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- (54) **CLEVIS LINK FOR TOGGLE MECHANISM OF RAM AIR TURBINE ACTUATOR**
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F16C 7/02 (2006.01)

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 See application file for complete search history.

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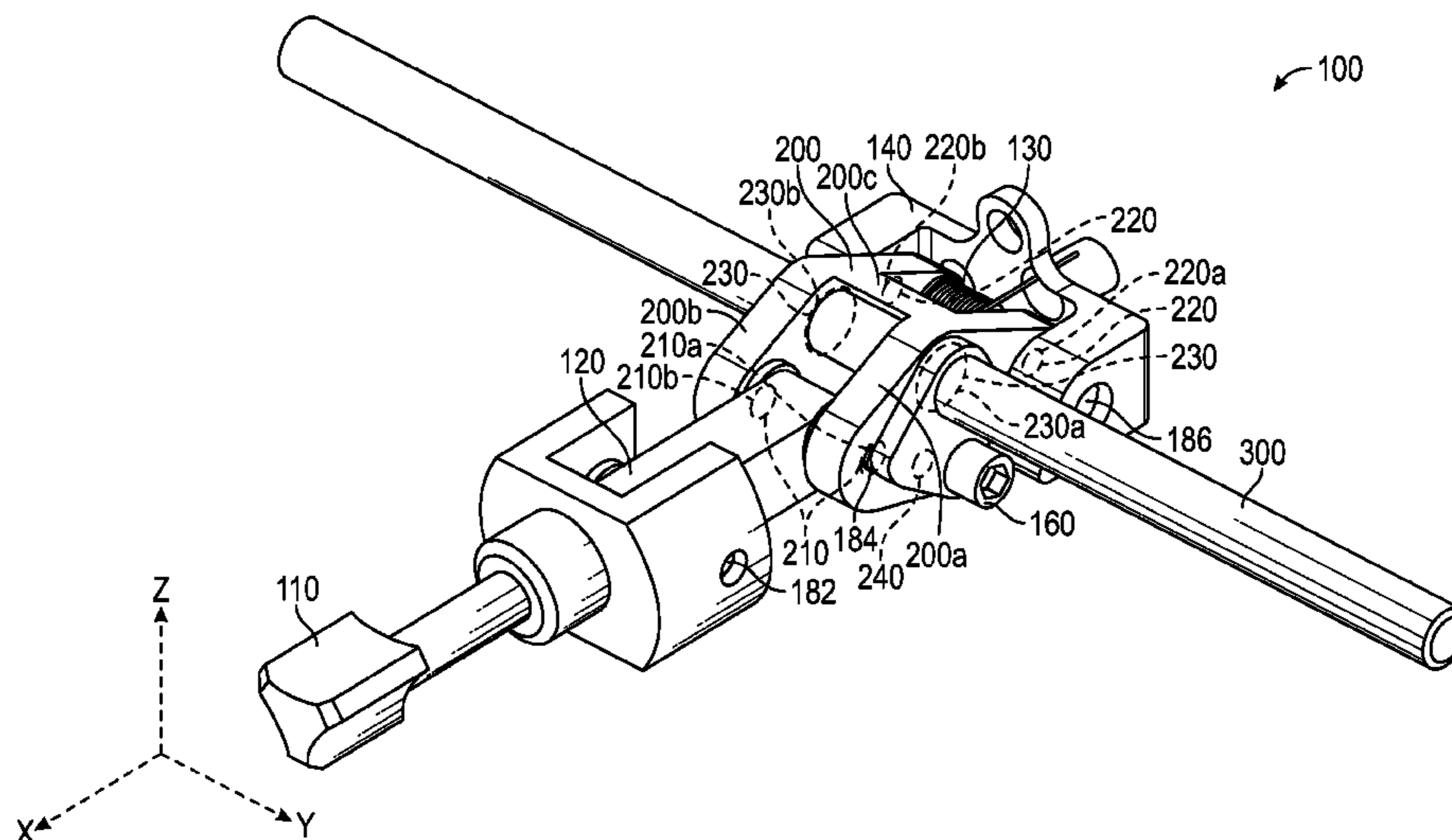
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(57) **ABSTRACT**

A clevis for use in a toggle mechanism of a ram air turbine actuator is provided comprising a first side; a second side parallel to the first side; a first set of parallel pivot holes; second set of parallel pivot holes; a set of parallel through holes; and a helicoil blind hole. The second side rigidly connected to the first side via at least one brace perpendicular to the first side and the second side. The helicoil blind hole being located in the first side and extending into the at least one brace. The first side having a first hole of the first set of parallel pivot holes, a first hole of the second set of parallel pivot holes, and a first hole of the set of parallel through holes. The second side having the hole pattern reflective of the first side, composed of second holes.

18 Claims, 8 Drawing Sheets



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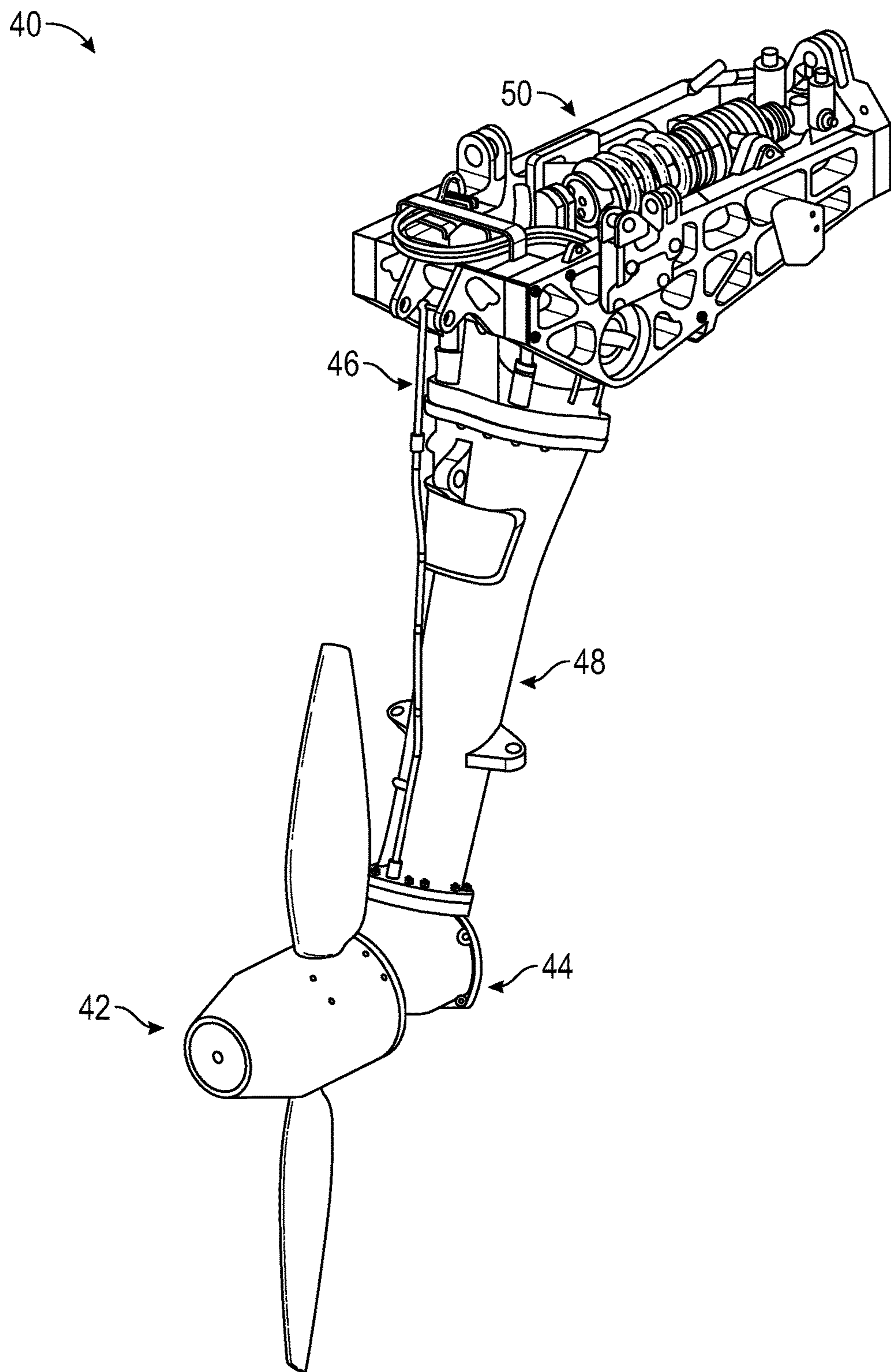
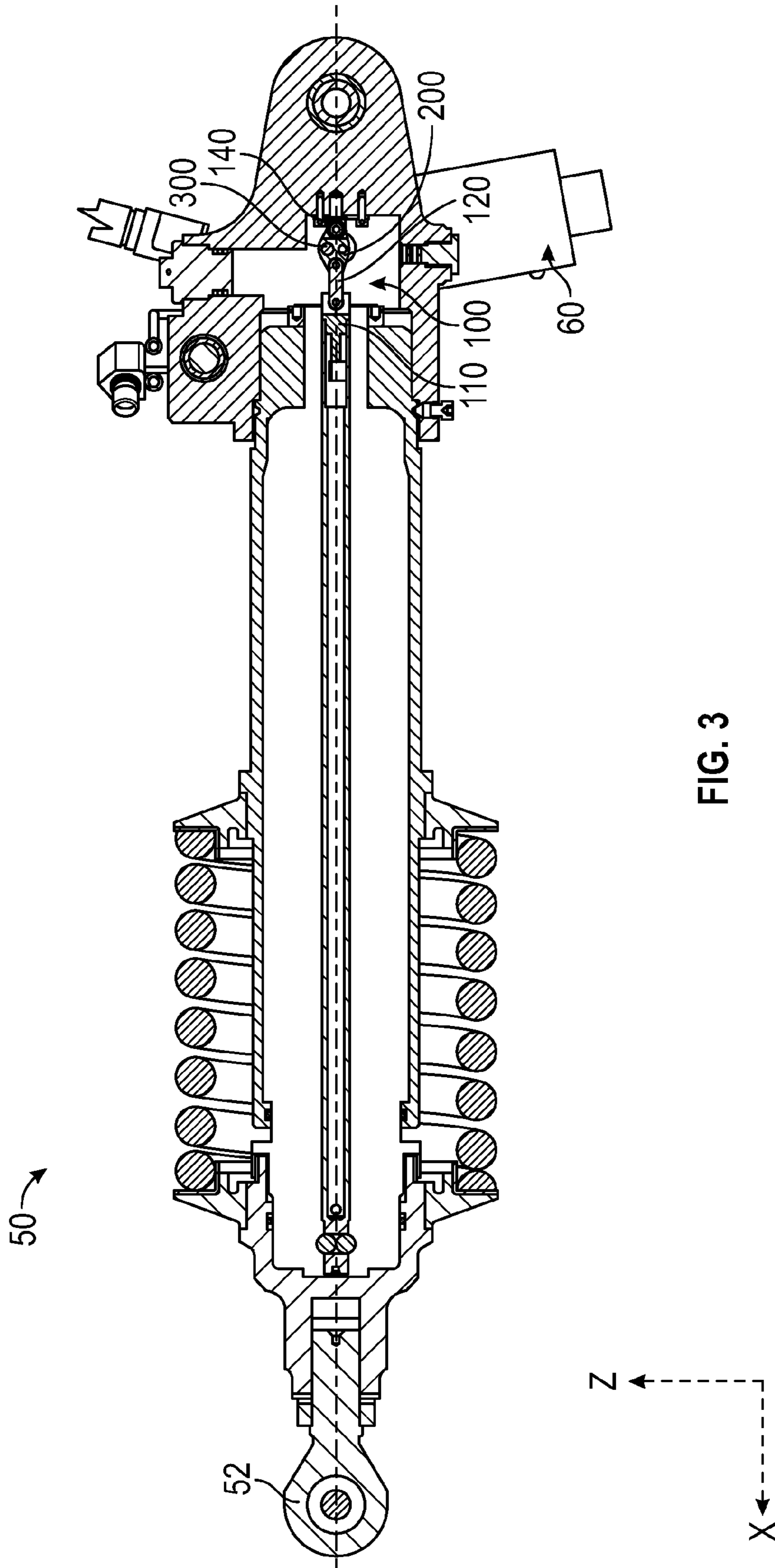


FIG. 2



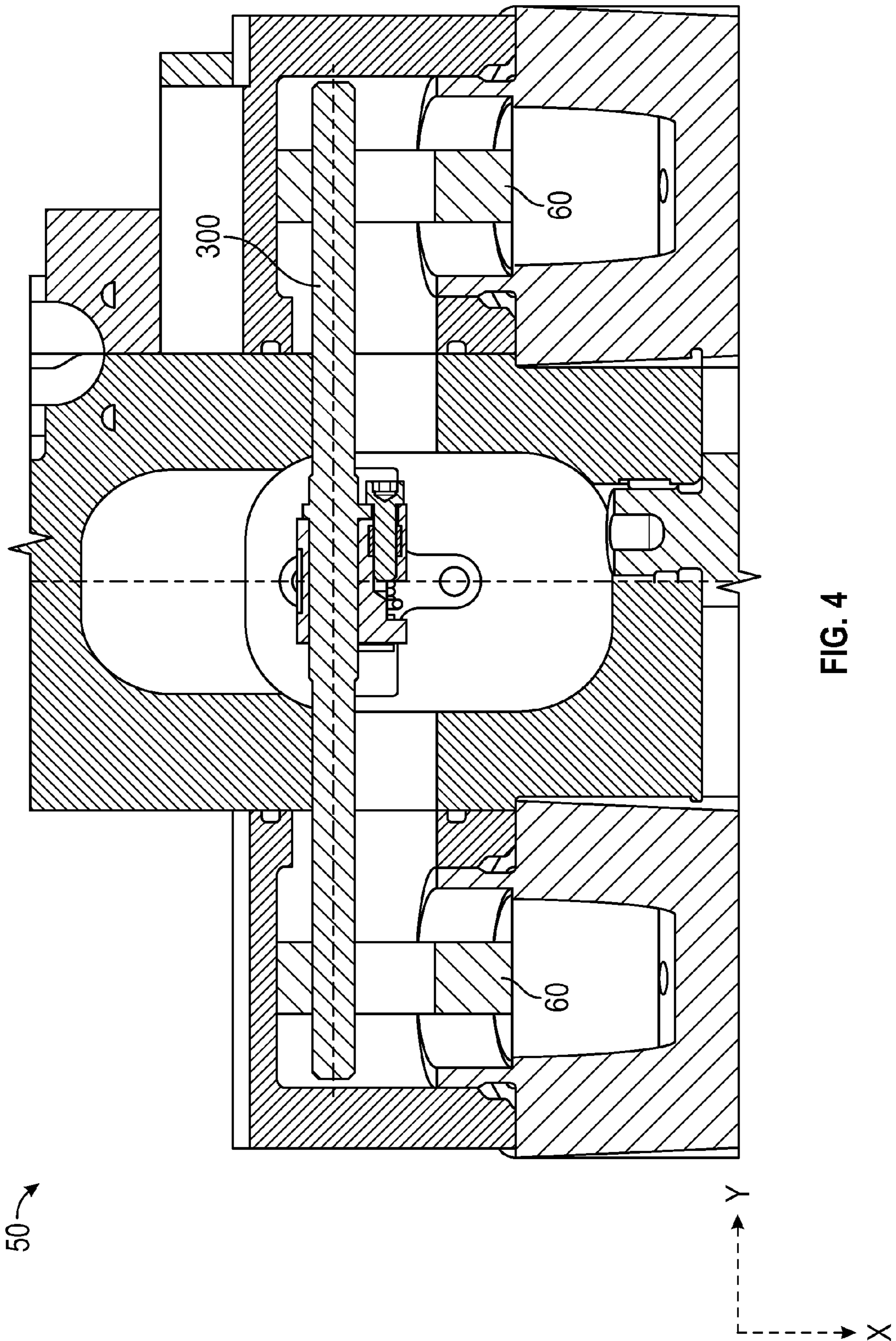


FIG. 4

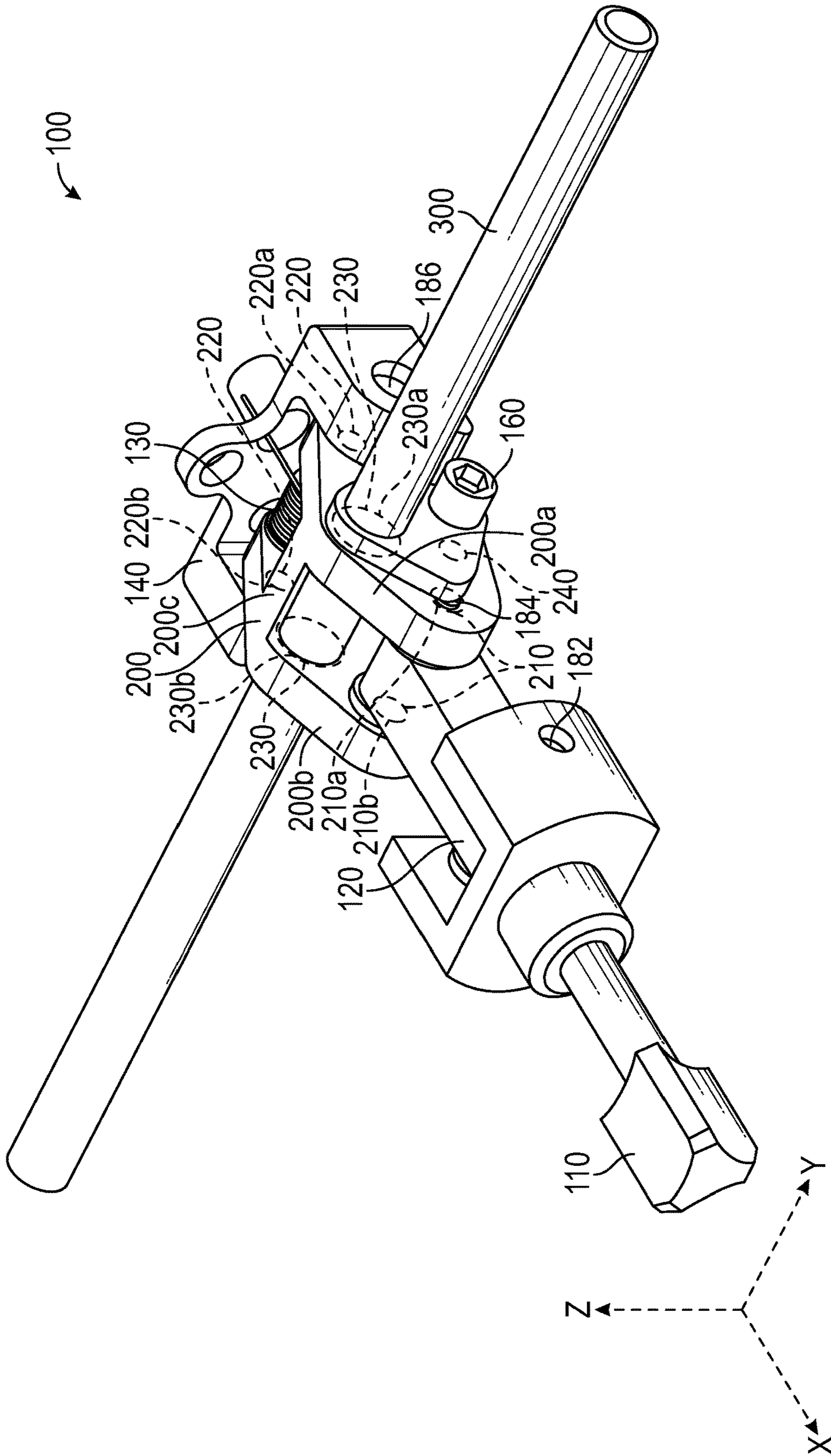


FIG. 5

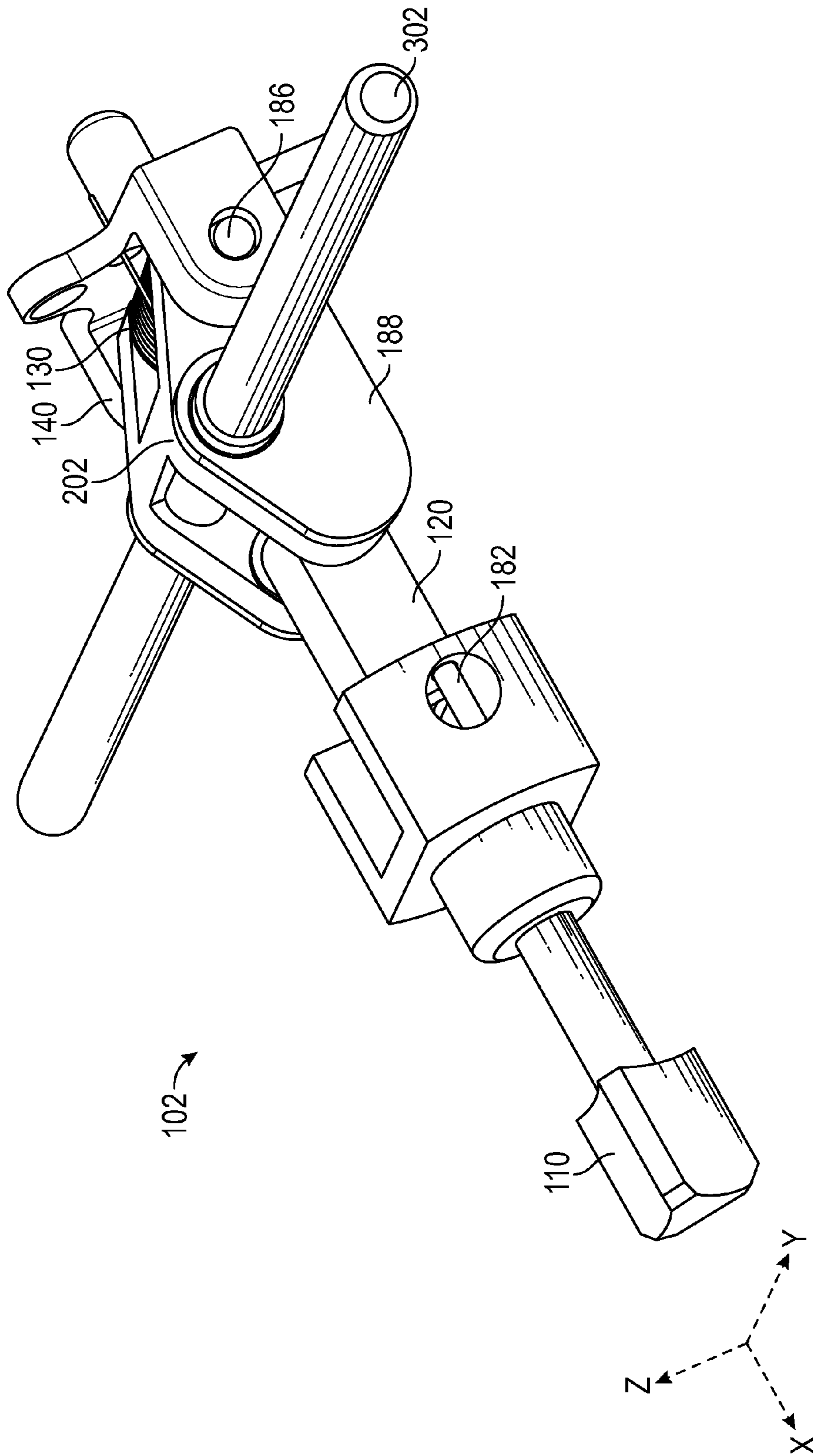


FIG. 6

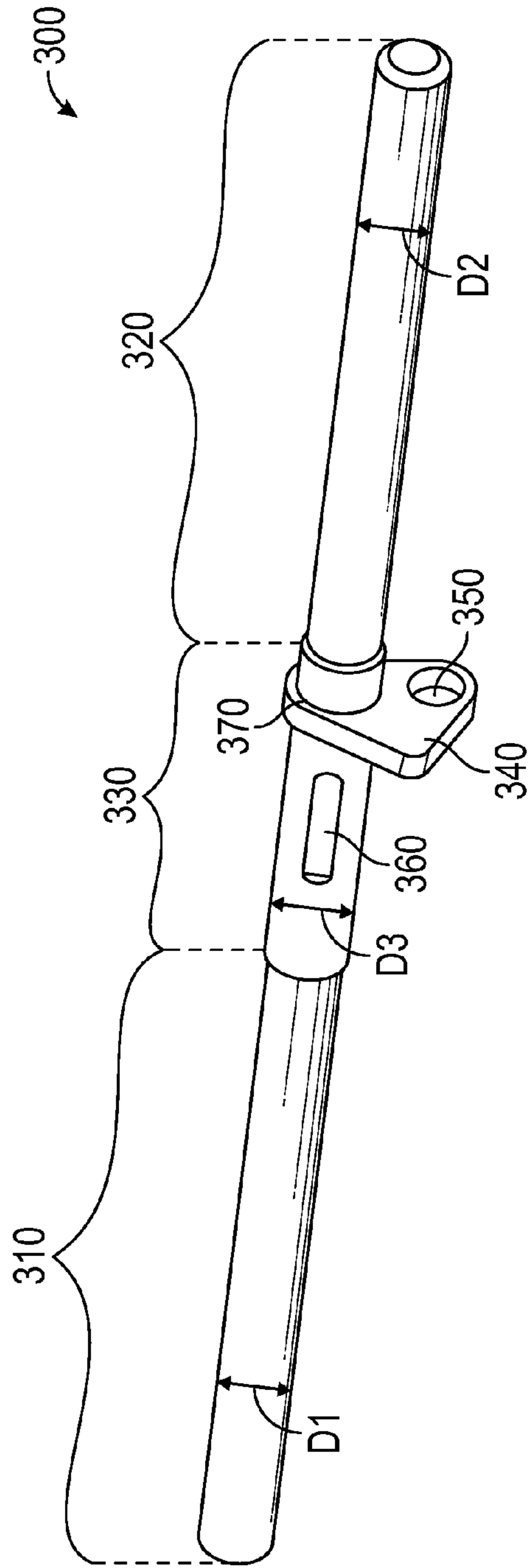


FIG. 7

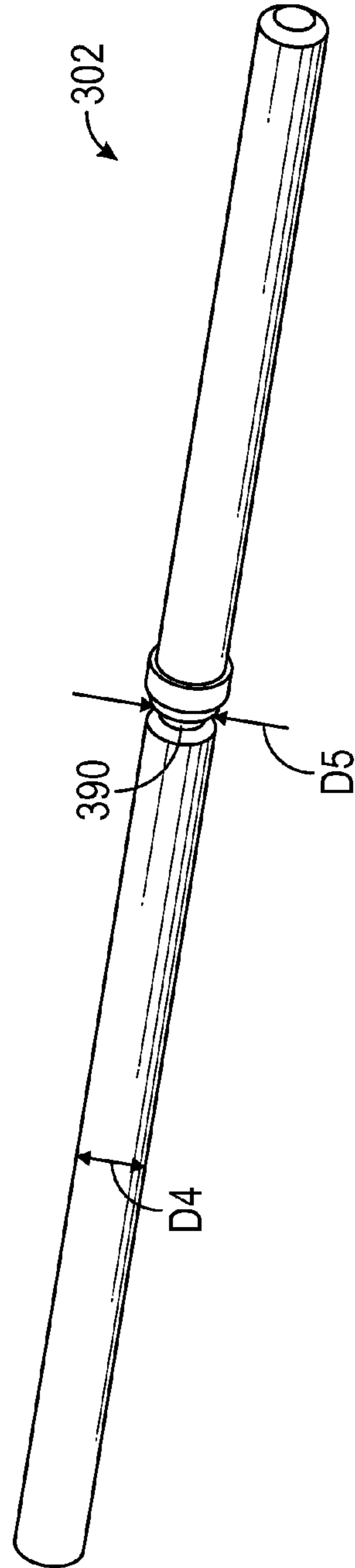


FIG. 8

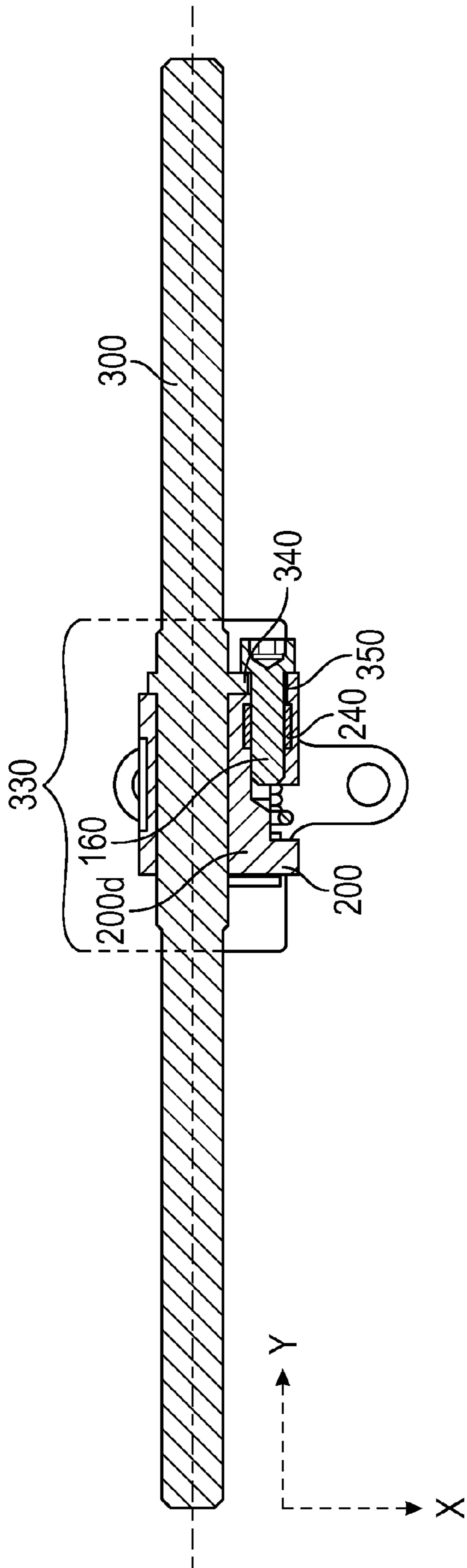


FIG. 9

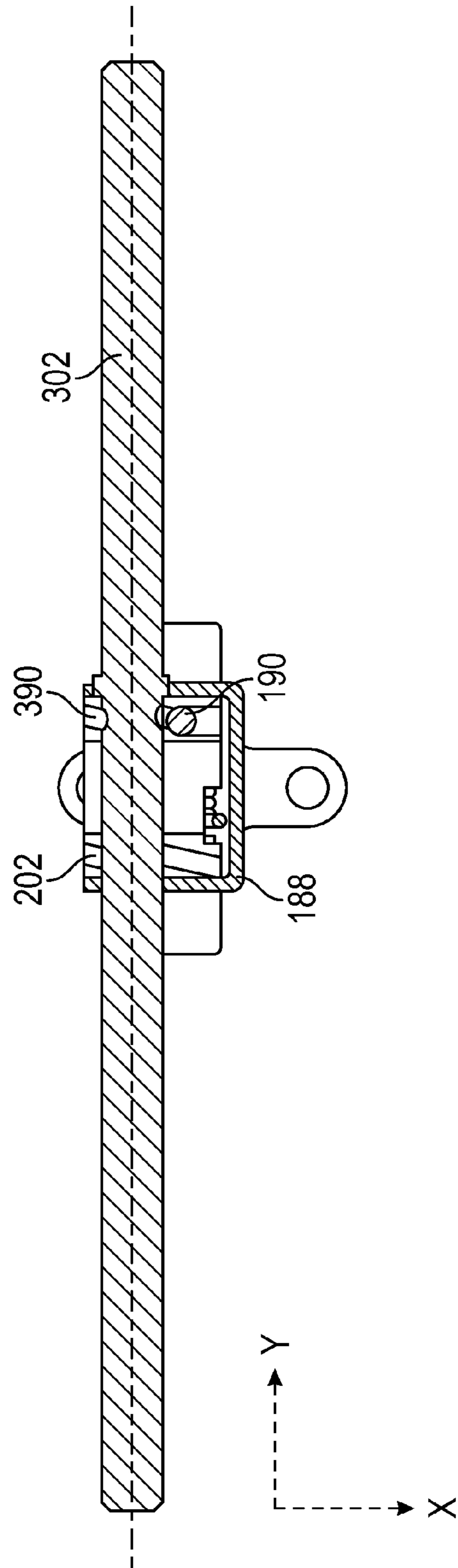


FIG. 10

CLEVIS LINK FOR TOGGLE MECHANISM OF RAM AIR TURBINE ACTUATOR

BACKGROUND

The subject matter disclosed herein generally relates to ram air turbine actuators, and more specifically to devices for use in a toggle mechanism of a ram air turbine (RAT) actuator.

RATs are commonly used on modern aircraft to provide a secondary and/or emergency power source in the event the primary power source is insufficient or fails. A typical RAT includes a turbine that remains internal to the aircraft until needed. When additional power is required, a door in the aircraft's fuselage will open and the actuator will deploy the RAT's turbine into the freestream air. The turbine is rotated by the freestream air and the rotational torque from the turbine is transferred through a drivetrain to be converted into electrical power by a generator. A RAT may also be used to drive a hydraulic pump.

A toggle mechanism internal to a RAT actuator may act as an over center mechanism to initiate the actuation process. After receiving an electrical command, solenoids pull on a cross rod, which turns over a clevis to move the toggle mechanism past its over center position. This motion then allows the actuator to actuate and deploy the RAT. The cross rod and clevis experience loading from the solenoids and also back loading from internal components of the actuator. Accordingly, clevis and cross rod capable of withstanding the loading, while being easy to install and maintain would provide both cost and reliability benefits.

SUMMARY

According to one embodiment, a clevis for use in a toggle mechanism of a ram air turbine actuator is provided. The clevis comprises a first side and a second side parallel to the first side. The second side rigidly connected to the first side via at least one brace perpendicular to the first side and the second side. The clevis also comprises a first set of parallel pivot holes. A first hole of the first set of parallel pivot holes being located in the first side and a second hole of the first set of parallel pivot holes being located in the second side. The clevis further comprises a second set of parallel pivot holes. A first hole of the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side. The clevis yet further comprises a set of parallel through holes. A first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side. The clevis also further comprises a helicoil blind hole. The helicoil blind hole being located in the first side and extending into the at least one brace.

In addition to one or more of the features described above, or as an alternative, further embodiments of the clevis may include that the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

According to another embodiment, a toggle mechanism of a ram air turbine actuator is presented. The toggle mechanism comprising a clevis. The clevis includes a first side and a second side parallel to the first side. The second side rigidly connected to the first side via at least one brace perpendicular to the first side and the second side. The clevis also includes a first set of parallel pivot holes. A first hole of the first set of parallel pivot holes being located in the first

side and a second hole of the first set of parallel pivot holes being located in the second side. The clevis further includes a second set of parallel pivot holes. A first hole of the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side. The clevis yet further includes a set of parallel through holes. A first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side. The clevis also further includes a helicoil blind hole. The helicoil blind hole being located in the first side and extending into the at least one brace. The toggle mechanism also comprises a cross rod operably connected to the clevis and located in the set of parallel through holes. The toggle mechanism further comprises a cap screw located in the helicoil blind hole. The cap screw securing the cross rod to the clevis.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include that the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include that the cross rod has a first section, a second section, and a midsection between the first section and the second section, the midsection includes a flange having a through hole.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include that the first section has a first diameter, the second section has a second diameter, and the midsection has a third diameter, the third diameter being larger than at least one of the first diameter and the second diameter.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include that the midsection includes a clearance notch.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include a lock piston operably connected to the clevis through a link, the link being operably connected to the first set of parallel pivot holes via a pivot pin, wherein the pivot pin is secured in the first set of parallel pivot holes by the flange.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include a bracket operably connected to the clevis at the second set of parallel pivot holes via a biasing mechanism.

In addition to one or more of the features described above, or as an alternative, further embodiments of the toggle mechanism may include that the cap screw secures the cross rod to the clevis via the through hole.

In another embodiment a method of manufacturing a toggle mechanism of a ram air turbine actuator is presented. The method comprises forming a first side of a clevis; forming a second side of a clevis; and rigidly connecting the second side to the first side via at least one brace perpendicular to the first side and the second side. The first side being parallel to the second side. The method also comprises forming a first set of parallel pivot holes. A first hole of the first set of parallel pivot holes being located in the first side and a second hole of the first set of parallel pivot holes being located in the second side. The method further comprises forming a second set of parallel pivot holes. A first hole of

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the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side. The method yet further comprises forming a set of parallel through holes. The first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side. The method also comprises drilling a helicoil blind hole. The helicoil blind hole being located in the first side and extending into the at least one brace. The method further comprises inserting a cross rod into the set of parallel through holes within the clevis and installing a cap screw in the helicoil blind hole. The cap screw securing the cross rod to the clevis.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include that the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include that the cross rod has a first section, a second section, and a midsection between the first section and the second section, the midsection includes a flange having a through hole.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include that the first section has a first diameter, the second section has a second diameter, and the midsection has a third diameter, the third diameter being larger than at least one of the first diameter and the second diameter.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include that the midsection includes a clearance notch.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include operably connecting a lock piston to the clevis through a link, the link being operably connected to the first set of parallel pivot holes via a pivot pin, wherein the pivot pin is secured in the first set of parallel pivot holes by the flange.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include operably connecting a bracket to the clevis at the second set of parallel pivot holes via a biasing mechanism.

In addition to one or more of the features described above, or as an alternative, further embodiments of the method may include that the cap screw secures the cross rod to the clevis via the through hole.

BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter is particularly pointed out and distinctly claimed at the conclusion of the specification. The foregoing and other features, and advantages of the present disclosure are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of an aircraft that may incorporate embodiments of the present disclosure;

FIG. 2 is a perspective view of ram air turbine (RAT) assembly that may incorporate embodiments of the present disclosure;

FIG. 3 is a cross-sectional side view of an actuator for use in the RAT assembly of FIG. 2, according to an embodiment of the present disclosure;

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FIG. 4 is an enlarged cross-sectional top view of the actuator of FIG. 3, according to an embodiment of the present disclosure;

FIG. 5 is a schematic illustration of a toggle mechanism for use in the actuator of FIG. 3, according to an embodiment of the present disclosure;

FIG. 6 is a schematic illustration of an alternate toggle mechanism capable of being used in the actuator of FIG. 3;

FIG. 7 is a schematic illustration of a cross rod for use in the toggle mechanism of FIG. 5, according to an embodiment of the present disclosure;

FIG. 8 is a schematic illustration of an alternate cross rod for use in the alternate toggle mechanism of FIG. 6;

FIG. 9 is a schematic cross-sectional illustration of a cross rod and clevis assembly for use in the toggle mechanism of FIG. 5, according to an embodiment of the present disclosure; and

FIG. 10 is a schematic cross-sectional illustration of an alternate cross rod and alternate clevis assembly for use in the toggle mechanism of FIG. 6.

The detailed description explains embodiments of the present disclosure, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION

Referring now to FIGS. 1 and 2. FIG. 1 shows a perspective view of an aircraft 2 that may incorporate embodiments of the present disclosure. FIG. 2 shows a perspective view of ram air turbine (RAT) assembly 40 that may incorporate embodiments of the present disclosure. Aircraft 2 includes a fuselage 4 extending from a nose portion 6 to a tail portion 8 through a body portion 10. Body portion 10 houses an aircraft cabin 14 that includes a crew compartment 15 and a passenger compartment 16. Body portion 10 supports a first wing 17 and a second wing 18. First wing 17 extends from a first root portion 20 to a first tip portion 21 through a first airfoil portion 23. First airfoil portion 23 includes a leading edge 25 and a trailing edge 26. Second wing 18 extends from a second root portion (not shown) to a second tip portion 31 through a second airfoil portion 33. Second airfoil portion 33 includes a leading edge 35 and a trailing edge 36. Tail portion 8 includes a stabilizer 38.

Aircraft 2 includes a ram air turbine (RAT) assembly 40 mounted within fuselage 4 or nose portion 6. When additional electrical and/or hydraulic power is required, a compartment door 54 in the fuselage 4 will open and an actuator 50 will actuate to deploy the RAT assembly 40 into the freestream air. As shown in FIG. 2, the RAT assembly 40 may include a turbine assembly 42, a gearbox assembly 44, a shaft assembly 48, a generator 46, and the actuator 50. As the turbine assembly 42 rotates, the rotational torque is transferred from the turbine assembly 42, through the gearbox assembly 44 to a driveshaft (not shown) in the strut assembly 48, and then to the generator 46. The generator 46 may be an electrical generator, hydraulic pump, or both an electrical generator and a hydraulic pump.

Referring now to FIGS. 3 and 4. FIG. 3 shows a cross-sectional side view of an actuator 50 for use in the RAT assembly 40 of FIG. 2, according to an embodiment of the present disclosure. FIG. 4 shows an enlarged cross-sectional top view of the actuator 50 of FIG. 3, according to an embodiment of the present disclosure. In the illustrated embodiment, the actuator 50 includes a toggle mechanism 100, solenoids 60 and a rod end 52. The toggle mechanism 100 may include a lock piston 110, a link 120, a clevis 200, a cross rod 300 and a bracket 140. The toggle mechanism

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100 operates as an over center mechanism. The solenoids 60 pull on the cross rod 300 to move the toggle mechanism 100 past its over-center position. Once the toggle mechanism 100 moves past its over-center position, the link 120 shifts and subsequently allows the lock piston 110 to translate in direction X. The lock piston 110 had been originally pre-loaded to translate in direction X but was previously prevented from translating by the link 120. The motion of the lock piston 110 activates the actuator 50, and thus as the lock piston 110 completes its motion, the actuator 50 begins translating the rod end 52 in direction X. The motion of the rod end will deploy and/or retract the RAT (e.g. RAT assembly 40 as shown in FIG. 2). The force generated by the solenoids 60 imparts a large bending force on the cross rod 300. Further, the preload on the lock piston 110 also imparts a large bending force on the cross rod 300. These forces can bend the cross rod 300 if it is not sufficiently thick.

Referring now to FIGS. 5 and 7. FIG. 5 shows a schematic illustration of a toggle mechanism 100 for use in the actuator 50 of FIG. 3, according to an embodiment of the present disclosure. FIG. 7 shows a schematic illustration of a cross rod 300 for use in the toggle mechanism 100 of FIG. 5, according to an embodiment of the present disclosure. The toggle mechanism 100 includes a clevis 200 and a cross rod 300 operably connected to the clevis 200. The cross rod 300 having a first section 310, a second section 320, and a midsection 330 between the first section 310 and the second section 320. The first section 310 has a first diameter D1, the second section 320 has a second diameter D2, and the midsection 330 has a third diameter D3. Further, the midsection 330 includes a flange 340. The flange 340 may be formed via machining the midsection 330 of the cross rod 300. Alternatively, the flange 340 may rigidly connected to the midsection 330. In an embodiment, the flange 340 may be rigidly connected to the midsection by a weld at a juncture 370. As shown, the flange 340 also includes a through hole 350. The flange 340 and the through hole 350 may be formed in a variety of different manors including but not limited to molding, machining and drilling. The midsection 330 also includes a clearance notch 360. The clearance notch 360 allows the cross rod 300 to avoid hitting the link 120 when lock piston 110 translates. The lock piston 110 may be operably connected to the clevis 200 via the link 120. The lock piston 110 may be operably connected to the link 120 via a pin 182.

The clevis 200 includes a first side 200a, a second side 200b parallel to the first side 200a, the second side 200b rigidly connected to the first side 200a via at least one brace (e.g. 200c & 200d of FIG. 10) perpendicular to the first side 200a and the second side 200b. The clevis 200 also includes a first set of parallel pivot holes 210. A first hole 210a of the first set of parallel pivot holes 210 being located in the first side 200a and a second hole 210b of the first set of parallel pivot holes 210 being located in the second side 200b. In an embodiment, the second hole 210b may be a blind hole and the blind hole opens towards the first side 200a. The clevis 200 also includes a second set of parallel pivot holes 220. A first hole 220a of the second set of parallel pivot holes 220 being located in the first side 200a and a second hole 220b of the second set of parallel pivot holes 220 being located in the second side 200b. The clevis 200 also includes a set of parallel through holes 230. A first hole 230a of the set of parallel through holes 230 being located in the first side 200a and a second hole 230b of the set of parallel through holes 230 being located in the second side 200b. The clevis 200 also includes a helicoil blind hole 240. The helicoil blind 240 hole being located in the first side 200a and extending into

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the brace 200d (see FIG. 10). The first set of parallel pivot holes 210, the second set of parallel pivot holes 220, the set of parallel through holes 230, and the helicoil blind hole 240 may be formed in a variety of different manors including but not limited to molding, machining and drilling.

The toggle mechanism 100 may also include a bracket 140 operably connected to the clevis 200 at the second set of parallel pivot holes 220 via a biasing mechanism 130. The biasing mechanism 130 may include a pin 186. In an embodiment, the biasing mechanism 130 may be a spring.

In the illustrated embodiment, the toggle mechanism 100 also includes a cap screw 160 located in the through hole 350. The cap screw 160 secures the cross rod 300 to the set of parallel through holes 230 of the clevis 200. The cap screw 160 secures the cross rod 300 to the clevis 200 via the helicoil blind hole 240. The cap screw 160 prevents the cross rod 300 from rotating in the clevis 200. If the cross rod 300 had bent due to heavy loads, and then rotated in the clevis 200, the over center position may change for various cross rod 300 rotational positions. In order to prevent the cross rod from bending, various changes were incorporated into the cross rod 300 in FIG. 7 versus alternate cross-rod designs.

Referring now to also FIGS. 6 and 8, in addition to FIGS. 5 and 7. FIG. 6 shows a schematic illustration of an alternate toggle mechanism 102 capable of being using in the actuator 50 of FIG. 3. FIG. 8 shows a schematic illustration of an alternate cross rod 302 for use in the alternate toggle mechanism 102 of FIG. 6. In comparing cross rod 300 in FIG. 7 to the alternate cross rod 302 in FIG. 8, it may be seen that the diameter (D1, D2, and D3) of cross rod 300 is greater than the diameter D4 of the alternate cross rod 302. Having a larger diameter allows cross rod 300 to withstand larger bending forces. Further, the third diameter D3 may be larger than at least one of the first diameter D1 and the second diameter D2. Having a larger diameter in the middle allows the cross rod 300 to be stronger where it is needed most. In contrast, the alternate cross rod 302 includes a scallop 390 near the center of the alternate cross rod 302, which results in a smaller diameter D5. The smaller diameter D5 creates a weak point near the center of the alternate cross rod 302, where the bending forces are often elevated.

Further difference in the cross rod 300 over the alternate cross rod 302 could be seen with the addition of the flange 340 on the cross rod 300. The flange 340 allows the pivot pin 184 connecting the link 120 to the clevis 200 to remain in the first set of parallel pivot holes 210 of the clevis 200. As mentioned above, the second hole 210b may be a blind hole and the blind hole opens towards the first side 200a. The pivot pin 184 may be pressed into the blind second hole 210b of the first set of parallel pivot holes 210 and then the flange 340 will cover up the pivot pin 184 on the first hole 210a. As seen in FIG. 6, the alternate toggle mechanism 102 required a separate piece, called a retainer 188, to keep the pivot pin 184 in its place.

Referring now to FIGS. 9 and 10. FIG. 9 shows a schematic cross-sectional illustration of a cross rod 300 and clevis 200 assembly for use in the toggle mechanism 100 of FIG. 5, according to an embodiment of the present disclosure. FIG. 10 shows a schematic cross-sectional illustration of an alternate cross rod 302 and alternate clevis 202 assembly for use in the alternate toggle mechanism 102 of FIG. 6. In order to reduce movement in direction Y, the cross rod 300 is secured to the clevis 200 via the cap screw 160, such that the flange 340 is abutting the clevis 200, as shown. The cap screw 160 is located in the through hole 350 of the flange 340 and screws into the clevis 200 at the helicoil blind hole 240. As shown in FIG. 10, the thickness of the alternate

cross rod **302** is reduced at the scallop **390**, in order to accommodate a set screw **190**, which reduces movement in direction Y. The cap screw **160**, the flange **340** and the helicoil blind hole **240** in FIG. **9** eliminates the need to reduce the thickness of the cross rod **200** in the midsection **330**, unlike the alternate cross rod **302**. Advantageously, a thicker diameter at the midsection **330** helps make the cross rod **300** stronger and more resistant to bending and/or breaking than the alternate cross rod **302**. Also advantageously, as mentioned above, the flange **340** of the cross rod **300** eliminates the need for the retainer **188**, which was required by the alternate cross rod **302** and alternate clevis **202** assembly of FIG. **10**. The elimination of the retainer **188** and the set screw **190** reduces part count and simplifies assembly.

While the present disclosure has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the present disclosure is not limited to such disclosed embodiments. Rather, the present disclosure can be modified to incorporate any number of variations, alterations, substitutions, combinations, sub-combinations, or equivalent arrangements not heretofore described, but which are commensurate with the scope of the present disclosure. Additionally, while various embodiments of the present disclosure have been described, it is to be understood that aspects of the present disclosure may include only some of the described embodiments. Accordingly, the present disclosure is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

What is claimed is:

1. A clevis for use in a toggle mechanism of a ram air turbine actuator comprising:

- a first side;
- a second side parallel to the first side, the second side rigidly connected to the first side via at least one brace perpendicular to the first side and the second side;
- a first set of parallel pivot holes, a first hole of the first set of parallel pivot holes being located in the first side and a second hole of the first set of parallel pivot holes being located in the second side;
- a second set of parallel pivot holes, a first hole of the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side;
- a set of parallel through holes, a first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side; and
- a helicoil blind hole, the helicoil blind hole being located in the first side and extending into the at least one brace.

2. The clevis of claim **1**, wherein:

the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

3. A toggle mechanism of a ram air turbine actuator comprising:

- a clevis including:
 - a first side;
 - a second side parallel to the first side, the second side rigidly connected to the first side via at least one brace perpendicular to the first side and the second side;
 - a first set of parallel pivot holes, a first hole of the first set of parallel pivot holes being located in the first side and a second hole of the first set of parallel pivot holes being located in the second side;

- a second set of parallel pivot holes, a first hole of the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side;
- a set of parallel through holes, a first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side;
- a helicoil blind hole, the helicoil blind hole being located in the first side and extending into the at least one brace;
- a cross rod operably connected to the clevis and located in the set of parallel through holes; and
- a cap screw located in the helicoil blind hole, the cap screw securing the cross rod to the clevis.

4. The toggle mechanism of claim **3**, wherein:

the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

5. The toggle mechanism of claim **3**, wherein:

the cross rod has a first section, a second section, and a midsection between the first section and the second section, the midsection includes a flange having a through hole.

6. The toggle mechanism of claim **5**, wherein:

the first section has a first diameter, the second section has a second diameter, and the midsection has a third diameter, the third diameter being larger than at least one of the first diameter and the second diameter.

7. The toggle mechanism of claim **5**, wherein:

the midsection includes a clearance notch.

8. The toggle mechanism of claim **5**, further comprising: a lock piston operably connected to the clevis through a link, the link being operably connected to the first set of parallel pivot holes via a pivot pin, wherein the pivot pin is secured in the first set of parallel pivot holes by the flange.

9. The toggle mechanism of claim **3**, further comprising: a bracket operably connected to the clevis at the second set of parallel pivot holes via a biasing mechanism.

10. The toggle mechanism of claim **5**, wherein:

the cap screw secures the cross rod to the clevis via the through hole.

11. A method of manufacturing a toggle mechanism of a ram air turbine actuator comprising:

- forming a first side of a clevis;
- forming a second side of a clevis;
- rigidly connecting the second side to the first side via at least one brace perpendicular to the first side and the second side, the first side being parallel to the second side;
- forming a first set of parallel pivot holes, a first hole of the first set of parallel pivot holes being located in the first side and a second hole of the first set of parallel pivot holes being located in the second side;
- forming a second set of parallel pivot holes, a first hole of the second set of parallel pivot holes being located in the first side and a second hole of the second set of parallel pivot holes being located in the second side;
- forming a set of parallel through holes, a first hole of the set of parallel through holes being located in the first side and a second hole of the set of parallel through holes being located in the second side;
- drilling a helicoil blind hole, the helicoil blind hole being located in the first side and extending into the at least one brace;

inserting a cross rod into the set of parallel through holes within the clevis; and installing a cap screw in the helicoil blind hole, the cap screw securing the cross rod to the clevis.

12. The method of claim **11**, wherein: 5

the second hole of the first set of parallel pivot holes is a blind hole, wherein the blind hole opens towards the first side.

13. The method of claim **11**, wherein:

the cross rod has a first section, a second section, and a midsection between the first section and the second section, the midsection includes a flange having a through hole. 10

14. The method of claim **13**, wherein:

the first section has a first diameter, the second section has a second diameter, and the midsection has a third diameter, the third diameter being larger than at least one of the first diameter and the second diameter. 15

15. The method of claim **13**, wherein:

the midsection includes a clearance notch. 20

16. The method of claim **13**, further comprising:

operably connecting a lock piston to the clevis through a link, the link being operably connected to the first set of parallel pivot holes via a pivot pin, wherein the pivot pin is secured in the first set of parallel pivot holes by the flange. 25

17. The method of claim **11**, further comprising:

operably connecting a bracket to the clevis at the second set of parallel pivot holes via a biasing mechanism.

18. The method of claim **13**, wherein: 30

the cap screw secures the cross rod to the clevis via the through hole.

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