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(54) **POWER TOOL FOR STAINLESS STEEL METAL LOCKING TIES**

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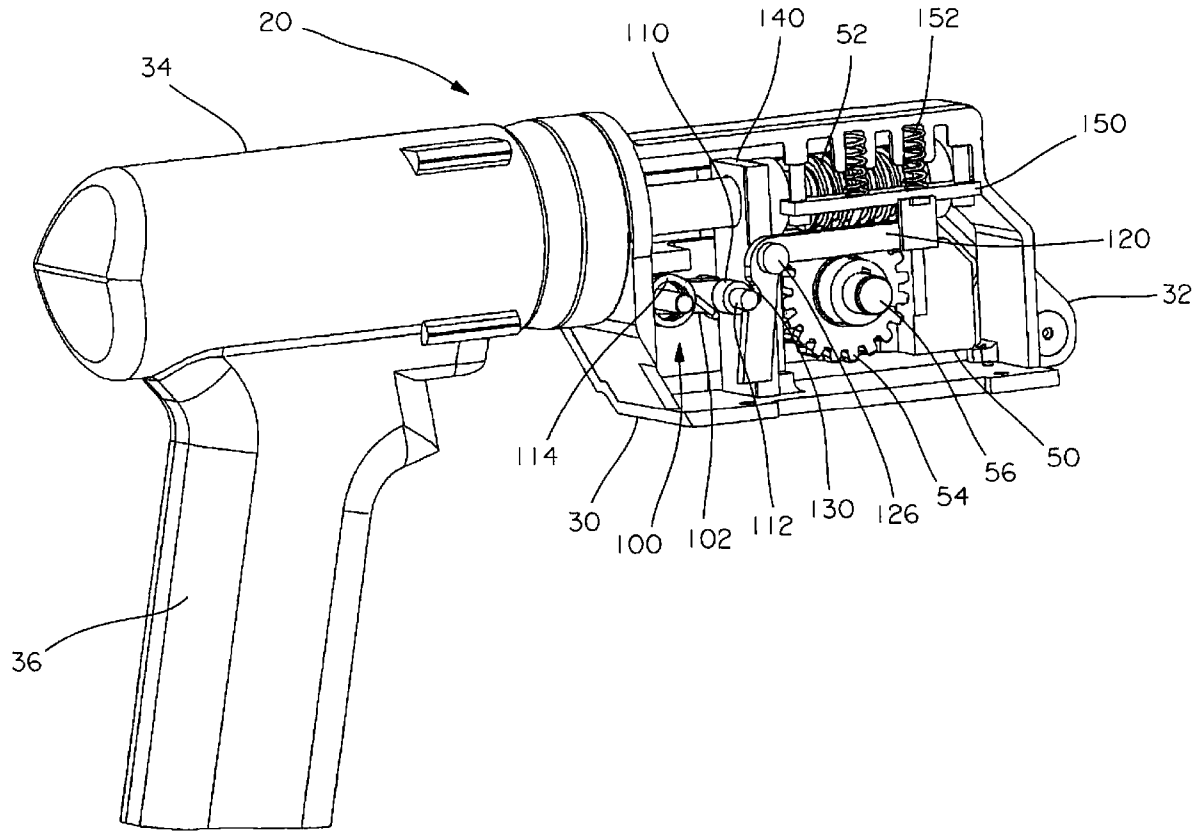
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(52) **U.S. Cl.** **140/93.2**

(57) **ABSTRACT**

A power tool for installing a metal locking tie is disclosed. The power tool includes a body and a power chassis. The body of the tool includes a gear carrier, a tensioning mechanism and a cutting mechanism. The gear carrier is positioned in the tool body and the tensioning mechanism is mounted in the gear carrier. The cutting mechanism engages the gear carrier. As the tie is tensioned, the gear carrier moves linearly in the tool body to cut the tensioned tie.



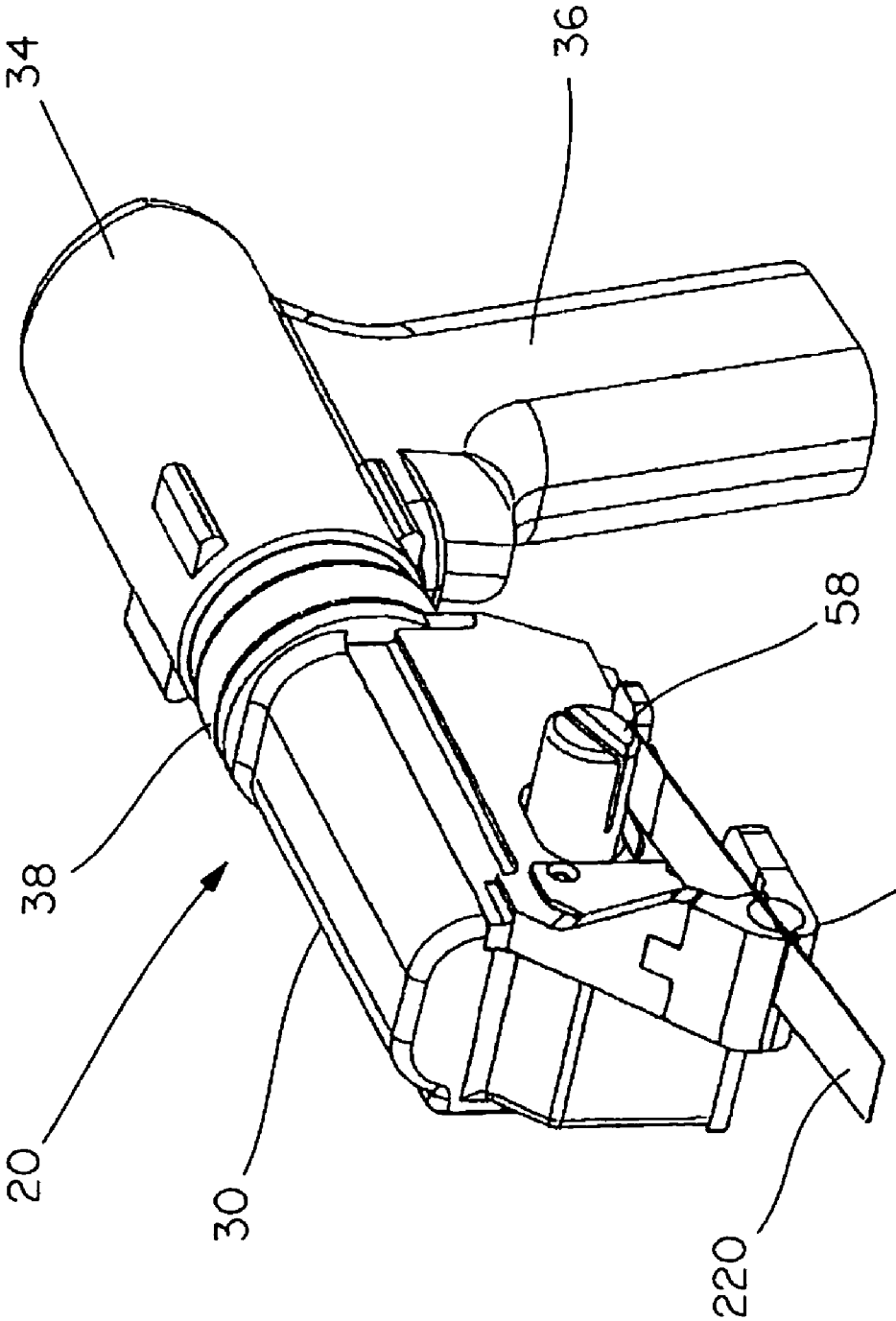


FIG. 1

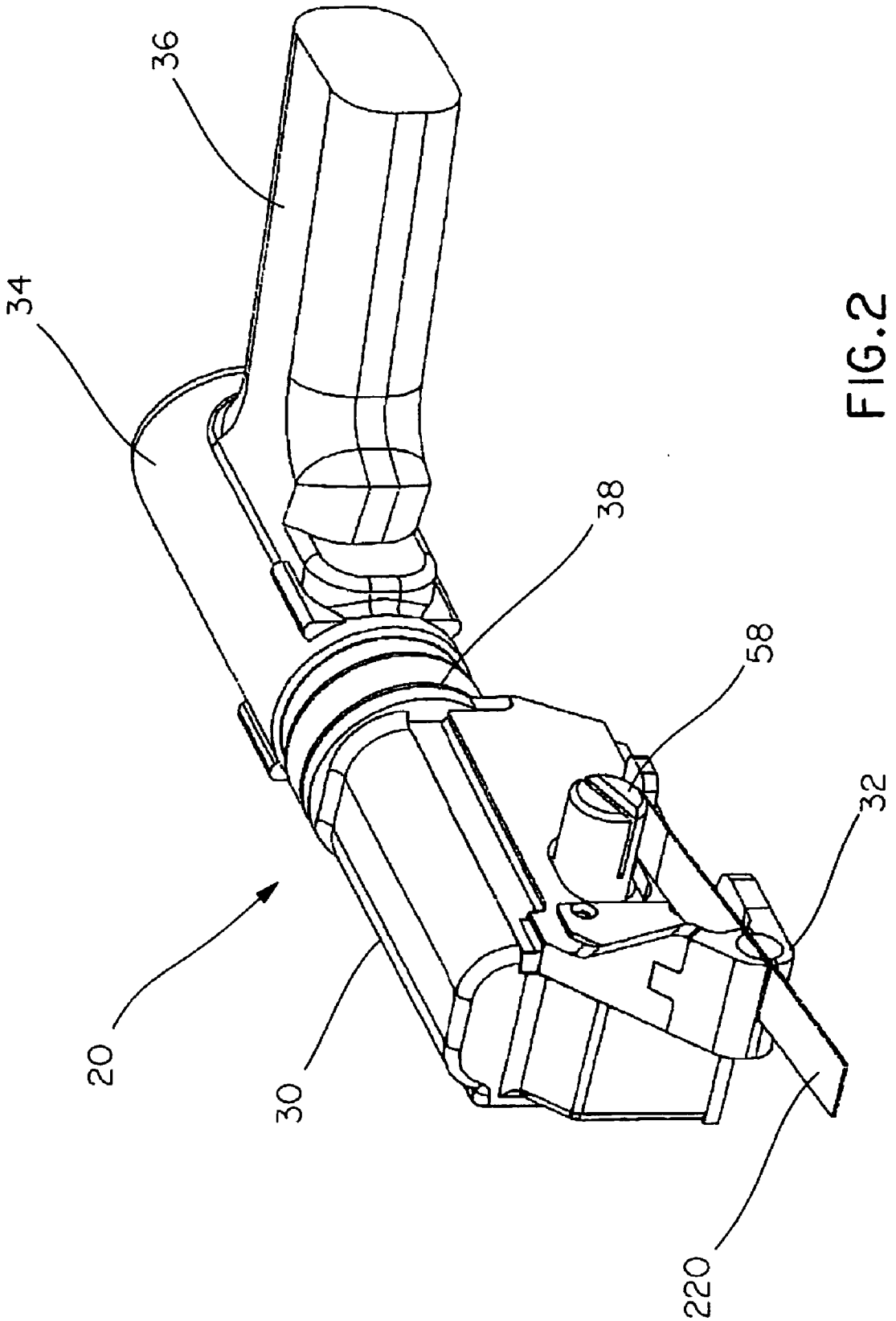


FIG.2

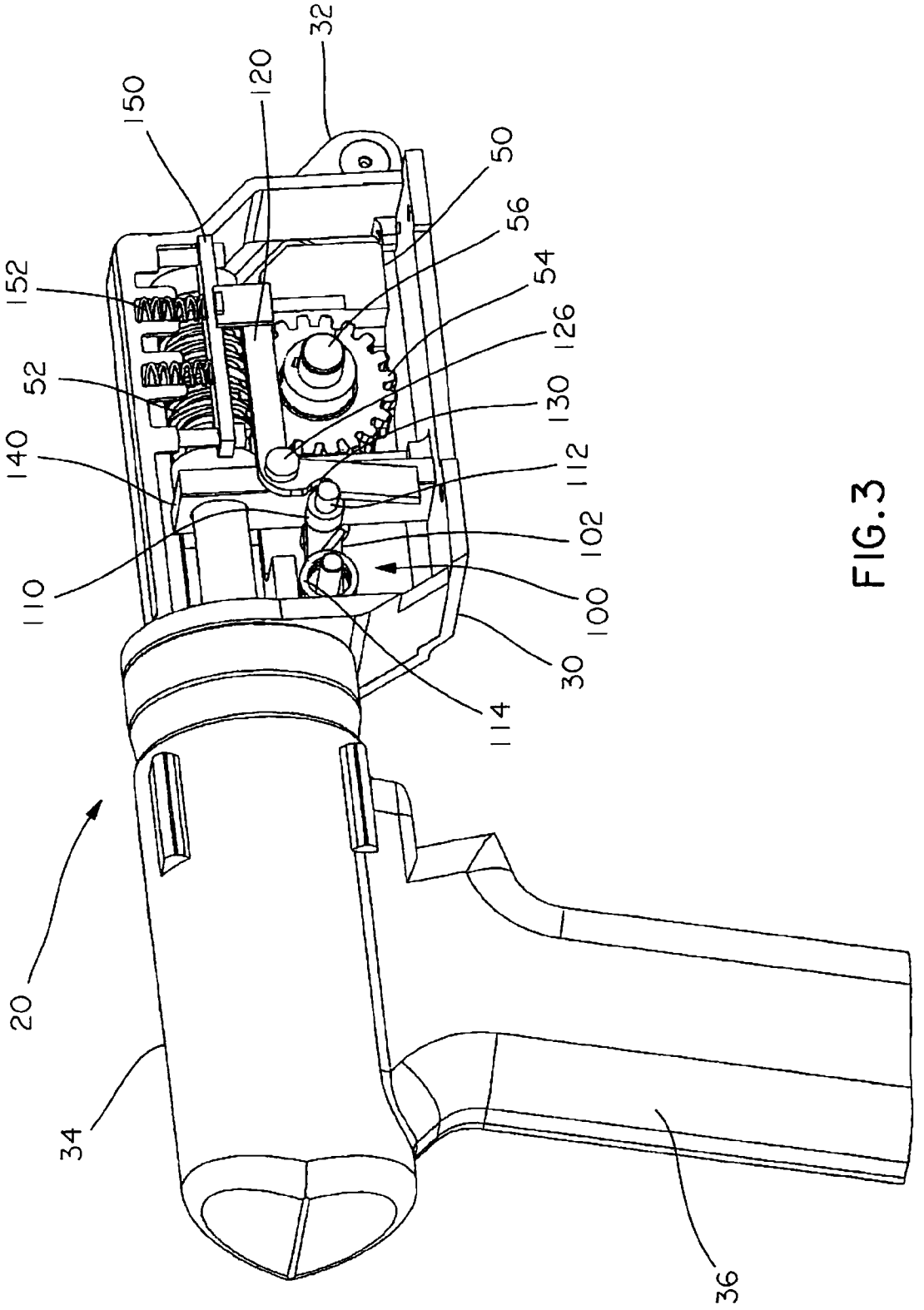

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FIG. 3

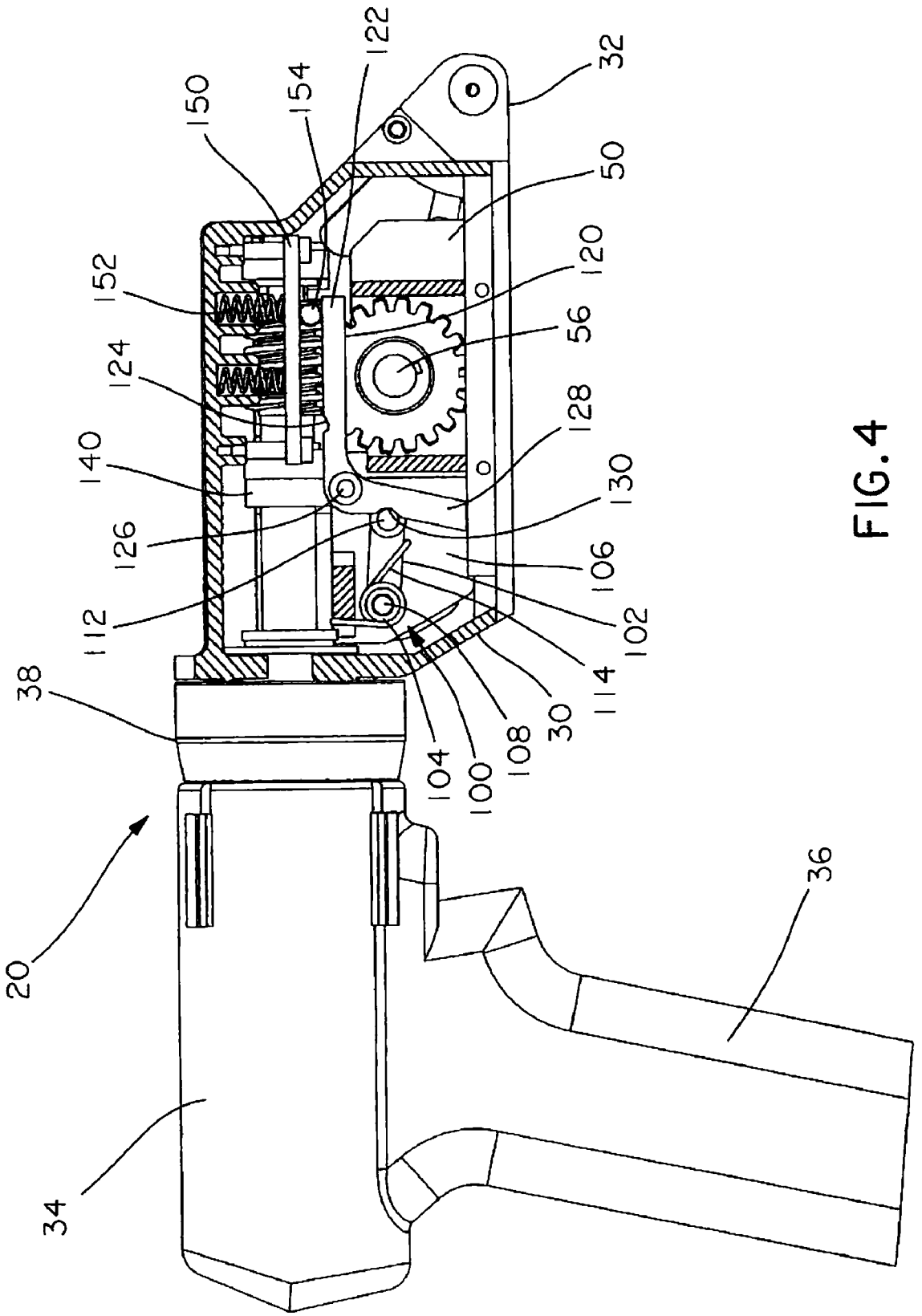

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FIG. 4

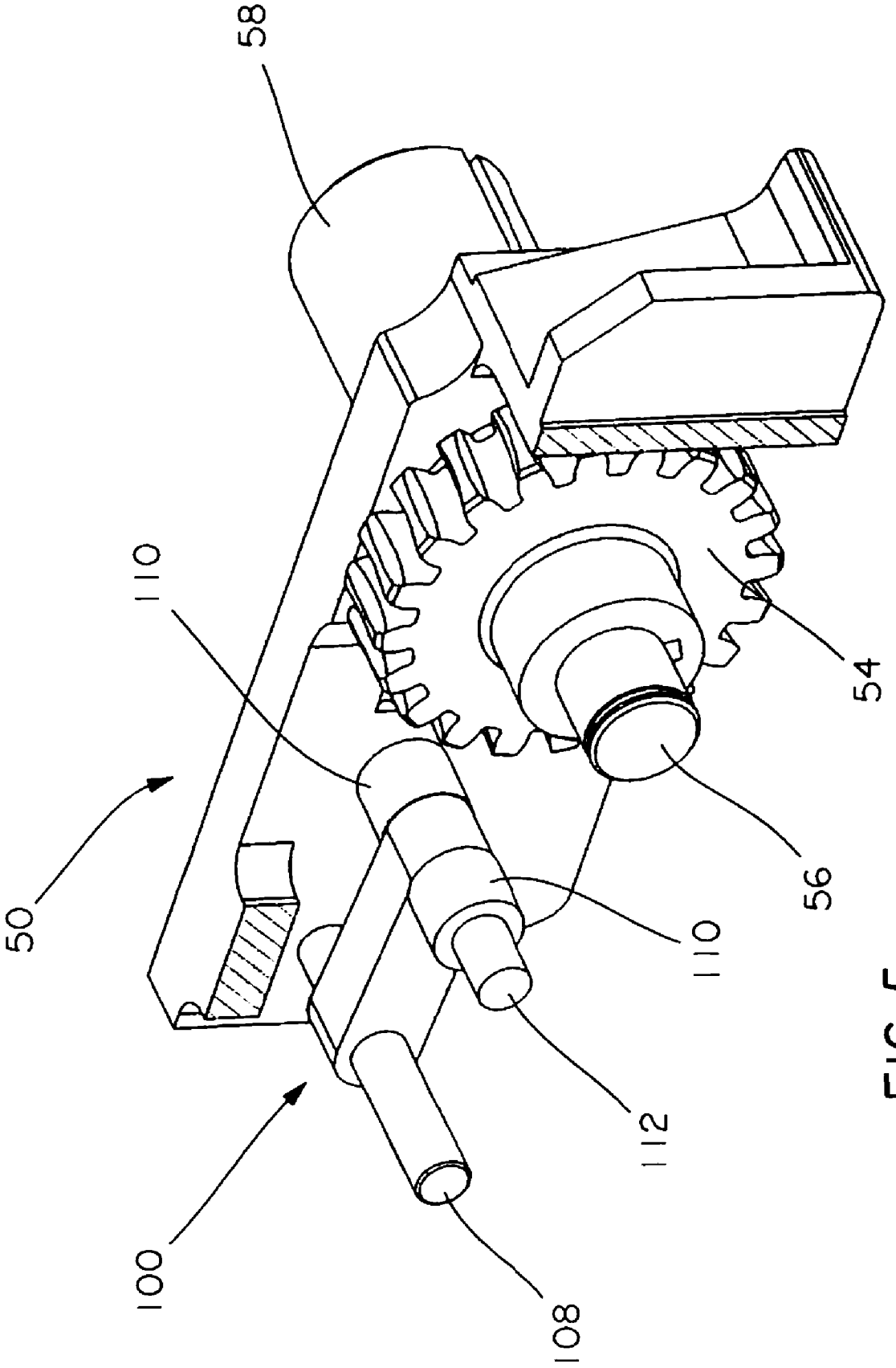


FIG.5

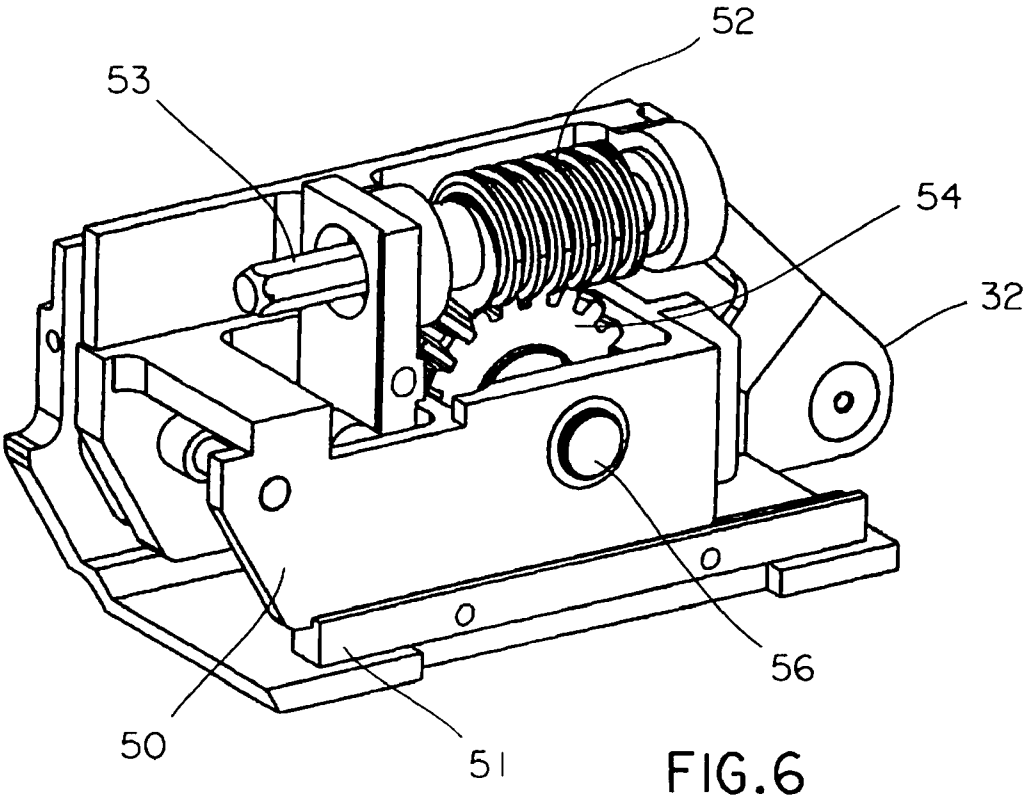

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FIG.6

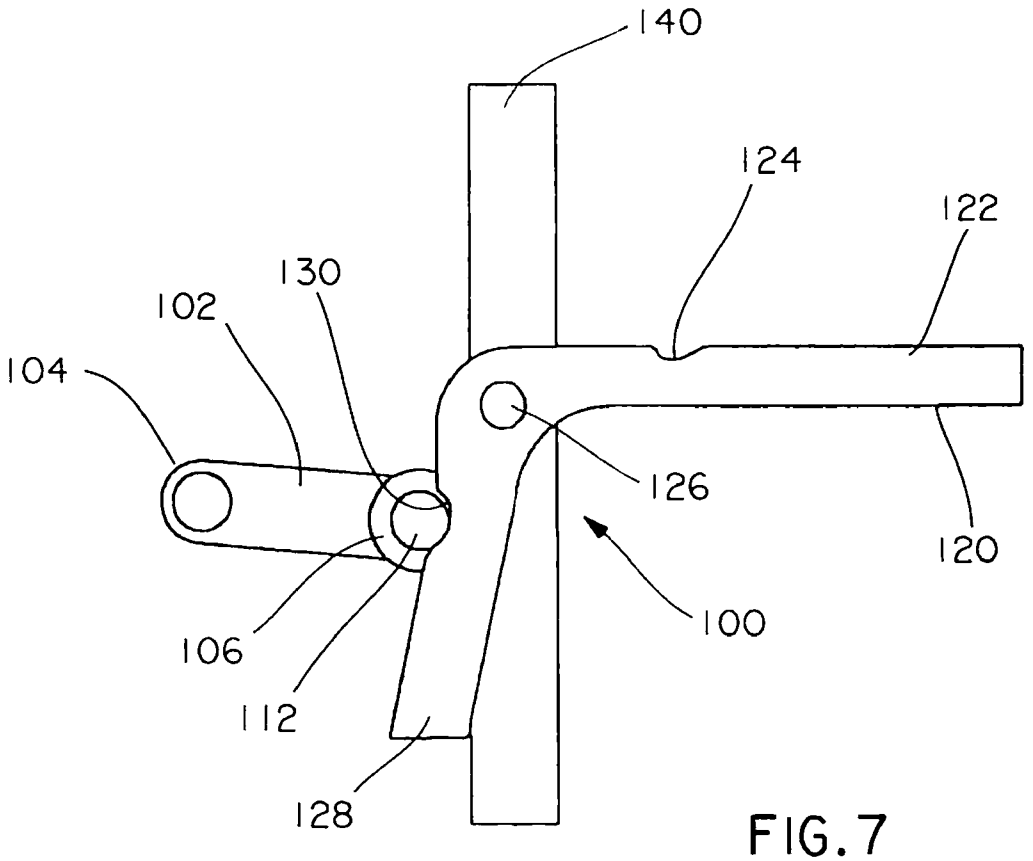
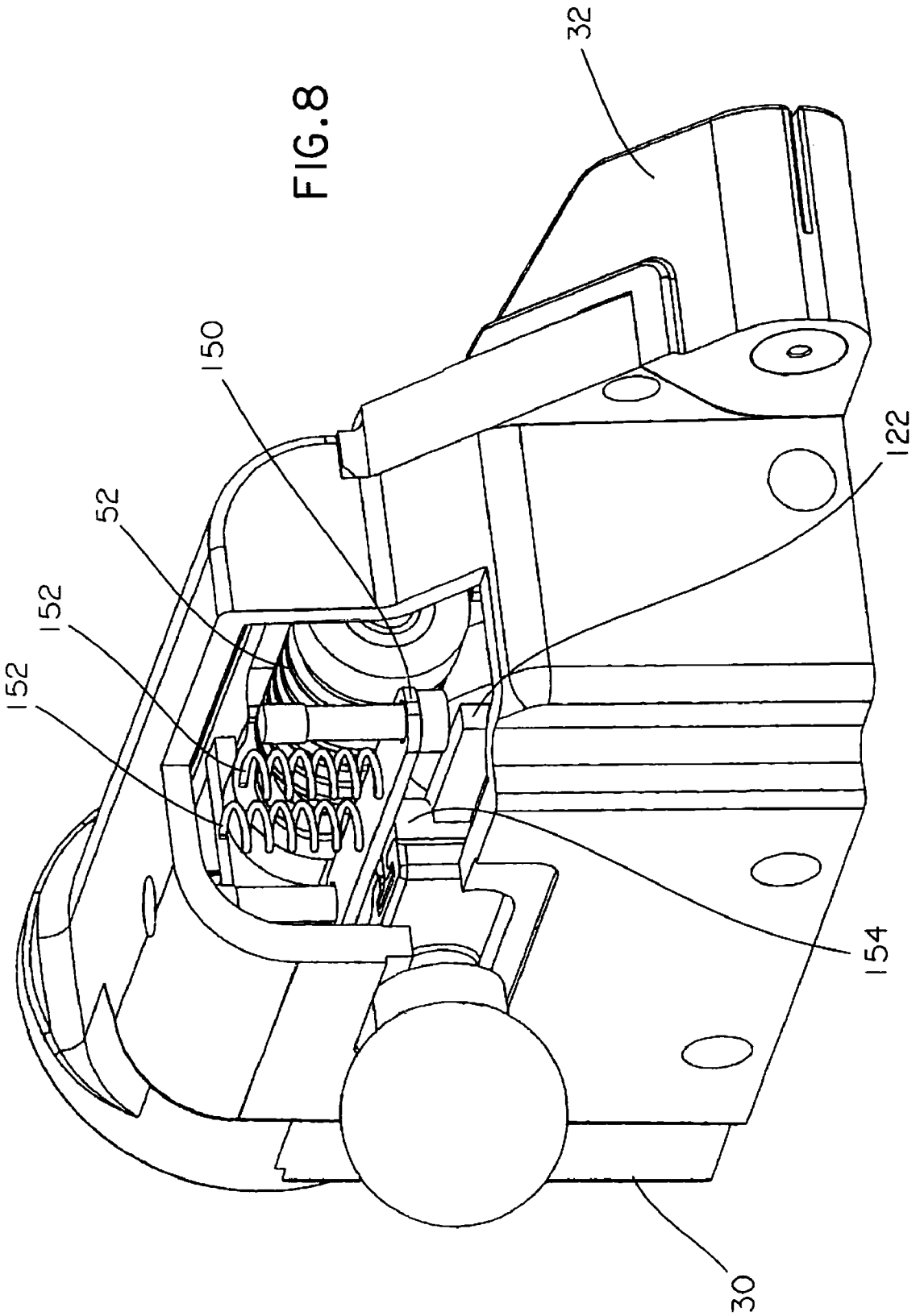

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FIG.7

FIG.8



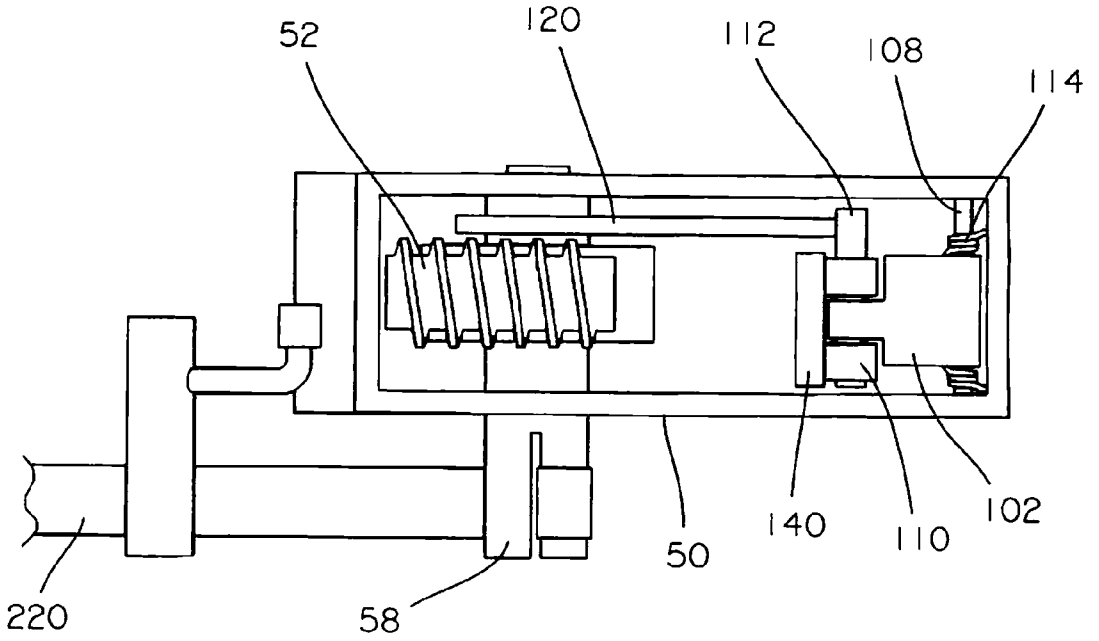

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FIG.9a

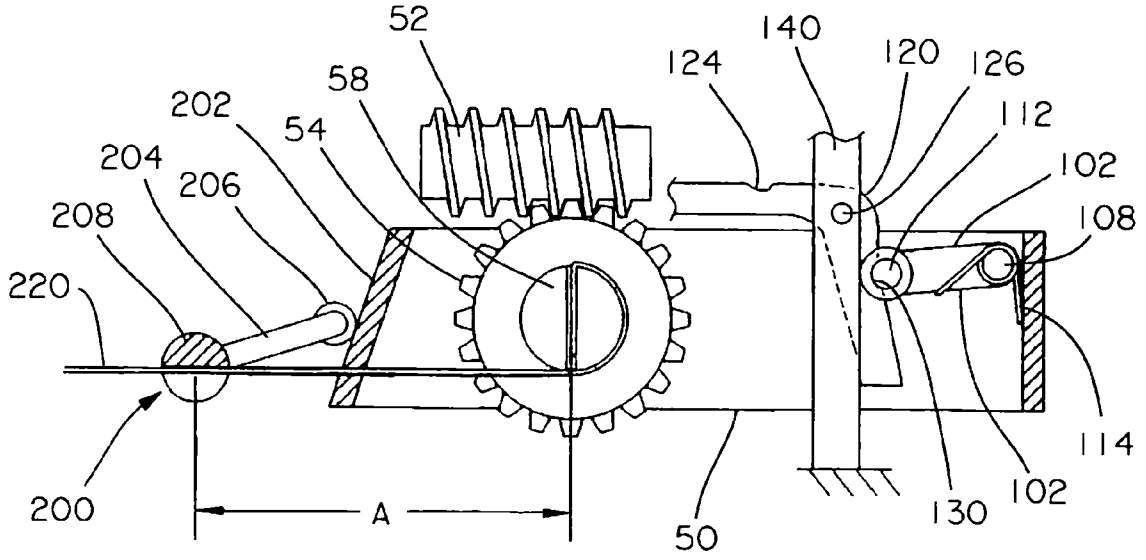

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FIG.9b

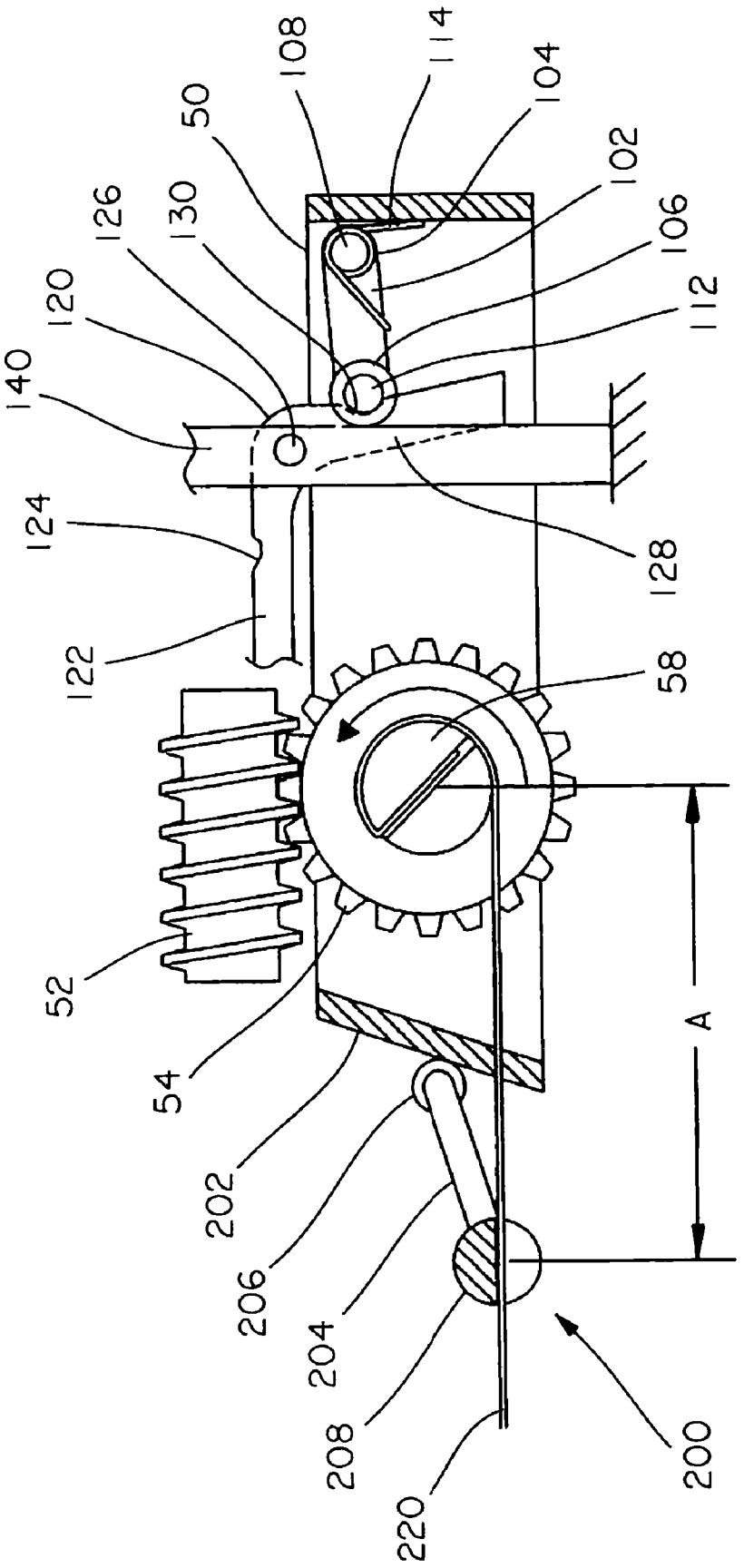

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FIG. 10

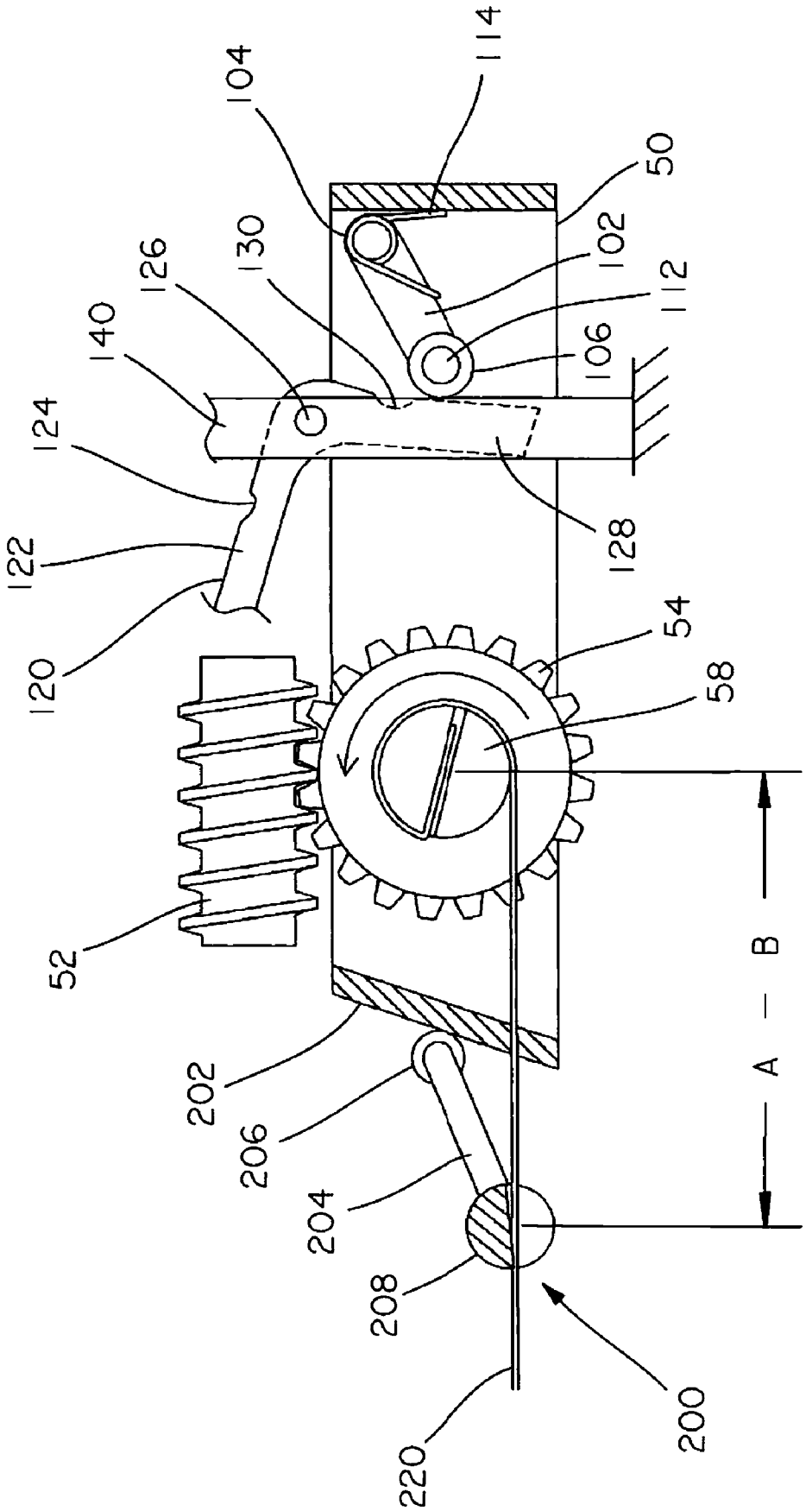

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FIG. 11

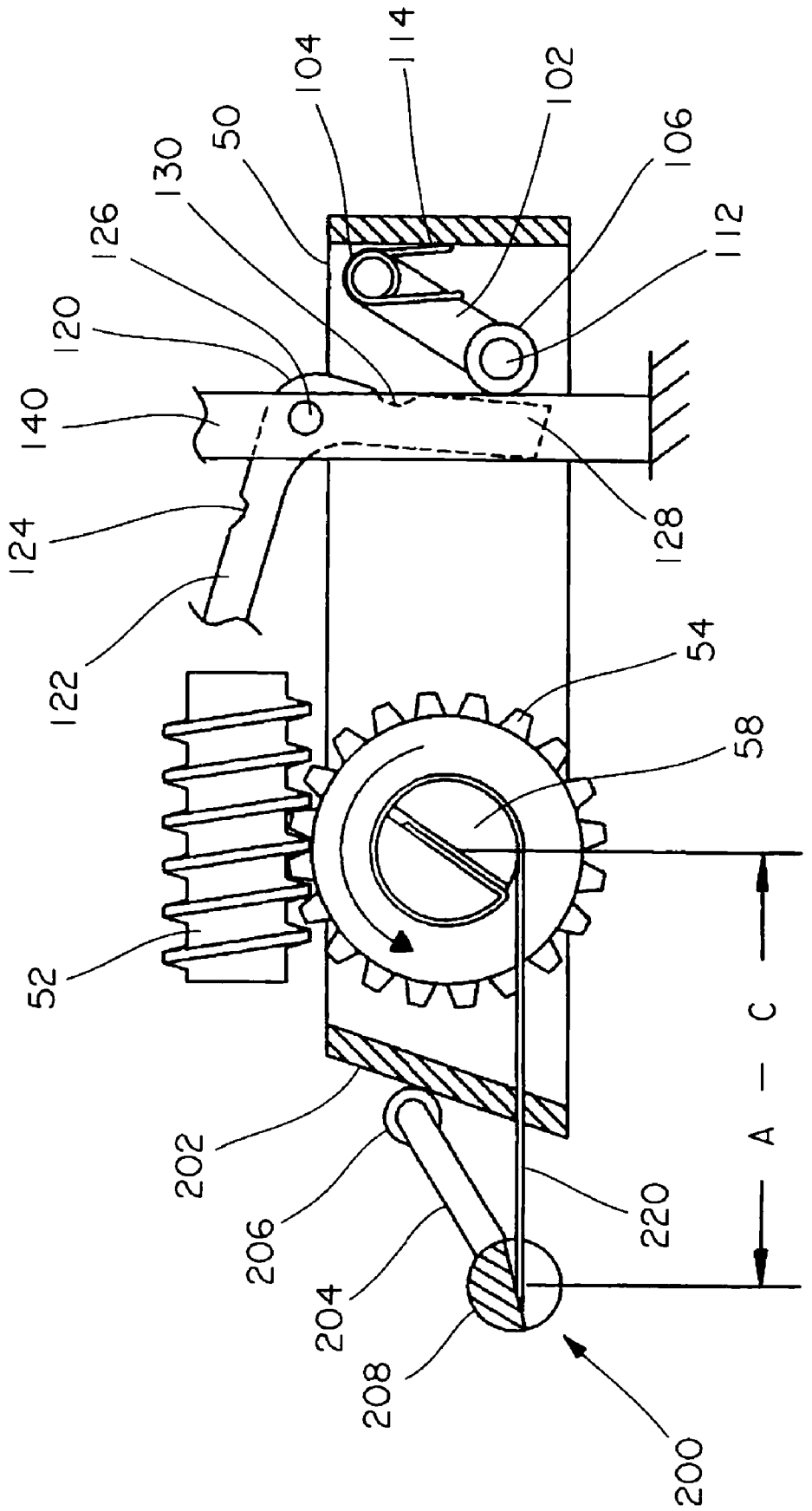

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FIG. 12

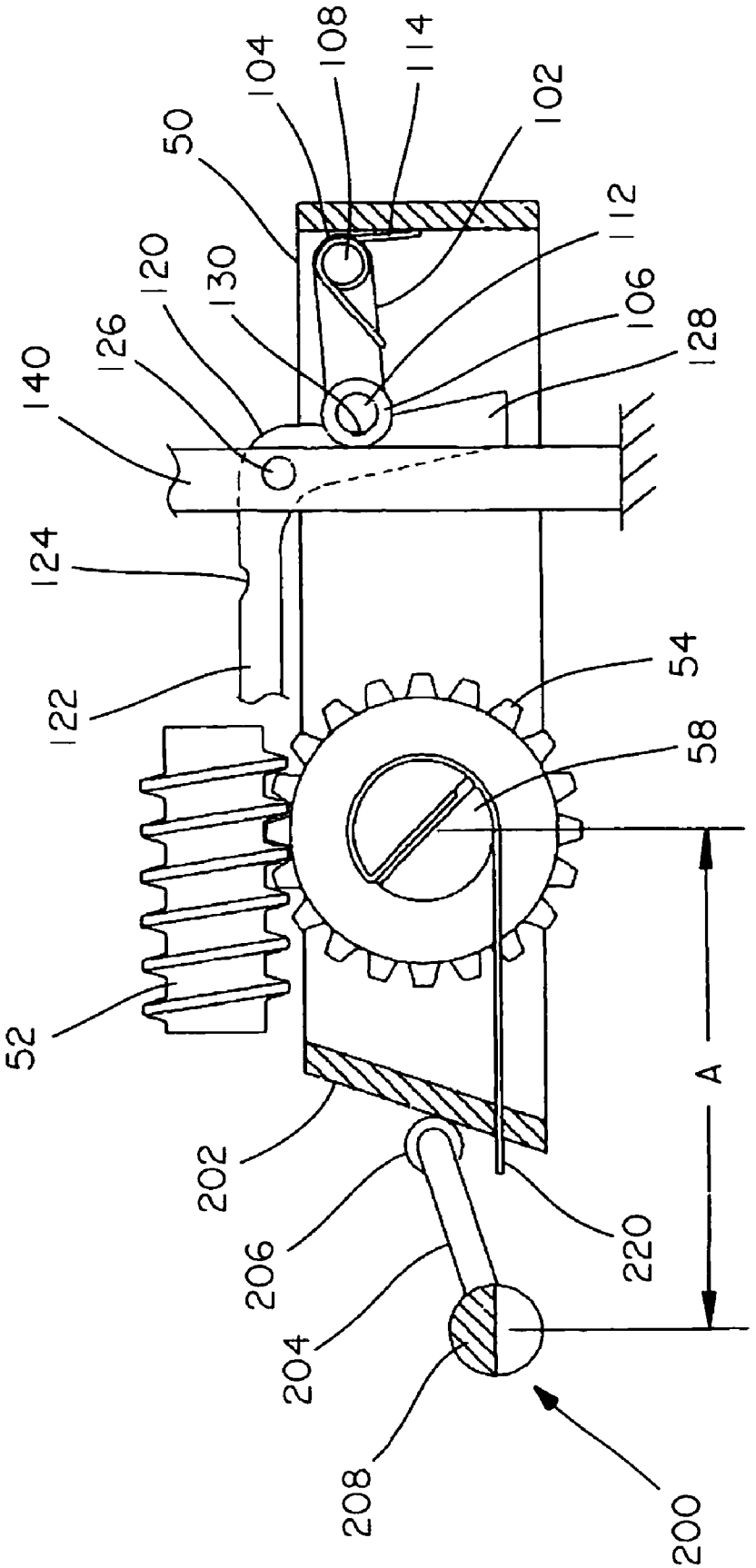

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FIG. 13

POWER TOOL FOR STAINLESS STEEL METAL LOCKING TIES

FIELD OF THE INVENTION

[0001] The present invention relates to a power tool for stainless steel metal locking ties, and more particularly to a power tool for stainless steel metal locking ties having a power source to tension the locking tie and to cut the locking tie.

BACKGROUND OF THE INVENTION

[0002] As is well known to those skilled in the art, cable ties or straps are used to bundle or secure a group of articles such as electrical wires and cables. Cable ties of conventional construction include a cable tie head and an elongated tail extending therefrom. The tail is wrapped around a bundle of articles and thereafter inserted through the passage in the head. The head of the cable tie typically supports a locking element, which extends into the head passage and engages the body of the tail to secure the tail to the head.

[0003] In practice, the installer manually places the tie about the articles to be bundled and inserts the tail through the head passage. At this point, a cable tie installation tool is used to tension the tie to a predetermined tension. The tools of the prior art, although capable of tensioning and thereafter severing the excess portion of the cable tie, typically have several disadvantages therewith. As a result, it is desirable to provide an improved metal tie tool having a single power source for tensioning and cutting the locking tie.

SUMMARY OF THE INVENTION

[0004] The present invention is directed towards a power tool for installing a metal locking tie. The tool includes a body and a power chassis. A gear carrier is positioned in the body and a tensioning mechanism is mounted in the gear carrier. A cutting mechanism is also positioned in the tool body and positioned to engage the gear carrier. As the tie is tensioned, the gear carrier moves linearly in the tool body to cut the tensioned tie.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. **1** is a front left side perspective view of the power tool for stainless steel metal locking ties of the present invention:

[0006] FIG. **2** is a front left side perspective view of the power tool for stainless steel metal locking ties of FIG. **1** with the tool in a rotated position:

[0007] FIG. **3** is a right side perspective view of the power tool of FIG. **1** with a portion of the tool removed:

[0008] FIG. **4** is a right side view of the power tool of FIG. **3**;

[0009] FIG. **5** is a front perspective view of the gear carrier in the power tool of FIG. **3**;

[0010] FIG. **6** is a right side perspective view of the worm mounted to the gear carrier in the power tool of FIG. **3**:

[0011] FIG. **7** is a side perspective view of the toggle mechanism of FIG. **4**;

[0012] FIG. **8** is a partial right side perspective view of the tool body of FIG. **1**:

[0013] FIG. **9***a* is a top view of the gear carrier and the toggle mechanism of FIG. **3**;

[0014] FIG. **9***b* is a side view of the gear carrier and the toggle mechanism of FIG. **9***a;*

[0015] FIG. **10** is a side view of the gear carrier and the toggle mechanism of FIG. **9***a* with the mandrel beginning to wind the stainless steel tie:

[0016] FIG. **11** is a side view of the gear carrier and the toggle mechanism of FIG. **9***a* with the detent setting of the toggle mechanism being overcome:

[0017] FIG. **12** is a side view of the gear carrier and the toggle mechanism of FIG. **9***a* with the tie being tensioned and the gear carrier moving forward to cut the stainless steel metal locking tie; and

[0018] FIG. **13** is a side view of the gear carrier and the toggle mechanism of FIG. **9***a* returned to the starting position after the tie has been cut.

DETAILED DESCRIPTION

[0019] FIG. **1** illustrates the portable power tool **20** for stainless steel metal locking ties **220** of the present invention. As discussed below, the power tool **20** includes an adjustable tension setting and an automatic cut-off mechanism operated by the same power source. The tool **20** has a tool body **30** with a nose **32** at the front of the tool body **30**, a power chassis **34** for housing a battery and a handle **36**. The tool body **30** is attached to the power chassis **34** by a swivel connector **38**. The swivel connector **38** enables the tool body **30** and the power chassis **34** to be rotated with respect to one another for ease of use. As a result, the operator may rotate the tool body **30** to position the tool at different angles to install the stainless steel locking ties.

[0020] The tool body **30** also includes a worm **52**, a worm gear **54**, a worm gear shaft **56** and a mandrel **58** for tensioning the stainless steel locking tie **220** (see FIGS. **9***a*-**13**). The tool nose **32** includes a cutting mechanism **200** for cutting the stainless steel locking tie **220** (see FIGS. **9***b*-**13**).

[0021] As illustrated in FIGS. **3**-**6**, the tool **20** includes a gear carrier **50** which moves linearly in the tool body **30** along a carrier guide **51** toward the nose **32** of the tool **20**. The worm **52** is mounted on the worm shaft **53** (see FIG. **6**). The worm shaft **53** is mounted in the tool body **30** and ends in a hexagonal driver which fits into the output shaft of the power chassis **34** (not shown). The worm gear **54**, worm gear shaft **56** and mandrel **58** are mounted in the gear carrier **50** and positioned such that the worm **52** engages the worm gear **54**. As illustrated in FIG. **9***a.* the mandrel **58** is part of the worm gear shaft **56**. As illustrated in FIGS. **1**-**3**, the gear carrier **50** with the worm gear **54** and worm gear shaft **56** are housed in the tool body **30** while the mandrel **58** extends from the tool body **30**.

[0022] The gear carrier **50** can move linearly toward the front of the tool, but is held in place in the tool body **30** by a spring loaded toggle mechanism **100** (see FIG. **7**). The toggle mechanism **100** includes a toggle link **102** with a torsion spring **114** (see FIGS. **3** and **4**) and a lever arm **120** with a lever arm pivot **126**. The lever arm pivot **126** is fixed in the stationary plate **140**. The lever arm **120** is generally L-shaped with a horizontally extending portion **122** and a generally vertically extending portion **128**. The lever arm pivot **126** is located at the intersection of the horizontally extending portion **122** and the vertically extending portion **128**. The vertically extending portion **128** includes a detent pocket **130**.

[0023] As illustrated in FIGS. **3**-**5**, the toggle link **102** is located at an end of the gear carrier **50** opposite the worm gear **54**, worm gear shaft **56** and mandrel **58**. The toggle link **102** includes a first end **104** and a second end **106**. The first end **104** of the toggle link **102** pivots about a rod **108** that is mounted to the gear carrier **50**. A torsion spring **114** is positioned on the rod **108**. The second end **106** of the toggle link **102** has two rollers **110** which are free to rotate on pin **112**. Both of the rollers **110** rest on a stationary plate **140** that is generally vertically orientated and attached to the tool body **30**. A portion of pin **112** rests in the detent pocket **130** in the vertically extending portion **128** of the lever arm **120**.

[0024] When the gear carrier **50** and toggle link **102** are in the starting position, the torsion spring **114** presses both rollers **110** against the stationary plate **140** which provides a force reduction on the pin **112** in the detent pocket **130**. The toggle link **102** is limited to a minimum rotational angle of no more than six degrees with respect to the linear movement of the gear carrier **50**. By limiting the angle of the toggle link **102** to no more than six degrees, or nearly in-line, with the line of force exerted by the stainless steel locking tie **220**, the force is reduced and only a small component of that force is resisted by the pin **112** in detent pocket **130**.

[0025] As illustrated in FIG. **8**, the tool body **30** also houses a spring loaded plate **150** and an actuator pin **154** for adjusting the tension setting. The actuator pin **154** is guided linearly in a slot in the tool body **30** and can be moved manually to adjust the detent force. The spring loaded plate **150** includes springs **152** that force the plate **150** to counteract the rotational force exerted by the toggle link **102** on the lever arm **120**. The tension setting can be adjusted by moving the actuator pin **154** (FIG. **4**) linearly along the load plate **150** thereby varying the moment arm between the lever arm pivot **126** and the point the load plate force is applied. The horizontally extending portion of the lever arm may also include a pocket **124** (sec FIG. **7**). The pocket **124** houses the actuator pin when it is desirable to remove the spring load from the lever arm **120**.

[0026] FIGS. **9-13** illustrate the operation of the power tool of the present invention. FIGS. **9***a* and **9***b* illustrate the gear carrier **50** and the toggle mechanism **100** in a starting position before the tool **20** begins to tension the stainless steel tie **220**. Once the tool is actuated, the worm **52** engages the worm gear **54** thereby rotating the worm gear **54**, worm gear shaft **56** and mandrel **58**. As illustrated in FIG. **9***b*, the stainless steel tie **220** has been inserted and wound on the mandrel **58**. The gear carrier **50** is held in place by the toggle mechanism **100**. As illustrated in FIGS. **10-13**, the gear carrier **50** moves linearly toward the front of the tool as the tie **220** is tensioned around the mandrel **58** and the toggle mechanism **100** detents.

[0027] As discussed above, the torsion spring **114** presses the toggle link rollers **110** against the generally vertically orientated stationary plate **140**. The orientation of the stationary plate **140** provides a force reduction on the toggle mechanism detent. The pin **112** of the toggle link **102** is positioned in the detent pocket **130** of the vertical portion **128** of the lever arm **120**.

[0028] As illustrated in FIGS. **9***b* and **10**, the gear carrier **50** is positioned in a starting position located a distance A from the nose **32** of the tool **20**. The worm **52** drives the worm gear **54** rotating the worm gear shaft **56** and mandrel **58**. As the mandrel **58** rotates, it winds the stainless steel tie **220** to tension the tie **220**. As the mandrel **58** tensions the tie **220**, a linear force is exerted on the gear carrier **50**.

[0029] FIG. **11** illustrates the mandrel **58** continuing to tension the tie **220**. The linear force exerted on the gear carrier **50** begins to overcome the spring load on the toggle mechanism **100**. The pin **112** on the end of the toggle link **102** forces the lever arm **120** to tilt as the pin **112** detents out of the detent pocket **130** in the vertical portion **128** of the lever arm **120**. As a result, the gear carrier **50** is now positioned at a distance A-B from the nose **32** of the tool **20**. As the gear carrier **50** is pulled forward toward the front of the tool nose **32**, the cutting mechanism **200** is actuated.

[0030] The cutting mechanism **200** is located in the nose **32** of the tool **20**. As illustrated in FIGS. **9***b*-**13**, the cutting mechanism **200** includes a cutter **208**, a cutter lever **204** and a roller **206**. The cutter **208** and the roller **206** are positioned at opposite ends of the cutter lever **204**. The front of the gear carrier **50** includes a ramp **202**. The ramp **202** is designed to actuate the cutter **208** via the roller **206** at the opposite end of the cutter lever **204**. As the gear carrier **50** is pulled forward, the roller **206** travels along the ramp **202** raising the cutter lever **204** to enable the cutter **208** to cut the tie **220**.

[0031] FIG. **12** illustrates the mandrel **58** further winding the stainless steel tie **220** and the gear carrier **50** pulled closer to the front of the tool **20** such that the gear carrier **50** is positioned at a distance A-C from the nose **32** of the tool **20**. During the forward motion of the gear carrier **50**, the worm gear **54** moves linearly along the worm **50**. The worm gear **54** continues to move along the worm **50** until the stainless steel tie **220** is completely cut.

[0032] After the tie **220** is cut, the tensioning force which pulled the gear carrier **50** forward is removed. As a result, the torsion spring **114** is now able to rotate the toggle link **102** back to the nearly horizontal position, exerting a linear force against the stationary plate **140** and moving the gear carrier **50** back to the starting position. As the toggle link **102** rotates back to the starting position, the end of pin **112** falls back into the detent pocket **130**. As the gear carrier **50** moves back to the starting position, the worm gear **54** walks back along the worm **52**.

[0033] FIG. **13** illustrates the gear carrier **50** returned to the starting position where the gear carrier **50** is positioned at a distance A away from the nose **32** of the tool **20**.

[0034] Furthermore, while the particular preferred embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the teaching of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only and not as limitation. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective based on the prior art.

1. A tool for installing a metal locking tie, the tool comprising:
- a tool body:
- a gear carrier positioned in the tool body;
- a tensioning mechanism mounted in the gear carrier; and
- a cutting mechanism engaging the gear carrier,
- whereby the gear carrier moves linearly in the tool body once the tie is tensioned to cut the tie.

2. The tool of claim **1**, further comprising a toggle mechanism positioned in the tool body, wherein the toggle mechanism holds the gear carrier in place until a toggle holding force has been exceeded.

3. The tool of claim **2**, wherein the toggle holding force is spring loaded.

4. The tool of claim **1**, further comprising a toggle mechanism including a toggle link and a lever arm, wherein the toggle link engages the lever arm.

5. The tool of claim **4**, wherein the lever arm includes a horizontally extending portion, a lever arm pivot and a vertically extending portion, the vertically extending portion includes a detent for housing the toggle link.

6. The tool of claim **4**, wherein the toggle link includes a torsion spring.

7. The tool of claim **1**, wherein the cutting mechanism includes a cutting lever with a roller and a cutter, whereby the roller engages the gear carrier to actuate the cutter.

8. The tool of claim **1**, wherein the tensioning mechanism includes a worm actuating a worm gear to rotate a mandrel.

9. The tool of claim **1**, wherein the body is attached to a power chassis by a swivel connector.

* * * * *