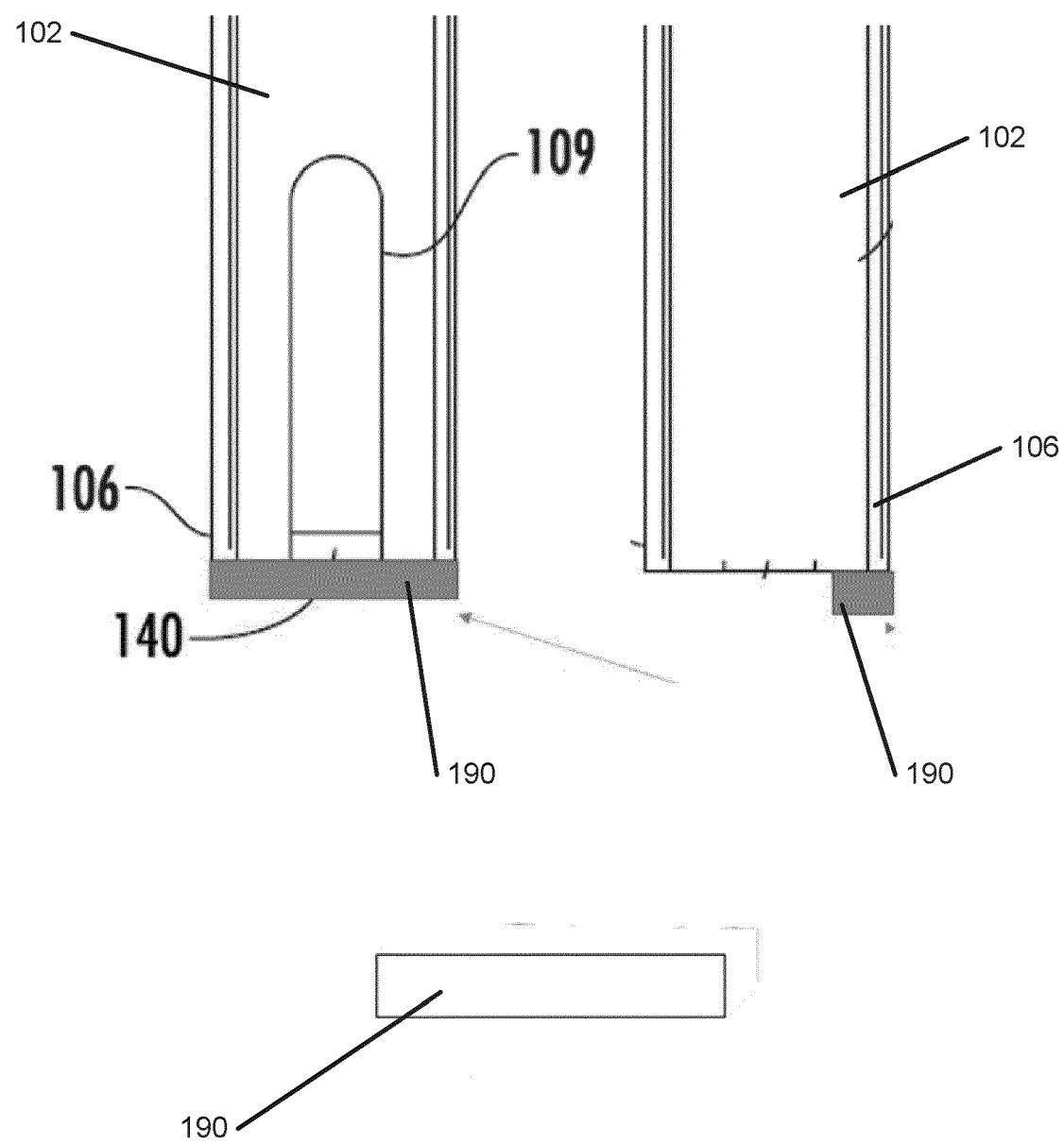


*FIG. 21A*





**FIG. 22**



**FIG. 23**



## EUROPEAN SEARCH REPORT

Application Number

EP 20 15 0387

5

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
10	A EP 3 255 207 A1 (RAILSERVE INC [US]) 13 December 2017 (2017-12-13) * column 5, paragraph [0017] - column 8, paragraph [0028]; claims 1-12; figures 1-9 *	1-15	INV. E01B29/26 B25C11/00
15	A ----- EP 1 041 203 A1 (FRAMATOME CONNECTORS INT [FR]) 4 October 2000 (2000-10-04) * column 3, paragraph [0012] - column 5, paragraph [0018]; figures 1-6 *	1-15	
20	A ----- US 6 113 073 A (LEFAVOUR JOHN DAVID [US] ET AL) 5 September 2000 (2000-09-05) * column 2, line 45 - column 5, line 27; figures 1-6 *	1-15	
25	A ----- DE 520 526 C (INGERSOLL RAND CO) 12 March 1931 (1931-03-12) * page 1, line 29 - page 2, line 92; figures 1-5 *	1-15	
30			TECHNICAL FIELDS SEARCHED (IPC)
35			E01B B25B B25C
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45			
50	1 The present search report has been drawn up for all claims		
55	Place of search Munich	Date of completion of the search 24 April 2020	Examiner Fernandez, Eva
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ON EUROPEAN PATENT APPLICATION NO.

EP 20 15 0387

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24-04-2020

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