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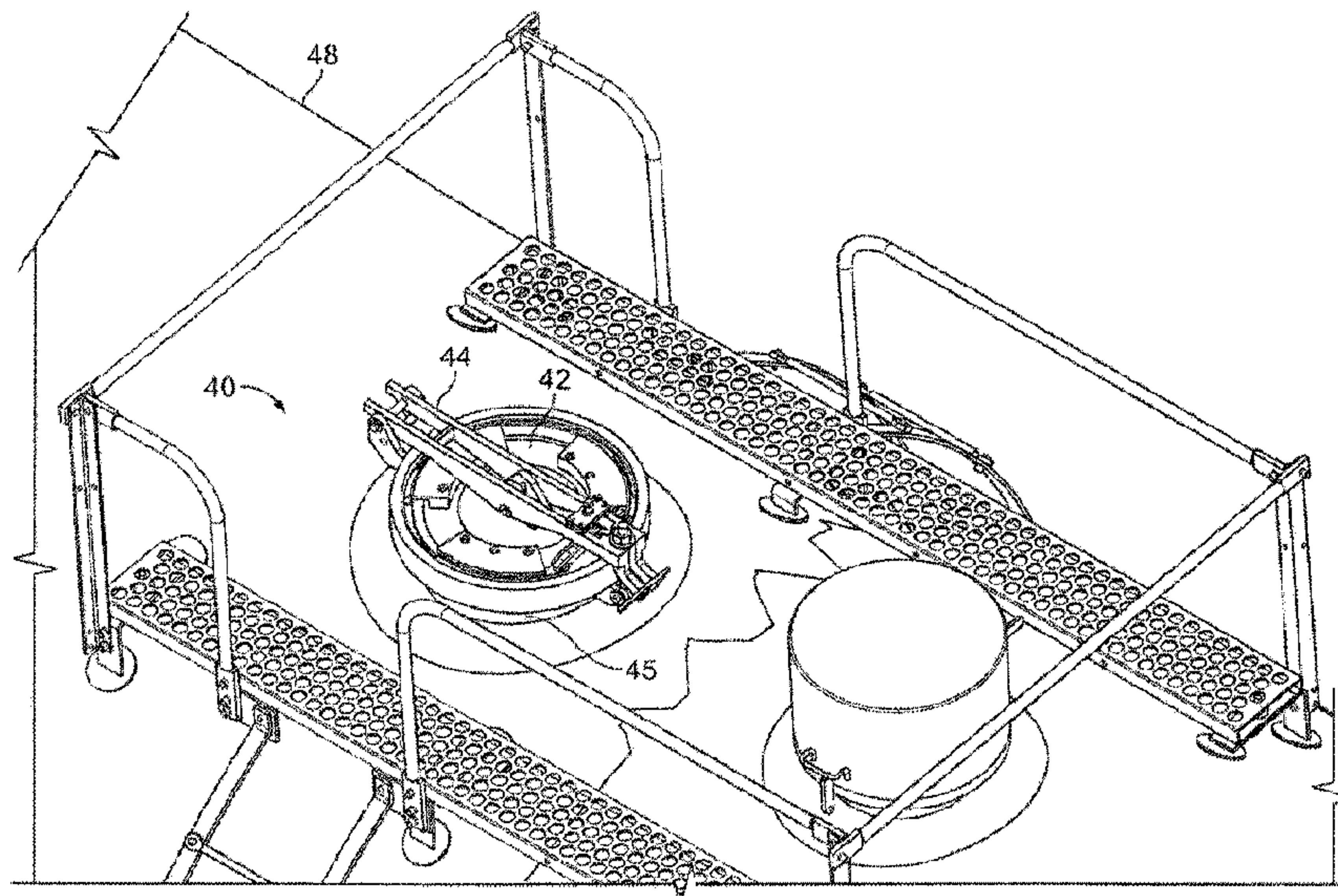
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(54) Titre : ASSEMBLAGE DE PASSAGE DE WAGONS-CITERNES

(54) Title: RAILROAD TANK CAR MANWAY ASSEMBLY



(57) Abrégé/Abstract:

A manway assembly features a nozzle defining a central opening. The nozzle has a groove or a plurality of grooves. A hinge pivotally attaches a cover to the nozzle so that the cover may be pivoted between an open position, where the central opening is generally uncovered, and a closed position, where the central opening is generally covered by the cover. Retainers secure a plurality of latch segments to the cover so that the latch segments may slide with respect to the cover. A latching mechanism moves the latch segments into engagement with the groove of the nozzle sidewall when the cover is in the closed position. The latching mechanism also removes the latch segments from engagement with the sidewall groove when the cover is to be opened.

ABSTRACT OF THE DISCLOSURE

A manway assembly features a nozzle defining a central opening. The nozzle has a groove or a plurality of grooves. A hinge pivotally attaches a cover to the nozzle so that the cover may be pivoted between an open position, where the central opening is generally uncovered, and a closed position, where the central opening is generally covered by the cover. Retainers secure a plurality of latch segments to the cover so that the latch segments may slide with respect to the cover. A latching mechanism moves the latch segments into engagement with the groove of the nozzle sidewall when the cover is in the closed position. The latching mechanism also removes the latch segments from engagement with the sidewall groove when the cover is to be opened.

RAILROAD TANK CAR MANWAY ASSEMBLY**CLAIM OF PRIORITY**

[0001] This application claims priority from U.S. Provisional Patent Application Serial No. 61/505,828, filed July 8, 2011, currently pending.

FIELD OF THE INVENTION

[0002] The present invention generally relates to railroad tank cars and, more particularly, to a manway assembly for a railroad tank car.

BACKGROUND

[0003] Railroad tank cars are well known and useful for carrying liquid commodities. A typical general purpose, non-pressurized railroad tank car is indicated in general at 22 in Figs. 1 and 2. The tank car features a tank body 24 mounted on a pair of wheel trucks 26a and 26b.

[0004] As illustrated in Figs. 1 and 2, a manway cover 28 is positioned on top of a nozzle 30 which is mounted on the tank body 24. As is known in the art, the manway cover pivots open and may be accessed by a ladder 32. The manway cover permits access to the interior of the tank body 24. Manway covers are typically designed to fit a 20" inner diameter manway nozzle. Nozzles having other inner diameters, however, have been made. These include nozzles having 24", 21", 18-1/2" and 18" inner diameters.

[0005] A prior art manway cover and nozzle is illustrated in Figs. 3 and 4. The manway cover is secured in the closed configuration on the nozzle by fasteners (eyebolts) that are spaced about the circumference of the manway cover. The typical quantity of eyebolts is either 6 (as illustrated in Figs. 3 and 4) or 8, however, the industry does have, on rare occasions, 10 bolt arrangements. The eyebolt nuts are individually loosened or tightened in a star pattern with a wrench or similar tool when the manway cover is opened or closed, respectively.

[0006] The manway cover features a hinge that permits it to be pivoted from the closed configuration, illustrated in Figs. 3 and 4, to an open configuration via the handle so that access to the manway is permitted. The manway cover of Figs. 3 and 4 is equipped with a torsion spring arrangement (Labeled "UTC E-Z Lift" in Fig. 4) at the hinge that aids in the lifting of the cover while opening. The two eyebolts nearest the handle act as safety bolts in that they secure

the cover in place while allowing pressure to be relieved in a safe manner. The cover must be slightly opened before the safety eyebolts may be disengaged so that the cover may be pivoted open completely.

[0007] All manway cover designs must be approved by the Association of American Railroad Tank Car Committee (AAR/TCC).

[0008] Manways are used for several purposes including dome loading or unloading, entry into the tank car, venting (by opening the manway cover), access to view gauging level and commodity sampling. The primary use of the manway at the loading rack is to open for dome loading, while the primary use at the unloading rack is for venting.

[0009] Issues with current manway nozzle and cover designs include out of round nozzles, out of flat nozzle and gasket grooves, loose hinge movements that cause interference with fit ups between the manway nozzle and cover, inconsistent sealing, difficulty of assembly and disassembly and loose eyebolts.

[0010] Prior art manway covers have been identified as a location where non-accidental leaks consistently occur. Indeed, as illustrated by the graphs of Figs. 5 and 6, manway covers are the largest contributor to non-accidental releases (NARs) for non-pressurized cars in transit.

[0011] In view of the above, it is desirable for manway nozzle and cover designs to feature a round nozzle and a seating surface that is flat. In addition, one input from the operator to secure the manway fasteners is desirable over the 6 to 10 individual inputs required by prior art designs. A repeatable placement of the cover and clamping force on the gasket is also preferable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a side elevational view of a railroad tank car equipped with a nozzle and manway cover;

[0013] Fig. 2 is an enlarged perspective view of the railroad tank car of Fig. 1;

[0014] Fig. 3 is a top plan view of a prior art manway cover;

[0015] Fig. 4 is a top plan and side elevation view of the manway cover of Fig. 3;

- 1 **[0016]** Figs. 5 and 6 are graphs of data for non-accidental releases (NARs) for non-pressurized
2 cars in transit;
- 3 **[0017]** Fig. 7 is a perspective view of a first embodiment of the manway assembly of the
4 present invention on a tank car in a closed configuration;
- 5 **[0018]** Fig. 8 is an enlarged perspective exploded view of the nozzle assembly of Fig. 7;
- 6 **[0019]** Fig. 9 is an enlarged perspective exploded view of the cover assembly of Fig. 7;
- 7 **[0020]** Fig. 10 is an enlarged perspective exploded view of the lift arm assembly of Fig. 7;
- 8 **[0021]** Fig. 11 is a perspective exploded view of the assembled nozzle, cover and lift arm
9 assemblies of Figs. 8-10;
- 10 **[0022]** Fig. 12 is a perspective assembled view of the manway assembly of Fig. 11 in the
11 closed configuration;
- 12 **[0023]** Fig. 13 is a cross sectional view of the manway assembly of Fig. 12 taken along a
13 vertical cutting plain passing through line 13-13 of Fig. 12;
- 14 **[0024]** Fig. 14 is an enlarged view of portions of the nozzle, cover and lift arm of Fig. 13
15 showing the detail of the seal between the cover and nozzle;
- 16 **[0025]** Fig. 15 is a cross sectional view of the nozzle and lift arm of Fig. 12 taken along a
17 vertical cutting plain passing through line 13-13 of Fig. 12 and a side elevation view of the cover
18 of Fig. 12 in a partially open configuration;
- 19 **[0026]** Fig. 16 is a perspective view of the manway assembly of Fig. 12 in an open
20 configuration;
- 21 **[0027]** Fig. 17 is a perspective view of a second embodiment of the manway assembly of the
22 present invention in a closed configuration;
- 23 **[0028]** Fig. 18 is a cross sectional view of the nozzle, lift arm and cover of Fig. 17 taken along
24 vertical cutting plain passing through line 18-18 of Fig. 17;

1 **[0029]** Fig. 19 is a top plan view of the manway assembly of Fig 17 with the lift arm omitted for
2 clarity;

3 **[0030]** Fig. 20 is a front perspective view of a third embodiment of the manway assembly of the
4 present invention in a closed configuration;

5 **[0031]** Fig. 21 is a rear perspective view of the manway assembly of Fig. 20 in an open
6 configuration.

7 **DETAILED DESCRIPTION OF EMBODIMENTS**

8 **[0032]** A first embodiment of the manway assembly of the present invention is indicated in
9 general at 40 in Fig. 7. More specifically, the manway cover assembly 42 and a lift arm
10 assembly 44 are mounted on the top of a nozzle assembly 45 which is positioned on top of tank
11 car body 48. The nozzle of the nozzle assembly 45 defines a manway for accessing the interior
12 of the tank car body 48, as described above. Fig. 7 illustrates the manway cover assembly 42
13 and lift arm assembly 44 in a closed configuration.

14 **[0033]** An enlarged, exploded perspective view of the nozzle assembly of the manway
15 assembly of Fig. 7, indicated in general at 45, is presented in Fig. 8. In addition to the nozzle
16 46, the nozzle assembly includes a hinge 54, a pair of eye bolt lugs 56 and an eye bolt 58. The
17 cylindrical interior wall 62 of the nozzle includes a circumferential groove 64 cut or otherwise
18 formed therein, as well as an upper circumferential ledge 65 and a lower circumferential ledge
19 66.

20 **[0034]** As illustrated in Fig. 11, the eye bolt 58 is pivotally secured to the eye bolt lugs 56 by pin
21 67. An eye bolt nut 69 engages a threaded distal portion 71 of the eye bolt 58.

22 **[0035]** The cover assembly of the manway assembly of Fig. 7 is indicated in general at 42 in
23 Fig. 9 in an exploded view. The cover assembly includes a disk-shaped cover 72 having a
24 cover lift bracket 74. The cover lift bracket is generally triangular-shaped, is centrally located on
25 the top surface of the cover and includes elongated slots 76.

1 **[0036]** The cover assembly also includes latch segments that may take the form of wedge
2 segments 78a-78c. The latch segments may take other forms, including those without a wedge
3 surface. Each wedge segment is generally arc-shaped and features a wedge surface 80a-80c.
4 Wedge segment 78a is connected to wedge segment 78b by an arc-shaped link 82, while
5 wedge segment 78b is similarly connected to wedge segment 78c by arc-shaped link 84. More
6 specifically, wedge segment 78a features pin openings 86a and 88a, wedge segment 78b
7 features pin openings 86b and 88b and wedge segment 78c features pin openings 86c and 88c.
8 Link 82 features pins 92 and 94, while link 84 features pins 96 and 98. Pin 92 of link 82
9 engages pin opening 88a of wedge segment 78a while pin 94 of link 82 engages pin opening
10 86b of wedge segment 78b. Pin 96 of link 84 similarly engages pin opening 88b of wedge
11 segment 78b while pin 98 of link 84 similarly engages pin opening 86c of wedge segment 78c.

12 **[0037]** As illustrated in Fig. 11, the assembled wedge segments and links rest on the top
13 surface 100 of the cover 72. Wedge segment 78b features a channel 104b formed along the
14 underside of the inner edge which receives adjacent end portions of links 82 and 84. Wedge
15 segment 78c similarly features a channel 104c formed along the underside of the inner edge
16 which receives the adjacent end portion of link 84. Wedge segment 78a features a similar
17 channel (not visible in Fig. 9) that receives the adjacent end portion of link 82.

18 **[0038]** The pins and pin openings described above are sized to permit pivoting movement
19 between the links and wedge segments.

20 **[0039]** As illustrated in Figs. 9 and 11, a pair of pivot lugs 102a and 102b are pivotally secured
21 within pin opening 86a of wedge segment 78a and pin opening 88c of wedge segment 78c,
22 respectively.

23 **[0040]** As illustrated in Figs. 9 and 11, the cover assembly also features three generally arc-
24 shaped retainer blocks 110a, 110b and 110c. As illustrated in Fig. 9, each retainer includes a
25 channel formed along the underside of the outer edge (illustrated at 111b for retainer 110b and
26 at 111c for retainer 110c, not visible for retainer 110a in Fig. 9). Each retainer features a set of
27 three openings, illustrated at 112a, 112b and 112c in Fig. 9, that are sized to receive fasteners
28 114a, 114b and 114c, which are preferably socket head cap screws. As illustrated in Fig. 9, the
29 top surface 100 of the cover 72 features openings 116a, 116b and 116c. As illustrated in Fig.

11, the fasteners secure the retainers 110a, 110b and 110c to the top surface of the cover via the retainer openings and the cover openings. The channels (such as 111b and 111c of Fig. 9) of the retainers are sized to secure the wedge segments to the cover lid, yet permit movement of the wedge segments parallel to the cover top surface as described below.

[0041] It should be noted that while three wedge segments, two links and three retainers are illustrated in the figures, alternative numbers of each component may be used instead (for example: four wedge segments joined by three links with four retainers, etc.).

[0042] The lift arm assembly of the manway assembly of Fig. 7 is indicated in general at 44 in Fig. 10 in an exploded view. The lift arm assembly includes a lift arm, indicated in general at 122. The lift arm features a proximal portion 124, a middle portion 126 and a distal portion 128.

[0043] A latching mechanism, indicated in general at 132 in Figs. 10 and 11, is mounted to the distal end of the lift arm. As illustrated in Fig. 10, the latching mechanism includes an adjusting plate 134, an adjusting screw 136, adjusting plate support blocks 138a and 138b and four adjusting plate fasteners 142. Four peripheral openings 143 are formed through the adjusting plate 134 and a corresponding four openings 144 are formed in the top surface of the lift arm 122 and through support blocks 138a and 138b. The adjusting plate, support block and lift arm openings are sized to be engaged by the adjusting plate fasteners 142. As illustrated in Fig. 11, the adjusting plate 134 is secured to the lift arm by the adjusting plate fasteners and the adjusting plate support blocks.

[0044] The adjusting plate features a central opening 146 that is sized to receive the adjusting screw 136 so that the adjusting screw is free to rotate about a vertical axis. The bottom portion of the adjusting screw is provided with a reduced diameter portion 150 that is secured to a pivot block 152 via opening 154 (such as by threads or a rivet-type connection). Pivot block 152 features an inverted, generally U-shaped profile.

[0045] As illustrated in Fig. 10, the lift arm 122 is constructed from a pair of beams 160 and 162 that are secured to one another by spacers 164 and 166. When the lift arm assembly is assembled, as illustrated in Fig. 11, the pivot block 152 is positioned between the lift arm beams

1 160 and 162 and spacers 164 and 166 provide sufficient space between the beams for the pivot
2 block to rotate 360° when adjusting screw 136 is turned.

3 **[0046]** Returning to Fig. 10, an inner linkage 170 and an outer linkage 172 are pivotally secured
4 by their proximal ends to a clevis 174 by pin 176, which engages clevis linkage opening 178.
5 The clevis 174 is secured to the pivot block via clevis transverse opening 182, pin 184 and pivot
6 block openings 186 and 188.

7 **[0047]** The lift arm features a safety catch, indicated in general at 189 in Fig. 10, which includes
8 spaced gooseneck members 190a and 190b and upon which a combination handle and safety
9 stop 192 is positioned. The functionality of the safety catch and combination handle and safety
10 stop will be explained below.

11 **[0048]** As illustrated in Fig. 12, the cover assembly of Figs. 9 and 11 is attached to the lift arm
12 of Figs. 10 and 11 by a pin 194 (also shown in Figs. 10 and 11). The pin 194 engages openings
13 196 (Fig. 10) formed through the middle portion 126 of beams 160 and 162 as well as the
14 elongated slots 76 of cover lift bracket 74 (Fig. 9).

15 **[0049]** In addition, with reference to Figs. 9-12, the distal ends of the inner and outer linkages
16 170 and 172 of the latching mechanism of the lift arm assembly are pivotally connected to pivot
17 lugs 102a and 102b, respectively, by pins 198a and 198b.

18 **[0050]** As illustrated in Fig. 12, the proximal portion of the lift arm 122 is secured to the hinge 54
19 of the nozzle assembly by pin 202 which passes through openings in the hinge and the proximal
20 portion of the lift arm (204 of Fig. 8 and 206 of Fig. 10, respectively).

21 **[0051]** When the cover 72 is in the closed configuration illustrated in Fig. 12, the eye bolt 58 is
22 pivoted up and into a generally vertical position, during which it passes between the spaced
23 gooseneck members 190a and 190b of the safety catch and ultimately into the fully latched
24 position illustrated in Fig. 12. The eye bolt nut 69 is then tightened down so secure the manway
25 assembly in the closed configuration.

1 **[0052]** As illustrated in Figs. 12 and 13, when the lift arm and cover are in the fully closed
2 positions, the distal ends of the inner and outer linkages 170 and 172 of the cover assembly
3 latching mechanism, and thus the pivot lugs 102a and 102b of the cover assembly, are
4 maximum distance from one another (see also Figs. 10 and 11). With reference to Figs. 12 and
5 13, this causes the linkages 82 and 84 and wedge segments to be positioned as radially
6 outward towards the circumferential edge of the top surface 100 of the cover 72 as possible. As
7 a result, as illustrated in Figs. 12 and 13, the wedge surfaces 80a-80c of the wedge segments
8 78a-78c are in engagement with the circumferential groove 64 of the nozzle 46. The degree of
9 engagement of the wedge segments with the nozzle circumferential groove can be adjusted by
10 turning the latching mechanism adjusting screw 136. As best illustrated in Fig. 13, it should also
11 be noted that pin 194 attaching the cover to the middle portion of the lift arm is positioned at the
12 bottom of the elongated slots 76 of the cover lift bracket 74 when the cover and lift arm are in
13 the closed configuration.

14 **[0053]** As illustrated in Figs. 13 and 14, the underside edge portion of the cover 72 is provided
15 with a circumferential seal channel 208 and a circumferential stop portion 210. A circumferential
16 seal 212 is positioned within the seal channel 208 with a portion of the seal extending radially
17 inward from the seal channel (towards the center of the cover 72). As illustrated in Figs. 13 and
18 14, when the cover and lift arm are in the closed configuration, and the wedge segments of the
19 cover assembly are engaging the circumferential groove of the nozzle, the circumferential seal
20 212 is gently compressed against the lower circumferential ledge 66 of the nozzle. As
21 illustrated in Figs. 13 and 14, the circumferential stop portion 210 of the cover 72 engages the
22 upper circumferential ledge 65 of the nozzle to limit compression of the seal 212.

23 **[0054]** With reference to Fig. 13, when a user wishes to open the cover 72 of the manway
24 assembly, the eye bolt nut 69 is first loosened. If there is no pressure in the tank car, the user
25 may pivot the eye bolt 58 down until it abuts the handle and safety stop 192 of the closed lift
26 arm and cover. The user may then lift up on the lift arm via the handle and safety stop 192 until
27 the lift arm and cover reach the position illustrated in Fig. 15. With reference to Fig. 15, as the
28 lift arm 122 moves up and away from the cover 72, pin 194 travels upward in elongated slot 76
29 of the cover lift bracket 74. As this occurs, the distal ends of the inner and outer linkages 170
30 and 172 of the latching mechanism of the lift arm assembly, and thus pivot lugs 102a and 102b
31 of the cover assembly, move towards one another. With reference to Figs. 12 and 15, this

causes the linkages 82 and 84 (Fig. 12) and wedge segments 78a-78c (Fig. 12) to move radially inward towards the center of the cover 72. As a result, the wedge surfaces 80a-80c (Fig. 12) of the wedge segments disengage the circumferential groove 64 (Fig. 12) of the nozzle 46, as illustrated for wedge surface 80b of wedge segment 78b in Fig. 15.

[0055] At this point (illustrated in Fig. 15), the user may pass the eye bolt 58 and the eye bolt nut 69 under the handle and safety stop 192. The eye bolt 58 may then be pivoted down into a position directed vertically downward, illustrated in phantom at 224 in Fig. 15. The user is then free to pivot the lift arm and cover into the open position illustrated in Fig. 16.

[0056] The handle and safety stop 192 of Figs. 12, 13 and 15 prevent a user from releasing the eye bolt 58 prior to venting if there is pressure in the tank car. More specifically, with reference to Figs. 12 and 13, when the user loosens eye bolt nut 69, the cover 72 will typically rise slightly, due to the pressure in the tank acting on the underside of the cover 72, so that the pressure within the tank car may vent through the circumferential space formed between the cover and the nozzle. The pressure of the top surface of the lift arm 122 against the bottom surface of the nut 69 prevents the user from pivoting the eyebolt 58 down over the lifting arm distal end corner 226 (Figs. 12 and 13) until after the venting is complete. Once venting has completed, the lid 72 will lower back into its original closed configuration, and the user may continue to loosen the nut 69. The cover may then be opened following the procedure described above.

[0057] In some situations, the cover 72 may become stuck in the closed configuration illustrated in Figs. 12 and 13, even though the eye bolt nut 69 has been loosened and pressure exists within the tank car tank. In such a situation, the nut 69 may be loosened, but when the eye bolt is pivoted downward, it will contact the handle and safety stop 192 of the closed lift arm and cover. It is impossible for the user to pivot the eye bolt 58 down beyond the handle and safety stop 192 when the cover 72 is fully closed.

[0058] The user may pull up on the handle and safety stop 192 until the cover becomes un-stuck. Alternatively, the cover may become un-stuck on its own. When this occurs, the pressure in the tank acting on the underside of the cover 72 will cause it to rise and, as a result, pressure from within the tank will vent through the circumferential space formed between the cover and the nozzle. In addition, due to the pressure within the tank acting on the underside of

1 the cover 72, the top surfaces of the spaced gooseneck members 190a and 190b of the safety
2 catch on the lift arm will press up against the bottom surface of the nut 69. This prevents the
3 user from further pivoting the eye bolt downwards over corner 228 (Figs. 12 and 15) of the
4 safety catch until venting is completed. When the venting is complete, the lift arm, cover and
5 eyebolt will be in the positions illustrated in Fig. 15. The eye bolt 58 may then be pivoted down
6 into a position directed vertically downward, illustrated in phantom at 224 in Fig. 15. The user is
7 then free to pivot the lift arm and cover into the open position illustrated in Fig. 16. As a result,
8 the lift arm, safety catch, handle and safety stop and eye bolt provide two levels of protection
9 from tank pressure – one when the cover is not stuck in a closed configuration and one when
10 the cover is stuck in a closed configuration.

11 **[0059]** A second embodiment of the manway assembly of the present invention is indicated in
12 general at 300 in Figs. 17 and 18. The manway assembly 300 includes a lift arm, indicated in
13 general at 302, mounted on the top of cover 304, both of which are positioned on a nozzle 306
14 which is positioned on top of a tank car body (such as 48 in Fig. 7). The nozzle defines a
15 manway for accessing the interior of the tank car body, as described above. Figs. 17 and 18
16 illustrate the manway cover and lift arm in a closed configuration.

17 **[0060]** Similar to the construction illustrated in Fig. 8, the nozzle 306 is provided with a pair of
18 hinge lugs 308, a pair of eye bolt lugs 310 and an eye bolt 312. The cylindrical interior wall of
19 the nozzle 306 includes a circumferential groove 314 cut or otherwise formed therein. The eye
20 bolt 312 is pivotally secured to the eye bolt lugs 310. An eye bolt nut 316 engages a threaded
21 distal portion of the eye bolt.

22 **[0061]** The disk-shaped cover 304 has a cover lift bracket 320. The cover lift bracket includes a
23 pair of ears 321a and 321b and is centrally located on the top surface of the cover. The ears
24 321a and 321b include openings for connection to the lift arm and latching mechanism as
25 explained below.

26 **[0062]** The cover is also provided with latch segments in the form of wedge segments 322a-
27 322e. The latch segments may take other forms, including those without a wedge surface.
28 Each wedge segment is generally arc-shaped and features a wedge surface, illustrated at 324c

1 and 324d for wedge segments 322c and 322d (wedge segments 322a, 322b and 322e have
2 similar wedge surfaces, but they are not visible in Figs. 17 and 18).

3 **[0063]** As best illustrated in Fig. 19, wedge segments 322a-322e are connected together by a
4 wire spring form 326. As illustrated in Fig. 19, wire spring form 326 is formed in a generally
5 circular shape and features upturned ends 328a and 328b. The wire spring form 326 is
6 constructed in such a manner to urge the wedge segments radially outward with respect to the
7 center cover and into the positions illustrated in Figs. 17-19. As an example only, the wire
8 spring form material may be 5/16" diameter steel wire, hard drawn ASTM A 227, finish zinc
9 plate- baked.

10 **[0064]** The assembled wedge segments and wire spring form rest on the top surface of the
11 cover 304. Wedge segments 322a-322e feature arcuate channels (illustrated in phantom at
12 330a-330e in Fig. 19) formed along their undersides that receive the wire spring form, as
13 illustrated in Fig. 17.

14 **[0065]** As best illustrated in Figs. 17 and 19, each wedge segment includes an elongated slot
15 (332a-332e). Retainer bolts 334a-334e pass through each slot and into bores formed through
16 the top surface of the cover 304 so that the wedge segments are secured to the top surface of
17 the cover. The slots 332a-332e and retainer bolts 334a-334e are sized so that the wedges may
18 be moved between a locked position, where the wedge surfaces of the wedge segments 322a-
19 322e engage the circumferential groove 314 of the nozzle 306 (as illustrated in Figs 17), and an
20 unlocked position, where the wedge segments are disengaged from the nozzle circumferential
21 groove.

22 **[0066]** It should be noted that while five wedge segments are illustrated in the figures,
23 alternative numbers of the wedge segments may be used instead.

24 **[0067]** As illustrated in Fig. 17, the latching arm 302 includes a pair of lift arm rails 336a and
25 336b joined by cross member 338. A latching mechanism, indicated in general at 340 in Figs.
26 18 and 19, is mounted to the distal end of the lift arm between lift arm rails 336a and 336b. The

1 latching mechanism includes a latch arm 342 having a distal end that is provided with a latch
2 handle 344.

3 **[0068]** As illustrated in Fig. 18, the proximal end of the latch arm 342 is pivotally mounted
4 between the ears 321a and 321b of the cover lift bracket by pin 343. In addition, a main link
5 346 is pivotally attached between ears 321a and 321b by pin 347. A cross link 348 is pivotally
6 attached at opposite ends to the proximal end of the latch arm 342 and the main link 346.

7 **[0069]** As illustrated in Figs. 18 and 19, a hook link 349 is pivotally connected by its proximal
8 end to the bottom of main link 346. The distal end of the hook link engages openings formed in
9 the proximal portions of a pair of spring form links 350a and 350b. While a hook is illustrated for
10 the hook link, it should be noted that the hook link does not necessarily require a hook end – it
11 may be attached to the proximal portions of the pair of spring form links by other fastening
12 arrangements. As illustrated in Fig. 19, the distal ends of the spring form links 350a and 350b
13 are engaged by the upturned ends 328a and 328b of the spring form 326.

14 **[0070]** A user operates the latching mechanism 340 to release the wedge segments of the
15 cover from engagement with the circumferential groove of the nozzle as follows. The user
16 raises the latch arm 342 via handle 344 and the latch arm 342 is pivoted counter-clockwise (in
17 the direction of arrow 352 of Fig. 18) about pin 343. As this occurs, cross link 348 acts on main
18 link 346 so that the main link 346 moves clockwise about pin 347. This causes the hook 349 to
19 move towards the center of the cover (and parallel with the top surface of the cover) in the
20 direction indicated by arrow 354 of Fig. 18. With reference to Fig. 19, as hook 349 moves, it
21 causes the spring form links 350a and 350b to pivot about, in the directions of arrows 356a and
22 356b, and slide along outer fulcrum pins 358a and 358b. This causes the ends of the wire
23 spring form 326 to be drawn closer together. As the proximal ends of the spring form links 350a
24 and 350b travel further towards the center of the cover, they encounter inner fulcrum pins 362a
25 and 362b which further drives their distal ends, and thus the free ends of the spring form, closer
26 together. This causes the wedge segments 322a-322e to move radially inward (towards the
27 center of the cover) so that their wedge surfaces disengage from the circumferential groove
28 (314 of Figs. 17 and 18) of the nozzle.

1 **[0071]** The positioning of the outer fulcrum pins 358a and 358b and the inner fulcrum pins 362a
2 and 362b provide smooth operation of the latch arm as a greater torque is applied to pulling the
3 ends of the spring form towards one another during initial upward movement of the latch arm.
4 In addition, the positioning of the inner and outer fulcrum pins and the sizing of the spring form
5 links and hook cause the spring form to maintain a generally round shape as the ends 328a and
6 328b of the spring form are drawn closer together. This gives generally uniform disengagement
7 of the wedge segments from the nozzle circumferential groove.

8 **[0072]** As illustrated in Fig. 17 and 18, the cover 304 is attached between the rails 336a and
9 336b of the lift arm 302 by pin 347. The pin 347 engages openings formed through the middle
10 portion of rails 336a and 336b as well as openings through the ears 321a and 321b of the cover
11 lift bracket. In addition, the proximal portion of the lift arm 302 is pivotally secured to the hinge
12 lugs 308 of the nozzle.

13 **[0073]** When the cover 304 is in the closed configuration illustrated in Figs. 17-19, the eye bolt
14 312 is pivoted up and into a generally vertical position illustrated, during which it passes
15 between the spaced rails 336a and 336b of the lift arm. The eye bolt nut 316 is tightened down
16 so secure the manway assembly in the closed configuration. In addition, as illustrated in Fig.
17 18, a washer 360 is positioned under eye bolt nut 316. This washer engages the distal tip of the
18 latch arm 342 so that it cannot be raised until the eyebolt nut is loosened, which guards against
19 accidental actuation of the latch arm.

20 **[0074]** As illustrated in Fig. 18, the underside edge portion of the cover 304 is provided with a
21 circumferential seal channel 368 and a circumferential stop portion 370. A circumferential seal
22 372 is positioned within the seal channel. As illustrated in Fig. 18, when the cover and lift arm
23 are in the closed configuration, and the wedge segments of the cover assembly are engaging
24 the circumferential groove of the nozzle, the circumferential seal 372 is gently compressed
25 against the circumferential ledge of the nozzle. As illustrated in Fig. 18, the circumferential stop
26 portion 370 of the cover 304 engages a second circumferential ledge of the nozzle to limit
27 compression of the seal 372. Suitable seals are available, as an example only, from the
28 Technetics Group (EnPro Industries) of Columbia, South Carolina.

1 **[0075]** With reference to Figs. 17 and 18, when a user wishes to open the cover 304 of the
2 manway assembly, the eye bolt nut 316 is first loosened and pivoted down to the inclined safety
3 stop at the distal end of the lift arm, indicated at 374. With washer 360 out of the way, latch
4 handle 342 may be pivoted as described above to unlock the cover from the nozzle. If there is
5 no pressure in the tank car, the user may further loosen the nut 316 and pivot the eye bolt 312
6 down clear of the lift arm and the lift arm handle 376, also attached near the distal end of the lift
7 arm 302, may be used to lift the cover into the open position.

8 **[0076]** The lift arm safety stop 374 prevents a user from releasing the eye bolt prior to venting if
9 there is pressure in the tank car. More specifically, when the user loosens eye bolt nut 316,
10 pivots the eye bolt 312 so that it is positioned over the safety stop and actuates the latching
11 mechanism as described above to unlock the cover, the cover 304 will typically rise slightly, due
12 to the pressure in the tank acting on the underside of the cover, so that the pressure within the
13 tank car may vent through the circumferential space formed between the cover and the nozzle.
14 The pressure of the top surface of the lift arm safety stop 374 against the bottom surface of the
15 washer 360 (as held in place by eye bolt nut 316) prevents the user from pivoting the eyebolt
16 312 further down over the lifting arm distal end corner 378 (Figs. 17 and 18) until after the
17 venting is complete. Once venting has completed, the lid 304 will lower back into its original
18 closed configuration, and the user may continue to loosen the nut 316. The cover may then be
19 opened following the procedure described above.

20 **[0077]** A third embodiment of the manway assembly of the present invention is indicated in
21 general at 400 in Figs. 20 and 21. As with previous embodiments, the manway assembly 400
22 includes a lift arm 402 mounted on the top of cover 404, both of which are positioned on a
23 nozzle 406 which is positioned on top of a tank car body (such as 48 in Fig. 7). The nozzle
24 defines a manway for accessing the interior of the tank car body, as described above. Fig. 20
25 illustrates the manway cover and lift arm in a closed configuration, while Fig. 21 illustrates the
26 manway cover and lift arm in an open configuration.

27 **[0078]** The manway assembly of Figs. 20 and 21 features a construction that is basically the
28 same as the embodiment of Figs. 17-19 (including the same latching mechanism) except that
29 the embodiment of Figs. 20 and 21 includes latch segments that take the form of wedge
30 segments 422a-422c (the latch segments may take other forms, including those without a

wedge surface) that are held in place by retainers 424a-424c (instead of the slots 332a-332e and retainer bolts 334a-334e of Figs. 17 and 19). More specifically, as illustrated in Figs. 20 and 21, the cover is provided with three generally arc-shaped retainer blocks 424a-424c. As illustrated in Figs. 20 and 21, each retainer includes a channel formed along the underside of the outer edge (illustrated at 411b for retainer 424b and at 411c for retainer 424c, not visible for retainer 424a). The retainers are secured to the top surface of the cover 404 by fasteners 414a, 414b and 414c, which are preferably socket head cap screws. The channels (such as 411b and 411c of Figs. 20 and 21) of the retainers are sized to secure the wedge segments 422a-422c to the cover lid, yet permit movement of the wedge segments parallel to the cover top surface, and radially with respect to the center of the cover, for engagement with a circumferential groove 414 of the nozzle 406.

[0079] As with the embodiment of Figs. 17-19, wedge segments 422a-422c of the embodiment of Figs. 20 and 21 are connected together by a wire spring form 426. The wire spring form 326 is constructed in such a manner to urge the wedge segments radially outward with respect to the center cover and into the positions illustrated in Fig. 20. The assembled wedge segments and wire spring form rest on the top surface of the cover 404. Wedge segments 422a-422c feature arcuate channels (illustrated at 430b for wedge segment 422b in Figs. 20 and 21) formed along their undersides that receive the wire spring form.

[0080] It should be noted that while three wedge segments are illustrated in Figs. 20 and 21 an alternative numbers of the wedge segments may be used.

[0081] As illustrated in Figs. 20 and 21, the manway assembly may include lift assist springs 440a and 440b. Lift assist spring 440a features a first leg portion 442a that engages a rod 444a attached to the hinge lugs of the nozzle 406. A second leg portion 406a of the lift assist spring 440a engages pin 448a positioned on the lift arm 402. Lift assist spring 440b features a similar construction and attachment to the nozzle and lift arm. Each lift assist spring 440a and 440b urges the cover 404 towards the open position illustrated in Fig. 21 so as to assist a user lifting the cover via the lift arm 402. The first and second embodiment of the manway assembly described above may be equipped with a similar lift assist hinge.

1 **[0082]** While the preferred embodiments of the invention have been shown and described, it will
2 be apparent to those skilled in the art that changes and modifications may be made therein
3 without departing from the spirit of the invention, the scope of which is defined by the appended
4 claims.

WHAT IS CLAIMED IS:

1. A manway assembly comprising:
 - a. a nozzle defining a central opening and having a sidewall with a groove;
 - b. a cover;
 - c. a hinge pivotally attaching the cover to the nozzle so that said cover may be pivoted between an open position, where the central opening is generally uncovered, and a closed position, where the central opening is generally covered by the cover;
 - d. a latch segment;
 - e. a retainer for securing the latch segment to the cover so that said latch segment may slide with respect to the cover; and
 - f. a latching mechanism for moving the latch segment into engagement with the groove of the nozzle sidewall when the cover is in the closed position.
2. The manway assembly of claim 1 wherein the latch segment is a wedge segment having a wedge surface adapted to engage the groove.
3. The manway assembly of claim 1 further comprising a plurality of latch segments secured together, said plurality of latch segments secured to the cover by a plurality of retainers.
4. The manway assembly of claim 3 wherein the plurality of latch segments are a plurality of wedge segments, each having a wedge surface.
5. The manway assembly of claim 3 wherein the groove is a circumferential groove formed on an interior surface of the nozzle side wall.

6. The manway assembly of claim 3 wherein the plurality of latch segments are secured together by a wire spring form and move generally radially with respect to the cover.

7. The manway assembly of claim 6 wherein the latching mechanism includes a latch arm pivotally attached to the cover, said latch arm having a proximal end connected to a proximal end of a hook link by a linkage mechanism, said hook link having a distal end connected to free ends of the wire spring form so that the free ends of the wire spring form are pulled generally towards one another when the latch arm is actuated.

8. The manway assembly of claim 7 where in the distal end of the hook link is attached to the free ends of the wire spring form by spring form links that engage fulcrum pins to move the free ends of the wire spring form generally towards one another when the latch arm is actuated.

9. The manway assembly of claim 7 wherein the hook link is a hook.

10. The manway assembly of claim 6 wherein the wire spring form urges the plurality of latch segments radially outward with respect to the cover.

11. The manway assembly of claim 3 wherein the plurality of latch segments are secured together by links and move generally radially with respect to the cover.

12. The manway assembly of claim 3 wherein the retainer includes an elongated slot formed in each latch segment and each latch segment having a retainer bolt passing through its elongated slot and attached to the cover.

13. The manway assembly of claim 3 wherein the retainer is a retainer block featuring a channel that receives the latching segment in a sliding fashion.

14. The manway assembly of claim 1 further comprising an annular seal positioned circumferentially around the nozzle, said seal engaging between a periphery of the cover and the nozzle when the cover is in the closed position.

15. The manway assembly of claim 1 further comprising a lift arm attached to the hinge so that the lift arm is pivotally attached to the nozzle and the cover is attached to the lift arm.

16. A manway assembly comprising:

- a. a nozzle having a groove or plurality of grooves;
- b. a cover pivotally attached to the nozzle;
- c. a plurality of latch segments movably positioned on said cover; and
- d. a latching mechanism for moving the plurality of latch segments into and out of engagement with the groove or plurality of grooves of the nozzle.

17. The manway assembly of claim 16 wherein the plurality of latch segments are a plurality of wedge segments, each having a wedge surface adapted to engage the groove or plurality of grooves.

18. The manway assembly of claim 16 wherein the groove or plurality of grooves is a circumferential groove formed on an interior surface of a nozzle sidewall.

19. The manway assembly of claim 16 wherein the plurality of latch segments are secured together by a wire spring form and move generally radially with respect to the cover.

20. The manway assembly of claim 19 wherein the latching mechanism includes a latch arm pivotally attached to the cover, said latch arm having a proximal end connected to a proximal end of a hook link by a linkage mechanism, said hook link having a distal end connected to free ends of the wire spring form so that the free ends of the wire spring form are pulled generally towards one another when the latch arm is actuated.

21. The manway assembly of claim 20 where in the distal end of the hook link is attached to the free ends of the wire spring form by spring form links that engage fulcrum pins to move the free ends of the wire spring form generally towards one another when the latch arm is actuated.

22. The manway assembly of claim 20 wherein the hook link is a hook.

23. The manway assembly of claim 19 wherein the wire spring form urges the plurality of latch segments radially outward with respect to the cover.

24. The manway assembly of claim 16 wherein the plurality of latch segments are secured together by links and move generally radially with respect to the cover.

25. The manway assembly of claim 16 further comprising a retainer securing the plurality of latch segments to the cover.

26. The manway assembly of claim 25 wherein the retainer includes an elongated slot formed in each latch segment and each latch segment having a retainer bolt passing through its elongated slot and attached to the cover.

27. The manway assembly of claim 25 wherein the retainer is a retainer block featuring a channel that receives the latching segment in a sliding fashion.

28. The manway assembly of claim 16 further comprising an annular seal positioned circumferentially around the nozzle, said seal engaging between a periphery of the cover and the nozzle when the cover is in the closed position.

29. The manway assembly of claim 16 further comprising a lift assist spring positioned between the cover and the nozzle to assist a user lifting the cover.

30. The manway assembly of claim 16 further comprising a hinge attached to the nozzle and a lift arm attached to the hinge so that the lift arm is pivotally attached to the nozzle and the cover is attached to the lift arm.

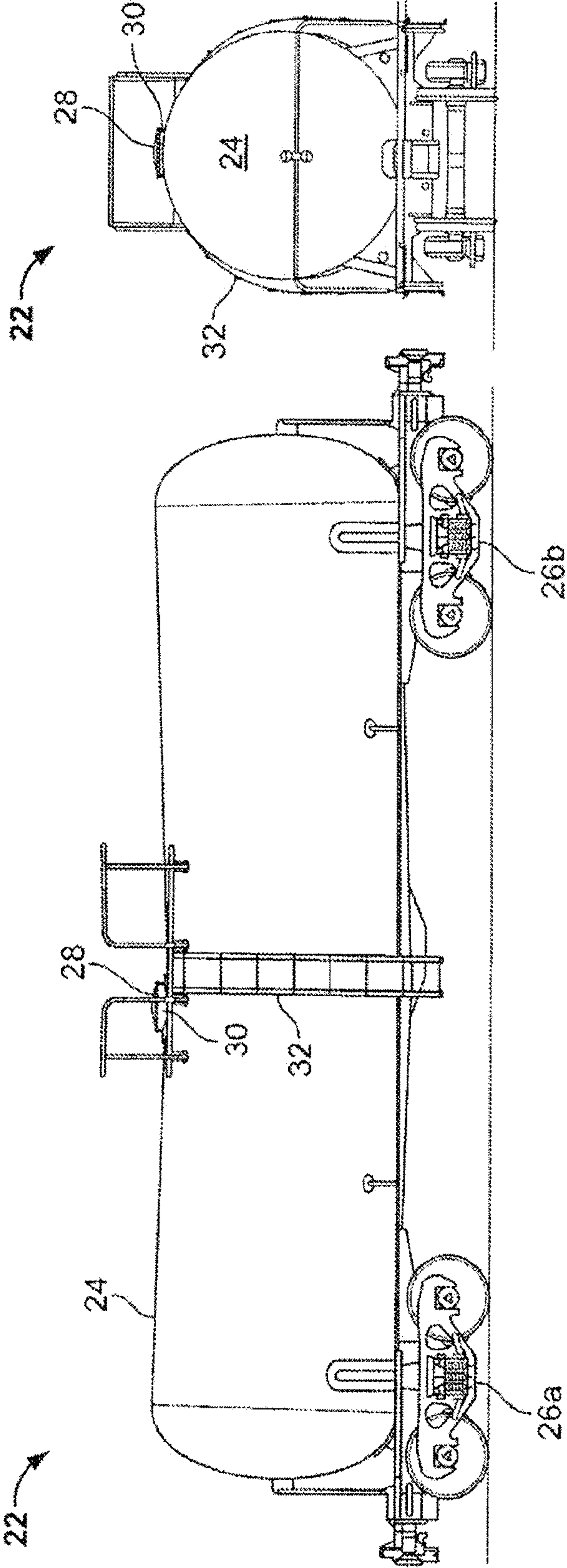


FIG. 1

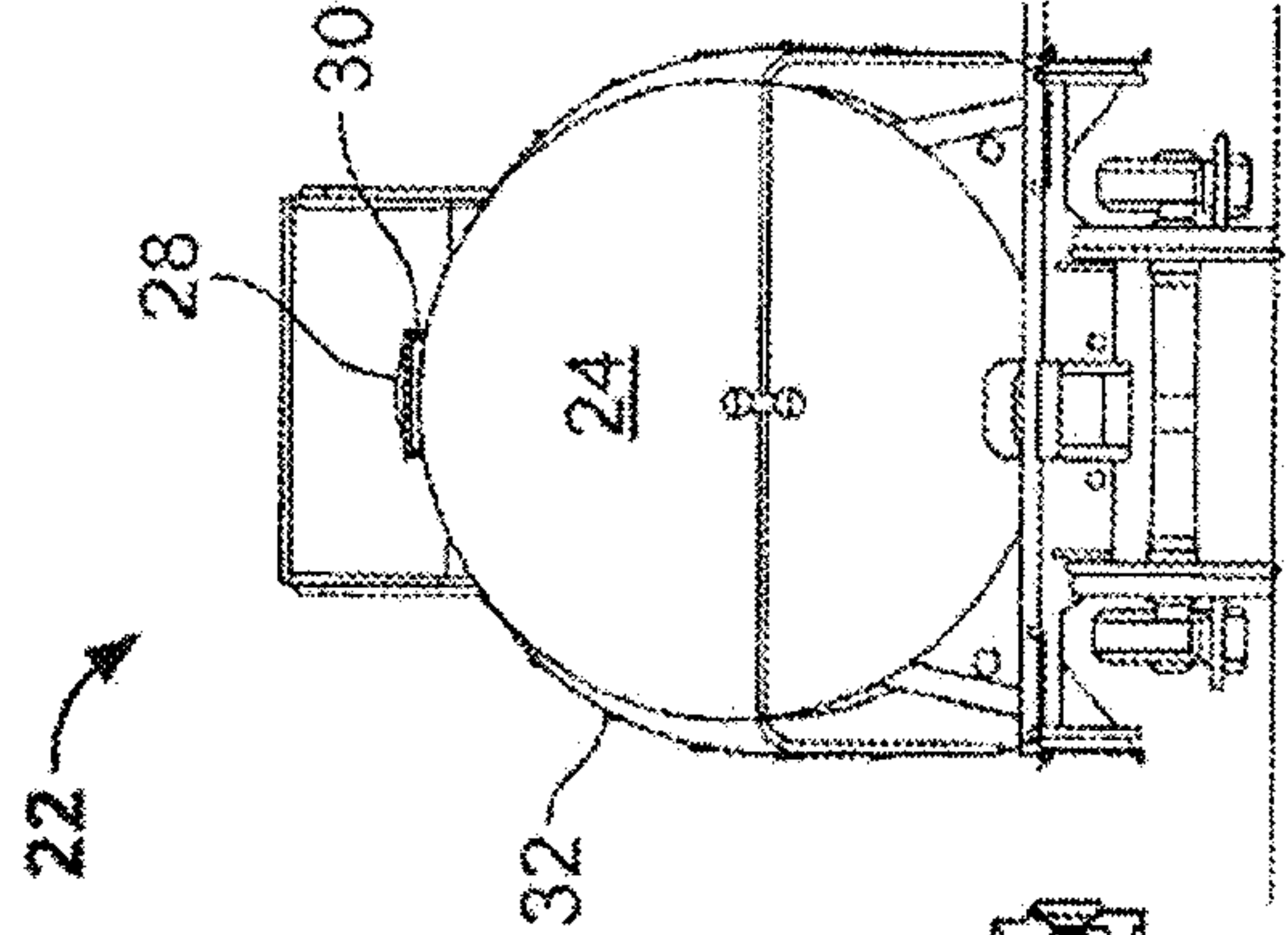


FIG. 2

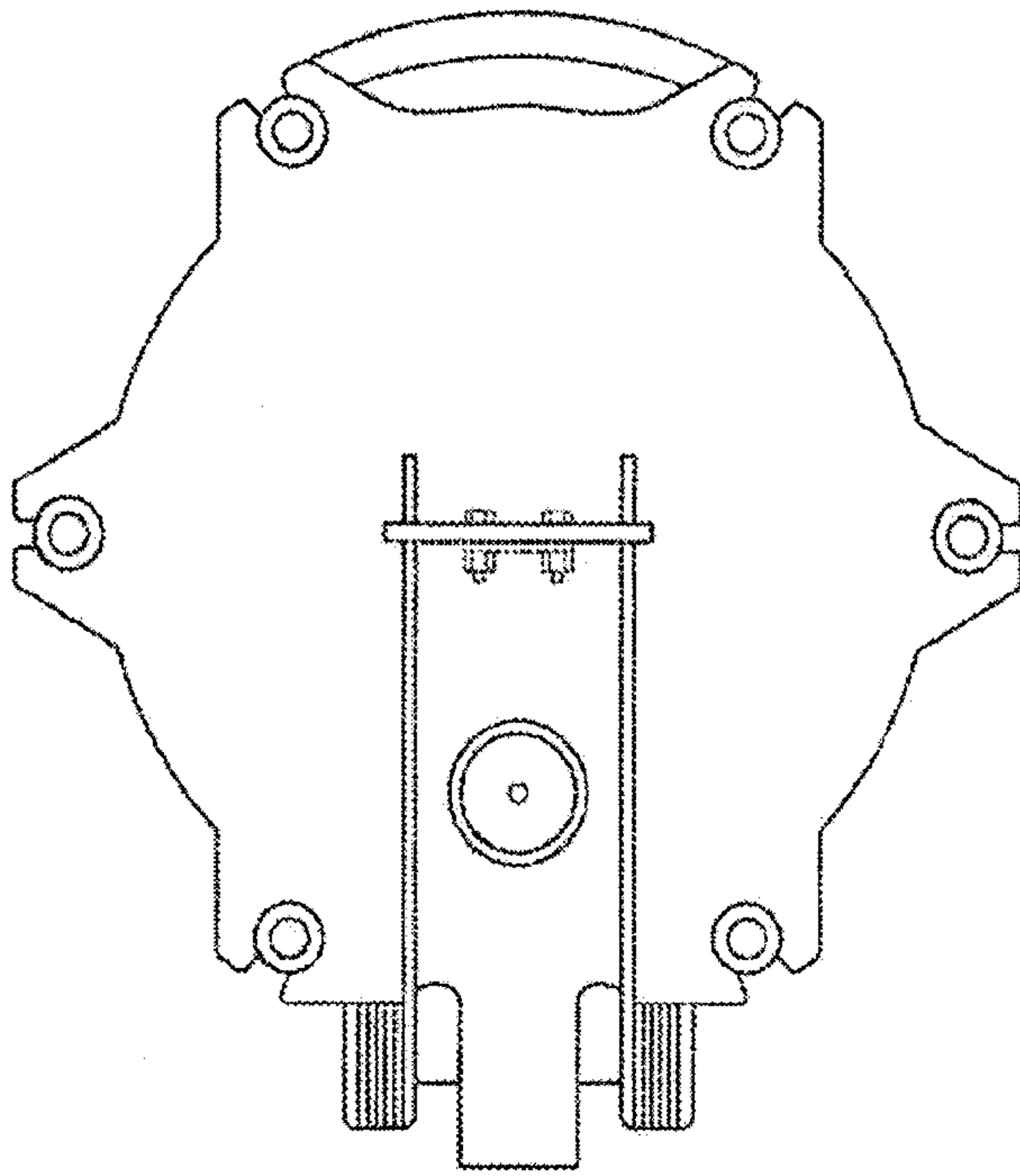


FIG. 3

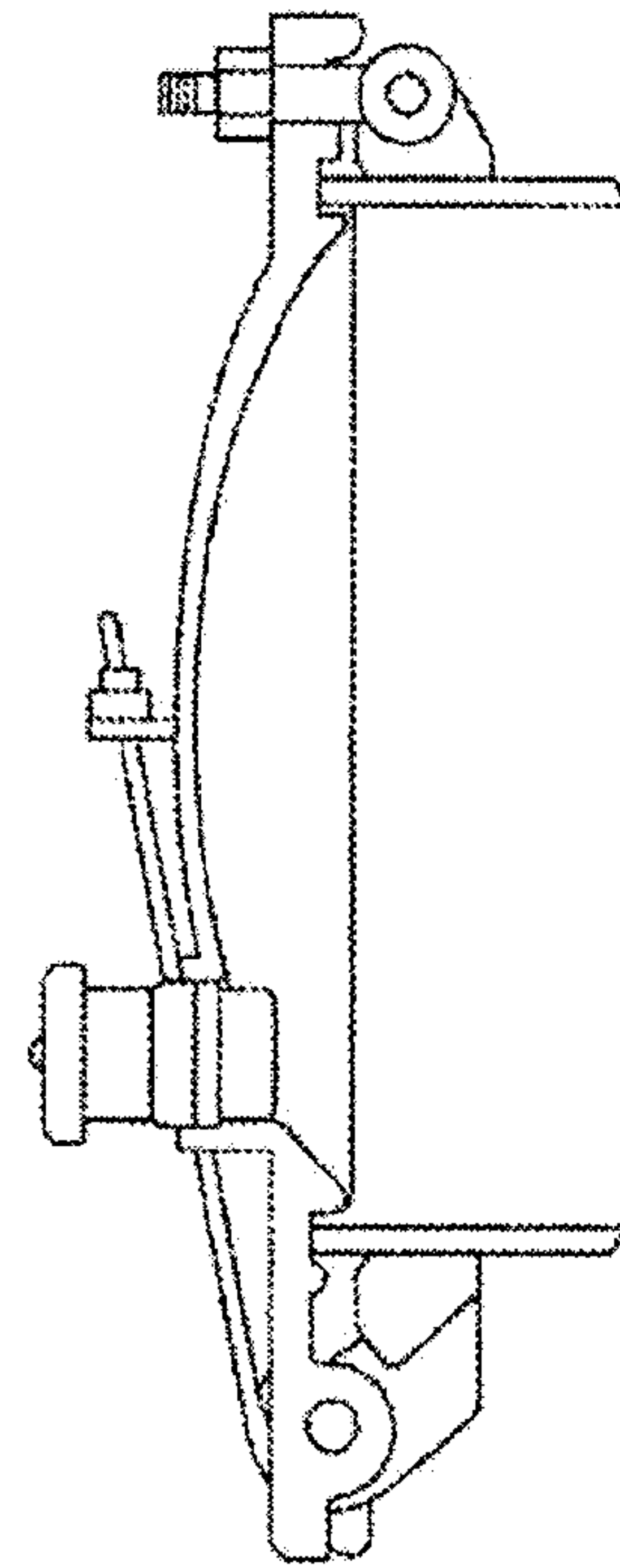


FIG. 4

**Top Specific Causes for Nonpressure Cars
2008 1st 7 Months**

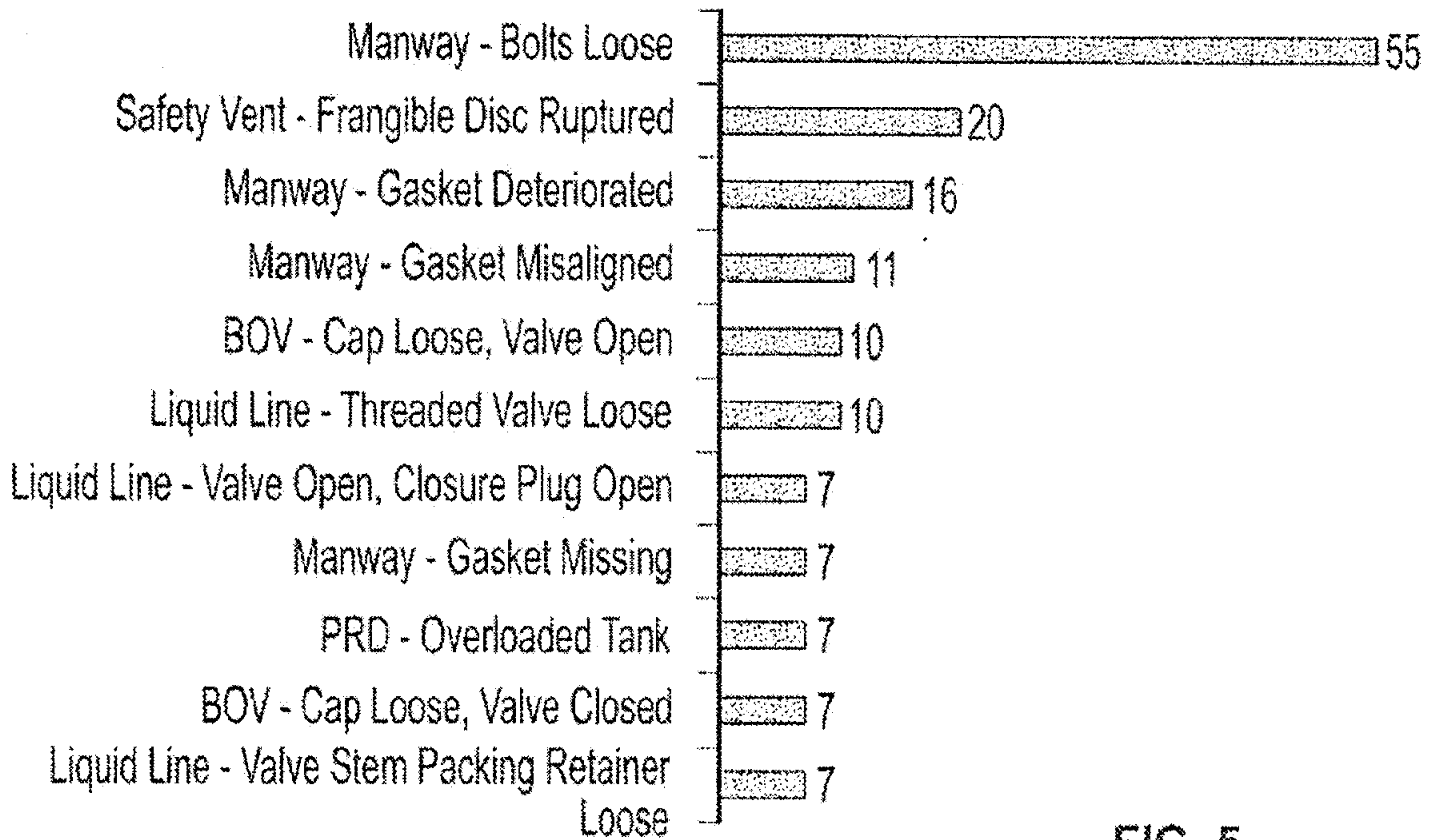


FIG. 5

**Top Specific Causes for Nonpressure Cars
2007**

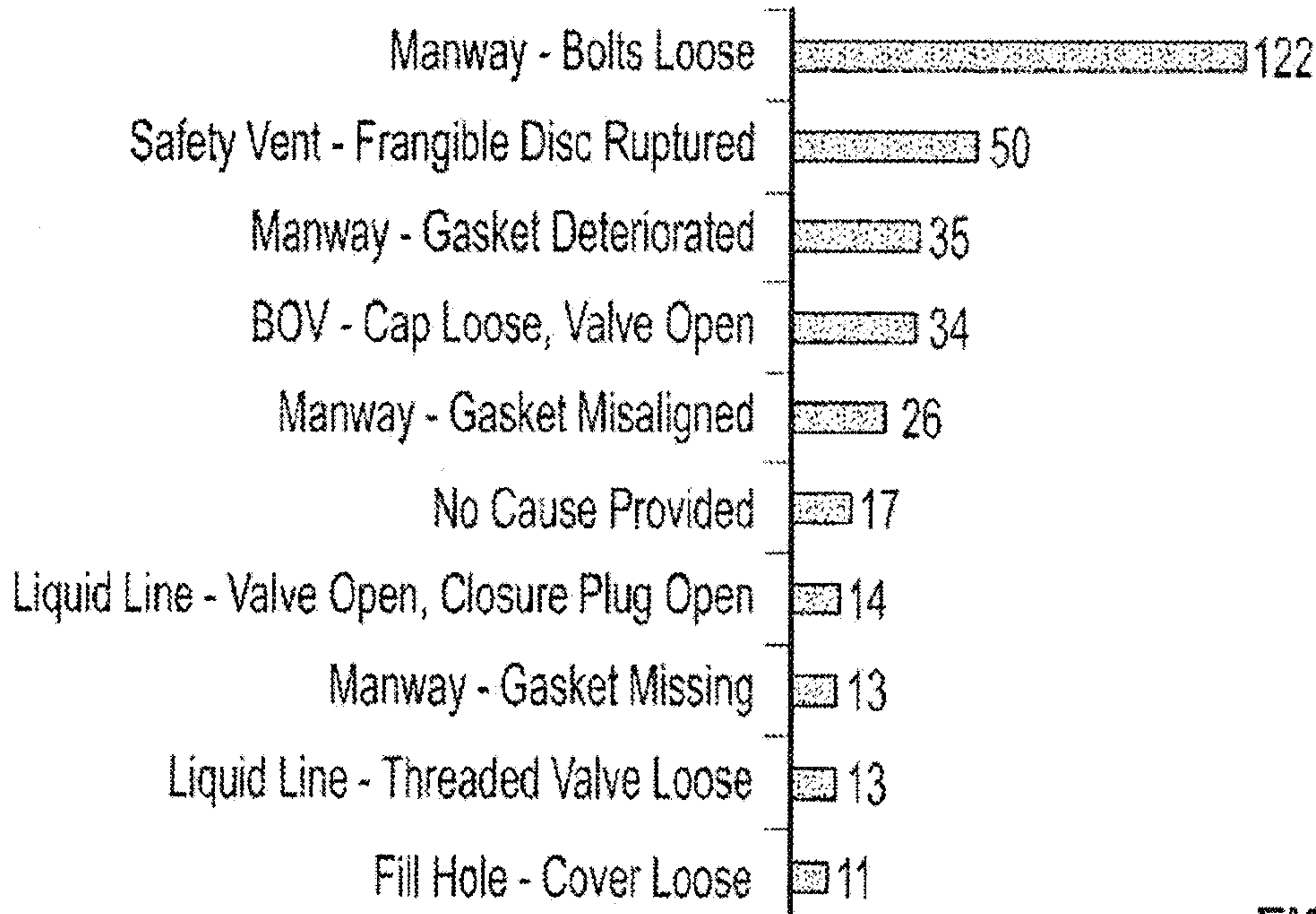


FIG. 6

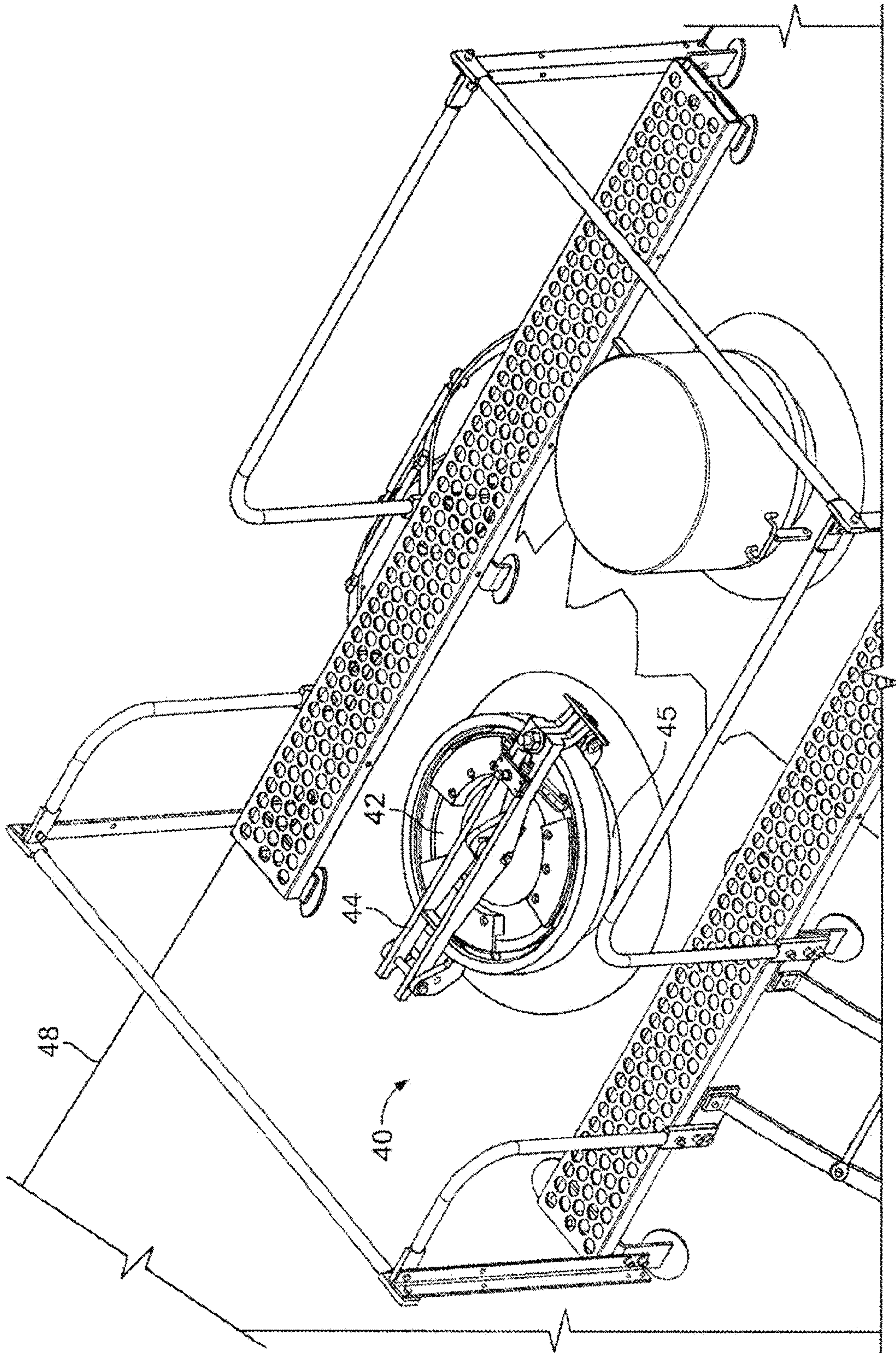


FIG. 7

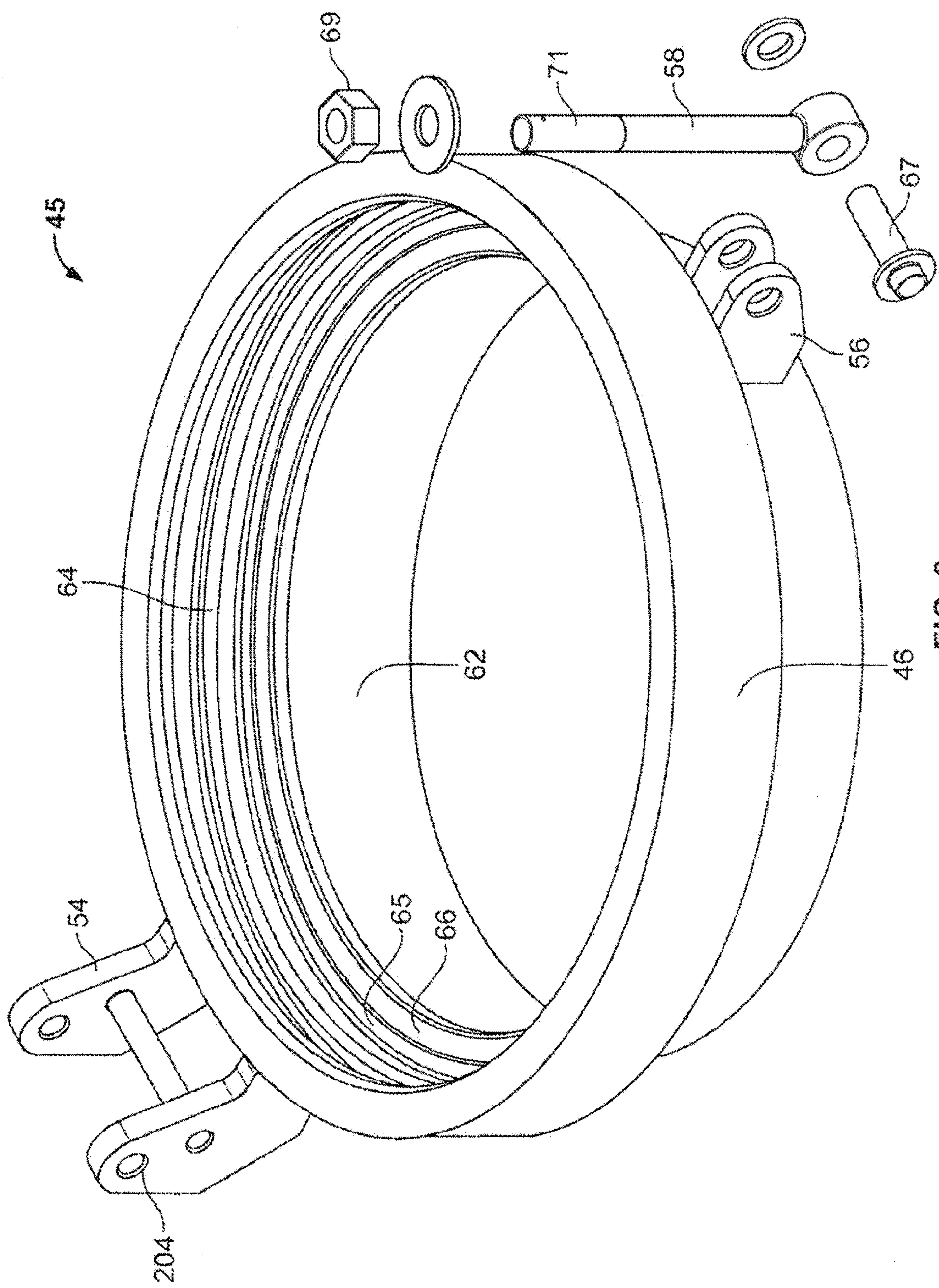


FIG. 8

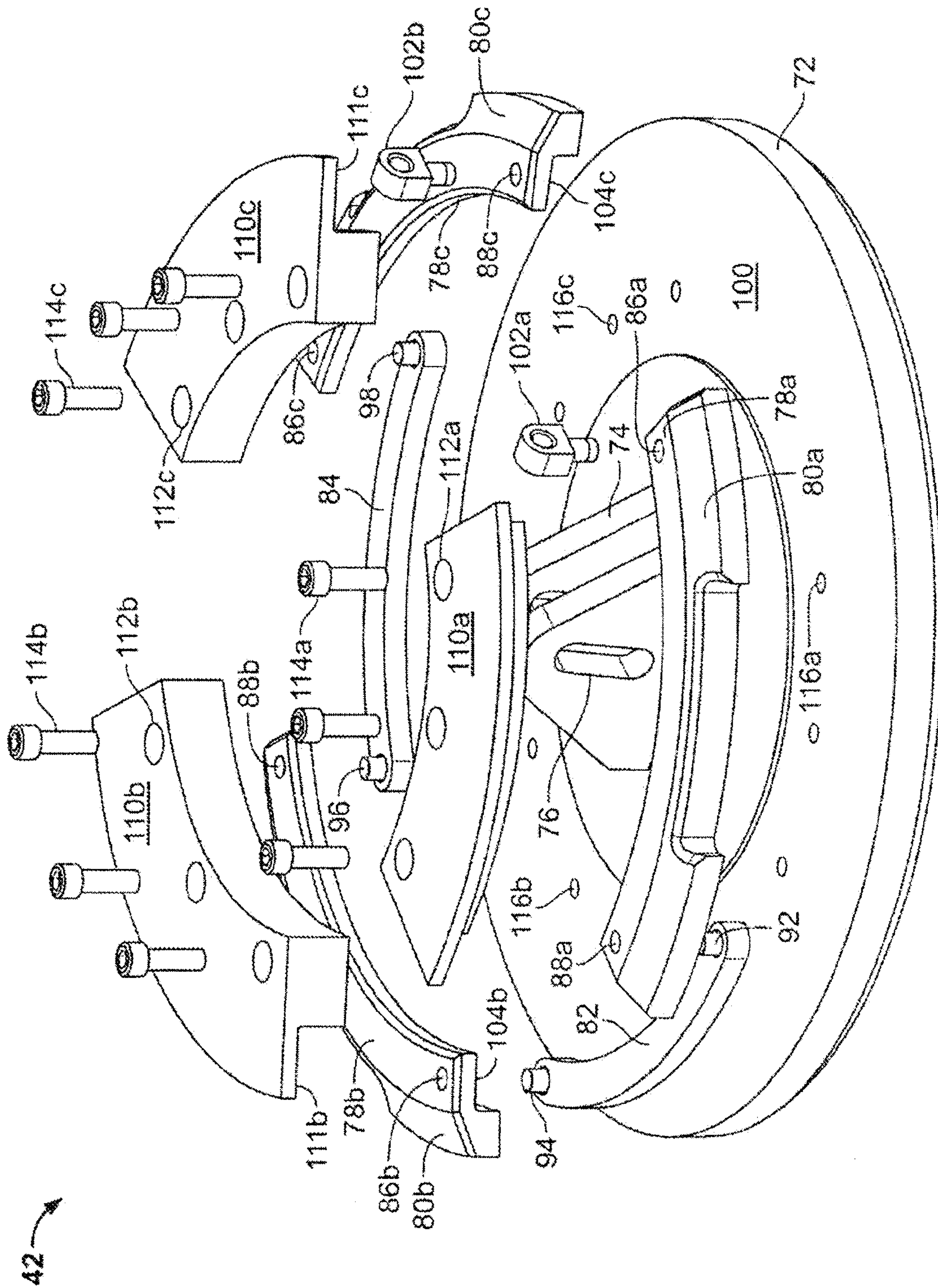


FIG. 9

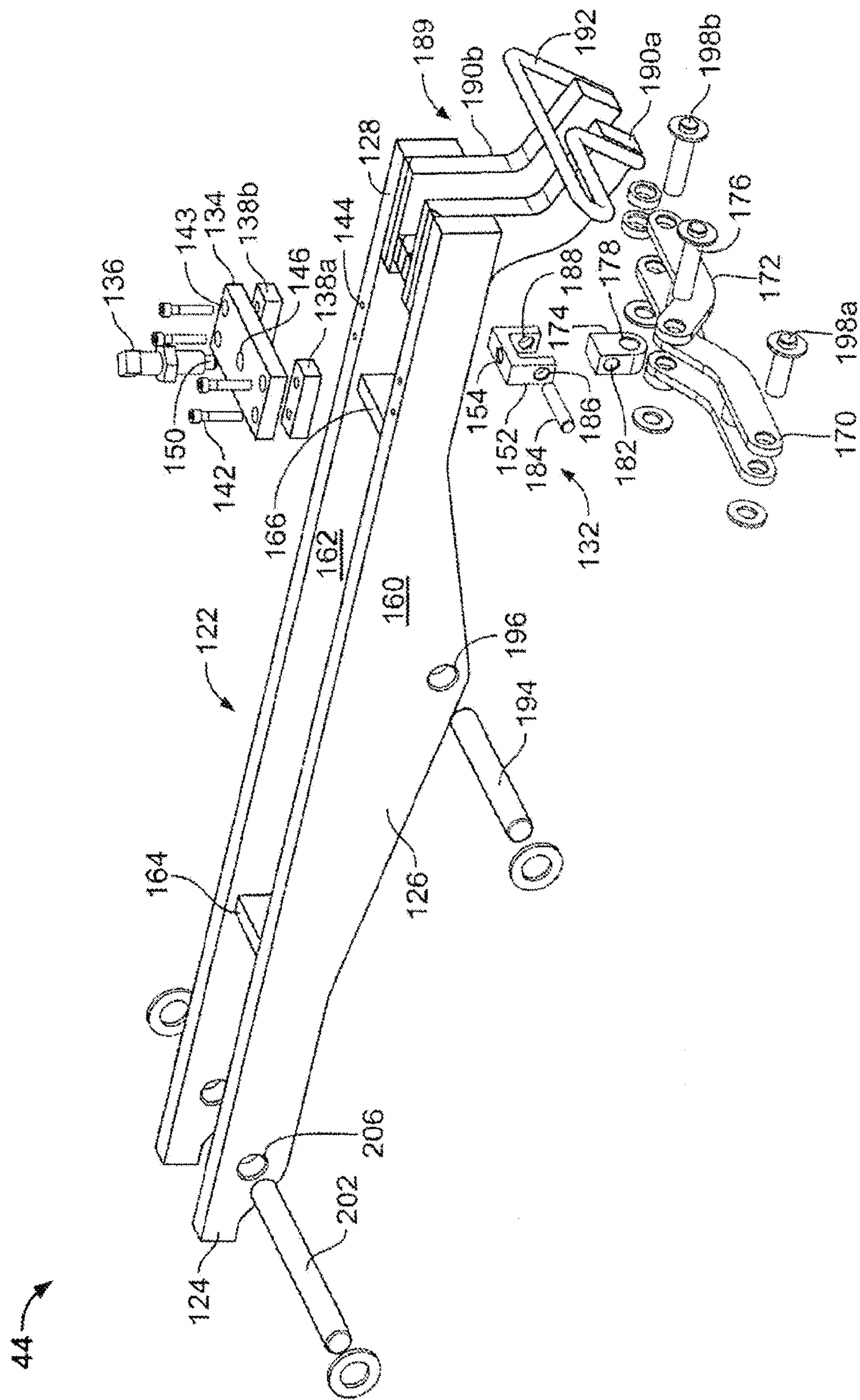


FIG. 10

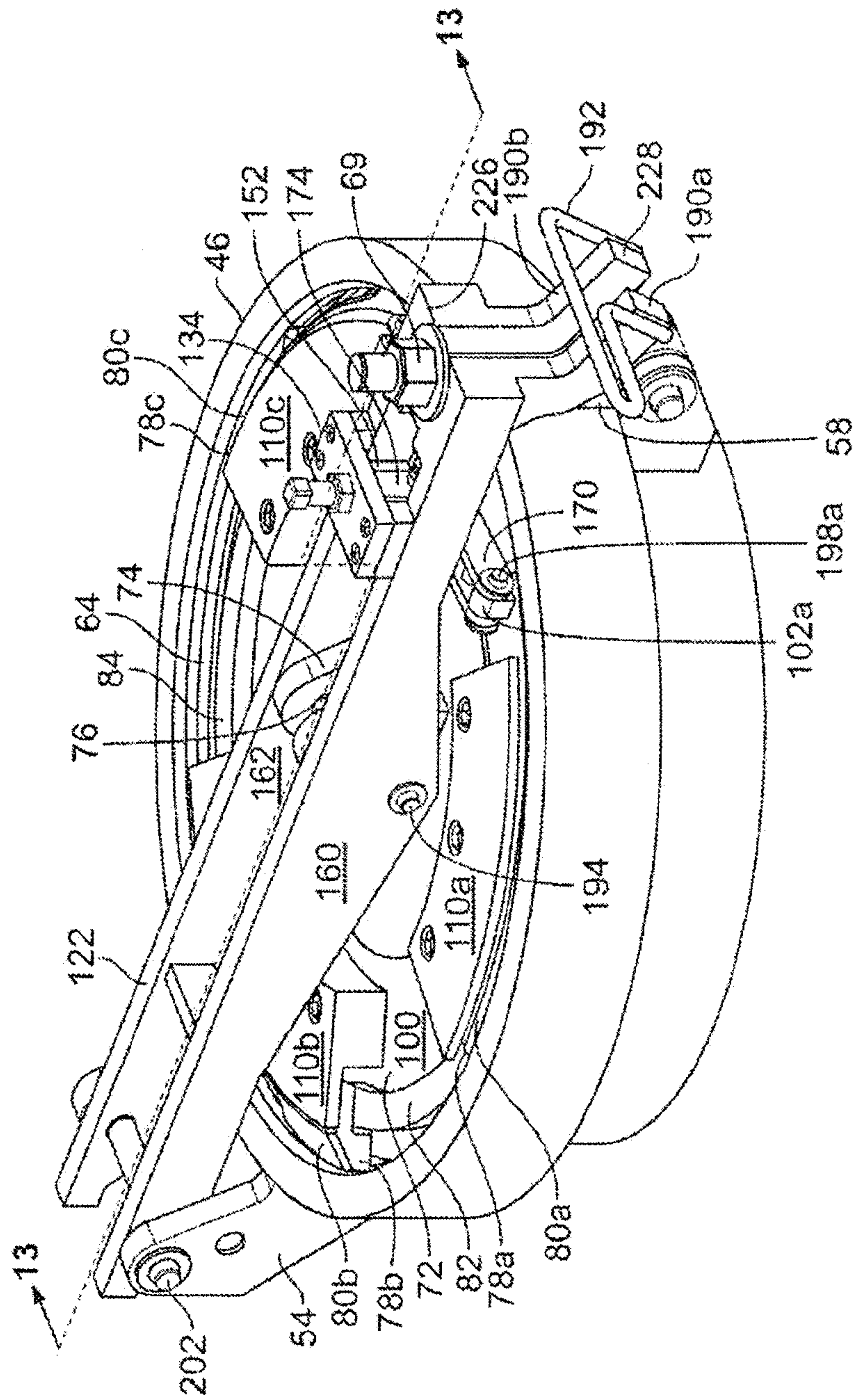


FIG. 12

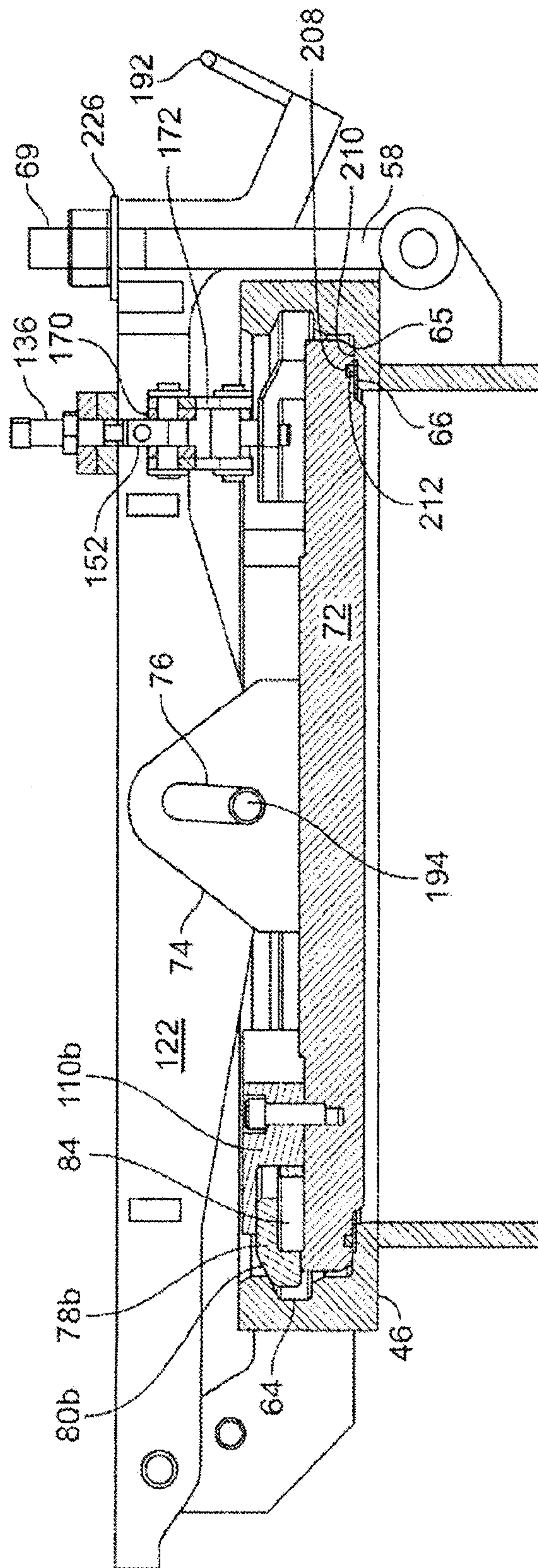


FIG. 13

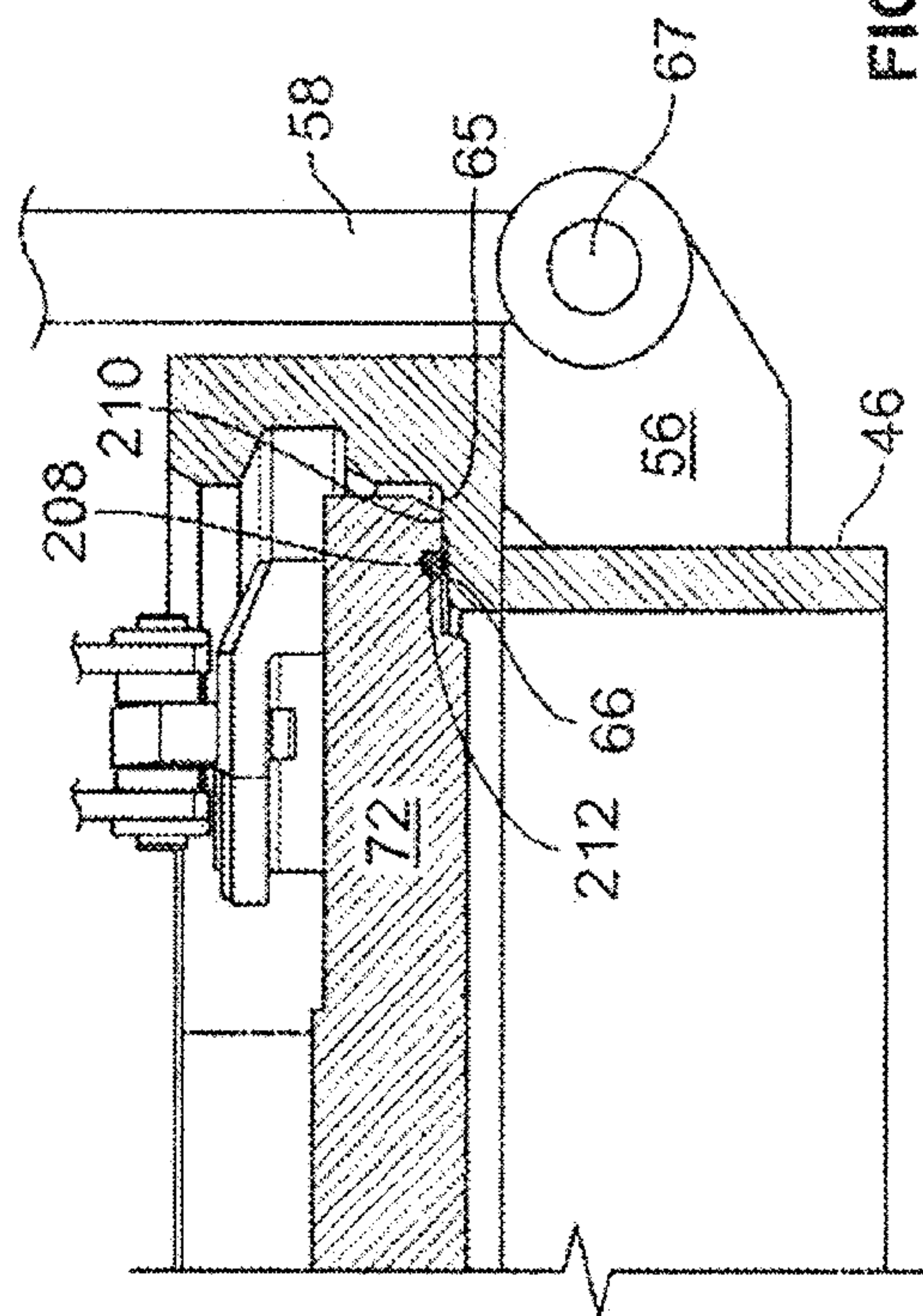
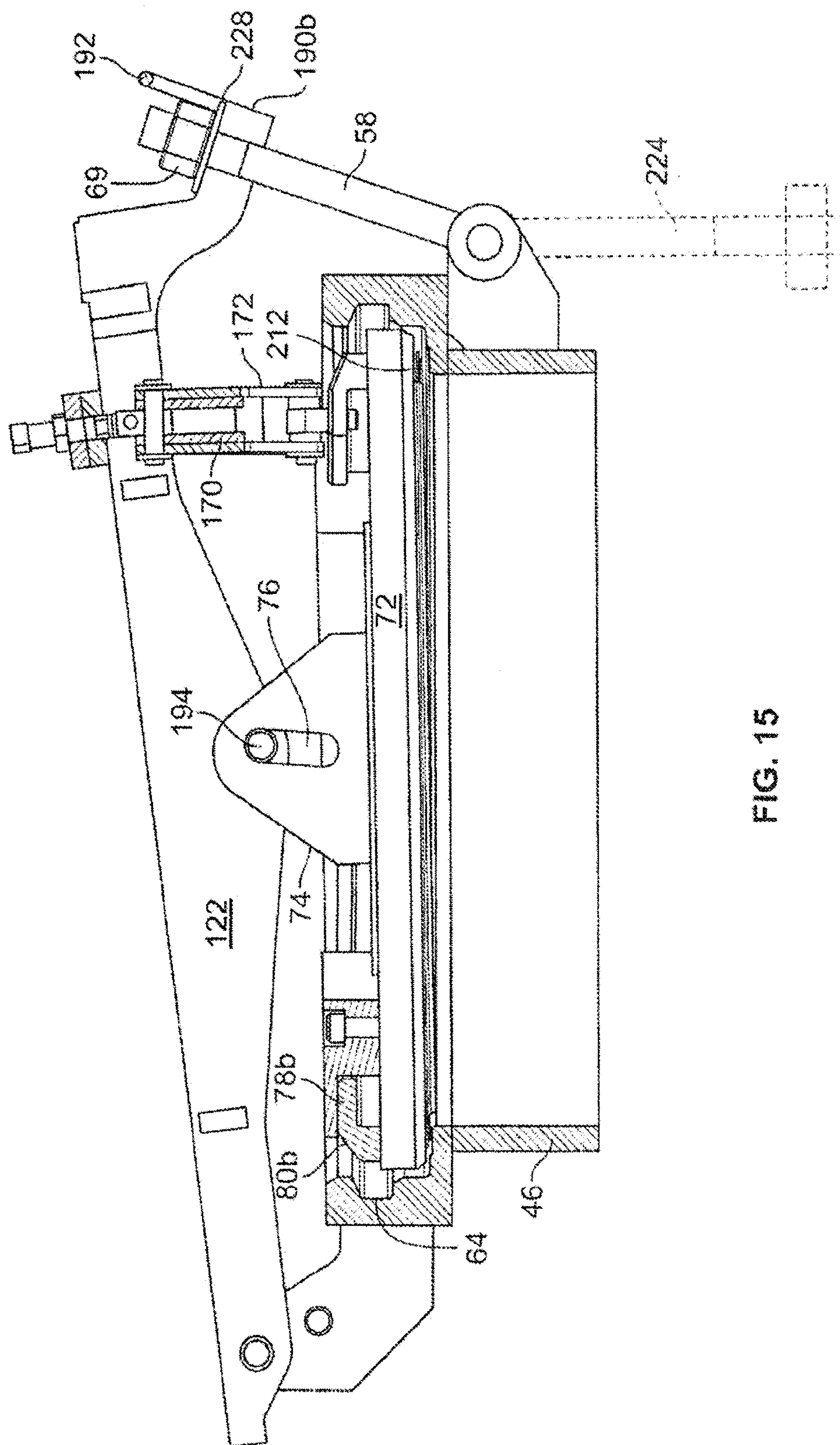


FIG. 14



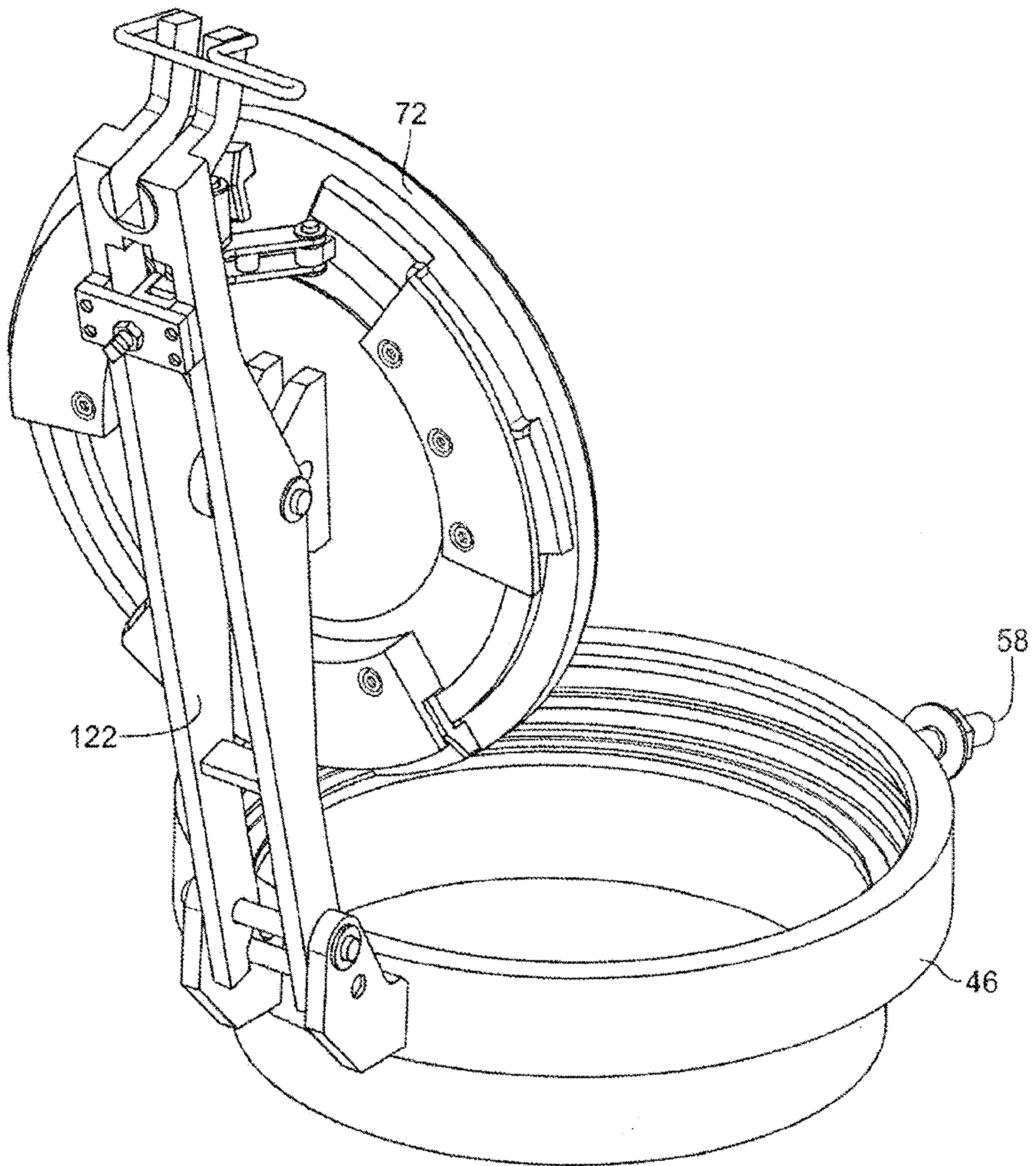
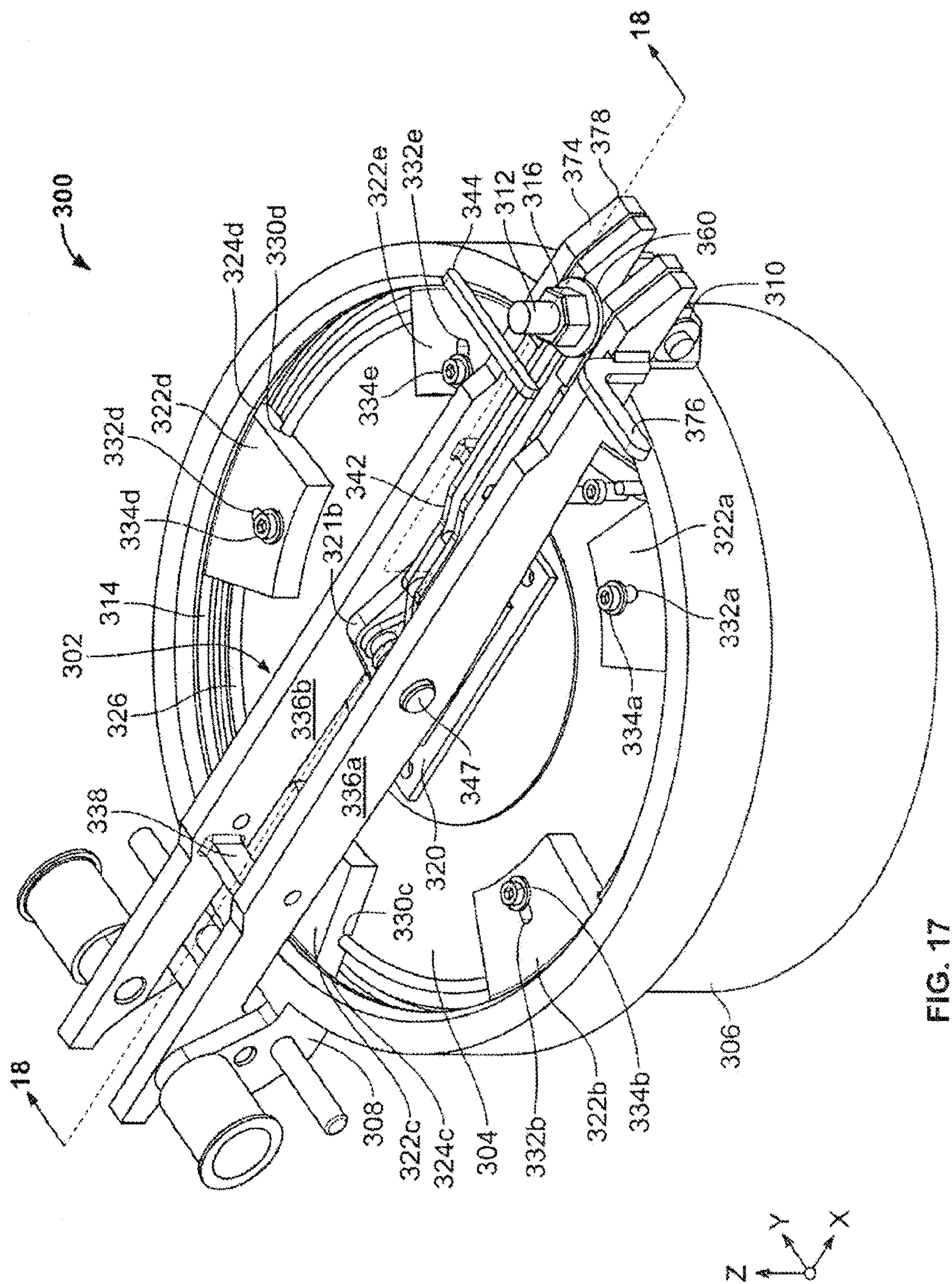


FIG. 16



A

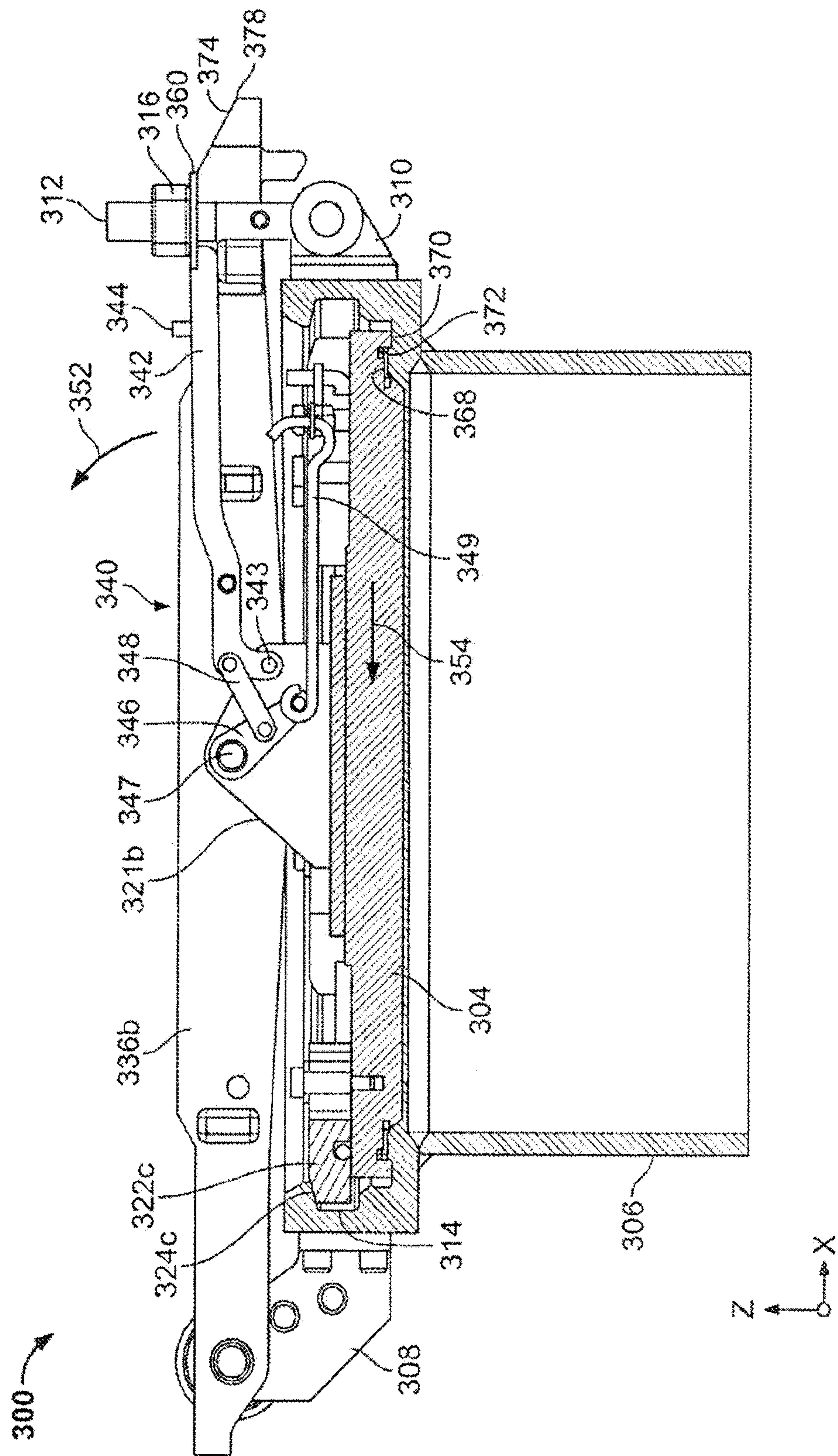


FIG. 18

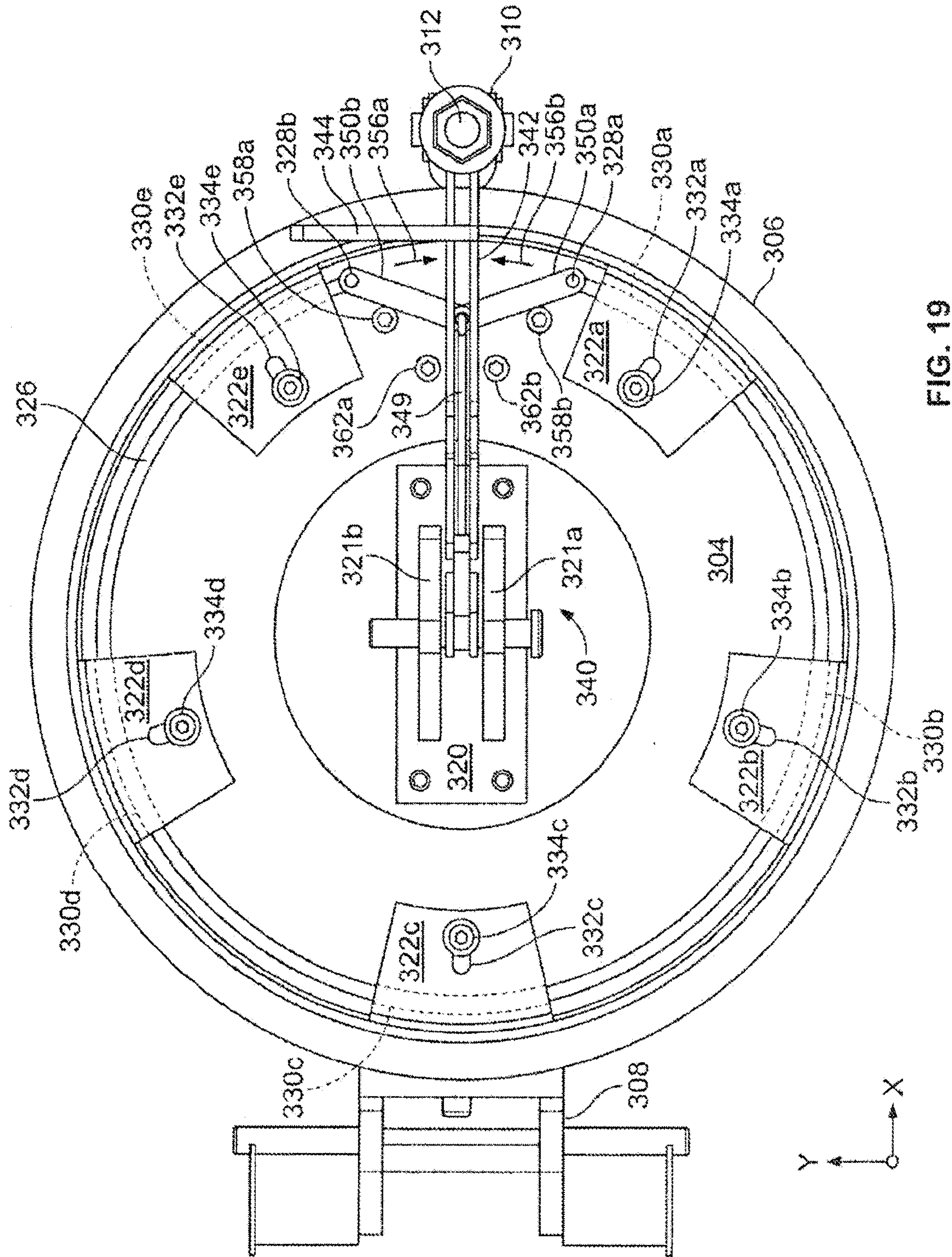
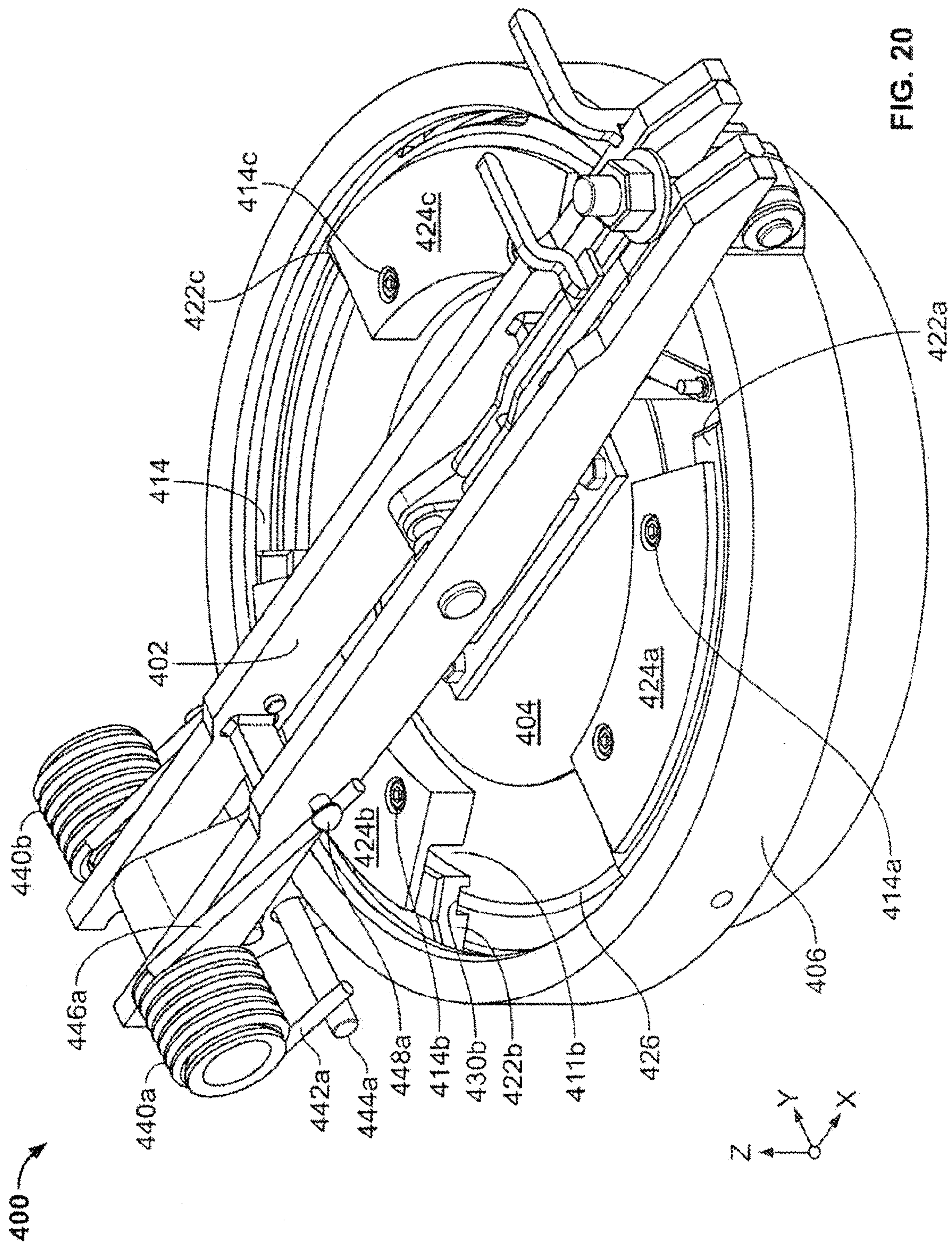


FIG. 19



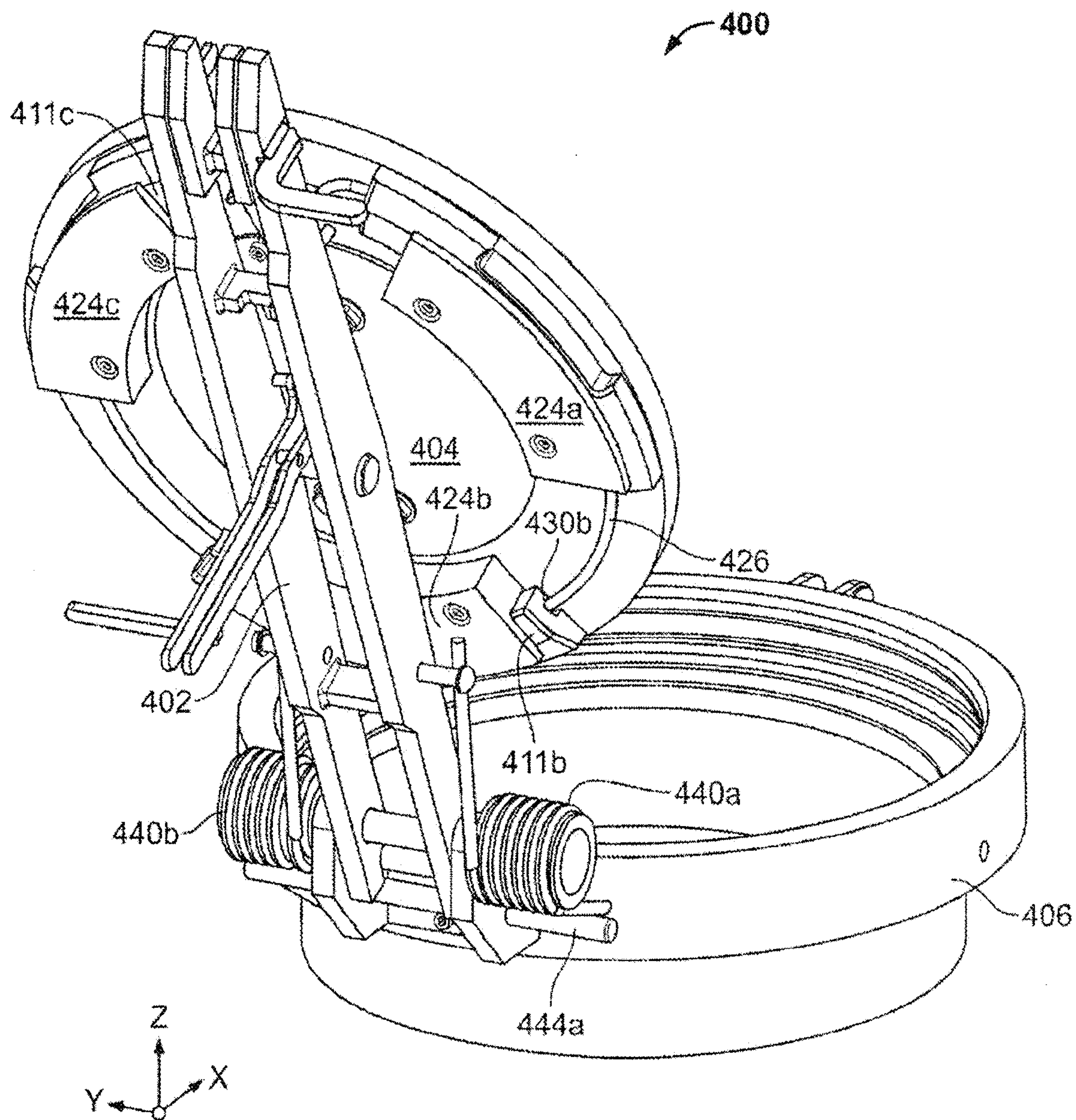


FIG. 21

