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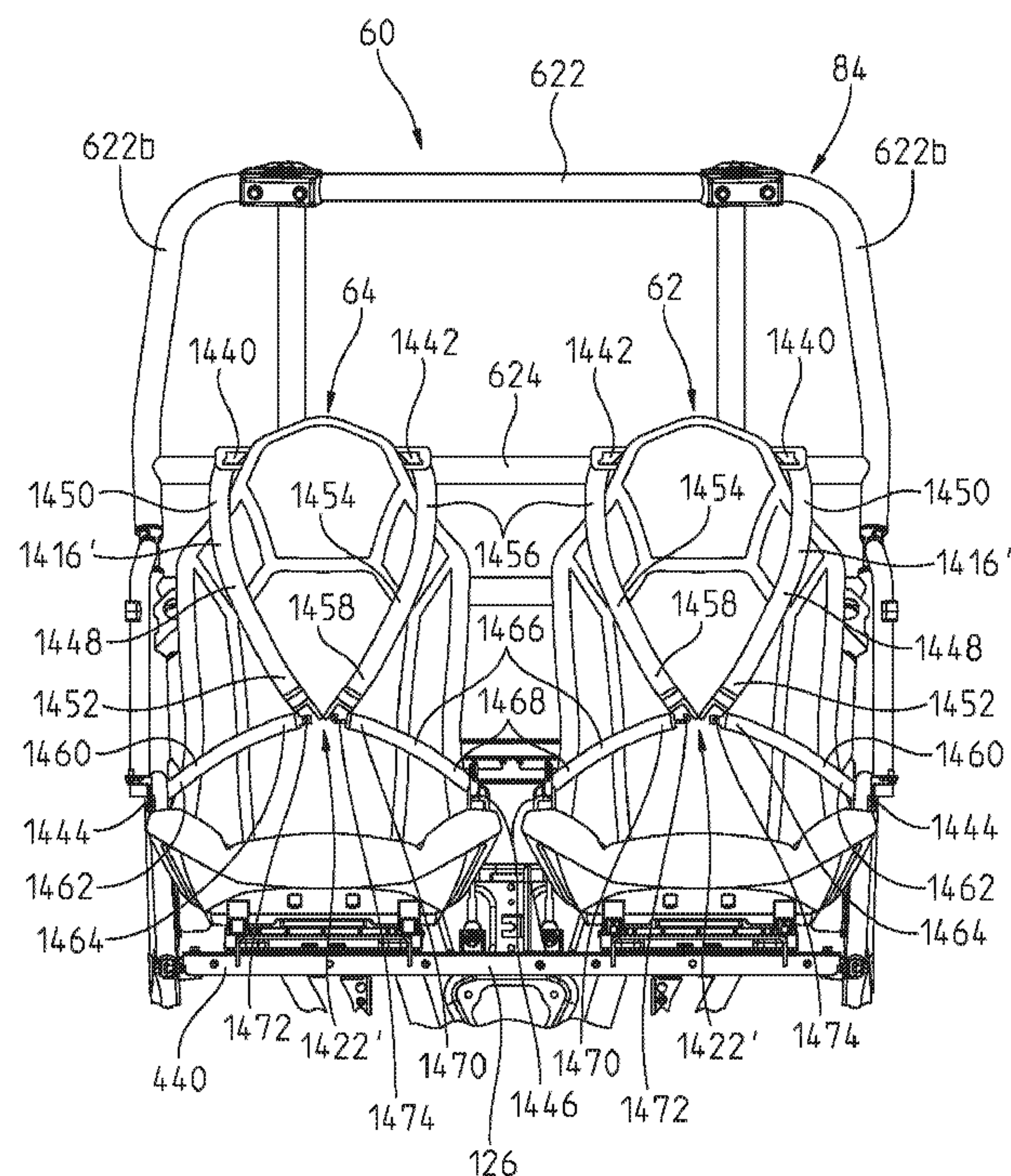
(71) Demandeur/Applicant:
POLARIS INDUSTRIES INC., US

(72) Inventeurs/Inventors:
DECKARD, AARON D., US;
SWAIN, PHILLIP B., US;
IVES, ANDY T., US;
HOUKOM, AUSTIN L., US;
PETERSON, SHAWN D., US;
STEINMETZ, GORDON J., US;
SCHLANGEN, ADAM J., US;
...

(74) Agent: SIM & MCBURNEY

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(72) **Inventeurs(suite)/Inventors(continued)**: ROYTEK, CORRIE S., US; GOFFMAN, DANIEL L., US; JOHNSON, CLINTON A., US; SCHLEIF, ANDREW C., US; FIELDS, JASON R., US; HANEGRAAF, THOMAS C., US; KASTANEK, JOHN A., US; ENDRIZZI, JAMES J., US; JAEGER, RICKY G., US; NYSSE, AARON J., US; NUGTEREN, DANIEL J., US; HURD, CHRIS J., US; CARRUTH, CURTIS C., US; STROBACH, DANIEL P., US

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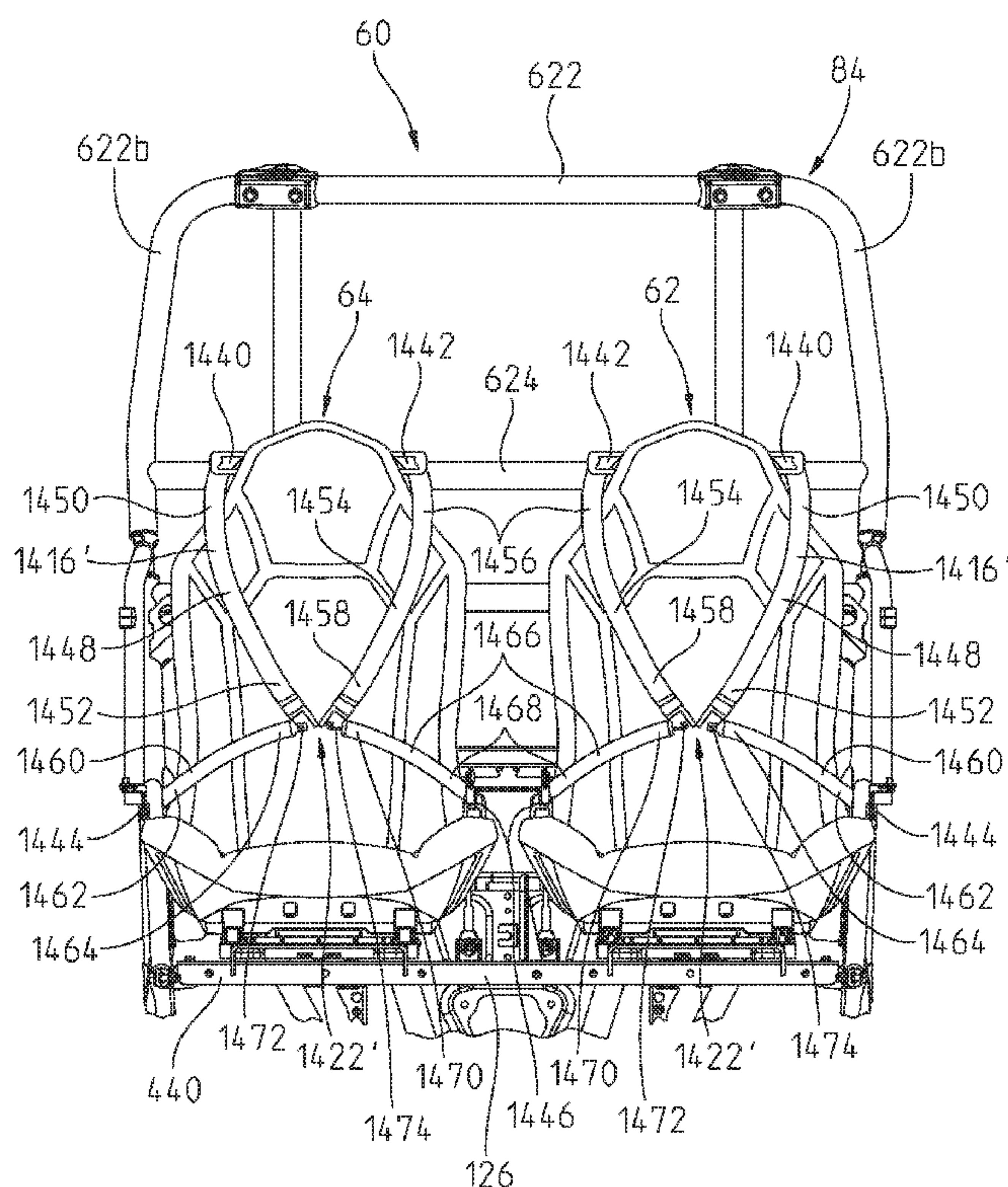
(71) Applicant: **POLARIS INDUSTRIES INC.** [US/US];
2100 Highway 55, Medina, MN 55340 (US).

(72) Inventors: **DECKARD, Aaron, D.**; 14834 Little Eagle
Creek Avenue, Zionsville, IN 46077 (US). **SWAIN, Phil-**

ip, B.; 542 Eagle Ridge Road, Woodbury, MN 55125 (US). **IVES, Andy, T.**; 4295 437th Street, Harris, MN 55032 (US). **HOUKOM, Austin, L.**; 4679 Empress Way North, Hugo, MN 55038 (US). **PETERSON, Shawn, D.**; 22848 Erskin Street Ne, East Bethel, MN 55005 (US). **STEINMETZ, Gordon, J.**; 9241 78th Street South, Cottage Grove, MN 55016 (US). **SCHLANGEN, Adam, J.**; 7874 475th Street, Rush City, MN 55069 (US). **ROYTEK, Corrie, S.**; 846 250th Street, Osceola, WI 54020 (US). **GOFFMAN, Daniel, L.**; 45 Tomahawk Trail, Cocolalla, ID 83813 (US). **JOHNSON, Clinton, A.**; 9739 240th Avenue, Elk River, MN 55330 (US). **SCHLEIF, Andrew, C.**; 31395 Gable Avenue, Stacy, MN 55079 (US). **FIELDS, Jason, R.**; 3860 88th Court NE, Circle Pines, MN 55014 (US). **HANEGRAAF, Thomas, C.**; 18466 Olson Street, Elk River, MN 55330 (US). **KASTANEK, John, A.**; 965A 143rd Street, Amery, WI 54001 (US). **ENDRIZZI, James, J.**; 4265 Lanewood Lane North, Plymouth, MN 55446 (US). **JAEGER, Ricky, G.**; 2169 84th

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- Avenue, Osceola, WI 54020 (US). **NYSSE, Aaron, J.**; 31945 Forest Boulevard, Stacy, MN 55079 (US). **NUGTEREN, Daniel, J.**; 15556 Empress Avenue, Unit 5, Hugo, MN 55038 (US). **HURD, Chris, J.**; 15172 French Drive North, Hugo, MN 55038 (US). **CAR-RUTH, Curtis, C.**; 9337 Ranchview Lane North, Maple Grove, MN 55369 (US). **STROBACH, Daniel, P.**; 2485 89th Avenue, Osceola, WI 54020 (US).

(74) **Agent: GROEN, Eric, J.**; Faegre Baker Daniels LLP, 300 North Meridian Street, Suite 2700, Indianapolis, IN 46204 (US).

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SIDE-BY-SIDE VEHICLE

[0001] This application claims priority to US Provisional Patent Application Serial Number 61/712,396 filed October 11, 2012 and Serial Number 61/829,743 filed May 31, 2013, the subject matter of which is incorporated herein by reference.

[0002] The present invention relates to side-by-side all terrain vehicles.

[0003] Generally, all terrain vehicles (“ATVs”) and utility vehicles (“UVs”) are used to carry one or two passengers and a small amount of cargo over a variety of terrains. Due to increasing recreational interest in ATVs, specialty ATVs, such as those used for trail riding, racing, and cargo hauling have entered the market place. Most ATVs include seating for up to two passengers which are either seated side-by-side or with the passenger positioned behind the driver of the ATV. Side-by-side ATVs, in which the driver and passenger are seated beside each other on laterally spaced apart seats, have become popular because of the ability to allow the passenger to share the driver’s viewpoint.

[0004] Some side-by-side ATVs are shown in US Patents 7,819,220 and 8,328,235; in US publication 2012/0031693; and in patent application serial number 61/712,396 filed October 11, 2012; the subject matter of each of which is incorporated herein by reference.

[0005] A utility vehicle, comprising a plurality of ground-engaging members; a frame supported by the ground-engaging members; a drivetrain supported by the frame; an operator’s area defined by side by side seats and operator controls; a cab frame covering the operators area and defined by at least first and second front support portions, at least first and second rear support portions, and longitudinally extending sections coupling the front and rear support portions; and the operator’s area having a driver seat having a driver restraint harness and a passenger seat having a passenger restraint harness, the driver seat and the passenger seat being in a side-by-side arrangement, the cab frame being configured to support a driver restraint harness for

the driver seat and a passenger restraint harness for the passenger seat, the driver and passenger restraint harnesses comprising a shoulder retractor coupled to the cab frame rearward of the respective driver and passenger seats.

[0006] According to an illustrative embodiment of the present disclosure, a utility
5 comprises a plurality of ground-engaging members; a frame supported by the ground-engaging members; a drivetrain supported by the frame; and an operator area having a seating portion supported by the frame. The seating portion includes a driver seat having a driver restraint harness and a passenger seat having a passenger restraint harness. The driver seat and the passenger seat are in a side-by-side arrangement.
10 The frame is configured to support a driver restraint harness for the driver seat and a passenger restraint harness for the passenger seat. The driver restraint harness is coupled to one of the driver seat and the frame in at least one of a first coupling location, a second coupling location, a third coupling location, a fourth coupling location, a fifth coupling location, and a sixth coupling location, and the passenger restraint
15 harness is coupled to one of the passenger seat and the frame in at least one of a first coupling location, a second coupling location, a third coupling location, a fourth coupling location, a fifth coupling location, and a sixth coupling location.

[0007] According to another embodiment of the present disclosure, a utility
vehicle comprises a plurality of ground engaging members; and a frame supported by
20 the ground engaging members. The frame includes a lower frame portion and a cab frame coupled to the lower frame portion to define an operator area. The utility vehicle further comprises a seating area supported within the operator area. The seating area includes a driver seat and a passenger seat in a side-by-side arrangement. The utility vehicle also comprises a first opening adjacent the driver seat and defined between the
25 lower frame portion and the cab frame for ingress and egress from the operator area; and a second opening adjacent the passenger seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area. Additionally, the utility vehicle comprises a first frame member that extends into the first opening and is removably coupled to at least one of the lower frame portion and the cab
30 frame; and a second frame member that extends into the second opening and is

removably coupled to at least one of the lower frame portion and the cab frame. The utility vehicle further comprises a first door extending across at least a portion of the first opening. The first door is coupled to the first frame member when the first frame member is coupled to at least one of the lower frame portion and the cab frame, and the
5 first door is coupled to at least one of the lower frame portion and the cab frame when the first frame member is removed from the utility vehicle. The utility vehicle also comprises a second door extending across at least a portion of the second opening. The second door is coupled to the second frame member when the second frame member is coupled to at least one of the lower frame portion and the cab frame, and the
10 second door is coupled to at least one of the lower frame portion and the cab frame when the second frame member is removed from the utility vehicle.

[0008] In another embodiment, a utility vehicle comprises a frame; ground engaging members supporting the frame; an operator's compartment; a powertrain; a rear utility bed positioned rearward of the operator's compartment; a bezel positioned
15 adjacent an upper edge of the rear utility bed and being coupled to and removable from the rear utility bed; and a conduit having a first end coupled to the powertrain and a second end coupled to the bezel; wherein air is delivered to the powertrain through the bezel and conduit to the powertrain.

[0009] In another embodiment, a utility vehicle comprises an operator's
20 compartment; at least one body panel member; a storage bin coupled to the body panel member, and having first and second enclosures, the first enclosure having a first panel with at least a partial transparent window.

[0010] In another embodiment, a utility vehicle comprises a frame; ground engaging members supporting the frame; an operator's compartment; a powertrain for
25 driving the ground engaging members; and a rear suspension comprising a trailing arm, the trailing arm being generally horizontally disposed.

[0011] In another embodiment, a utility vehicle comprises a frame; ground engaging members supporting the frame; an operator's compartment having at least

one seat comprised of a seat bottom and a seat back; and a fuel tank positioned under the seat and extending to a forward most position forward of a front of the seat bottom.

[0012] In another embodiment, a utility vehicle comprises a frame; ground engaging members supporting the frame; an operator's compartment; body panels at least partly defining the operator's compartment with seams of the body panels overlapping; a seat support frame positioned over the overlapping portion; and a seat coupled to the seat support frame.

[0013] In another embodiment, a bypass shock comprises an elongate shock cylinder having a substantially tubular shaped body having a tubular wall, the body having an upper end and a lower end, at least two channels extending within the tubular wall and between the upper and lower end, and each channel having a passageway communicating with an interior of the body, where a first of the passageways is closer to the upper end than a second of the passageways; a piston positioned in the body interior; a piston rod fixed to the piston and extending beyond one of the upper and lower ends; an upper cap enclosing the upper end; a lower cap enclosing the lower end; one of the upper and lower caps being provided with a first passage communicating with the first and second channels; a first check valve positioned in the first passage; and hydraulic fluid positioned in the cylinder between the piston and the cap containing the passage.

[0014] In another embodiment, a utility vehicle comprises a holder frame profiled to hold a spare tire and rim; clamps for attachment of the holder frame to the vehicle; and retaining members for coupling the holder frame to the clamps; whereby the retaining members may be removed to remove the holder frame from the vehicle leaving the clamps, or the retaining members on one side thereof may be removed, allowing the holder frame to pivot about a second side.

[0015] In another embodiment, a seat for a utility vehicle comprises a seat bottom including a first portion, a second portion, and a third portion; first portion intermediate second and third portions and has a generally flat orientation for supporting a driver; second and third portions are angled outwardly and upwardly relative to first portion in

order to retain the operator and passenger on seat bottoms during operation of the vehicle; the first, second and third portions having an inner layer surrounded by a waterproof outer cover; and an outer covering surrounding the outer cover.

[0016] In another embodiment, a coupling assembly comprises a washer; a deformable shank having a head, a body portion and deformable wings; and fasteners.

[0017] In another embodiment, a vehicle comprises a frame; and a suspension having lower alignment arms and upper alignment arms, having arms where arm includes a radiused portion projecting an arm portion in a relatively horizontal position, the radiused portion defining a predefined buckling point in the suspension, where the alignment arm buckles rather than damaging the frame.

[0018] In another embodiment, a utility vehicle, comprises longitudinally extending main frame tubes; front frame tubes; a U-shaped frame tube; frame tubes; suspension mounts coupled to the longitudinally extending main frame tubes, wherein front frame tubes are coupled to the U-shaped frame tube at a rearward end and to the longitudinally extending main frame tubes at a forward end, and the frame tubes are coupled to the U-shaped frame tube at a forward end and extend rearwardly; a front shock mounting bracket coupled to the U-shaped frame tube; suspension arms coupled to the suspension mounts; and a shock absorber coupled between the front shock mounting bracket and the suspension arms.

[0019] In another embodiment, a utility vehicle comprises a frame; side by side seats coupled to the frame and positioned in an operator's area; floor board panels positioned below and forward of the side by side seats; at least one a drain positioned in one of the floorboards and having a drain opening to allow fluids, dirt, and debris to exit the operator area when drain is open; and a cap that is removably coupled to the floor board panels.

[0020] In another embodiment, a utility vehicle comprises a frame; an engine; an air intake system communicating air into the engine; dual bore throttle body couple between the air intake system and the engine; an operator control for supplying fuel and

air to the engine; and an electronic throttle control system (1640) coupled to the operator control and electronically controlling the dual bore throttle body.

[0021] In another embodiment, a utility vehicle comprises a plurality of ground engaging members; a frame supported by the ground engaging members and including a lower frame portion and a cab frame coupled to the lower frame portion to define an operator area; a seating area supported within the operator area and including a driver seat and a passenger seat in a side-by-side arrangement; a first opening adjacent the driver seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area; a second opening adjacent the passenger seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area; a first door extending across at least a portion of the first opening, the first door being coupled to the frame; a second door extending across at least a portion of the second opening, the second door being coupled to the; and the first and second doors being bowed outwardly and away from the seats to increase the room in the seating area.

[0022] In another embodiment, a utility vehicle comprises a first plurality of ground engaging members; a second plurality of ground engaging members; a frame having at least one elongate frame tube assembly comprised of plural sections, the frame supported by the first plurality of ground engaging members and the second plurality of ground engaging members, the plural sections including first frame tubes extending in a generally longitudinal direction, and second frame tubes being angled relative the longitudinal direction; a drive train supported by the frame; a frame tube coupler removably coupling the frame tube sections at a longitudinal position from either end of the frame and between the first plurality of ground engaging members and the second plurality of ground engaging members, wherein the frame tube coupler includes two interengaging coupler members, each coupler member comprising an angled shank portion and a front face, the interengaging sections connecting to each other to couple the frame tube sections, each interengaging section comprising a complementary projection and a recess, the recess being spaced apart from the projection, wherein the projection and the recess are both on a first side of the interengaging section, wherein

the projection of each of the interengaging sections is profiled for receipt within the recess of the other of the interengaging sections and the first side of one of interengaging coupler member faces the first side of the other interengaging coupler member when the projection of each of the interengaging sections is received within the
5 recess of the other of the interengaging sections.

[0023] In another embodiment, a utility vehicle comprises a frame; a cab frame enclosing a portion of the frame, and including front frame portions and rear frame portions; a visor coupled to the front frame portions; and a windshield assembly coupled to the front frame portions of the cab frame and positioned adjacent to the visor.

10 **[0024]** In another embodiment, a utility vehicle comprises a frame; a cab frame enclosing a portion of the frame, and including front frame portions and rear frame portions; and a windshield assembly coupled to the front frame portions of the cab frame, the windshield assembly comprises a windshield and a clamp assembly clamping the windshield to the front frame portions of the cab frame.

15 **[0025]** The above mentioned and other features of this invention, and the manner of attaining them, will become more apparent and the invention itself will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, where:

[0026] FIG. 1 shows a front left perspective view of the vehicle of the present
20 disclosure;

[0027] FIG. 2 shows a rear right perspective view of the vehicle of FIG. 1;

[0028] FIG. 3 shows a left side view of the vehicle of FIG. 1;

[0029] FIG. 4 shows a right side view of the vehicle of FIG. 1

[0030] FIG. 5 shows a top view of the vehicle of FIG. 1;

25 **[0031]** FIG. 6 shows a bottom view of the vehicle of FIG. 1;

- [0032] FIG. 7 shows a front view of the vehicle of FIG. 1;
- [0033] FIG. 8 shows a rear view of the vehicle of FIG. 1;
- [0034] FIG. 9 shows a front left perspective view of the vehicle frame;
- [0035] FIG. 10 shows a rear right perspective view of the vehicle frame;
- 5 [0036] FIG. 11 shows a top view of the vehicle frame;
- [0037] FIG. 12 is a view similar to that of FIG. 9 showing the cab frame removed;
- [0038] FIG. 13 is a rear right perspective view of the vehicle frame of FIG. 12;
- [0039] FIG. 14 is a left front perspective view of the vehicle frame of FIG. 12 in an exploded manner;
- 10 [0040] FIG. 14A shows an enlarged fragmented view of a portion of the vehicle frame of FIG. 14;
- [0041] FIG. 15 is a rear right perspective view of the vehicle frame of FIG. 14;
- [0042] FIG. 16 shows a front left perspective view of a first portion of the vehicle frame of FIG. 12;
- 15 [0043] FIG. 16A shows an enlarged fragmented view of a portion of the vehicle frame of FIG. 16;
- [0044] FIG. 17 is a rear right perspective view of the frame portion of FIG. 16;
- [0045] FIG. 18 shows a left front perspective view of the vehicle frame rear portion;
- 20 [0046] FIG. 19 shows a right rear perspective view of the vehicle frame portion of FIG. 18;

[0047] FIG. 20 shows an underside perspective view of the rear frame portion showing the rear suspension mount;

[0048] FIG. 21 shows a front left perspective view of the front and rear portions of the vehicle frame being coupled together;

5 **[0049]** FIG. 22 shows the frame portions of FIG. 20 coupled together, and an auxiliary side frame;

[0050] FIG. 23 shows a perspective view of the couplers that retain the side frame of FIG. 22 in position;

10 **[0051]** FIG. 24 is a cross-sectional view through lines 24-24 of FIG. 21, with the retainers in a pre-locked position;

[0052] FIG. 25 shows the cross-sectional view of FIG. 24 with the retainers in the locked position;

[0053] FIG. 26 shows a front left perspective of the cab frame;

[0054] FIG. 27 shows a rear right perspective view of the cab frame;

15 **[0055]** FIG. 28 shows a view similar to that of FIG. 26 showing the cab frame components in an exploded manner;

[0056] FIG. 29 shows a rear left perspective view of the vehicle rear suspension;

[0057] FIG. 30 shows a rear underside perspective view of the rear suspension shown in FIG. 29;

20 **[0058]** FIG. 31 shows the rear suspension of FIG. 29 exploded from the rear frame portion.

[0059] FIG. 32 shows the rear suspension in an exploded manner;

[0060] FIG. 32A shows a perspective view of the trailing arm of the rear suspension;

- [0061] FIG. 32B is a top view of the trailing arm of FIG. 33A;
- [0062] FIG. 32C is an inside view of the trailing arm of FIG. 33A;
- [0063] FIG. 32D shows an exploded view of the trailing arm of FIG. 33A;
- [0064] FIG. 32E shows the shock coupling brackets for the trailing arm of FIG.
5 33D;
- [0065] FIG. 33 shows a side view of the rear suspension;
- [0066] FIG. 34 shows a front left perspective view of the power train as installed
in the frame;
- [0067] FIG. 35 shows a view similar to that of FIG. 34 including the air intake
10 system;
- [0068] FIG. 36 is a top view of the engine intake and exhaust systems;
- [0069] FIG. 37 is a perspective of the air intake system;
- [0070] FIG. 38 is an exploded view of the air filter of the air intake system of FIG.
37;
- 15 [0071] FIG. 39 shows the air inlet for the CVT air intake system of FIG. 35;
- [0072] FIG. 39A shows an alternate air inlet for the CVT air intake system of FIG.
35;
- [0073] FIG. 40 shows a perspective view similar to that of FIG. 34 and including
the exhaust system;
- 20 [0074] FIG. 41 shows a perspective view of the exhaust system;
- [0075] FIG. 42 shows a rear perspective view of the exhaust system;

- [0076]** FIG. 43 shows an exploded and perspective view of the engine exhaust system;
- [0077]** FIG. 44 shows a rear perspective view of the frame and power train and including the engine cooling system;
- 5 **[0078]** FIG. 44A is an enlarged view of a retaining clip for the water cooling hoses;
- [0079]** FIG. 44B shows a perspective view of the retaining clip of FIG. 44A in an exploded manner;
- [0080]** FIG. 45 shows a front view of the vehicle grill;
- 10 **[0081]** FIG. 46 shows a rear perspective view of the grill of FIG. 45 and including the radiator and shroud;
- [0082]** FIG. 47 shows an exploded view of the assembly shown in FIG. 46;
- [0083]** FIG. 48 shows a front view of the radiator and shroud;
- [0084]** FIG. 49 is a front perspective view of the front suspension;
- 15 **[0085]** FIG. 49A is a view similar to that of FIG. 49 showing the components of the front suspension exploded;
- [0086]** FIG. 49B is a front left perspective view of a front suspension similar to that described in FIG 49, having a torsion bar;
- [0087]** FIG. 50 is a front view of the vehicle frame and front suspension;
- 20 **[0088]** FIG. 51 is a rear left perspective view of the front left suspension;
- [0089]** FIG. 52 shows a front perspective view of the upper alignment arm of the front suspension;

[0090] FIG. 53 shows a rear perspective view of the upper alignment arm of the front suspension;

[0091] FIG. 54 shows a top view of the braking system;

[0092] FIG. 55 is front elevational view of a seating area having a driver seat and a passenger seat of the vehicle of the present invention;

[0093] FIG. 56 is a top elevational view of a seat bottom of the driver seat of FIG. 55;

[0094] FIG. 57 is a cross-sectional view of the seat bottom of FIG. 56;

[0095] FIG. 57A is a cross-sectional view of an alternate seat bottom to that of FIG 56;

[0096] FIG. 58 is a rear perspective view of the driver seat of FIG. 55, including a seat frame and a seat base member;

[0097] FIG. 59 is a rear exploded view of the driver seat and seat frame of FIG. 58;

[0098] FIG. 60 is a front exploded view of the driver and passenger seats and base members of FIG. 58, and a seat mounting bracket of the frame;

[0099] FIG. 61 is a front exploded view of the driver seat, passenger seat, and seat mounting bracket of FIG. 60, including an alternative embodiment of the base members;

[00100] FIG. 61A is a rear perspective view of a bottom side of the base member of FIG. 61;

[00101] FIG. 61B is a rear perspective view of the top side of the base member of FIG. 61, showing the travel of a plate of the base member relative to the frame of the base member;

[00102] FIG. 61C is a cross-sectional view of the seat frame and the base member of FIG. 61;

[00103] FIG. 62 is a front exploded view of the driver and passenger seats and seat mounting bracket of FIG. 61, including an alternative embodiment of the base member;

[00104] FIG. 62A is a cross-sectional view of the seat frame and the base member of an alternative embodiments;

[00105] FIG. 63 is a front elevational view of the seating area, showing the driver seat and the passenger seat having seat belts;

10 **[00106]** FIG. 64 is a front elevational view of the seating area of FIG. 63, showing the driver seat and the passenger seat with an alternative embodiment of the seat belts;

[00107] FIG. 65 is a front elevational view of the seating area of FIG. 64, showing the driver seat and the passenger seat with a further alternative embodiment of the seat belts;

15 **[00108]** FIG. 66 is a front elevational view of the seating area of FIG. 65, showing the driver seat and the passenger seat with another alternative embodiment of the seat belts;

[00109] FIG. 67 is a side perspective view of a door assembly of the vehicle of the present invention;

20 **[00110]** FIG. 68 is an exploded view of the door assembly of FIG. 67;

[00111] FIG. 69 is an exploded view of a frame, a hinge assembly, and a latch assembly of the door assembly of FIG. 68;

[00112] FIG. 70 is an exploded view of an alternative embodiment of the door assembly of FIG. 67;

[00113] FIG. 71 is a side perspective view of an alternative embodiment of the door assembly of FIGS. 67 and 70;

[00114] FIG. 72 is a top elevational view of the door assembly;

[00115] FIG. 73 is a cross-sectional view of a frame tube of a cab frame section of the vehicle of the present invention;

[00116] FIG. 74 is a rear perspective view of a passenger grab bar;

[00117] FIG. 75 is an exploded view of the passenger grab bar of FIG. 74;

[00118] FIG. 76 is a cross-section view of the passenger grab bar of FIG. 74;

[00119] FIG. 77 is a rear perspective view of the operator area of the vehicle of the present invention, including a steering wheel assembly, the passenger grab bar of FIG. 74, and operator controls;

[00120] FIG. 78 is a side view of the steering wheel assembly of FIG. 77;

[00121] FIG. 79 is a rear perspective view of an accelerator pedal assembly of the vehicle of the present invention;

[00122] FIG. 80 is a side view of the accelerator pedal assembly of FIG. 79;

[00123] FIG. 81 is a rear perspective view of the operator area of FIG. 77;

[00124] FIG. 82 is an exploded view of a floor drain within the operator area of FIG. 77;

[00125] FIG. 83 is a side view of a shifter boot of the operator controls of FIG. 77;

[00126] FIG. 84 is a rear perspective view of a light and a storage compartment within the operator area of FIG. 77;

[00127] FIG. 85 is a schematic view of an electrical system of the vehicle of the present disclosure;

- [00128]** FIG. 86 is a front perspective view of a winch assembly positioned at the front end of the vehicle of the present invention;
- [00129]** FIG. 87 is an exploded view of the winch assembly of FIG. 86;
- [00130]** FIG. 88 is a side view of the winch assembly of FIG. 86;
- 5 **[00131]** FIG. 89 is rear perspective view of body panels coupled to the frame of the vehicle of the present invention with connectors;
- [00132]** FIG. 90 is an exploded view of the connectors and body panels of FIG. 89;
- [00133]** FIG. 91A is a perspective view of a connector of FIG. 90;
- [00134]** FIG. 91B is a further perspective view of the connector of FIG. 91A;
- 10 **[00135]** FIG. 91C is a top view of the connector of FIG. 91A;
- [00136]** FIG. 92 shows a front left perspective view of a second embodiment of the vehicle of the present disclosure;
- [00137]** FIG. 93 shows a rear right perspective view of the vehicle of FIG. 92;
- [00138]** FIG. 94 shows a left side view of the vehicle of FIG. 92;
- 15 **[00139]** FIG. 95 shows a right side view of the vehicle of FIG. 92;
- [00140]** FIG. 96 shows a top view of the vehicle of FIG. 92;
- [00141]** FIG. 97 shows a bottom view of the vehicle of FIG. 92;
- [00142]** FIG. 98 shows a front view of the vehicle of FIG. 92;
- [00143]** FIG. 99 shows a rear view of the vehicle of FIG. 92;
- 20 **[00144]** FIG. 100 is a partially fragmented view of the operator's compartment of the vehicle of FIG. 92;

[00145] FIG. 101 is a view similar to that of FIG. 100 showing just the body panel portions exploded away from each other;

[00146] FIG. 102 is a rear perspective view of the sealed bin shown in FIG. 101;

[00147] FIG. 103 is a view similar to that of FIG. 102 showing the components of the sealed bin exploded away from one another;

[00148] FIG. 104 is a view similar to that of FIG. 103 showing a right front perspective view;

[00149] FIG. 105 is a cross-sectional view of the sealed bin of FIG. 102 taken through the center of the bin;

[00150] FIG. 106 is a view similar to that of FIG. 100 showing the assembly of the front frame to the vehicle frame;

[00151] FIG. 107 is a view similar to that of FIG. 106 showing the hood and body panels removed from the vehicle;

[00152] FIG. 108 is a view similar to that of FIG. 107 showing the frame exploded away from the vehicle;

[00153] FIG. 109 is a front perspective view of the fuel tank mounted to the vehicle frame;

[00154] FIG. 110 shows a top view of the passenger's seat showing the location of the fuel tank;

[00155] FIG. 111 is a view similar to that of FIG. 109 showing the various components exploded away from each other;

[00156] FIG. 111A is an underside perspective view of the fuel tank;

[00157] FIG. 111B is a transverse cross-sectional view of the fuel tank as mounted to the frame;

[00158] FIG. 112 is a top perspective view showing the floorboard in position over the fuel tank;

[00159] FIG. 113 shows an exploded view of the panels that make up the operator's compartment;

5 **[00160]** FIG. 114 shows the seat support exploded away from the assembled panels;

[00161] FIG. 115 is a cross-sectional view through lines 115-115 of FIG. 14;

[00162] FIG. 116 is a side plane view of the left-hand door;

10 **[00163]** FIG. 117 is a cross-sectional view through lines 117-117 of FIG. 116, when the door is in the closed position;

[00164] FIG. 118 is a view similar to that of FIG. 117 showing a door in the maximum open position;

[00165] FIG. 119A is a view similar to that of FIG. 67 showing an additional accessory lower panel attached to the door;

15 **[00166]** FIG. 119B is a view from the inside of the door as shown in FIG. 119A;

[00167] FIG. 120A is an alternate door skin available for use with the door frame as shown in FIG 119B;

[00168] FIG. 120B is a view from the inside of the door as shown in FIG. 120A;

[00169] FIG. 121 shows an exploded view of a rear air intake bezel;

20 **[00170]** FIG. 122 shows a front perspective view of the engine and CVT;

[00171] FIG. 123 shows the bezel removed and the air duct in position;

[00172] FIG. 124 is a cross-sectional view through lines 124-124 of FIG. 123;

[00173] FIG. 125 is an underside perspective view of the utility bed;

[00174] FIG. 126 is a rear perspective view similar to that of FIG. 125 showing the brackets exploded away from the utility bed;

[00175] FIG. 126A is a rear perspective view similar to that of FIG. 126 showing an
5 alternative reinforcing bracket;

[00176] FIG. 126B is a rear perspective view similar to that of FIG. 126 showing an alternative heat shield;

[00177] FIG. 127 is a forward perspective view of the access panel removed through the rear floor of the utility bed showing access to various vehicle components;

10 **[00178]** FIG. 128 shows a front perspective view of the utility bed with the shock reservoirs coupled to the cab frame;

[00179] FIG. 129 shows a top view of the utility bed;

[00180] FIG. 130 shows an access panel removed to access the shocks;

[00181] FIGS. 131 and 132 show an access panel intermediate the driver and
15 passenger seats for access of various engine components;

[00182] FIG. 133 shows a visor member attached to a front portion of the cab frame;

[00183] FIG. 134 shows the visor of FIG. 133 exploded from the cab frame;

[00184] FIG. 135 shows an underside perspective view of the visor coupled to the
20 cab frame;

[00185] FIG. 136 shows an accessory roof coupled to the cab frame;

[00186] FIG. 137 shows an underside perspective view of the roof exploded from the cab frame;

- [00187]** FIG. 138 shows a cross-sectional view of the roof coupled to the cab frame;
- [00188]** FIG. 139 shows an accessory spare tire bracket coupled to the rear of the cab frame;
- 5 **[00189]** FIG. 140 shows the tire bracket of FIG. 139 in perspective view;
- [00190]** FIG. 141 shows a front perspective view of the steering gear coupled to the frame;
- [00191]** FIG. 142 shows a front perspective view of the steering gear removed from the frame;
- 10 **[00192]** FIG. 143 is a perspective view of the engine mounted to the frame;
- [00193]** FIG. 144 shows an exploded view of the engine and an engine coupler;
- [00194]** FIG. 144A is a perspective view of the engine mounted to the frame via an alternative engine coupler;
- [00195]** FIG. 145 shows a perspective view of the front and rear suspension
15 assemblies;
- [00196]** FIG. 146 shows an exploded view of the needle shock of the front suspension assembly;
- [00197]** FIG. 147 shows a perspective view of an externally regulated bypass shock;
- 20 **[00198]** FIG. 148 shows a perspective view similar to that FIG. 147 from a different angle;
- [00199]** FIG. 149 shows another perspective view of the shock of FIG. 147;
- [00200]** FIG. 150 shows in phantom view the internal passageways of the shock cap and shock outer casing;

- [00201]** FIG. 151 is a perspective view showing the cap removed from the shock casing;
- [00202]** FIG. 152 shows a view similar to that of FIG. 150 showing the entire length of the shock casing;
- 5 **[00203]** FIG. 153 shows a view similar to that of FIG. 152 from a different angular perspective;
- [00204]** FIG. 154 shows a cross-sectional view through the shock reservoir.
- [00205]** FIG. 155A is a view similar to that of FIG. 152 which shows the fluid flow diagrammatically;
- 10 **[00206]** FIG. 155B is a view similar to that of FIG. 153 which shows the fluid flow diagrammatically;
- [00207]** FIG. 156 is an underside perspective view of an intrusion bar coupled to the cab frame;
- [00208]** FIG. 157 is an exploded view of the intrusion bar assembly;
- 15 **[00209]** FIG. 158 shows a rear windshield coupled to a rear portion of the cab frame;
- [00210]** FIG. 159 shows an opposite side view of the rear windshield shown in FIG. 158;
- [00211]** FIG. 160 shows an exploded view of the windshield of FIG. 158;
- 20 **[00212]** FIG. 161 shows a front windshield for the utility vehicle;
- [00213]** FIG. 162 shows a cross-sectional view through lines 162-162 of FIG. 161;
- [00214]** FIG. 163A shows an inside view of the windshield lower corner as taken from arrow 163A in FIG. 161;

[00215] FIG. 163B shows an upward view of the windshield lower corner of FIG. 163A;

[00216] FIG. 164 is a cross-sectional view through lines 164-164 of FIG. 161;

[00217] FIG. 165 is an exploded view of the windshield assembly taken from a rear side thereof;

[00218] FIG. 166 is a cross-sectional view similar to that of FIG. 164 for an alternate embodiment where the latching members are aluminum;

[00219] FIG. 167 is a front left perspective view of an alternative windshield having multiple positions;

10 **[00220]** FIG. 168 is a close-up view of the windshield slider;

[00221] FIG. 169 is a close-up view of the windshield in the vented position;

[00222] FIG. 170 is a top view of the rear clamp; and

[00223] FIG. 171 is a view of the windshield in the fully opened position.

15 **[00224]** Corresponding reference characters indicate corresponding parts throughout the several views. Although the drawings represent embodiments of the present invention, the drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the present invention.

20 **[00225]** The embodiments disclosed below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may utilize their teachings. For example, while the following description refers primarily to UVs, certain features described herein may be applied to other applications such as ATVs, snowmobiles, motorcycles, mopeds, etc.

25 **[00226]** With reference first to FIGS. 1-6, the vehicle of the present disclosure will be described. The vehicle is shown generally at 10 and is commonly referred to as an

all terrain vehicle (ATV), a side-by-side vehicle (SxS) or a utility vehicle. As shown, vehicle 10 generally comprises a frame 12 (FIG. 3) supported by ground engaging members 14 and 16. As shown in this disclosure, ground engaging members 14 and 16 are comprised of wheels 18 and tires 20; and wheels 22 and tires 24. Vehicle 10 further comprises a drive train 30 (FIG. 3) operatively connected to frame 12 and drivingly connected to one or more of the ground engaging members 14, 16. In the present disclosure, the drivetrain 30 is comprised of a fuel-burning engine and transmission combination, together with a driveshaft extending between the drivetrain and both of the front and rear ground engaging members 14, 16, as described in greater detail herein. However, any drivetrain could be contemplated such as hybrid, fuel cell or electric. The drivetrain 30, the front and rear suspension assemblies, and steering assemblies are more thoroughly described in our pending applications Serial Nos. 11/494,891 filed July 28, 2006 and 11/494,890 filed July 28, 2006, the subject matter of which is incorporated herein by reference.

[00227] As shown in FIGS. 1-4, vehicle 10 further includes a body portion or chassis shown generally at 40 to include a hood 42, front fender 44, dash 46, sideboard 48, front floorboard 50, rear sideboard 52 and rear cargo area 56. As also shown, vehicle 10 is comprised of operator or seating area 60, having a driver seat 62 and a passenger seat 64. As shown best in FIG. 3, driver seat includes a seat back 62a and a seat bottom 62b, while passenger seat 64 (FIG. 4) includes a seat back 64a and a seat bottom 64b. Furthermore, vehicle 10 includes operator controls shown generally at 68, which includes controls for steering, acceleration and braking, as described further herein. Vehicle 10 also includes a front suspension 70 and a rear suspension 72.

[00228] With respect now to FIGS. 9-28, frame 12 will be described in greater detail. Frame 12 is generally comprised of a main frame section 80, front frame section 82, and cab frame section 84, where the sections are interconnected by way of couplers 86, 87, 88, 90 and 92. In addition to providing the structural rigidity for the vehicle, frame 12 provides mounting accessories for mounting various vehicle components. With reference now to FIGS. 9-18, front section 82 includes a front suspension mount 100, steering mount 104 (FIG. 13), controls mount 108 (FIG. 10), and front differential

mount 110 (FIG. 9). Rear section 80 includes engine mount 120 (FIG. 10), rear differential mount 122, rear suspension mount 124, and seating mount 126. In general it should be noted that frame 12 is comprised of substantially round tubes which increases the strength of the frame and decreases the weight. Couplers 86, 87, 88, 90 and 92 could be as disclosed in US Patent 8,328,235; or as disclosed in co-filed patent application serial number 61/829,434 (Attorney docket PLR-06-25994.01P); the subject of which are incorporated herein by reference.

[00229] With reference now to FIGS. 9-11, frame 12 will be described in greater detail. As shown best in FIG. 11, frame 12 includes longitudinally extending frame tubes 150 having a lengthwise portion 150a and rear angled portions 150b and front angled portions 150c. Frame tubes 150 couple with frame tubes 152 via couplers 87. Main frame section 80 further includes outer frame rails 154 (FIG. 9) having longitudinal section 154a and upright portion 154b. The frame further includes frame tube portions 156 (FIG. 9) including portions 156a, upright portions 156b, and inclined portions 156c. Frame tubes 152 and 156 are coupled together by way of frame tubes 158. Frame tubes 154 and 156 are coupled together by way of couplers 86 as described herein. Frame 12 also includes side frame tubes 160 having longitudinal sections 160a and upwardly inclined portions 160b, which intersect and connect with upright portions 154B of outer frame tubes 154. Frame 12 also includes frame tube 162, which couples with upright portion 156b of frame tube 156 and which is coupled to frame tube portion 160A by way of couplers 88 (FIG. 9). Side tube 164 is coupled to coupler 90 at a top end thereof and to frame tube 160 at a lower end. side tube 164 includes hinge components 164a and 164b as further described herein.

[00230] With reference now to FIGS. 14-16, front frame portion 82 will be described in greater detail. As shown best in FIG. 16, frame tubes 156 extend upwardly to connect with U-shaped frame tube 170 where U-shaped portion 170 includes a center section 170a, inclined sections 170b, and upwardly and rearwardly extending section 170c. As shown best in FIG. 14, frame tube 176 extends upwardly from frame tube 162 to connect with frame tube portion 170c. Mounting brackets 180 having mounting apertures 180a are coupled to and connect frame tubes 156, 176, and assist

in the mounting of upper front frame section 190, as described herein. With reference to FIG. 16, front frame portion 82 further includes front frame tubes 200 having tube portions 200a coupled to frame tube portions 170b of frame tube 170; tube portions 200b, and downwardly and inwardly angled tube portions 200c, which couple with a front end of frame tubes 152. Frame tubes 202 also extend upwardly from frame tubes 152 and couple with frame tubes 170 at tube portions 170a. Furthermore, channel portions 204 extend upwardly and rearwardly coupling frame tubes 152 with frame tubes 202.

[00231] With reference now to FIG. 16A, front suspension mount 100 will be described in greater detail. As shown in FIG. 16A, channel portions 210 and 212 straddle frame tubes 152 defining sidewalls 210a and 212a, each having mounting apertures 210b and 212b for mounting a lower control arm of the front suspension as described herein. As also shown in FIG. 16A, channel portion 220 straddles frame tubes 202 and defines a front face at 220a having a mounting aperture at 220b. Channels 222 extend between channel 220 and channel 204 and retain a plate portion 224 defining an aperture at 224a. Bracket 230 straddles frame tube portions 200c and defines a tab portion 230a extending beyond frame tube 200c having an aperture at 230b. Bracket 230 also defines an upper horizontal wall at 230c defining apertures at 230d as described herein. Bracket 240 straddles frame tube portions 200C on a front side thereof and defines plate portions 240a extending beyond frame tube portions 200c and defines apertures at 240b. It should be appreciated then that apertures 220b, 224a; and 230b, 240b define a mounting location for an upper control arm of the front suspension as described herein.

[00232] Bracket 240 also includes upper flanges 240c having mounting apertures 240d as described herein. With reference still to FIG. 16A, upper channel 250 flanks tube portion 170a of frame tube 170 defining parallel plate portions 250a having mounting apertures 250b for mounting a top end of a shock absorber of front suspension 70 as described herein. Channel portion 250 also defines an upper wall 250c having mounting apertures 250d as described herein. As shown best in FIGS. 16a and 17, control mount 260 is shown. Control mount 260 has a front wall 260a

coupled to frame tube 202 having fasteners 260b (FIG. 17) surrounding an opening 260c. Bracket 260d extends rearwardly from front wall 260a including mounting apertures 260e.

[00233] Front frame portion 82 includes further additional brackets such as 270 (FIG. 14), 280 (FIG. 16A), 282 (FIG. 16A) and 284 having mounting apertures 284a (FIG. 16A). Lower plate 290 (FIG. 16A) is coupled to a lower portion of frame tubes 152 and includes a mounting aperture 290a. Channel 292 also couples frame tube portions 152 and includes a mounting aperture at 292a.

[00234] With reference again to FIGS. 14 and 17, upper frame portion 190 includes a transverse tube 300; transverse channel 302 where tube 302 and channel 302 are coupled by way of cross tube 304 and steering mount 306. Steering mount 306 includes a plurality of mounting apertures at 306a. Mounting tubes 308 extend downwardly from tube 300 and include mounting brackets at 310 and have mounting apertures at 310a. It should be appreciated that channel 302 overlies brackets 270 and that brackets 310 overlie brackets 180 (FIG. 17) with fasteners 312 positioned through apertures 310a, 180a. Brackets 320 (FIG. 17) extend rearwardly from tubes 308 and include a flange 322 having fasteners 324 and a mounting tab 326 having a mounting aperture at 326A. Front frame portion 82 further includes mounting tabs 330 and 332.

[00235] With reference now to FIGS. 14-15 and 18-20, rear frame portion 80 will be further described. As shown in FIG. 18, rear frame portion 80 further includes a truss portion 350 positioned between tube portions 154a and 160a. Truss portions 352 extend between frame tubes 150 and 154, and trusses 354, 356 (FIG. 14) extend between frame tubes 150. A cross tube 358 extends between frame tube 150 and frame tubes 154. With respect now to FIG. 14a, mount portions 360 are coupled to frame tube 160 providing a mounting aperture at 360a and mounting bracket 362 is provided coupled to frame tubes 152 providing a mounting aperture at 362a.

[00236] As shown in FIG. 18, rear frame portion 80 further includes frame tubes 370 coupled to frame tubes 150 at a lower end thereof and to a cross tube 372 at an upper end thereof. Cross tube 372 also couples between upper portions 154b of frame

tubes 154. Cross tube 374 extends between frame tubes 370 providing mounting apertures 374a and 374b. Rear frame tubes 380 extend from cross bar 372 rearwardly and relatively horizontally through frame tube portions 380a and are then bent downwardly and inwardly at tube portions 380b to couple with rear portions 150b of frame tubes 150. Rear channel 390 and rear plate 392 (FIG. 14) extend between frame tube portions 380b of frame tubes 380.

[00237] As shown in FIG. 18, rear differential mount 122 is defined by plate 392 for mounting rear differential of the power train as described herein. As shown best in FIGS. 14a and 18, engine mounting brackets 402 are provided coupled to frame tubes 150 having mounting apertures at 402a. As shown in FIG. 19, an upper shock mount 410 is defined as a gusset at the intersection of frame tubes 380 and 370 defining a mounting aperture 410a for a shock absorber as described herein. As shown in FIG. 20, rear suspension mount 124 is defined by channel 412 coupled between cross tube 358, having mounting apertures at 414.

[00238] In a like manner, brackets 416 (FIG. 19) are provided at an upper side of frame tube 380A and defining mounting apertures at 416a for mounting of cab frame 84 as described herein. With reference again to FIG. 14, rear frame portion 80 includes seating mount 126, mounting strap 430 for utility box 56, muffler bracket 432 and skid plate 434. With reference still to FIG. 14, seating bracket 126 includes a front channel at 440 including mounting apertures at 440a. Bracket 126 further includes a rear frame tube at 442 having seat mounting pins at 444. Front channel 440 also includes seat mounting hooks at 440b. A control mounting bracket 450 is positioned laterally intermediate mounting portions 440b as further described herein.

[00239] As shown best in FIGS. 18 and 19, seat mounting bracket 126 is shown coupled to rear frame portion 80 with channel 440 positioned over mounting brackets 360 (FIG. 14a) and with a fastener 460 positioned through apertures 440a into apertures 360A (FIG. 14a). In a like manner, rear tube 442 sits atop brackets 362 with fasteners 462 positioned through apertures 442a (FIG. 14) and into apertures 362a (FIG. 14a).

[00240] Strap 430 includes mounting arms 470 (FIG. 14) having mounting apertures at 470a and a lower support member at 472. Strap 430 is shown in the mounted position in FIGS. 18 and 19 with fasteners 474, coupling strap 430 to upper arms 380. Muffler mount 432 is also shown in FIG. 19 in a coupled position to rear frame tube portions 380b and has a cross tube 432a having mounting apertures at 432b.

[00241] As shown in FIG. 18, rear frame portion 80 further includes various other mounting brackets, namely, front mounting brackets 490 coupled to frame tube portions 150a, brackets 492 coupled to frame tube portions 155b, brackets 494 coupled to frame tube 160, and mounting brackets 496 are coupled to frame tubes 370.

[00242] As previously mentioned, frame portions 80 and 82 are coupled together by way of couplers 86, 87, and 88, and this is shown in exploded fashion in FIG. 21. Couplers 87 include an inline coupler 87a and an angled coupler 87b. The couplers 87b include an angled shank portion 500 having a front face at 502 having protrusions 504, recesses 506, and apertures at 508. In a like manner, coupler 87a includes a face 512, projection 514, recess 516, and aperture 518. It should be appreciated that the couplers 87a and 87b couple together with the two faces 502, 512 in a planar manner with projections 504 received in recesses 516 and with projections 514 received in recesses 506. This allows fasteners 520 and 522 to couple together frame tubes 150 and 152.

[00243] Frame tubes 154 and 156 are coupled together in a like manner by way of couplers 86. Couplers 86 are identical having a front face 522, projection 524, recess 526, and aperture 528. It should be appreciated that the couplers 86 are positioned with their respective faces 522 in a planar manner with respective projections 524 received in respective recesses 526 of the opposite coupler 86. Thus fasteners 530, 532 fasten the couplers 86 together coupling frame tubes 154 and 156.

[00244] Finally, frame tubes 160 and 162 are coupled together by way of their respective couplers 88. Couplers 88 are also identical having a front face 532, projection 534, recess 536 and aperture 538. Couplers 88 are positioned with their

respective faces 532 in a planar manner with respective projection 534 received in a respective recess 536. Fastener 540 is receivable through apertures 538 to receive fasteners 542 and fasten couplers 88 together thereby coupling frame tubes 160, 162 together.

5 **[00245]** With reference now to FIGS. 22-25, an optional outer guard 562 is described which may be coupled to a side of frame 12, and namely to frame tubes 154, 156. Guard 560 includes a longitudinal tube portion 562 and a rearward tube 564. Guard 560 includes frame tube couplers 566a, 566b, and 566c. Apertures 568a, 568b, and 568c align with an internal cylindrical volume of each of the coupling tubes 566a, 10 566b, and 566c, respectively. A coupling assembly 570 (FIG. 23) includes a contoured washer 572, a deformable shank 574, and fasteners 576, 578. Contoured washer 572 has an outer diameter at 572a having an arcuately curved face at 572b providing extreme most points at 572c in order to lie flushly against the outer cylindrical surface of frame tubes 154, 156. Contoured washer 572 further includes a front face at 572d 15 opposing curved surface 572b and includes an inner diameter at 572e having flat portions at 572f and a shoulder at 572g. An internal diameter is provided at 572j.

[00246] Deformable shank 574 includes a head at 574a having an internal diameter 574b interrupted by flat portions 574c and an outer diameter portion 574d interrupted by flat portions 574e. Deformable wings 574f extend from a body portion 20 574g.

[00247] Fastener 576 includes a bolt head 576a having a shoulder portion 576b having an inner face at 576c and a threaded portion at 576d. Fastener 578 has a cylindrical body at 578a having flats at 578b, and internal threads at 578c. A head 578d defines a camming surface at 578e (FIG. 24).

25 **[00248]** As shown best in FIG. 24, tube coupler 566b is attached to contoured washer 572 by way of an end of tube 566b fitting within undercut portion 572k on washer 572. The coupling assembly 570 may be preassembled such that the deformable shank 574 is positioned within contoured washer with the head 574a abutting the shoulder 572g and with diameters 574d and 572e and flats 574e, 572f in

complementary relationship. This positions the deformable wings 574 beyond the contoured washer 572 and allows fasteners 576 and 578 to be threadably received on opposite sides of the deformable shank 574 (FIG. 24). Thus the tube 566b and the coupler assembly 570 may be positioned through an aperture 580 (FIG. 24) of frame tube 150 with flange 566 in abutting relationship with frame tube 150.

[00249] Fastener 576 is thereafter tightened down which draws the two fasteners 576 and 578 together. A tool such as a wrench is not required on the inside of frame tube 150 due to the corresponding flats 578b, 574c and 574e and 572f together with the contour of the arcuate surface 572b of contoured washer 572. Thus the camming surface 578 is drawn into the deformable wings 574 as shown in FIG. 25 deforming the wings outwardly and pinching the wings to aperture 580 locking the entire assembly to frame tubes 150.

[00250] With reference to FIGS. 26-28, cab frame 84 will be described in greater detail. With reference first to FIGS. 26 and 27, cab frame 84 includes a front portion 600, rear portion 602, and rear supports 606. As shown best in FIG. 28, front portion 600 includes first and second frame portions 610, 612 coupled together by way of a cross bar 614. Frame portions 610 and 612 each include tube portions 610a, 612a, which would extend forward of the operator and be coupled to the frame. Frame portion 610 and 612 further include longitudinally extending sections 610b and 612b, which extend rearwardly and over the operator's head. Corresponding brackets 616 on frame portion 610, 612 and corresponding brackets 618 on cross tube 614 allows coupling together to define the front frame portion 600. Frame tube portion 610 further includes rear brackets 620 for coupling tube rear frame portion 602.

[00251] Rear frame portion 602 includes a U-shaped tube 622 defined by a laterally extending tube portion 622a and downwardly extending tube portions 622b having ends at 622c. Radiused portions 622d extend between 622b and 622c. The cross tube 624 couples tube ends 622c and retains couplers 90a thereto. Brackets 630 face forwardly to couple with bracket 620. Rear brackets 632 face rearwardly to couple with rear support arms 606.

[00252] Rear support arms 606 include rearwardly and downwardly extending sections 606a having couplers 94 at the lowest most end and tube portions 606b having brackets 640 facing forwardly, and profiled to couple with brackets 632. As assembled, and as best shown in FIG. 11, tube portions 610b, 612b angle inwardly along lines 644 as they project rearwardly. This provides an offset with the overhead portion of the cab frame 84 allowing better ingress/egress.

[00253] With reference now to FIGS. 29-32E, rear suspension 72 will be described in greater detail. Rear suspension 72 is a trailing arm type suspension generally comprised of rear trailing arms 650, radius arms 652a, 652b, torsion bar or sway bar 654, and shock absorbers 656. Trailing arms 650 couple to spindles 658, which in turn hold wheel hubs 660 and brake discs 662. With reference now to FIGS. 32-32D, the details of the trailing arm suspension components will be described in greater detail.

[00254] As shown in FIG. 32A, trailing arms 650 includes a generally longitudinally extending channel portion 670 having a link arm 672 at a front end thereof including a front coupling 674. Trailing arm 650 further includes a rear bracket 680 defining a mounting face at 682 having mounting apertures 684. As shown, face 682 defines an opened ended aperture at 686 as described herein. Trailing arm 650 further includes a first bracket 690 having mounting apertures 692, and a second bracket 694 having mounting apertures 696.

[00255] With reference to FIG. 32D, channel portion 670 includes a first portion 670a and a second portion 670b, the two portions having an interfacing miter cut at 670c, with the two portions 670a, 670b being welded together at the seam. Bracket 680 also includes a cutout portion at 680a which is profiled to overlap channel second portion 670b, where it is welded in position. A rear brace 698 is provided having first and second plate portions 698a, 698b for coupling to and bracing the two portions 670a, 670b.

[00256] As best shown in FIG. 32E, bracket 690 includes a struck tab 690a which upstands and provides protection to brake line 699, should fastener 690b fail. In a like

manner, bracket 694 includes a struck tab 694a which upstands and provides protection to brake line 699, should fastener 694b fail.

[00257] With reference to FIG. 32, alignment arms 652 include outer couplings 700 and inner couplings 702. Connector plate 704 includes apertures 706 in alignment
5 with inner couplings 702 of lower radius arms 652a and upper apertures 708 in alignment with couplers 702 of upper radius arms 652b. Spindle 658 includes flange 710 having mounting apertures at 710a profiled to align with apertures 684 for mounting thereof. Spindle 658 also includes threaded apertures 710b extending rearwardly and profiled to couple with outer couplings 700 of alignment arms 652. Spindle 710 also
10 includes a central opening at 710c, which is profiled to receive a stub shaft or half shaft (not shown) in order to drive hub 660. Due to the open aperture 686, the stub shafts may be removed without the removal of the trailing arms 650.

[00258] With respect to FIG. 32, torsion bar 654 includes a laterally extending shaft portion 720 and longitudinally extending arm portions 722 having mounting
15 apertures at 724. Link arm 730 includes an upper coupler 732 for coupling at aperture 724 and a lower coupler 734 for coupling to bracket 690. Clamps 740 are provided together with bearings 742 to clamp torsion bar to the frame as described herein. Shock absorbers 656 include a shock absorber portion 750 with an over spring 752. As shown, shock absorber portion 750 is a gas assist shock having a gas canister at 754.
20 In the embodiment shown, rear shocks 656 are Walker Evans part number 7043983. Shock absorber 750 has a lower coupling at 760 for mounting to bracket 694 and an upper coupler 762 for mounting to frame 12 as described herein.

[00259] As shown in FIG. 30, trailing arms 650 are coupled to frame 12 by way of fasteners 770 extending through channel member 412 (through apertures 414, FIG. 20)
25 and through coupling 674 (FIG. 32) of trailing arm 650. This allows trailing arms 650 to pivot upwardly and downwardly about a pivot axis which is transverse to a longitudinal direction of the vehicle. Trailing arms 650 are coupled to each other by way of the torsion bar 654 as clamps 740 retain the torsion bar to frame bracket 494 and links 730 are coupled between each torsion bar 650. Radius arms 652 maintain trailing arms 650

in a laterally fixed manner by way of connection to the spindles and to frame plate 392 by way of fasteners 772 through connector plate 704. Shock absorbers 656 are fixed at an upper end to bracket 410 by way of fasteners 774 and are fixed at a lower end to trailing arm 650 by way of fasteners 776 connected to bracket 694. Canisters 754 are
5 coupled to cab frame tubes 606a.

[00260] As shown in FIG. 33, trailing arms 650 are shown in an unsprung, steady state position where trailing arm 650 is substantially horizontal to axis 780. This maximizes the ground clearance 782 between the ground and the bottom of trailing arm 650.

10 **[00261]** With reference now to FIG. 33, a second embodiment of rear suspension is shown incorporating a second shock absorber 790. Thus trailing arm 650 includes an additional bracket 792 and an alternate upper bracket 794 is provided to accommodate the upper ends of both shocks 656 and 790.

[00262] With reference now to FIG. 34, frame 12 is shown having a power train
15 installed therein. As shown, power train 800 is comprised of an engine 802, transmission 804, which may include a continuously variable transmission (CVT), and a rear differential 806. A rear drive 808 is provided between transmission and rear differential 806. A front drive shaft 810 is provided between transmission 804 and front differential 812. Engine 802 is mounted to frame 12 by way of an engine mount 814
20 coupled to engine 802 and to frame 12 at brackets 402. Engine mount 814 is similar in nature to that described in Applicants' Patent Applications, Serial No. 13/370,139, Attorney Docket No. PLR-06-24808.03P, the subject matter of which is incorporated herein by reference.

[00263] With reference now to FIG. 35, engine air intake system 820 is comprised
25 of an air filter 822, ducting 824, air filter 826, and air intake duct 828. A CVT cooling duct is also provided at 830 drawing ambient air to CVT transmission 804 for cooling purposes. Air intake system 820 and CVT cooling 830 is similar in nature to that described in Applicants Serial No. 12/849,480, Attorney Docket No. PLR-06-24357.01P, the subject matter of which is incorporated herein by reference.

[00264] With reference now to FIG. 36, air intake system 820 is shown in plan view connected to engine 802. As shown, air manifold 822 is connected to throttle bodies 840, which in turn are directly connected to engine 802. Air filter 826 includes mounting tabs 846 having apertures at 846a for coupling with apertures 374a (FIG. 18) of cross tube 374 for mounting purposes.

[00265] As shown in FIGS. 37 and 38, air filter 826 includes a fixed housing 850 and a removable lid 852, the lid being fixed in place by binding clips 854. As shown in FIG. 38, air filter 826 includes an air filter canister 860 having an inlet end 862 and an outlet end 864. Outlet end 864 couples with duct coupling 866 and intake end couples with intake aperture 868. Filter canister is positioned in housing 850 and is aligned by way of stand-offs 870, 872. The air inlet for the CVT cooling air is shown at 880 in FIG. 39, where inlet 880 draws air from an outside of utility box. Alternatively, the air inlet may include a rear air inlet 880' which draws air from inside the utility box. The air inlet for the engine air intake is shown at 882 in FIG. 4.

[00266] The engine exhaust is shown generally at 900 in FIGS. 36 and 40. The engine exhaust 900 includes an exhaust manifold 902 having a casting 904 with flanges 906, 908 coupled to the exhaust ports of the engine 802. Exhaust system 900 further includes a rearwardly extending section 910 and muffler 912. As shown best in FIG. 43, manifold portion 902 includes exhaust tube portions 920 and 922, as well as, upper heat shield 924 and lower heat shield 926. As shown, exhaust tube portion 920 is coupled to exhaust port 908 and exhaust tube portion 922 is coupled to exhaust port 906. Exhaust tube portion 922 includes a first radiused portion 930 angled outwardly from exhaust port 906, which transitions into a straight section 932 extending laterally of port 906. Exhaust tube portion 920 includes a radiused section 938, which extends laterally and upwardly to an inclined section 940, which then transitions into a straight section 942 extending over the top of straight section 932. This allows for a simplified heat shield comprised of upper and lower heat shields 924 and 926 to be positioned there over for shielding the heat from the exhaust tube portions 920, 922.

[00267] More particularly, heat shield 924 includes an inverted U-shaped body 950 having a neck down section at 952 and a semi-cylindrical covers at 954 and 956; the semi-cylindrical covers 954, 956 conforming to overlie radiused portions 938, 930, respectively. Lower heat shield portion 926 includes a U-shaped body portion 960 having a necked down section 962 and semi-cylindrical covers at 964, 966. It should be appreciated that upper and lower heat shielding members 924, 926 cooperate together such that semi-cylindrical portions 954, 960 cover radius portion 938 and semi-cylindrical portion 956, 966 cover radius portions 930. The two U-shaped body portions 950, 960 cover the exhaust tube portion 920, 922 as shown in FIGS. 41 and 42.

[00268] The longitudinally extending section 910 of exhaust system 900 includes outer heat shield 970 and upper and lower exhaust tube portions 972, 974. Outer heat shield 970 includes a necked down portion at 978, which cooperates with necked down section 952 and 962 of heat shield members 924, 926. Heat shield portion 970 also includes a radiused portion at 980, which conforms to radius portions 982 and 984, and a longitudinally extending section 990 of heat shield 970 that overlies longitudinally extending sections 972 and 974. A necked down section 996 closely conforms to the outer profile of tubes 972 and 974. Inner heat shield 1000 includes a necked down section 1002, which cooperates with necked down section 996 and section 1004, which cooperates with section 990. An elongate section at 1006 covers the remaining length of the exhaust tubes 972 and 974. Necked down section 1010 covers the necked down portion 1012, which transitions together exhaust from exhaust tubes 972 and 974 into a single outlet at 1014.

[00269] The manifold portion 902 has advantages over previous manifolds. First, the casting provides a tight turn allowing the distance between the casting 904 and manifold generally to be as far as possible from the operator area. Also, the tube sections 932 and 942 are positioned in a generally overlying position, which moves tube portion 942 further away from the passenger area. As mentioned above, this also allows for a simplified heat shield comprised of upper and lower heat shields 924 and 926 to be positioned there over for shielding the heat from the exhaust tube portions 920, 922.

[00270] With reference now to FIGS. 44-48, the engine cooling system will be described in greater detail. With reference first to FIG. 44, the engine cooling system is shown generally at 1020, which includes radiator 1022 having a return line 1024 and a supply line 1026. Thus a close loop circuit is provided for the engine cooling water from the back of the vehicle at engine 802 to the front of the vehicle at radiator 1022 and returned. Various brackets such as 1028 may be utilized to retain the lines 1024, 1026 in a managed relationship relative to the frame. Bracket 1028 is shown in greater detail in FIG. 44A and has been coupled to bracket 490 and including bracket 1034 and retainer 1036. Clip 1036 is shown in greater detail in FIG. 44B as including a center wall section 1040 having central arms 1042 defining a T-shaped clip 1044. Top arms 1046 and bottom arms 1048 define receiving areas 1050 and 1052 for receiving supply lines 1024, 1026.

[00271] With reference now to FIGS. 45 and 46, a front grill 1060 is shown having a web pattern defined by a plurality ribs 1062 defining openings 1064 there through for the passage of air. As shown in FIG. 46, a shroud 1066 is shown and is coupled to grill 1060 and mounts radiator 1022 and fan 1070 thereto. It should be appreciated that either air traveling through shroud 1060 by virtue of the vehicle movement and/or by the operation fan causes air to flow across radiator 1022 in the direction of arrow 1071.

[00272] As shown best in FIG. 47, shroud 1066 includes a top wall 1072 having a contoured extension 1074 and sidewalls 1076 having contoured extensions 1078. Meanwhile grill 1060 includes a wall 1082 surrounding openings 1064. Additional wall portions are provided at 1084, 1086, and 1088. Additionally, grill 1060 is defined with wall portions 1090 having constrictions at 1092. Shroud 1066 includes mounting tabs 1094, 1096, and 1098, which mount to respective stand-offs 1100, 1102, and 1104. As shown in FIGS. 46 and 48, shroud 1066 conforms closely with the profile of grill 1060 including a crimped portion 1110 conforming to constriction 1092. Thus, in the longitudinal direction, a combination of walls 1082, 1084, 1086, and 1088 overlap with walls 1072 and 1076. This allows all of air traveling through to grill 1060 to enter through and into the shroud 1066. As also shown in FIG. 46, radiator 1022 closely conforms to shroud 1066 preventing leaking of air around the periphery of the

shroud/radiator interface. As also shown in FIG. 46, radiator 1022 has fins 1112, and when mounted thereto, fan 1070 does not completely all of the fins 1112.

[00273] Radiator 1022 further includes a return coupling at 1120 and a supply coupling at 1122 which cooperate with cooling lines 1024, 1026, respectively. Radiator
5 1022 further includes mounting lugs 1126, which cooperate with mounting apertures 230d of bracket 230 (FIG. 16A). Finally, radiator 1022 includes mounting apertures at 1128, which cooperate with mounting apertures 1130 on fan 1070. As shown in FIG. 46, fasteners 1132 retain fan 1070 directly to radiator 1022.

[00274] With reference now to FIGS. 49-54, front suspension 70 will be described
10 in greater detail. With reference first to FIG. 49, front suspension generally comprises lower alignment arm 1150, upper alignment arm 1152, spindle 1154, wheel hub 1156, and shock absorber 1158. Front stub shafts 1160 provide driving power to wheel hubs 1156, through a constant velocity joint (or similar device), and a steering shaft 1162 is provided and coupled to spindle 1154 for steering purposes. With reference now to FIG.
15 49A, lower alignment arms 1150 will be described in greater detail.

[00275] Lower alignment arm 1150 includes arm portions 1170 and 1172 joining at an outer end to ball joint 1174. At opposite ends of each of the arms 1170, 1172 are couplings 1176 and 1178 respectively. It should be appreciated that couplings 1176 and 1178 couple with channels 212, 210, respectively, by way of fasteners 1180 (FIGS.
20 49A, 50). It should also be appreciated that ball joint 1174 of lower suspension arm 1150 couples to a lower coupling 1182 (FIG. 50) of spindle 1154. With reference now to FIGS. 52 and 53, upper alignment arm 1152 will be described in greater detail.

[00276] As shown, upper alignment arm 1152 includes two arms 1190, 1192. Outer ends of arms 1190, 1192 converge to couple with ball joint 1194. Opposite ends
25 of arms 1190, 1192 include couplings 1196, 1198 and couples to frame 12 by way of fasteners 1200, 1202 (FIG. 49).

[00277] As shown best in FIGS. 52 and 53, upper alignment arm 1152 provides a different configuration for each of the arms 1190 and 1192. As shown, arm 1190 is

substantially parallel along an axial length of the arm 1190, while arm 1192 is discontinuous along the length of its arm. More particularly, arm 1192 includes a first arm portion 1210, which projects away from ball joint member 1194 in a substantially parallel plane as arm 1190. Arm 1192 has a first radiused bend at 1212, which projects
5 an arm portion 1214 upwardly at an angle relative to arm portion 1210. Arm 1192 further includes a second radiused portion at 1216 projecting an arm portion 1218 in a relatively horizontal position. Bracket 1220 is provided and coupled to an outer end of arms 1190, 1192 and includes mounting apertures at 1222.

[00278] The geometry of upper alignment arm 1152 and, in particular, the
10 geometry of arm 1192 is provided for at least two reasons. Firstly, by providing the radiused portion 1212, 1216, predefined buckling points are provided in the suspension, such that if vehicle encounters a large jolt, the alignment arm buckles rather than damaging the frame 12. Secondly, and with reference to FIG. 51, alignment arm 1152 is provided over the top of steering arm 1162, which provides clearance for arm 1162.
15 Absent the radiused portion 1216, the alignment arm 1152 and steering arm 1162 could not co-exist in the same space.

[00279] With reference again to FIG. 49A, shock absorber 1158 includes a gas shock absorber portion 1230 and an over spring at 1232. Shock absorber 1158 further includes a mounting coupler 1234 and a lower mounting coupler 1236. With reference
20 to FIG. 50, shock absorber 1158 is shown mounted at its lower end to bracket 1220 by way of fasteners 1240 and at its upper end to bracket 230 by way of fasteners 1242. Thus, the shock mounting to bracket 230 is substantially higher than previously mounted providing the ability to utilize a much longer shock absorber 1158. In the disclosed embodiment, the shock absorbers are provided by Walker Evans part number
25 7044018 and 7043979, right and left shocks respectively. In addition, the shock mounting at bracket 230 is rigidified through the entire frame 12 by way of connection to the transverse tube 170 and by way of the triangulation of tubes 156, 170, and 200. The stresses of the shock absorber 1158 are also taken up through cab frame 84 (FIG. 9) by way of the connection tube couplings 92.

[00280] With reference now to FIG. 49B, a version of the suspension is shown at 70', which includes a torsion (or sway) bar 1250. Torsion bar 1250 is coupled to the upper alignment arm 1152 by way of link arm 1252; link arm 1252 having an upper coupling 1254 coupled to torsion bar 1250, and a lower coupling 1256 attached to
5 bracket 1258 on upper alignment arm 1152.

[00281] With reference now to FIGS. 51 and 54, braking system is shown at 1260. Braking system 1260 includes a brake pedal 1262 in the operator's area which actuates a master cylinder 1264, which in turn operates brake calipers 1266. Brake calipers provide frictional force against brake disk 1268 through hydraulic lines 1270. Rear
10 brake line 1272 feeds rear brake lines 1274, which in turn operate rear brake calipers 1276 to control rear disks 662.

[00282] With reference to Figs. 55-63, seating area 60 is positioned within cab frame section 84 and includes driver seat 62 having seat back 62a and seat bottom 62b, and passenger seat 64 having seat back 64a and seat bottom 64b. As shown in
15 Fig. 55, seats 62, 64 are in a side-by-side arrangement and are supported on seat mounting bracket 126, as is further detailed herein. Illustratively, as shown in Figs. 58 and 59, seat backs 62a and 64a are spaced apart from seat bottoms 62b and 64b respectively. Alternatively, seat backs 62a and 64a may be integrally formed with, or otherwise connected to, respective seat bottoms 62b and 64b in order to distribute
20 loads throughout seats 62, 64.

[00283] Figs. 56 and 57 illustrates the configuration of seat bottom 62b, however, seat bottom 64b of passenger seat 64 also may be constructed in the manner detailed herein. Additionally, seat backs 62a, 64a may be constructed in the manner detailed herein. Seat bottom 62b includes a first portion 1300, a second portion 1302, and a
25 third portion 1304. First portion 1300 is intermediate second and third portions 1302, 1304 and has a generally flat orientation for supporting a driver. Second and third portions 1302, 1304 are angled outwardly and upwardly relative to first portion 1300 in order to retain the operator and passenger on seat bottoms 62b, 64b during operation of vehicle 10. Similarly, seat backs 62a, 64a may be contoured or have angled portions to

further retain the operator and passenger on seats 62, 64 during operation of vehicle 10. A cover 1318 generally surrounds first, second, and third portions 1300, 1302, and 1304. Illustratively, first, second, and third portions 1300, 1302, and 1304 are three separate and independent portions positioned adjacent to each other. In one embodiment, portions 1300, 1302, and 1304 may be coupled together in a conventional manner, for example by sewing, bonding, molding, radio frequency welding, stapling and/or using an adhesive. Alternatively, other embodiments of seat bottom 62b may be configured as a single component, in which portions 1300, 1302, and 1304 are integrally formed together to define seat bottom 62b.

[00284] Referring to Fig. 57, first portion 1300 includes an inner layer 1306 generally surrounded by an outer layer 1312, second portion 1302 includes an inner layer 1308 generally surrounded by an outer layer 1314, and third portion 1304 includes an inner layer 1310 generally surrounded by an outer layer 1316. Inner layers 1306, 1308, and 1310 may be comprised of a foam or other polymeric material and may be available from BASF Corporation. Inner layers 1306, 1308, and/or 1310 may be thicker at the h-point, or the point where the hips of the operator or passenger are positioned on seat bottoms 62b, 64b. Alternatively, additional padding or foam may be coupled to inner layers 1306, 1308, and/or 1310 at the h-point to provide additional comfort to the operator and passenger.

[00285] At an interface 1320 between first portion 1300 and second portion 1302, outer layer 1312 is adjacent outer layer 1314. Similarly, at an interface 1322 between first portion 1300 and third portion 1304, outer layer 1312 is adjacent outer layer 1316. Outer layers 1312, 1314, and 1316 are comprised of a water resistant polymeric material, for example vinyl. As such, each inner layer 1306, 1308, 1310 is surrounded by a water resistant material. By covering each inner layer 1316, 1308, 1310 with the water resistant material of outer layers 1312, 1314, 1316, respectively, each inner layer 1306, 1308, 1310 remains dry if seats 62, 64 are splashed with water, mud, or other fluids. In particular, even if fluid penetrates cover 1318, fluid does not penetrate outer layers 1312, 1314, 1316 and, therefore, is prevented from contacting inner layers 1306, 1308, 1310, respectively.

[00286] Cover 1318 extends around outer layers 1312, 1314, and 1316, such that outer layers 1312, 1314, and 1316 are intermediate cover 1318 and inner layers 1306, 1308, and 1310, respectively. Cover 1318 may be comprised of a polymeric film material, a polymeric sprayable material, a vinyl material, or other similar material, which also may be water resistant.

[00287] Alternatively, a seat 62' could include a single section 1300' including an inner layer 1306' generally surrounded by an outer layer 1312', as shown in FIG. 57A.

[00288] Referring to Figs. 58 and 59, driver seat 62 is supported on a seat frame 1324. While Figs. 58 and 59 illustrate the configuration of seat frame 1324 for driver seat 62, passenger seat 64 also is supported on frame 1324 in an identical manner. Seat frame 1324 includes an upper section 1328 for supporting seat back 62a and a lower section 1330 for supporting seat bottom 62b. Upper section 1328 includes generally upstanding tubes 1332 and cross bars 1334, 1336 extending between upstanding tubes 1332. Upstanding tubes 1332 include a plurality of apertures 1338, and more particularly, two groupings of apertures 1338. Apertures 1338 are configured to receive conventional fasteners 1340 in order to couple upper section 1328 of seat frame 1324 to a rear surface of seat back 62a. Because fasteners 1340 may be positioned in any of apertures 1338, the vertical position of seat back 62a may be adjusted along upper section 1328 of seat frame 1324 to accommodate different preferences for comfort, lumbar support, bolstering, and head rest position for various drivers. As shown in Fig. 59, the rear surface of seat back 62a may be contoured to define grooves or channels for receiving upstanding tubes 1332 and cross bars 1334, 1336. A panel or cover (not shown) may be comprised of a polymeric material and coupled to the rear surface of seat back 62a in order to conceal upper section 1328 of seat frame 1324.

[00289] Fig. 59 illustrates that upper section 1328 of frame 1324 is separate from lower section 1330 and is coupled thereto with gussets 1346. Gussets 1346 may be welded to upper and lower sections 1328, 1330. Alternatively, seat frame 1324 may be comprised of single, continuous tubes that are bent to define upper section 1328 and

lower section 1330, such that upper section 1328 is integral with lower section 1330. Seat frame 1324 also may be stamped or otherwise formed to define upper and lower sections 1328, 1330.

[00290] Lower section 1330 includes lower frame members 1342 extending in a generally horizontal direction. Upstanding tubes 1332 form an approximate 90-degree angle with lower frame members 1342. Alternatively, upstanding tubes 1332 may be angled rearwardly such that upstanding tubes 1332 form an angle greater than 90 degrees with lower frame members 1342. Seat bottom 62b may include channel members 1344 on a bottom surface thereof for receiving lower frame members 1342.

[00291] As shown in Fig. 59, lower frame members 1342 include a plurality of apertures 1348, in particular apertures 1348a and 1348b, for receiving conventional fasteners 1349a and threaded couplers 1349b, therethrough. Illustratively, lower frame members 1342 include two groupings of apertures 1348a, 1348b. Fasteners 1349a extend through apertures 1348a in order to couple lower frame members 1342 of lower section 1330 to channel members 1344 of seat bottom 62b. As shown in Fig. 59, aperture 1348a is larger than aperture 1348b. The larger size of aperture 1348a allows a head portion 1345a and a body portion 1345b of fastener 1349a to extend therethrough. As such, and as shown in Fig. 61C, head portion 1345a of fastener 1349a abuts the top surface of lower frame members 1342 and body portion 1345b (Fig. 59) extends into channel members 1344 and seat bottom 62b.

[00292] Conversely, as shown in Fig. 59, the smaller size of aperture 1348b prevents a head portion 1347a of threaded coupler 1349b from extending therethrough. Instead, head portion 1347a is retained outside of lower frame member 1342 and aperture 1348b, as is further detailed herein. A body portion 1347b of threaded coupler 1349b extends within lower frame member 1342 but is spaced apart from the top surface of lower frame member 1342 (Fig. 61C). While illustrative threaded coupler 1349b does not couple lower section 1330 of seat frame 1324 to seat bottom 62b, alternative embodiments of seat bottoms 62b, 64b may be coupled to seat frames 1324 with both fasteners 1349a and threaded couplers 1349b.

[00293] Referring to Figs. 60-62A, seat frame 1324 of seats 62 and 64 may be removably coupled to seat mounting bracket 126 and may be configured to move relative to seat mounting bracket 126, as is further detailed herein. In particular, lower sections 1330 of seat frames 1324 are coupled to a base member 1350 such that when
5 seats 62, 64 are removed from seat mounting bracket 126, seat bottoms 62b, 64b, seat backs 62a, 64a, seat frames 1324, and seat bases 1350 also are removed. Base member 1350 may be comprised of a polymeric material or a metal material, and may be formed through extrusion methods, molding methods, stamping methods, or other similar processes. Base member 1350 may be available from Attwood Corporation.

10 **[00294]** As shown in Fig. 60, base member 1350 includes a frame 1352 which supports a plate 1354. Plate 1354 includes a mounting bracket 1356 having at least one aperture 1362 for receiving mounting pin 444 therethrough. Frame 1352 includes side channels 1358 and tabs or projections 1360.

[00295] A bottom surface 1363 of side channels 1358 of frame 1352 includes
15 longitudinally extending slots 1364. Side channels 1358 also include vertical side walls, illustratively an inner side wall 1366 and an outer side wall 1368, extending upwardly from bottom surface 1363. Lower frame members 1342 of seat frame 1324 are positioned on bottom surface 1363 and are retained within side channels 1358 by inner and outer side walls 1366 and 1368. Additionally, and as shown in Fig. 61C, a threaded
20 fastener 1370, such as a shoulder bolt, screw, or other similar device, is coupled to threaded coupler 1349b in order to further retain seat frame 1324 to base member 1350. In particular, body portion 1347b of threaded coupler 1349b includes internal threads (not shown) which engage with external threads (not shown) on threaded fastener 1370. A portion of fastener 1370 extends through slot 1364 (Fig. 61) and a
25 flanged portion (not shown) of fastener 1370 is positioned below slot 1364 in order to couple base member 1350 to seat frame 1324. When seats 62, 64 are coupled to base members 1350 of Fig. 60, seats 62, 64 are removable from seat mounting bracket 126 but do not slide or move relative to frame 1352 of base member 1350. By configuring base members 1350 to be removable from vehicle 10 with seats 62, 64, base members
30 1350 do not compromise the space available for other components of vehicle 10, such

as the fuel tank, which may be positioned below or near seats 62, 64. Additionally, base member 1350 maintains the low profile of seats 62, 64 within cab frame section 84.

[00296] Base member 1350 is removably coupled to seat mounting bracket 126, and in particular, the engagement between mounting pin 444 and mounting bracket 1356 allows seats 62, 64 to be released from seat mounting bracket 126 without tools. To couple base 1350 with seat mounting bracket 126, frame 1352 rests atop front channel 440 and rear tube 442. Mounting pin 444 is received within aperture 1362 and tabs 1360 are positioned underneath mounting hooks 440b in order to secure base members 1350 and seats 62, 64 to seat mounting bracket 126. When mounting pin 444 is received within aperture 1362 of bracket 1356, latch device 1386 (Fig. 61A) maintains the engagement therebetween to retain seats 62, 64 on seat mounting bracket 126. However, when seat 62 and/or seat 64 is removed from vehicle 10, latch device 1386 disengages pin 444 from aperture 1362 and tabs 1360 may be removed from mounting hooks 440b such that seats 62, 64 can be pulled upwardly away from seat mounting bracket 126 and removed from vehicle 10. Base members 1350 are self-contained portions of seats 62, 64 and are removed from vehicle 10 when seats 62, 64 are removed from vehicle 10. Additional details of the engagement between mounting pin 444 and base member 1350 are disclosed in pending U.S. Patent Application Serial No. 12/246,948, filed October 7, 2008, the complete disclosure of which is expressly incorporated by reference herein.

[00297] Alternatively, according to the embodiment of Figs. 61-61C, base members 1350' allow seats 62, 64 to slide relative to seat mounting bracket 126. Base member 1350' of Fig. 61 includes features similar to those of base member 1350 of Fig. 60, with like reference numerals indicating like elements, except as described below. As with base member 1350, base member 1350' is removable from vehicle 10 with seats 62, 64, and therefore, is a self-contained adjustment member of seats 62, 64. Additionally, base member 1350' allows seats 62, 64 to maintain a low profile within cab frame section 84 but does not decrease the space available for other components of

vehicle 10, such as the fuel tank. Base member 1350' may be available from Attwood Corporation.

[00298] Base member 1350' includes frame 1352', plate 1354', a lever 1384, a latching mechanism 1382, fasteners 1378, and support members 1376. Side channels
5 1358' of frame 1352' include inner side walls 1366, outer side walls 1368, and slots 1364' extending longitudinally along bottom surface 1363. The outer perimeter of slots 1364' are raised or elevated relative to bottom surface 1363, as best shown in Fig. 61B and further detailed herein. Fastener 1370 extends through slots 1364' in order to couple with threaded coupler 1349b. Frame 1352' also includes tabs 1360 which
10 extend forwardly therefrom. Frame 1352' may be comprised of a polymeric material and may be extruded, molded, or otherwise formed in a similar manner.

[00299] Plate 1354' includes mounting bracket 1356 for receiving mounting pin 444, as detailed herein. As such, when pin 444 is received within aperture 1362 of mounting bracket 1356 and tabs 1360 are positioned underneath mounting hooks 440b,
15 seats 62, 64 are coupled to seat mounting bracket 126. Alternatively, pin may be released from mounting bracket 1356 by engaging latch device 1386 (Fig. 61B), such that seat 62 and/or seat 64, including base members 1350', are released from seat mounting bracket 126 and removed from vehicle 10.

[00300] Plate 1354' also includes side portions 1372, which are elevated relative to
20 frame 1352'. Side portions 1372 extend over inner side wall 1366 of side channels 1358 and are positioned above a portion of bottom surface 1363. Lower frame members 1342 of seat frame 1324 are positioned intermediate bottom surface 1363 of side channels 1358 and side portions 1372 of plate 1354'. Illustratively, as best shown in Fig. 61C, side portions 1372 are intermediate the top surface of lower frame
25 members 1342 and channels 1344 of seat frame 1324.

[00301] Additionally, plate 1354' includes longitudinal openings 1374 and, more particularly, includes three longitudinal openings 1374. Alternatively, plate 1354' may include more than three longitudinal openings 1374 or less than three longitudinal openings 1374. At least a portion of fasteners 1378 and support members 1376 are

positioned above longitudinal openings 1364. Support members 1376 rest atop plate 1354' and fasteners 1378 extend through an aperture (not shown) of support members 1376 and below longitudinal openings 1374. Fasteners 1378 may be carriage bolts or other similar components configured to prevent rotation against support members 1376.

5 As shown in Fig. 61A, couplers, such as nuts 1390, are threadedly coupled to fasteners 1378 in order to secure fasteners 1378 to base member 1350'. Nuts 1390 may be nylon insert lock nuts, polymer insert lock nuts, elastic stop nuts, or other similar components.

[00302] As shown in Figs. 61-61B, lever 1384 is generally positioned below seat bottoms 62b, 64b but extends in a forward direction such that lever 1384 is accessible

10 to the operator and passenger. Lever 1384 is positioned above plate 1354' and is coupled thereto with conventional fasteners, for example a shoulder bolt 1392 and a nut 1394. Shoulder bolt 1392 may be supported within a polymeric sleeve or insert (not shown) in order to reduce noise when the position of seats 62, 64 is adjusted.

[00303] Lever 1384 is operably coupled to latch mechanism 1382, which includes

15 a spring 1396, a tab 1388, a support portion 1380, a pin (not shown) received within support portion 1380, and a gear tooth portion 1398 having a plurality of individual teeth 1399. Illustratively, gear tooth portion 1398 is coupled to the bottom surface of frame 1352'. Gear tooth portion 1398 may be sealed or covered to protect gear tooth portion 1398 from dirt and debris. The pin is movable along gear tooth portion 1398 in order to

20 move plate 1354' relative to frame 1352', as is detailed herein. As best shown in Fig. 61B, spring 1396 may be a constant tension spring and is coupled to tab 1388 and lever 1384 in order to hold the pin, and therefore lever 1384, in a particular position along gear tooth portion 1398. More particularly, the pin extends through support portion 1380 and is held within one of teeth 1399. By maintaining the position of the pin in gear

25 tooth portion 1398, seat 62 and/or seat 64 are prevented from sliding.

[00304] In operation, when lever 1384 is laterally pushed, spring 1396 extends and the pin is released from teeth 1399. As such, plate 1354' is free to slide along frame 1352' in order to move seat 62 and/or seat 64 because the pin is not held by teeth 1399. More particularly, longitudinal openings 1374 slide along frame 1352' relative to support

members 1376 and fasteners 1378. Additionally, fastener 1370 slides within slots 1364' to allow lower frame members 1342 of seat frame 1324 to slide with plate 1354'. The elevated outer perimeters of slots 1364' reduce surface area and facilitate the sliding motion of lower frame members 1342 along side channels 1358'. As shown best in Fig. 61B, illustrative plates 1354' may be configured to slide approximately five inches in a forward direction along frame 1352' of base member 1350'. When seat 62 and/or seat 64 have been moved to a desired position within cab frame section 84, lever 1384 is released and the pin engages with a different one of teeth 1399 in order to maintain the new position of plate 1354' relative to frame 1352'.

- 10 **[00305]** Alternatively, seats 62, 64 may include a base member 1350", shown in Figs 62 and 62A, which includes features similar to those of base members 1350, 1350' of Figs. 60-61A, with like reference numerals indicating like elements, except as described below. Base member 1350" may be available from Attwood Corporation and includes a frame 1352", a plate 1354", and a bracket 1356" having aperture 1362".
- 15 Lower frame members 1342 of seat frame 1324 are coupled to plate 1354" with conventional fasteners (not shown). As shown best in Fig. 62A, frame 1352" includes a lower member 1414 which supports an adjustment mechanism 1410.

- [00306]** Illustratively, adjustment mechanism 1410 allows plate 1354", and therefore, seats 62, 64, to slide relative to frame 1352". Adjustment mechanism 1410
- 20 includes an upper adjustment member 1402 which is configured to move relative to a lower adjustment member 1404. Lower adjustment member 1404 is coupled to lower member 1414 of frame 1352" with conventional fasteners 1406, illustratively a bolt and nut. Upper adjustment member 1402 is coupled to plate 1354" with conventional fasteners 1408, illustratively a bolt and a nut. Adjustment mechanism 1410 also
- 25 includes an arm 1412, which is movable relative to lower member 1414 of frame 1352" and is coupled to lever 1384", as is detailed further herein. Adjustment mechanism 1410 may be sealed or covered to protect upper adjustment member 1402, lower adjustment member 1404, and arm 1412 from dirt and debris.

[00307] Base member 1350" is removably coupled to seat mounting bracket 126 by engaging mounting pin 444 with aperture 1362" of bracket 1356". A latch device (not shown) may be included in order to engage and disengage mounting pin 444 with bracket 1356". Additionally, base member 1350" may include forward tabs (not shown) to engage mounting hooks 440b of seat mounting bracket 126. Alternatively, mounting hooks 440b may be removed from seat mounting bracket 126 such that mounting pin 444 is the primary device for coupling base member 1350" to seat mounting bracket 126. It may be appreciated that when seat 62 and/or 64 are removed from vehicle 10, base members 1350" also are removed from vehicle 10.

[00308] In operation, base members 1350" may be used to adjust the position of seats 62, 64 within cab frame section 84. Seats 62, 64 may be configured to move in forward and rearward directions to accommodate specific preferences of the operator and/or passenger. More particularly, because seat frames 1324 are coupled to plate 1354", when the position of plate 1354" is adjusted relative to frame 1352", the position of seats 62, 64 also is adjusted. The operator and/or passenger may push or pull on lever 1384, which releases latch mechanism 1410. When lever 1384" is engaged, arm 1412 moves in a forward direction, which allows upper adjustment member 1402 to slide along lower adjustment member 1404 while lower adjustment member 1404 remains stationary on lower member 1414 of frame 1352". When lever 1384" is released (i.e., no longer engaged), then arm 1412 moves rearwardly to engage latch mechanism 1410 to retain the position of upper adjustment member 1402 relative to lower adjustment member 1404.

[00309] Referring to Figs. 63-66, seats 62, 64 may be configured with restraint harness-type seat belts. In the embodiment of Fig. 63, seat belts 1416 are three-point harnesses having a first point, illustratively a shoulder retractor 1418 positioned above seat backs 62a, 64a, a second point, illustratively a hip retractor 1420 positioned near seat bottoms 62b, 64b, and a third point, illustratively a latching mechanism 1422 generally opposite hip retractors 1420.

[00310] Shoulder retractor 1418 is coupled to a bracket 1428 on tube portions 622b of U-shaped tube 622 (Figs. 26-28). As shown best in Fig. 1, tube portions 622, and therefore brackets 1428, are positioned rearward of seats 62, 64 such that shoulder retractors 1418 also are positioned rearward of seats 62, 64. Additionally, due to the configuration of cab frame section 84, brackets 1428 may be positioned above a forward portion of rear cargo area 56. Illustratively, brackets 1428 are positioned generally above seats 62, 64, however, brackets 1428 also may be positioned lower than the head rest portion of seats 62, 64. Alternatively, brackets 1428 may be coupled to the rear surface of seat backs 62a, 64a and also may be lower than the head rest portion of seats 62, 64.

[00311] A first strap 1424 extends between shoulder retractor 1418 and latching mechanism 1422 in order lay against the chest of the operator and passenger. First strap 1424 includes an anchor end 1432 which is coupled to shoulder retractor 1418 and a terminal end 1434 which is coupled to latching mechanism 1422. The operator or passenger needs only to pull terminal end 1434 across his or her chest in order secure first strap 1424 to latching mechanism 1422. As such, the operator or passenger is not required to pull first strap 1424 down over his or her head when engaging first strap 1424 with latching mechanism 1422.

[00312] Shoulder retractor 1418 automatically adjusts first strap 1424 to a length necessary to fit across the operator or passenger, which eliminates the need for the operator or passenger to manually adjust the length of first strap 1424. Additionally, shoulder retractor 1418 allows the operator or passenger to have mobility while wearing seat belt 1416 because the length of first strap 1424 automatically adjusts to accommodate movement of the operator or passenger while wearing seat belt 1416. However, shoulder retractor 1418 also includes an inertial lock (not shown) which prevents first strap 1424 from extending or lengthening in response to sudden movement. As such, the operator or passenger is restrained by first strap 1424 if vehicle 10 suddenly stops, changes directions, or moves in a manner that causes the operator or passenger to move suddenly.

[00313] Hip retractor 1420 is coupled to outer frame rails 154 (Fig. 12) and latching mechanism 1422 is coupled to seat mounting bracket 126. A second strap 1426 lays across the lap of the operator and passenger and extends between hip retractor 1420 and latching mechanism 1422. Second strap 1426 includes an anchor end 1436 coupled to hip retractor 1420 and a terminal end 1438 coupled to latching mechanism 1422. The operator or passenger only needs to pull terminal end 1438 across his or her lap in order secure second strap 1426 to latching mechanism 1422.

[00314] Hip retractor 1420 automatically adjusts second strap 1426 to a length necessary to fit across the operator's or passenger's lap, which eliminates the need for the operator or passenger to manually adjust the length of second strap 1426. Additionally, hip retractor 1420 allows the operator or passenger to have mobility while wearing seat belt 1416 because the length of second strap 1426 automatically adjusts to accommodate movement of the operator or passenger while wearing seat belt 1416. However, hip retractor 1420 also includes an inertial lock (not shown) which prevents second strap 1426 from extending or lengthening in response to sudden movement. As such, the operator or passenger is restrained by second strap 1426 if vehicle suddenly stops, changes directions, or moves in a manner that causes the operator or passenger to move suddenly.

[00315] As shown in Figs. 60, 61, and 62, seat mounting bracket 126 includes brackets 1430 for supporting latching mechanism 1422. As such, brackets 1430 may be positioned generally rearward of the operator or passenger. Latching mechanism 1422 is configured to receive terminal ends 1434, 1438 of straps 1424, 1426. Terminal ends 1434, 1438 may be coupled together, for example through a clip (not shown), stitching, or other similar means, in order to reduce the number of latching points for latching mechanism 1422. For example, terminal ends 1434 and 1438 of respective first and second straps 1424 and 1426 may be releasably secured to a single latching point of latching mechanism 1422. As such, latching mechanism 1422 may include only one latching point for both first and second straps 1424, 1426.

[00316] Latching mechanism 1422 may include a release tab (not shown) for engaging and releasing terminal ends 1434, 1438 from latching mechanism 1422. Latching mechanism 1422 may include only one release tab because when terminal ends 1434, 1438 are coupled together, only one release tab is needed to engage and release both first and second straps 1424 and 1426 from latching mechanism 1422. For example, the operator or passenger may depress the release tab in order to release both terminal ends 1434, 1438 from latching mechanism 1422. First and second straps 1424 and 1426 automatically retract toward shoulder and hip retractors 1418 and 1420, respectively, when terminal ends 1434, 1438 are released from latching mechanism 1422. As such, seat belts 1416 do not rest on seats 62, 64 when not in use, which facilitates movement into and out of seating area 60.

[00317] Alternatively, as shown in Fig. 64, seat belts 1416' include features similar to seat belts 1416 of Fig. 63, with like reference numerals indicating like elements, except as described below. Seat belts 1416' may be four-point harnesses having a first point, illustratively a first or outer shoulder retractor 1440 positioned near the head rest portion of seat backs 62a and 64a, a second point, illustratively a second or inner shoulder retractor 1442 positioned opposite outer shoulder retractor 1440 and near the head rest portion of seat backs 62a and 64a, a third point, illustratively a first or outer hip retractor 1444 positioned near seat bottoms 62b and 64b, and a fourth point, illustratively a second or inner hip retractor 1446 positioned generally opposite outer hip retractor 1444. Seat belts 1416' also include a latching mechanism 1422' configured to be positioned against the operator's or passenger's chest and is generally centrally positioned between the first, second, third, and fourth points of seat belts 1416'.

[00318] Outer and inner shoulder retractors 1440 and 1442 are coupled to cross tube 624 of cab frame section 84 (Figs. 26-28). As shown best in Fig. 1, cross tube 624 is rearward of seats 62 and 64, and, therefore, outer and inner shoulder retractors 1440 and 1442 are rearward of seats 62, 64. Additionally, due to the configuration of cab frame portion 84, shoulder retractors 1440, 1442 may be positioned above a forward portion of rear cargo area 56. Illustratively, outer and inner shoulder retractors 1440 and 1442 are positioned generally above seat backs 62a, 64a, however, shoulder

retractors 1440, 1442 also may be positioned below the head rest portion of seats 62, 64. Alternatively, shoulder retractors 1440, 1442 may be coupled to the rear surface of seat backs 62a, 64a.

[00319] Outer hip retractor 1444 is coupled to outer frame rails 154 (Fig. 12) and, as shown in Fig. 64, is positioned rearward of the operator and passenger when seated in seats 62, 64, respectively. Additionally, as shown in Figs. 60, 61, and 62, seat mounting bracket 126 includes brackets 1430 for supporting inner hip retractors 1446. Brackets 1430, and, therefore, inner hip retractors 1446, may be positioned generally rearward of the operator or passenger when seated in seats 62, 64, respectively.

[00320] A first strap 1448 having an anchor end 1450 and a terminal end 1452 extends between outer shoulder retractor 1440 and latching mechanism 1422' in order lay against the chest of the operator and passenger. Anchor end 1450 is coupled to outer shoulder retractor 1440 and terminal end 1452 is coupled to latching mechanism 1422'. A third strap 1460 is positioned below first strap 1448 and includes an anchor end 1462 and a terminal end 1464. Anchor end 1462 is coupled to outer hip retractor 1444 and terminal end 1464 is coupled to latching mechanism 1422'. Illustratively, terminal ends 1452, 1464 of respective first and third straps 1448 and 1460 may be coupled together such that first and second straps 1448 and 1460 are coupled to latching mechanism 1422' at one single latching point.

[00321] A second strap 1454 may be positioned generally opposite first strap 1448 and extends between an anchor end 1456 at inner shoulder retractor 1442 and a terminal end 1458 at latching mechanism 1422'. A fourth strap 1466 is positioned below second strap 1454 and includes an anchor end 1468 and a terminal end 1470. Anchor end is coupled to inner hip retractor 1446 and terminal end is coupled to latch mechanism 1422'. Illustratively, terminal ends 1458, 1470 of respective second and fourth straps 1454 and 1466 may be coupled together such that second and fourth straps 1454 and 1466 are coupled to latching mechanism 1422' at one latching point.

[00322] Latching mechanism 1422' includes a tongue portion 1472 and a receptacle portion 1474. Tongue portion 1472 is releasably coupled to receptacle

portion 1474 through a release tab (not shown). As shown in Fig. 64, first and third straps 1448, 1460 are coupled to tongue portion 1472, and second and fourth straps 1454, 1466 are coupled to receptacle portion 1474. As such, seat belt 1416' includes only one latching point defined by the engagement between tongue portion 1472 and
5 receptacle portion 1474.

[00323] To secure seat belt 1416', the operator or passenger only needs to pull tongue portion 1472, which is coupled to first and third straps 1448, 1460, toward receptacle portion 1474, which is coupled to second and fourth straps 1454, 1466. As such, seat belts 1416' allow easy mounting and dismounting because the operator or
10 passenger is not required to pull seat belt 1416' over his or her head.

[00324] Shoulder retractors 1440, 1442 and hip retractors 1444, 1446 automatically adjust the length of straps 1448, 1454, 1460, 1466, respectively, which eliminates the need for the operator or passenger to manually adjust the length of straps 1448, 1454, 1460, 1466. Therefore, shoulder retractors 1440, 1442 and hip
15 retractors 1444, 1446 allow the operator or passenger to have mobility while wearing seat belt 1416' because the length of straps 1448, 1454, 1460, 1466 automatically adjusts to accommodate movement of the operator or passenger while wearing seat belt 1416'. However, shoulder retractors 1440, 1442 and hip retractors 1444, 1446 also include an inertial lock (not shown) which prevents straps 1448, 1454, 1460, 1466 from
20 extending or lengthening in response to sudden movement. As such, the operator or passenger is restrained by seat belt 1416' if vehicle 10 suddenly stops, changes directions, or moves in a manner that causes the operator or passenger to move suddenly. Additionally, when tongue portion 1472 is disengaged from receptacle
25 portion 1474, shoulder retractors 1440, 1442 and hip retractors 1444, 1446 automatically retract straps 1448, 1454, 1460, 1466, respectively, in order to move straps 1448, 1454, 1460, 1466 away from seats 62, 64 when not in use.

[00325] Alternatively, as shown in Fig. 65, seat belts 1416" include features similar to seat belts 1416' of Fig. 64, with like reference numerals indicating like elements, except as described below. Seat belts 1416" may be five-point harnesses having a first

point, illustratively outer shoulder retractor 1440 positioned near the head rest portion of seat backs 62a and 64a, a second point, illustratively inner shoulder retractor 1442 positioned opposite outer shoulder retractor 1440 and near the head rest portion of seat backs 62a and 64a, a third point, illustratively outer hip retractor 1444 positioned near
5 seat bottoms 62b and 64b, a fourth point, illustratively inner hip retractor 1446 positioned generally opposite outer his retractor 1444, and a fifth point, illustratively a leg retractor 1476. Seat belts 1416" also include a latching mechanism 1422" configured to be positioned against the operator's or passenger's chest and is generally centrally positioned between the first, second, third, fourth, and fifth points of seat belts
10 1416".

[00326] As detailed above with respect to seat belts 1416', outer shoulder retractor 1440 is coupled to first strap 1448, inner shoulder retractor 1442 is coupled to second strap 1454, outer hip retractor 1444 is coupled to third strap 1460, and inner hip retractor 1446 is coupled fourth strap 1466. Shoulder retractors 1440, 1442 and hip
15 retractors 1444, 1446 automatically retract or lengthens straps 1448, 1454, 1460, 1466 in order to automatically adjust the length of straps 1448, 1454, 1460, 1466 when the operator or passenger moves or when seat belts 1416" are not in use.

[00327] Seat belts 1416" include a fifth strap 1478 operably coupled to leg retractor 1476. Fifth strap 1478 is configured to be positioned between the operator's or
20 the passenger's legs. Fifth strap 1478 includes an anchor end 1480 coupled to leg retractor 1476 and a terminal end 1482 coupled to latch mechanism 1422". Leg retractor 1476 is configured to automatically adjust the length of fifth strap 1478, such that when fifth strap 1478 is not in use, terminal end 1482 is retracted and is adjacent leg retractor 1476. Conversely, when fifth strap 1478 is in use, terminal end 1482 is
25 adjacent latching mechanism 1422". Additionally, the automatic adjustment of fifth strap 1478 allows the operator or passenger to easily move when wearing seat belt 1416". However, leg retractor 1476 includes an inertial lock which maintains the position of fifth strap 1478 during sudden movements.

[00328] Terminal end 1482 of fifth strap 1478 illustratively includes a tongue portion 1484. Tongue portion 1484 may be engaged with receptacle portion 1474 to secure fifth strap 1478 thereto. As such, latching mechanism 1422" may include two latching points – one latching point defined by the engagement between tongue portion 1472 and receptacle portion 1474 for securing first and third straps 1448 and 1460 to second and fourth straps 1454 and 1466, and a second latching point defined by the engagement between tongue portion 1484 and receptacle portion 1474 for securing fifth strap 1478 to first, second, third, and fourth straps 1448, 1454, 1460, and 1466. Alternatively, terminal end 1482 of fifth strap 1478 may be coupled to terminal ends 1452 and 1464 of respective first and third straps 1448 and 1460, such that latching mechanism 1422" includes only one single latching point defined by the engagement between tongue portion 1472 and receptacle portion 1474.

[00329] Leg retractor 1476 is coupled to front channel 440 of seat mounting bracket 126, and more particularly, is mounted to a middle portion of front channel 440. As shown best in Fig. 65, leg retractor 1476 is positioned below seat bottoms 62b, 64b of seats 62, 64. Additionally, leg retractor 1476 is generally positioned forward of seat bottoms 62b, 64b. Seat belt 1416" allows for easy mounting and dismounting therefrom because the operator and passenger are not required to pull seat belt 1416" over his or her head.

[00330] Alternatively, as shown in Fig. 66, seat belts 1416'" include features similar to seat belts 1416" of Fig. 65, with like reference numerals indicating like elements, except as described below. Seat belts 1416'" may be six-point harnesses having a first point, illustratively outer shoulder retractor 1440 positioned near the head rest portion of seat backs 62a and 64a, a second point, illustratively inner shoulder retractor 1442 positioned opposite outer shoulder retractor 1440 and near the head rest portion of seat backs 62a and 64a, a third point, illustratively outer hip retractor 1444 positioned near seat bottoms 62b and 64b, a fourth point, illustratively inner hip retractor 1446 positioned generally opposite outer hip retractor 1444, a fifth point, illustratively an outer leg retractor 1476', and a sixth point, illustratively an inner leg retractor 1486. Seat belts 1416'" also include a latching mechanism 1422'" configured to be positioned

against the operator's or passenger's chest and is generally centrally positioned between the first, second, third, fourth, fifth, and sixth points of seat belts 1416".

[00331] As detailed above with respect to seat belts 1416", outer shoulder retractor 1440 is coupled to first strap 1448, inner shoulder retractor 1442 is coupled to second strap 1454, outer hip retractor 1444 is coupled to third strap 1460, and inner hip retractor 1446 is coupled fourth strap 1466. Shoulder retractors 1440, 1442 and hip retractors 1444, 1446 automatically retract straps 1448, 1454, 1460, 1466 in order to automatically adjust the length of straps 1448, 1454, 1460, 1466 when the operator or passenger moves or when seat belts 1416" are not in use.

[00332] Seat belts 1416" include a fifth strap 1478' operably coupled to outer leg retractor 1476'. Fifth strap 1478' is configured to be positioned between the operator's or the passenger's legs. Fifth strap 1478' includes an anchor end 1480' coupled to outer leg retractor 1476' and a terminal end 1482' coupled to latch mechanism 1422". More particularly, terminal end 1482' may be coupled to a tongue portion 1484' which engages with receptacle portion 1474 of latch mechanism 1422". Alternatively, terminal end 1482' may be coupled to terminal ends 1452 and 1464 of first and third straps 1448 and 1460 such that tongue portion 1472 couples first, third, and fifth straps 1448, 1460, and 1478' with latch mechanism 1422".

[00333] Seat belts 1416" further include a sixth strap 1488 operably coupled to inner leg retractor 1486. Sixth strap 1488 is configured to be positioned between the operator's or the passenger's legs. Sixth strap 1488 includes an anchor end 1490 coupled to inner leg retractor 1486 and a terminal end 1492 coupled to latch mechanism 1422". More particularly, terminal end 1492 may be coupled to a tongue portion 1494 which engages with receptacle portion 1474 of latch mechanism 1422". Alternatively, terminal end 1494 may be coupled to terminal ends 1458 and 1470 of second and fourth straps 1454 and 1466 such that receptacle portion 1474 couples second, fourth, and sixth straps 1454, 1466, and 1488 with first, third, and fifth straps 1448, 1460, and 1478'. As such, latching mechanism 1422" includes one, two, or three latching points,

depending on whether each of fifth and sixth straps 1478' and 1488 include respective tongue portions 1484' and 1494.

[00334] Outer and inner leg retractors 1476' and 1486 are configured to automatically adjust the length of fifth and sixth straps 1478' and 1488, such that when
5 fifth and sixth straps 1478' and 1488 are not in use, terminal ends 1482' and 1490 are retracted and adjacent outer and inner leg retractors 1476' and 1486, respectively. Conversely, when fifth and sixth straps 1478' and 1488 are in use, terminal ends 1482' and 1490 are adjacent latching mechanism 1422". Additionally, the automatic adjustment of fifth and sixth straps 1478' and 1488 allows the operator or passenger to
10 easily move when wearing seat belt 1416". However, outer and inner leg retractors 1476' and 1486 each include an inertial lock which maintains the positions of fifth and sixth straps 1478' and 1488 during sudden movements.

[00335] Outer and inner leg retractors 1476' and 1486 are coupled to front channel 440 of seat mounting bracket 126, and more particularly, outer leg retractor 1476' is
15 mounted to an outer end portion of front channel 440, and inner leg retractor 1486 is mounted to an inner end portion of front channel 440. As shown best in Fig. 66, outer and inner leg retractors 1476' and 1486 are positioned below seat bottoms 62b, 64b of seats 62, 64. Additionally, outer and inner leg retractors 1476' and 1486 are generally positioned forward of seat bottoms 62b, 64b. Seat belt 1416" allows for easy mounting
20 and dismounting therefrom because the operator and passenger are not required to pull seat belt 1416" over his or her head.

[00336] In addition to seat belts 1416, 1416', 1416", or 1416"', door assemblies 1500 also help retain the operator and passenger within vehicle 10. Door assemblies 1500 are positioned adjacent both driver seat 62 and passenger seat 64. As shown in
25 Figs. 67-69, door assembly 1500 includes a frame 1502, hinges 1514 and 1520, a latch assembly 1524, and an outer cover 1540. In the embodiment of Fig. 67, frame 1502 is comprised of a metal or polymeric material and, illustratively, is stamped to define a plurality of frame members, including an upper frame member 1504, a lower frame member 1506, a first brace 1508, and a second brace 1510. Upper and lower frame

members 1504 and 1506 extend between side tube 164 and mounting tube 308. Braces 1508, 1510 extend between upper and lower frame members 1504 and 1506 to define openings 1512a, 1512b, and 1512c.

[00337] The rear ends of upper and lower frame members 1504 and 1506 are hingedly coupled to side tubes 164 through hinges 1514 and 1520. More particularly, a projection 1516 extending from upper frame member 1504 is positioned above hinge component 164a and is pivotally coupled thereto with a fastener 1518. Similarly, a projection 1522 extends from lower frame member 1506 and is pivotally coupled to hinge component 164b with fastener 1523. As such, door frame 1502 is pivotally coupled to side tube 164.

[00338] Alternatively, as shown in Fig. 70, door assembly 1500 may include a frame 1502' comprised of a plurality of frame members welded together. Frame 1502' of Fig. 70 includes features similar to those of frame 1502 of Fig. 68, with like reference numerals indicating like features, except as disclosed below. Frame 1502' includes an upper frame member 1504', a lower frame member 1506', a first brace 1508', and a second brace 1510'. First and second braces 1508', 1510' extend between upper and lower frame members 1504', 1506' to define openings 1512a', 1512b', 1512c'.

[00339] Referring to Fig. 70, upper frame member 1504' of frame 1502' is pivotally coupled to side tube 164 through hinge component 164a and a tab 1554 coupled thereto with fastener 1518. Tab 1554 is welded or otherwise coupled to upper frame member 1504' and illustratively rests atop hinge component 164a. Similarly, lower frame member 1506' includes a tab 1556 welded or otherwise coupled thereto in order to pivotally couple lower frame member 1506' to side tube 164. Tab 1556 rests atop hinge component 164b and is coupled to hinge component 164b with fastener 1523. Latch assembly 1524 is welded or otherwise coupled to frame 1502' and, illustratively, is coupled to lower frame member 1506'.

[00340] Regardless of whether door assembly 1500 includes frame 1502 or 1502', upper frame member 1504 is operably coupled mounting tube 308 and bracket 320 through latch assembly 1524 (Figs. 68 and 69). Latch assembly 1524 includes a handle

1526 operably coupled to frame 1502 through a spring 1527 and a pin 1528. The tension in spring 1527 allows handle 1526 to rotate relative to frame 1502, as is further detailed herein.

[00341] Latch assembly 1524 further includes a housing 1529 coupled to frame 1502 with conventional fasteners (not shown) extending through apertures 1534a of frame 1502 and apertures 1534b of housing 1529. An arm 1530 is positioned within housing 1529 and overlaps a portion of handle 1526. An opening or cut-out 1531 of arm 1530 is configured to engage a latching hook 1536 when securing door assembly 1500 to frame 12 of vehicle 10, as is further detailed herein. A groove or opening 1532 of housing 1529 exposes opening 1531 of arm 1530. A mechanism 1533 for rotating arm 1530 between an open position and a closed position also is supported by housing 1529.

[00342] Latching hook 1536 is supported on flange 322 of bracket 320. A plate member 1537 is proximate flange 322 and secures latching hook 1536 thereto with fasteners 324. Fasteners 324 are received through apertures 1538 of plate member 1537 and apertures 1539 of flange 322. Washers 1535b may be intermediate plate member 1537 and flange 322. Additionally, washers 1535a may be intermediate fasteners 324 and plate member 1537.

[00343] Alternative embodiments of latch assembly 1524 may be configured with a double-acting latch that allows door assembly 1500 to be partially released from frame 12 when in a first position and fully released when in a second position. A catch mechanism (not shown) may be used to partially release door assembly from frame 12 while preventing door assembly 1500 from rotating to the open position.

[00344] Cover 1540 may be outward of frame 1502 and coupled thereto. Cover includes an upper longitudinal member 1542 generally corresponding to upper frame member 1504 and a lower longitudinal member 1544 generally corresponding to lower frame member 1506. Cover further includes a first cross member 1546 and a second cross member 1548 generally corresponding to first and second braces 1508 and 1510, respectively. Longitudinal members 1542, 1544, and cross members 1546, 1548 may

be comprised of a polymeric material. Covered portions 1550a, 1550b, and 1550c extend between longitudinal members 1542, 1544 and cross members 1546, 1548 to generally correspond to openings 1512a, 1512b, and 1512c, respectively. Covered portions 1550 may be comprised of a fabric or polymeric material, such as mesh, netting, webbing, or other similar materials. Covered portions 1550 may allow air to flow through door assembly 1500 and also provide additional protection for the operator and passenger. Covered portion 1550a may include an opening 1552 for exposing handle 1526 of latch assembly 1524. Additionally, door 1550 is shown to bow outwardly, as best shown in FIGS. 72 and 96, providing more room inside the operator's area for the driver and passenger.

[00345] Door assembly 1500 may further include side nets or, alternatively, may be comprised of side nets, additional details of which are disclosed in U.S. Patent Application Serial No. 12/484,888, filed on June 15, 2009; and U.S. Patent Application Serial No. 12/796,495, filed on June 8, 2010, the complete disclosures of which are expressly incorporated by reference herein. The side nets may be coupled to side tubes 164, or alternatively, side tubes 164 may be removed from frame 12 such that the side nets are coupled to portion 154b of outer frame rail 154.

[00346] Referring to Fig. 71, regardless of whether door assembly 1500 includes stamped frame 1502 or welded frame 1502', door assembly 1500 may also include a security bar 1558 extending therefrom. As shown in Fig. 71, security bar 1558 extends below frame 1502 and cover 1540 and may be generally U-shaped. Bar 1558 is coupled to lower frame member 1504 of frame 1502, or alternatively, may be coupled to lower longitudinal member 1544 of cover 1540. Security bar 1558 is positioned adjacent the operator's or passenger's legs to further stabilize and secure the operator and passenger within vehicle 10.

[00347] As shown in Fig. 72, door assembly 1500 is configured to pivot about hinge 1514 and hinge 1520 in a counter clockwise direction. In operation, door assembly 1500 is secured to frame 12 of vehicle 10 when arm 1530 is engaged with latching hook 1537. When handle 1526 is pulled inwardly, handle 1526 contacts arm

1530 such that mechanism 1533 causes arm 1530 to rotate away from latching hook 1536. As such, when handle 1526 is pulled, opening 1531 of arm 1530 no longer engage latching hook 1536 and door assembly 1500 may be swung open and moved away from frame 12. When door assembly 1500 is closed and secured to frame 12, mechanism 1533 causes opening 1531 of arm 1530 to engage latching hook 1536. A sound, for example a “click,” may be heard when latch assembly 1524 is positively engaged and door assembly 1500 is fully secured to frame 12. An exemplary embodiment of latch assembly 1524 may be available from Eberhard Manufacturing Company.

10 **[00348]** Illustratively, when door assembly 1500 is in the open position, door assembly is angled approximately 90 degrees from side tube 164. Hinge component 164a includes a stop surface 165 (Figs. 67-72) which contacts cover 1540 of door assembly 1500 to prevent door assembly 1500 from rotating past approximately 90 degrees when in the open position. By limiting the rotation of door assembly 1500 to approximately 90 degrees, the operator and passenger are able to easily close door assembly 1500 when entering vehicle 10. Furthermore, door assembly 1500 may be tapered inwardly such that door assembly 1500 may naturally rotate towards frame 12 to assist the operator and passenger when closing door assembly 1500.

20 **[00349]** As shown in Fig. 67, door assembly 1500 may be generally flush with body portion 40 of vehicle 10 such that door assembly 1500 does not extend outwardly from vehicle 10 when in the closed position. Alternative embodiments of door assembly 1500 may be full doors that extend between outer frame rails 154 (Fig. 9) and frame portion 612 of cab frame section 84 (Fig. 28). The full doors also would be flush with frame 12 when closed because frame members, such as frame portion 612, may be profiled. As shown in Fig. 73, frame portion 612 may have a channel 1560 with opposing surfaces 1560a and 1560b. An inner surface of the full door may rest against surface 1560b and an upper surface of the full door may rest against surface 1560a in order to remain flush with body portion 40 when in the closed position. Additionally, frame 12 may include members with two profiled surfaces, additional details of which

are disclosed in U.S. Patent Application Serial No. 13/492,589, filed on June 8, 2012, the complete disclose of which is expressly incorporated by reference herein.

[00350] Referring to Figs. 74-76, the operator area contained between door assembly 1500 includes a grab bar 1562 positioned forward of passenger seat 64 and extending towards the passenger. As shown best in Figs. 75 and 76, grab bar 1562 includes a shaft 1564 and a handle member 1566. Illustratively, handle member 1566 and shaft 1564 define a square in cross-section; however, handle member 1566 and shaft 1564 may define other shapes in cross-section, for example a circle or triangle. Shaft 1564 includes a plurality of apertures 1598 which allows grab bar 1562 to telescope closer to, or further from, the passenger. Handle member 1566 is generally perpendicular to shaft 1564 and defines opposing gripping portions for the passenger to hold onto during operation of vehicle 10. Handle member 1566 may be coupled to shaft 1564 with a coupler 1568 positioned at the coupling location of handle member 1566 and shaft 1564. Handle member 1566 and shaft 1564 may be comprised of a polymeric or metal material, and, in addition to coupler 1568, may be coupled together with conventional fasteners, such as bolts, clips, screws, pins, welds, rivets, adhesive, or other similar components.

[00351] A grip or cover 1570 generally surrounds handle member 1566 and a portion of shaft 1564. Grip 1570 has a generally rounded shape that allows the passenger to comfortably grip grab bar 1562. Grab bar 1562 may be comprised of a polymeric material, for example a vibration isolating material.

[00352] Grab bar 1562 is supported on upper frame portion 190, and more particularly, on transverse tube 300 and transverse channel 302. Shaft 1564 is positioned within cross tube 304 and is configured to telescope relative thereto, as is further detailed herein. A first or rear insert member 1572 is adjacent grip 1570 and is positioned intermediate shaft 1564 and cross tube 304. Rear insert member 1572 includes a lip 1574 to prevent rear insert member 1572 from sliding forward in cross tube 304. Rear insert member 1572 may include a protrusion 1580 which is received within an aperture 1582 of cross tube 304 to further retain rear insert member 1572

within cross tube 304. Protrusion 1580 may be detent fingers or other resilient members configured to slide against the inner surface of cross tube 304 and extend outwardly at aperture 1582. Rear insert member 1572 further includes at least one opening 1584 which generally corresponds to an opening 1586 of cross tube 304 when rear insert member 1572 is positioned therein. A pin 1588 and a clip 1590 may be received through openings 1584 and 1586 of respective rear insert member 1572 and cross tube 304. Furthermore, when shaft 1564 is positioned within cross tube 334, pin 1588 may be inserted through openings 1584, 1586, and one of apertures 1598 in order to lock the position of grab bar 1562 relative to cross tube 304. The square cross-section of shaft 1564 does not allow rotation within cross tube 304, and therefore, may prevent grab bar 1562 from rattling or moving when vehicle 10 is in use. Additionally, illustrative rear insert member 1572 is a bushing that may be comprised of a polymeric material to further prevent rattling or movement or between shaft 1564 and cross tube 304.

[00353] A second or forward insert member 1576 is intermediate shaft 1564 and cross tube 304 and is generally opposite rear insert member 1572. Forward insert member 1576 includes a lip 1578 and is positioned generally below transverse channel 302. Forward insert member 1576 may be comprised of a polymeric material and illustratively is a bushing between shaft 1564 and cross tube 304. Forward insert member 1576 also may include a protrusion 1592 that extends from an aperture 1594 of cross tube 304 to couple forward insert member 1576 to cross tube 304. Protrusion 1592 may be detent fingers or other resilient members configured to slide against the inner surface of cross tube 304 and extend outwardly from aperture 1594. Forward insert member 1576 further includes at least one opening 1596 which may correspond to an opening (not shown) of cross tube 304 when forward insert member 1576 is positioned therein. Conventional fasteners, such as pins, clips, bolts, and screws may be received through opening 1596 of forward insert member 1576 and the corresponding opening in cross tube 304.

[00354] In operation, when the passenger desires to change the position of grab bar 1562, pin 1588 and clip 1590 are removed from cross tube 304, rear insert member

1572, and shaft 1564. Grab bar 1562 is pulled in a generally rearward direction relative to cross tube 304 in order to position grab bar 1562 closer to the passenger. Conversely, grab bar 1562 is pushed in a generally forward direction relative to cross tube 304 in order to position grab bar 1562 further from the passenger. When grab bar 5 1562 is in the desired position, one of apertures 1598 aligns with openings 1584 of rear insert member 1576 and openings 1586 of cross tube 304 in order to receive pin 1588 therethrough. Clip 1590 also is coupled to pin 1588. As such, the configuration of grab bar 1562 accommodates different passengers with different physical characteristics, such as different heights or different arm lengths. Additional details of grab bar 1562 10 are available in U.S. Patent Application Serial No. 13/492,589, filed on June 8, 2012, the complete disclose of which is expressly incorporated by reference herein.

[00355] As shown in Figs. 77 and 78, the operator controls in the operator area also include a steering assembly 1600 having a steering wheel 1602, a steering column 1604, a steering rod 1606 having portions 1606a and 1606b, steering shafts 1162 15 operably coupled to ground engaging members 14, and a steering adjustment mechanism 1610. Steering wheel 1602 is operably coupled to steering rod portion 1606a through steering column 1604 and a U-joint 1608. Steering rod portions 1606a and 1606b are operably coupled to each other through a U-joint 1608 and are operably coupled to steering shafts 1162 through a U-joint 1608.

20 **[00356]** Referring to Fig. 78, steering wheel 1602 and steering column 1602 are forward of driver seat 62 and are supported on transverse tube 300 through steering mount 306. Steering adjustment mechanism 1610 allows steering column 1604 and steering wheel 1602 to tilt upwardly or downwardly to accommodate the preferences of various operators. Additionally, steering adjustment mechanism 1610 may allow 25 steering wheel 1602 to telescope relative to transverse tube 300 to adjust the fore and aft position of steering wheel 1602 (i.e., to adjust the position of steering wheel 1602 closer or further from the operator).

[00357] Steering adjustment mechanism 1610 includes a housing 1612, a lever 1614, a lever bracket 1616, a coupler 1618, and friction pads or plates 1620. Housing

1612 may be comprised of a metal material and generally surrounds a portion of steering column 1604. Lever 1614 is supported on housing 1612 by lever bracket 1616 such that lever 1614 is outside of housing 1612. Lever 1614 is coupled to bracket 1616 and housing 1612 by coupler 1618.

5 **[00358]** Friction pads 1620 are intermediate housing 1612 and lever bracket 1616, and illustratively include a first pad 1620a and a second pad 1620b. Coupler 1618 may extend through apertures (not shown) in friction pads 1620a, 1620b to secure friction pads 1620a, 1620b between housing 1612 and lever bracket 1616. Friction pads 1620a and 1620b are comprised of a polymeric or friction material and have complimentary
10 and adjacent profiled surfaces at the interface therebetween. For example, friction pad 1620a may have a convex profiled surface facing a concave profiled surface on friction pad 1620b. The profiled surfaces frictionally engage each other in order to maintain a particular position and tilt angle of steering wheel 1602.

[00359] In order to tilt steering wheel 1602, the operator actuates lever 1614,
15 which disengages friction pad 1620a from friction pad 1620b. As such, friction pad 1620a is not frictionally engaged with friction pad 1620b, which allows steering wheel 1602 to move or tilt relative to housing 1612. More particularly, the operator is able to push up or pull down on steering wheel 1602 when the profiled surface of friction pad 1620a is not frictionally held against the profiled surface of friction pad 1620b. As
20 shown best in Fig. 78, the tilt angle of steering wheel 1602 may be approximately 45 degrees.

[00360] When steering wheel 1602 is in the desired position, lever 1614 is again actuated in order to frictionally engage friction pad 1620a with friction pad 1620b. More particularly, the profiled (e.g., convex) surface of friction pad 1620a aligns or mates with
25 the profiled (e.g., concave) surface of friction pad 1620b to retain steering wheel 1602 in a particular position. The engagement between friction pads 1620a, 1620b also may prevent rattling or other movement in steering assembly 1600. Exemplary components of steering assembly 1600 may be available from Admiral Tool & Manufacturing Co. of Michigan.

[00361] Alternative embodiments of steering adjustment mechanism 1610 may include grooves or apertures that receive a pin or other similar device in order to move steering wheel 1602 incrementally when the pin is released from the aperture or groove. A further alternative embodiment of steering adjustment mechanism 1610 includes a gas shock absorber positioned below steering wheel 1602 for adjusting the tilt position of steering wheel 1602, additional details of which may be available in U.S. Patent Application Serial No. 13/492,589, filed on June 8, 2012, the complete disclosure of which is expressly incorporated by reference herein.

[00362] Referring to Figs. 77, 79, and 80, the operator controls further include an accelerator pedal 1622, which also operates to move ground engaging members 14, 16. Accelerator pedal 1622 is coupled to an arm 1626 comprised of a resilient material, thereby allowing arm 1626 to flex without breaking when the operator depresses accelerator pedal 1622. Arm 1626 is pivotally coupled to an electrical system 1700 (Fig. 85) of vehicle 10 through an electronic throttle control (“ETC”) 1640. ETC 1640 is electrically coupled to throttle bodies 840 (Fig. 36) at engine 802 (Fig. 34). Illustratively, the housing for ETC 1640 is supported by a plate 1642 and is coupled to an upper front panel 1646 with fasteners 1644. It may be appreciated that the illustrative housing of ETC 1640 does not support a throttle cable because ETC 1640 is in electrical communication with engine 802.

[00363] Accelerator pedal 1622 is positioned in a foot well of the operator area. As shown in Fig. 77, accelerator pedal 1622 is positioned below steering wheel 1602 and is adjacent a brake pedal 1624. Additionally, accelerator pedal 1622 is above a floor board panel 1630 and is rearward of a lower front panel 1628. Lower front panel 1628 includes a profiled recess 1634 that is configured to receive arm 1626 when accelerator pedal 1622 is depressed and arm 1626 moves in a forward direction. Illustratively, profiled recess 1634 is molded into lower front panel and functions as a “stop” for arm 1626 and accelerator pedal 1622.

[00364] In operation, as shown best in Fig. 80, when vehicle 10 is not moving, accelerator pedal 1622 and arm 1626 are in an idle position A_1 . When in position A_1 ,

accelerator pedal 1622 and arm 1626 are spaced apart from profiled recess 1634 and vehicle 10 is not moving. However, when the operator depresses accelerator pedal 1622, arm 1626 and accelerator pedal 1622 are moved in a forward direction and pivot relative to ETC 1640. The pivoting motion of arm 1626 signals ETC 1640 to open throttle bodies 840, thereby causing vehicle 10 to move. Accelerator pedal 1622 may be depressed to a “wide open” or maximum throttle position A_2 , which also correlates to the maximum movement of accelerator pedal 1622 and arm 1626. When in position A_2 , arm 1626 may contact recess 1634 which stops the forward movement of arm 1626. When in position A_2 , arm 1626 resiliently flexes to allow accelerator pedal 1622 to contact floor board panel 1630 before arm 1626 is flexed to a breaking point.

[00365] Referring again to Fig. 77, floor board panel 1630 and lower front panel 1628 are forward of driver seat 62 and may include a stationary “dead pedal” 1648. Walls 1649 elevate dead pedal 1648 relative to floor board panel 1630 and lower front panel 1628. Dead pedal 1648 supports the operator’s left foot when the operator is seated in driver seat 62. The position of dead pedal 1648 provides a natural and comfortable position for the operator’s foot. The upper surface of dead pedal 1648 may be textured to prevent the operator’s foot from sliding. Additionally, floor board panel 1630 may include a recessed pocket 1650 forward of driver seat 62. Pocket 1650 is sized and positioned to accommodate at least the heel of the operator’s right foot, which may increase the operator’s comfort when depressing accelerator pedal 1622.

[00366] Fig. 77 also discloses that the passenger side of vehicle 10 includes a floor board panel 1632 and a lower front panel 1636 forward of passenger seat 64. Floor board panel 1632 also may include a recessed pocket 1658 for supporting the passenger’s feet, for example, the passenger’s left heel or foot. Additionally, floor board panel 1632 and lower front panel 1636 support an inner dead pedal 1652 and an outer dead pedal 1654. Illustratively, inner dead pedal 1652 is angled relative to floor board panel 1632. Additionally, inner dead pedal 1652 may be flush with lower front panel 1635 and, therefore, would be angled at the same degree as lower front panel 1636. Alternatively, inner dead pedal 1652 may include walls (not shown) for elevating and angling inner dead pedal 1652 relative to lower front panel 1636 and floor board panel

1632. Inner dead pedal 1652 is positioned at a natural and comfortable location for the passenger's left foot and may include a textured surface to prevent the passenger's foot from slipping.

[00367] Outer dead pedal 1654 is supported by both floor board panel 1632 and lower front panel 1636. Outer dead pedal 1654 includes walls 1656 that elevate outer dead pedal 1654 relative to floor board panel 1632 and lower front panel 1636. Illustratively, outer dead pedal 1654 is offset from inner dead pedal 1652, and more particularly, is rearward of inner dead pedal 1652. Outer dead pedal 1654 also may be angled relative to floor board panel 1632, and more particularly, may be angled at the same degree as inner dead pedal 1652. As such, illustrative inner and outer dead pedals 1652, 1654 are offset from each other but positioned in parallel planes. Outer dead pedal 1654 provides a natural and comfortable location for the passenger's feet (e.g., the right foot) and may include a textured surface to prevent the passenger's foot from slipping.

[00368] As shown in Figs. 81 and 82, floor board panels 1630, 1632 each may include at least one drain 1680 to allow fluids, dirt, and debris to exit the operator area when drain 1680 is open. Drain 1680 includes a cap 1682 that is removably coupled to a drain opening 1684 in floor board panels 1630, 1632. Drain cap 1682 includes a handle 1686, a body portion 1688, and a locking tab 1690. Handle 1686 extends upwardly from body portion 1688 to allow the operator or passenger to rotate drain cap 1682. Locking tabs 1690 are illustratively positioned below body portion 1688. Drain cap 1682 is positioned above drain opening 1684 and is rotatably coupled thereto, as is further detailed herein.

[00369] Drain opening 1684 includes a receiving surface 1692 that generally corresponds to the shape of body portion 1688 of cap 1682. Drain opening 1684 also includes channels 1694 for receiving locking tabs 1690 of cap 1682. When closed, body portion 1688 of cap 1682 contacts receiving surface 1692 and locking tabs 1690 extend within channels 1694. When handle 1686 is rotated to the closed position, locking tabs 1690 rotate below receiving surface 1692 such that locking tabs 1690 are

no longer aligned with channels 1694. As such, drain cap 1682 may not be released from drain opening 1684. Conversely, when drain caps 1682 are rotated to the open position, locking tabs 1690 are aligned with channels 1694 such that locking tabs 1690 may be pulled through channels 1694. As such, drain caps 1682 may be released from
5 drain opening 1684 which allows dirt, debris, and fluids to flow from the operator area and below vehicle 10. Illustrative drain caps 1682 may be snapped into, or released from, drain openings 1684 with only quarter turns (i.e., rotation through one-fourth of drain cap 1682).

[00370] Alternatively, floor board panels 1630, 1632 may include other removable
10 portions. In one embodiment, floor board panels 1630, 1632 include removable portions larger than drains 1680. In another embodiment, floor board panels 1630, 1632 are removable from vehicle 10. However, floor board panels 1630, 1632 and/or frame 12 would include seals for sealing floor board panels 1630, 1632 against the frame members to prevent fluids, dirt, debris, and noise from entering the operator area.

[00371] Referring to Figs. 77, 81, and 83, the operator area further includes a
15 center console 1660 having cup holders 1662, a shifter boot 1664, and an access panel 1666. Access panel 1666 may be opened to provide access to drivetrain 30 and other components of vehicle 10 for cleaning, maintenance, and other actions. Console 1660 may be comprised of a polymeric material and is illustratively positioned between seat
20 mounting brackets 126 on the driver side and the passenger side of vehicle 10. Console 1660 extends above floor board panels 1630, 1632 and extends in a generally longitudinal direction of vehicle 10.

[00372] As shown in Fig. 83, shifter boot 1664 supports a shift lever 1668 for
signaling the drive mode of vehicle 10. Shifter boot 1664 is coupled to a top surface of
25 console 1660. More particularly, shifter boot 1664 is sealed against the top surface of console 1660 in order to seal the operator area from dirt, debris, fluids, and noise from below vehicle 10.

[00373] Shift lever 1668 extends through shifter boot 1664 and includes an arm
1670. Arm 1670 is pivotally coupled to a pivot member 1672 at pivot point 1674. Pivot

member 1672 connects shift lever 1668 to a cable 1676 for signaling the drive mode to drivetrain 30. As shown in Fig. 83, less than half of arm 1670 is positioned within shifter boot 1668 which allows shifter boot 1664 to remain close to pivot point 1674. Therefore, shifter boot 1664 does not move excessively during movement of shift lever
5 1668.

[00374] Dash 46 is positioned within the operator area and supports as steering wheel 1602 and gauges (Fig. 77), as is further detailed herein. Referring to Fig. 84, dash 46 also supports at least one storage container 1704 having a front end 1706 and a rear end 1708. Storage container 1704 is supported on a bottom surface of dash 46
10 and is positioned over the foot well area of the operator area. Storage container 1704 is open to the operator area such that the passenger can reach into storage container without opening a door or removing a cover. Alternatively, storage container 1704 may include a removable or rotatable cover that extends over rear end 1708 of storage container 1704. Contents positioned within storage container 1704 remain therein
15 during operation of vehicle 10 because front end 1706 of storage container 1704 is angled downwardly.

[00375] Dash 46 also includes a glove box 1709 for additional storage in the operator area. Glove box 1709 may include a cover for securing the contents therein, which is configured to rotate or slide to expose the contents within glove box 1709.
20 Additionally, dash 46 has at least one boss 1707 for mounting accessories within the operator area.

[00376] Additional operator controls 68 are accessible to the operator and passenger when seated in the operator area. For example, and referring to Fig. 84, electrical system 1700 may include a light 1702 projecting below dash 46. Illustrative
25 light 1702 may be a light emitting diode ("LED") or other similar device configured to illuminate the foot well of the operator area. Light 1702 is illustratively shown on the passenger side of vehicle 10, however, the driver side also may include light 1702. As shown, light 1702 illuminates floor board panel 1632 and lower front panel 1636, as well as inner dead pedal 1652 and outer dead pedal 1654 in front of passenger seat 64.

Light 1702 also may illuminate storage container 1704 and console 1660, including cup holders 1662 and shift lever 1668. Additional lights (not shown) also may be used to illuminate other components of the operator area and vehicle 10.

[00377] Light 1702 may be electrically coupled to electrical system 1700, and may be controlled through a switch (not shown). The switch may be manually activated by the operator or passenger, or may be automatically activated by electrical system 1700. Electrical system 1700 may turn on light 1702 only when the headlights and/or other lights within the operator area are illuminated, or may turn on light 1702 when vehicle 10 starts such that light 1702 remains on when vehicle 10 is operating.

[00378] As shown in Figs. 77 and 85, dash 46 also supports other components of electrical system 1700, such as a power sports interface ("PSI") 1724. PSI 1724 is an interface for a graphical multi-functional display, such as a display unit 1710, which is positioned on dash 46 and is accessible to the operator. Through display unit 1710, PSI 1724 displays various functional groups of vehicle 10 as pages of a multi-page menu structure. For example, the functional groups of PSI 1724 may include vehicle performance, vehicle dynamics, component setup, infotainment, navigation, weather, and phone and other external communications, as is detailed further herein. Display unit 1710 may be a double din unit in order to accommodate the various outputs.

[00379] Display unit 1710 may be a color touch screen graphical device, or alternatively, may include buttons and switches on display unit 1710, dash 46, steering wheel 1602, or other locations within the operator area for selecting the options presented on display unit 1710. Display unit 1710 also may include a light indicator 1712 and/or an audio signal for indicating a particular status of a component of vehicle 10.

[00380] Additionally, dash 46 may support various buttons, levers, or switches, such as ignition push button 1714 (Fig. 84), of electrical system 1700. Bosses 1707 on dash 46 also may support other components of vehicle 10, for example a CD, MP3, or musical player, a Bluetooth or wireless system for cell phones, and other systems or components in order to integrate those accessories into vehicle 10.

[00381] Alternatively, accessories such as cell phones, computers, musical players, or chargers for these various devices may be integrated into vehicle 10 near seats 62, 64. For example, a panel or box (not shown) may be positioned intermediate seats 62, 64, or positioned intermediate seats 62 or 64 and door assembly 1500 or side tubes 164, to support cell phones, computers, musical players, chargers, or GPS devices. Additionally, a panel or box may be supported under hood 42 for additional storage and support locations for accessories and cargo. Whether adjacent seats 62, 64, or under hood 42, the panels or boxes may be sealed to prevent fluids, dirt, and debris from entering and damaging the accessories therein, and therefore, are considered dry storage containers.

[00382] Frame tubes 602, 606, 610, 612, 614, 622, 624 of cab frame section 84 (Fig. 28) may include openings for passing the wires of the various integrated accessories (e.g., cell phones, chargers, computers, GPS devices, or musical players) to other locations of vehicle 10. As such, cab frame section 84 further integrates these accessories into vehicle 10 and also prevents the electrical wires from interfering with the operator area. Additionally, by supporting the wires for the various on-board and external devices within the frame tubes of cab frame section 84, zip ties or other coupling components are not required for securing the wires in vehicle 10.

[00383] Electrical system 1700 may operate various components of vehicle 10 as follows. Vehicle 10 may be started using a remote mechanism, such as a wireless or radio frequency ("RF") key fob 1716. When key fob 1716 is brought into proximity with vehicle 10, key fob 1716 communicates a wireless, RF, or other identification signal to a vehicle control unit 1730 ("VCU") and/or an engine control unit 1732 ("ECU") of electrical system 1700. The polymeric components of vehicle 10, such as body panels 40 and dash 46, are comprised of materials that allow transmission of RF, wireless, or other signals to and from key fob 1716. When VCU 1730 identifies key fob 1716 as being associated with vehicle 10, the operator may turn on vehicle 10 by depressing ignition push button 1714. As shown in Fig. 85, VCU 1730 and ECU 1732 may be coupled to a battery 1722 in order to power VCU 1730 and ECU 1732 when vehicle 10 is not turned

on. Alternatively, vehicle 10 may be started using a conventional key that is turned in the ignition

[00384] When vehicle 10 is operating, VCU 1730 and ECU 1732 may communicate with each other and also may send signals to display unit 10 to allow the operator and passenger to view the functions, operations, and status of the components of vehicle 10. For example, through PSI 1724, display unit 1710 may output the speed of vehicle 10, fluid and temperature levels, the time, the geographic coordinates of vehicle 10, the weather, the charging status of on-board and external devices, warnings, alarms, and other indicators to alert the operator of a status of the components of vehicle 10. PSI 1724 also may cooperate with internet or satellite signals to display a web browser, GPS, infotainment system, audio or sound displays, and/or other network or system outputs on display 1710. More particularly, PSI 1724 includes at least one network interfaces for allowing display unit 1710 to communicate with, display information from, and/or control certain aspects of the various components of electrical system 1700.

[00385] For example, one of the control functions of PSI 1724 displayed on display unit 1710 relates to a vehicle control system, which includes an engine management system, a drivetrain management system, a transmission control, a steering control, a suspension control, a traction control, stability control, and drive modes. Additional details about the drive modes are disclosed in U.S. 13/152981, filed on June 3, 2011, and 13/325561 filed December 14, 2011 the complete disclosures of which are expressly incorporated by reference herein. PSI 1724 allows the operator to select pre-designed active vehicle dynamic control algorithms, which are presented on display unit 1710, for viewing and tuning vehicle dynamics and performance. The active vehicle dynamic control algorithms may reside in PSI 1724 or another vehicle module. Additionally, the vehicle control system of PSI 1724 may display service or diagnostic alerts from various vehicle systems. The information from the vehicle control system of PSI 1724 may be uploaded to external devices, such as cell phones, smart phones, computers, cellular networks, wireless or satellite networks, the internet, a computer network, or other vehicle networks via one or more of the network interfaces of PSI

1724. Exemplary network interfaces of PSI 1724 may include CAN, Bluetooth, Wi-Fi, GSM, USB, and others.

[00386] Additionally, PSI 1724 connects to and manages the infotainment systems of vehicle 10 through interconnection to on-board and external devices, such as smart
5 phones, radio receivers, USB memory devices, audio devices, amplifiers, speakers, and wired or wireless headsets. Additionally, PSI 1724 may include audio amplifiers and drivers for the external devices.

[00387] PSI 1724 also cooperates with display unit 1710 to overlay the location of vehicle 10 onto maps, terrain images, obstacle maps, and/or satellite and weather
10 imagery. PSI 1724 also may record, save, and display vehicle log data and ride information. The log data and ride information may be communicated to on-board and external devices through at least one of the network interfaces.

[00388] Furthermore, electrical system 1700 may include cameras at the front and/or rear ends of vehicle 10, and through display unit 1710, PSI 1724 may display the
15 video data. Additionally, PSI 1724 may be configured to playback the data on display unit 1710 or to send the data to another device via one of the network interfaces.

[00389] PSI 1724 also may control a security system for vehicle 10. Additional details of an exemplary security system are disclosed in U.S. U.S. 12/475531, filed on
20 May 31, 2009, the complete disclosure of which is expressly incorporated by reference herein. Additionally, through display unit 1710, PSI 1724 may display anti-collision warnings that are generated by external devices on vehicle 10. Alternatively, the anti-collision warnings may be generated by external inputs and algorithms that are included in PSI 1724.

[00390] Electrical system 1700 also may include a feedback system for
25 communicating with various sensors, such as a sensor on light 1702 or other illumination devices (e.g., headlights), a sensor on seat belts 1416, and a MAP sensor 1728 on engine air intake system 820 (Fig. 37). For example, VCU 1730 and/or ECU 1732 communicate with the sensor on light 1702 to determine if light 1702 has been

turned on. Depending on the conditions, such as time of day, operating conditions, or pre-configured parameters, electrical system 1700 may automatically turn on light 1702.

[00391] Additionally, VCU 1730 and/or ECU 1732 communicate with the sensor on seat belt 1416 to determine if the operator and/or passenger have securely latched seat belt 1416 before operation of vehicle 10. If the sensor indicates that seat belt 1416 is not engaged, a visual or audible alert may be communicated to the operator through light indicator 1712 on display unit 1710. Furthermore, ECU 1732 may prevent vehicle 10 from moving if the sensor indicates that seat belt 1416 is not latched.

[00392] VCU 1730 and/or ECU 1732 also communicate with MAP sensor 1728 (Figs. 37 and 85) on intake system 820 to monitor intake air pressure. Display unit 1710 may output the intake pressure which alerts the driver to the reduction made by the filter and/or whether the filter is dirty and should be changed. This could be accomplished by sensors before and after the air cleaner, such that a comparison of the two sensors would yield a pressure drop reading across the air cleaner. A signal, such as a warning light, would be triggered when the pressure drop indicates that the filter should be changed.

[00393] When vehicle 10 is no longer operating, ECU 1732 may include a controlled chassis relay which allows ECU 1732 to remain operational (via battery 1722) for a predetermined amount of time after vehicle 10 is shut off. For example, ECU 1732 may remain operational for approximately 30 seconds after the operator turns off vehicle 10 in order to maintain the operation of various components of electrical system 1700. For example, after vehicle 10 is turned off, ECU 1732 may maintain operation of head lights, tail lights, light 1702 in the operator area, communication devices, and/or the security system for the predetermined time limit (e.g., 30 seconds).

[00394] In addition to the accessories of electrical system 1700, vehicle 10 also supports other accessories thereon. For example, as shown in Figs. 86-88, a winch assembly 1750 may be supported on vehicle 10 on the outside of body portion 40 of vehicle 10. Alternatively, winch assembly 1750 may be positioned within body portion 40 of vehicle 10 to allow the operator access to winch assembly 1750 from the operator

area. A further embodiment may include more than one location (e.g., a front end location and a rear end location) for winch assembly 1750 such that frame 12 may support more multiple winch assemblies 1750.

[00395] Winch assembly 1750 includes a winch device 1752, a device brace 1754, an alignment plate 1756, and a guide device 1758. Winch device 1752 is supported by device brace 1754, which is coupled to channels 222 and plate 224 at the front end of frame 12. As shown best in Fig. 88, winch device 1752 is intermediate tube portions 200b and frame tubes 202. More particularly, winch device 1752 is forward of frame tubes 202 and is rearward of tube portions 200b. Additionally, because winch device 1752 is coupled to channels 222 and plate 224, winch device 1752 is spaced apart from frame tubes 152. Illustratively, winch device 1752 is positioned above frame tubes 152 and device brace 1754 is coupled to channels 222 and plate 224 with fasteners 1760 and 1762, respectively.

[00396] Winch device 1752 is rearward of bracket 230 but the cable, rope, or line (not shown) that extends therefrom may be received through an opening (not shown) in bracket 230. When in use, the cable continuously extends from bracket 230 to bracket 240 which is forward of bracket 230. The cable extends through an aperture 240e of bracket 240 and also passes through an aperture 1764 of alignment plate 1756 before extending through an aperture (not shown) of guide device 1758. Alignment plate 1756 is coupled to bracket 240 and is intermediate bracket 240 and guide device 1758 when in use. Guide device 1758 is forward of alignment plate 1756 and includes rollers 1766 or other rounded devices. Rollers 1766 prevent damage to the cable of winch device 1752 if the cable slides to the outer edges of the aperture of guide device 1758. The cable may be coupled to an external object in order to carry or support the object. Winch device 1752 includes a retraction mechanism to retract the cable into winch device 1752 when not in use. Additional detailed of winch assembly 1750 are disclosed in U.S. Patent Application Serial No. 13/492,589, filed on June 8, 2012, the complete disclose of which is expressly incorporated by reference herein.

[00397] As shown in Figs. 89-91C, body portion 40, including hood 42, front fender 44, dash 46, sideboard 48, front floorboard 50, rear sideboard 52, and rear cargo area 56, may be coupled to each other with connectors 1770. Illustratively, connectors 1770 are “H” connectors which are configured to couple with projections 1772 extending from
5 body portions 40. Projections 1772 have opposing angled surfaces 1774 generally defining a V-shape. A distal end 1776 is coupled to a rear surface of body portions 40 and is wider than a proximate end 1778 which extends from the rear surface of body portions 40. Proximate end 1778 is received through apertures 1780 in adjacent body portions 40 to couple adjacent body portions to each other.

10 **[00398]** Connectors 1770 are coupled to proximate end 1778 in order to further secure adjacent body portions 40 together. Connectors 1770 also include opposing angled surfaces 1782, 1784, which generally correspond to opposing surfaces 1774 of projections 1772. Connectors 1770 also include an arm 1786 extending along a portion of surface 1782 and an arm 1788 extending along a portion of surface 1784. Tabs 1790
15 are positioned at a distal end 1792 of connectors 1770. A proximate end 1794 is narrower than distal end 1792.

[00399] In operation, when projections 1772 of body portions 40 are received through apertures 1780 of adjacent body portions 40, connectors 1770 slide over projections 1772 to further secure adjacent body portions 40 together. In particular,
20 distal end 1792 of connector 1770 is coupled to distal end 1776 of projection 1772 such that tabs 1790 are in contact with the rear surface of body portions 40. Proximate end 1794 is coupled to proximate end 1778 of projections 1772. When connectors 1770 are received over projections 1772, arms 1786, 1788 engage opposing surfaces 1774 of projections 1772 to prevent connectors 1770 from sliding off of projections 1772. As
25 such, connectors 1770 remain coupled to projections 1772, thereby securing body portions 40 to each other.

[00400] With reference now to FIGS. 92-99, a second embodiment of the vehicle of the present disclosure will be described. The vehicle is shown generally at 1800 and is commonly referred to as an all terrain vehicle (ATV), a side-by-side vehicle (SxS) or a

utility vehicle. As shown, vehicle 1800 generally comprises a frame 1802 (FIG. 94) supported by ground engaging members 1804 and 1806. As shown in this disclosure, ground engaging members 1804 and 1806 are comprised of wheels 1808 and tires 1810; and wheels 1812 and tires 1814. Vehicle 1800 further comprises a drive train 1816 (FIG. 94) operatively connected to frame 1802 and drivingly connected to one or more of the ground engaging members 1804, 1806. In the present disclosure, the drivetrain 1816 is comprised of a fuel-burning engine and transmission combination, together with a driveshaft extending between the drivetrain and both of the front and rear ground engaging members 1804, 1806, as described in greater detail herein. However, any drivetrain could be contemplated such as hybrid, fuel cell or electric. The drivetrain 1816, the front and rear suspension assemblies, and steering assemblies are more thoroughly described in our pending applications Serial Nos. 11/494,891 filed July 28, 2006 and 11/494,890 filed July 28, 2006, the subject matter of which is incorporated herein by reference.

[00401] As shown in FIGS. 92-96, vehicle 1800 further includes a body portion or chassis shown generally at 1818 to include a hood 1820, front fender 1822, dash 1824 (FIG. 93), sideboard 1826, front floorboard 1828 (FIG. 96), rear fender 1830 and rear cargo area 1832, shown as a rear cargo bed. As also shown, vehicle 1800 is comprised of seating area 1834, having a driver seat 1836 and a passenger seat 1838 (FIG. 98). As shown best in FIG. 96, driver seat includes a seat back 1836a and a seat bottom 1836b, while passenger seat 1838 includes a seat back 1838a and a seat bottom 1838b. Furthermore, vehicle 1800 includes operator controls shown generally at 1840 (FIG. 94), which includes controls for steering, acceleration and braking, as described further herein. Vehicle 1800 also includes a front suspension 1842 and a rear suspension 1844 (FIG. 97). Operator's compartment 1848 (FIG. 94) is provided with an overhead cab frame 1850 as described herein. Operator's compartment 1848 is enclosed on the sides by doors 1852, as further described herein.

[00402] With reference now to FIGS. 100-101, the hood 1820 and dash 1824 will be described in greater detail. With reference to FIG. 101, the body panels that make up the hood and dash are shown as comprised of body panel 1854, instrument panel 1856,

and removable bin 1858. As shown, body panel 1854 includes a removable hood portion 1860 having quarter turn locks 1862, which may couple to panel 1856 as described herein. Body panel 1854 includes an opening at 1864, which defines a marginal seam at 1866 having margins 1866a, 1866b, and 1866c. Panel 1856 fits over opening 1864 and includes marginal front edges 1868a that correspond with margins 1866a; marginal front edges 1868b that correspond with margins 1866b and lower marginal edge 1868c corresponding to marginal edge 1866c. Marginal tabs 1870 are slidably received under the hood portion 2096, whereby apertures 1870a may receive latch portions 1862a to retain instrument panel 1856 in position. Multiple panels 1856 could be available for use with different options.

[00403] Body portion 1854 further includes an aperture 1872 defined in central body portion 1874 for receipt of bin 1858. Bin 1858 is shown in FIGS. 102-105. Bin 1858 includes an enclosure 1876, inner or intermediate plate 1878 having a latch 1880, a seal 1882, a front plate 1884, and a seal 1886. As shown in FIG. 102, enclosure 1876 includes lower wall 1876a, sidewalls 1876b, top wall 1876c, and rear wall 1876d. Mounting bosses 1876e and 1876f may project from rear wall 1876d for mounting enclosure 1876 to the vehicle frame. Enclosure 1876 may include rubber grommets such as 1876g for receipt of wires or cables there through, as well as, knock-outs at 1876h and 1876i. Knock-out 1876h could be used for bringing in accessory power and knock-out 1876i could be used for a winch control cable. Enclosure 1876 further includes a peripheral wall at 1876j, which seats inside marginal edge 1884a of opening 1872 (FIG. 101). As shown best in FIG. 105, enclosure 1876 further defines a rearwardly facing surface 1876k for receipt against marginal edge 1872a and a lower lip at 1876L for seating against marginal edge 1872a.

[00404] As shown best in FIGS. 103 and 104, enclosure 1876 includes lower bosses at 1876m, having apertures 1876n. As shown best in FIG. 104, enclosure 1876 further includes a top brim portion 1876p having a latching aperture at 1876q. An outer peripheral groove at 1876r circumscribes a front opening 1876s and receives seal 1882 therein.

[00405] With reference still to FIGS. 103 and 104, intermediate plate 1878 includes plate portion 1878a having a lower wall at 1878b with depending lugs 1878c having apertures 1878d. A peripheral groove 1878e circumscribes plate portion 1878a to receive seal 1886. Mounting lugs 1878f (FIG. 103) are provided on a backside of 1878a to mount latch 1880. Latch 1880 includes a mounting boss 1880a to receive a locking pin 1886 therethrough. Latch 1880 includes a double-clasp having a first clasp at 1880b (FIG. 103) and a second clasp at 1880c (FIG. 104). Latch 1880 also includes a handle portion 1880d.

[00406] Front panel portion 1884 includes a body portion 1884a and a window portion at 1884b, where window portion 1884b could be transparent, such as a transparent glass or plastic portion in order to view any components behind the front cover 1884. As shown in FIG. 103, front plate 1884 further includes an inner peripheral wall at 1884c, a first set of mounting lugs at 1884d and a second set of mounting lugs 1884e. Mounting lugs 1884d are coupled to lugs 1876m by way of fasteners 1888 through apertures 1876n. Inner plate 1878 is also coupled to front plate 1884 by way of fasteners 1890 extending through apertures 1878d and coupled to mounting lugs 1884e. Front plate portion 1884 further includes an opening at 1884f (FIG. 104) providing access to amounting lug as 1884g.

[00407] With reference to FIG. 105, a double-sealed storage compartment is provided defining a first sealed compartment 1900a and a second-sealed compartment 1900b. Moreover, both compartments are latched by the same latch component 1880. As shown in FIG. 105, moving latch handle 1880d downwardly as viewed in FIG. 105 would release latch lug 1880c from apertures 1876q. This would allow the combination of front plate 1884 and intermediate plate 1878 to continue to be latched together by way of 1880b and 1884g and rotate about fasteners 1888. This would provide access from the front of enclosure 1876 to access storage compartment 1900b. Rotating latch member 1880d upwardly now would release lugs 1884g and 1880b and allow access to compartment 1900a with rotation about fasteners 1890.

[00408] Compartment 1900a could be used to house such items as a smartphone or GPS, whereas compartment 1900b could be used to house any other electronic components desired such as radios, and the like. It is also anticipated that an electronics package, such as the one described in Applicants' pending application serial
5 number 61/769,378 filed February 26, 2013 (Attorney Docket No. PLR-00TC-25635.01P), the subject matter of which is incorporated herein by reference, could be utilized. Front plate 1884 could be profiled such that peripheral wall 1884c (FIG. 103) positions a smart phone screen viewable through window 1884b. Multiple front plates could be available to correspond to different smart phones.

10 **[00409]** With reference now to FIGS. 106-108, the front frame of vehicle 1800 will be described in greater detail. It should be recalled from FIGS. 12 and 14 above, that front frame portion 190 was coupled directly to front frame portion 82 whereupon the plastic body panels are positioned over front panel portion 190. In this embodiment, front frame portion 2050 is assembled to vehicle 1800 after the plastic body panels are
15 assembled. As shown in FIG. 106, vehicle 1800 is shown with hood 1820 in position, yet with panel portion 1856, removable bin 1858, and dash portion 2095 disassembled from vehicle 1800.

[00410] With reference to FIGS. 106 and 113, vehicle 1800 further includes a front inner panel portion 2052 coupled in place to the vehicle frame. Vehicle 1800 also
20 includes a floorboard portion 2054 coupled in place. A rear seat panel 2056 is also shown coupled in place over which seats are assembled, as described further herein. As for the combination of panel 2052, floorboard 2054, and panel 2056, reference is also made generally to FIG. 113. As shown in FIG. 108, front frame portion 2050 includes transverse channel portions 2050a and 2050b coupled together by way of
25 brackets 2050c and 2050d. Vertically extending frame tubes 2050e are coupled to channel 2050a and include brackets 2050f, which may be coupled to front brackets 180 (FIG. 14) through an indent 2060 of panel portion 2052. As also shown in FIG. 108, front frame portion 170c upstands through panel portion 2052 providing access to bracket 270 (also see FIG. 14), whereby fasteners 2050i can be positioned through

apertures 2050h and couple to bracket 270. In this manner, the three (3) panels 2052, floor board 2054, and rear panel 2056 may be form fitted.

[00411] With reference now to FIGS. 109-111A, fuel tank 2070 is shown nested between frame tubes 150 and 154 and over channel 352 (FIG. 111). As shown best in
 5 FIGS. 111 and 111A, fuel tank 2070 includes front edge 2072, right edge 2074, enlarged portion 2076, having a rearwardly extending portion 2078 extending beyond rear wall 2080. A lower side of fuel tank 2070 includes a lower wall 2082 on a right hand side of the fuel tank and a contoured section 2084 defining scalloped section 2086 and 2088. Fuel tank 2070 also includes a left most edge at 2090 and a fuel tank filler neck
 10 2091. Thus, as positioned in frame, fuel tank 2070 has front edge 2072 extending forwardly of passenger seat bottom 1838b (FIG. 110) with left edge 2090 extending laterally beyond seat bottom 2065 and with driveshaft 810 extending under contoured portion 2084 and positioned in scalloped portion 2088 (FIGS. 111, 111A and 111B).

[00412] Now with reference to FIGS. 112-115, a seat support assembly will be
 15 described in greater detail. With reference first to FIG. 113, front body panel 2052 includes front wall section 2081 extending downwardly to a marginal edge 2083. Marginal edge 2083 includes a plurality of apertures, for example at 2083a, 2083b, etc., for coupling with floor board panel 2054. Panel 2052 also includes sidewalls 2085, which includes indent portions 2060 as previously described.

[00413] Floor board portion 2054 includes a front wall portion 2091 on the driver's
 20 side transitioning into wall portion 2092 including a footrest pedal portion at 2094 (often times referred to as a "Dead Pedal"). Floor board portion 2054 also includes a left sidewall 2096, rear wall 2098, floor portion 2100, recessed floor portion 2102, and right most wall 2104 defining a tunnel 2106. Floor board portion 2054 also includes a
 25 passenger front wall portion 2110, a floor board portion 2112, left wall 2114, rear wall 2116, and right most wall 2118. On the passenger side, two footrests are provided, 2120 and 2122. As shown, the footrests 2120 and 2122 are longitudinally offset with footrest 2122 being positioned closer to the passenger than footrest 2120.

[00414] Floor board portion 2054 further includes a front upper marginal edge 2130 having apertures 2132 and 2134. It should be appreciated that marginal edges 2082 and 2130 overlap and cooperate to couple together by way of fasteners positioned in overlapping apertures 2082a, 2082b; 2132, 2134. This overlap and coupling together provides a sealed operator's compartment for the operator. It should also be appreciated that floor board portion 2054 includes a rear marginal edge 2140 as described herein.

[00415] With reference still to FIG. 113, rear panel 2056 will be described in greater detail. As shown, rear panel 2056 includes a front marginal edge 2150 profiled to cooperate with rear marginal edge 2140 of floor board portion 2054 as described herein. Rear panel portion 2056 further includes a front wall portion 2152, sidewall portions 2154, 2156; and rear wall 2158, thereby defining compartment 2160 under the driver's seat. Rear portion 2056 further includes an upper panel 2162 having an access opening at 2164 and a profiled open 2166 for receipt of fuel tank filler neck 2091 (FIG. 111). Rear panel portion 2056 further includes a recessed and stepped portion 2170 (See also FIG. 112). It should be appreciated that the panel portions 2052, 2054, and 2056, are assembled to the frame and to each other with front marginal edge 2150 of panel portion 2056 positioned on top of rear marginal edge 2140 of floor board portion 2054. The overlapping marginal edges 2140 and 2150 are positioned on top of brackets 360 (FIG. 111). This positions the stepped portion 2170 (FIG. 114) on top of brackets 362 (FIG. 111).

[00416] Thus with the body panel portions 2054, 2056, in the position of FIG. 114, seat frame 126 may be positioned over the body panel portions whereby front channel 440 overlaps the intersection of marginal edges 2140, 2150, whereby fasteners 2180 are recessed through apertures 2182 of channel portion 440 to be threadably engaged with brackets 360 (FIGS. 111 and 115). In a like manner, fasteners 2184 are received through apertures 2186 (FIG. 114) to be received in threaded engagement with apertures 362a of pedestals 362 (FIG. 111). As mentioned above, with respect to the front body panel portions, the intersection of body panels 2054, 2056, by way of the overlapping marginal edges 2140, 2150, provides for a sealed operator's compartment,

and as frame member 126 is positioned over this intersection and covers the intersection, the seam is virtually sealed. This is also shown in FIG. 115 in cross-section, where seat support frame 126 is shown in a fully installed position.

[00417] With reference now to FIGS. 116-118, doors 1852 will be described in greater detail. It should be appreciated that a passenger door 1852 is substantially similar, yet mirror-imaged from a driver door and thus, only one door, the driver's door 1852 will be described. As shown in FIG. 116, door 1852 is shown coupled by way of a hinge assembly 2200 to frame tube 2202, which in turn is shown coupled to frame tube portions 154b and 160b. Frame tube 2202 includes a generally horizontal upper portion 2202a coupled to connector 90c, and a substantially vertical portion 2202b coupled to connector 90d, and to which hinges 2200 are attached. As shown best in FIGS. 117 and 120, door 1852 includes an outer panel portion 2206 and an inner frame portion 2208.

[00418] With reference now to FIGS. 117 and 118, hinge 2200 includes a base portion 2210 coupled to vertically extending portion 2202b, a pin portion 2212 and a swinging hinge portion 2214, where the hinge portion 2214 may rotate about pin portion 2212. Hinge 2200 includes a stop portion 2216 having a stop surface 2218 (FIG. 117). Hinge portion 2214 includes a horizontally extending portion 2214a and a vertically extending portion 2214b. Vertically extending portion 2214b is coupled to frame 2208 by way of fasteners 2224. As shown in FIG. 118, door 1852 is rotated in the direction of arrow O into an open position wherein inner surface of hinge portion 2214b abuts stop surface 2218. This provides for the maximum open position for door 1852. A door latch 2230 (FIG. 120) is substantially similar to the latch assembly as shown and described in FIGS. 68-70 herein.

[00419] With reference now to FIGS. 119A and 119B, a lower door portion 2240 may be attached to door 1852 to substantially close the operator's compartment where lower door portion 2204 fills the void between door 1852 and lower panel portion 1826. As shown, door portion 2240 includes an outer panel portion 2242 and an inner frame 2244 (FIG. 119B). As shown, panel portion 2242 includes an upper edge 2246 and a

rearward edge 2248 lying adjacent to a lower edge panel portion 2206 of upper door 1852.

[00420] As shown best in FIG. 119B, frame 2244 includes an oval-shaped frame tube 2250 having a plurality of mounting tabs 2252 whereby fasteners 2254 may be received in threaded bosses 2256. A bracket portion 2260 is coupled to tubular frame 2250 and includes a lower plate portion 2262 coupled to tubular frame 2250. Bracket 2260 also includes an upper flap portion 2264, which would include an upper tab portion received through aperture 2266 of frame portion 2208 and fastened by way of fastener 2268. Bracket 2270 is substantially similar to bracket 2260 and is coupled to frame 2208 by way of fastener 2272. A front bracket assembly 2280 includes a bracket plate 2282 having a first plate portion 2282a and a second plate portion 2282b. Plate portion 2282a is coupled to bracket 2284 while plate portion 2282b is coupled directly to frame 2208.

[00421] Thus, it should be appreciated that door portion 2240 is easily assembled and disassembled. For example, to disassemble lower door portion 2240 from the position shown in FIG. 119B, fasteners 2288, 2268, and 2272 are removed whereby the door portion 2240 may be rotated outwardly to remove the tab portions from apertures 2266.

[00422] With reference now to FIGS. 120A and 120B an alternative door frame 2290 is shown, which coupled to the same inner door frame 2208. Door 2290 would include a peripheral seal at 2092 providing a sealed fit against the vehicle frame. Door frame 2290 is coupled by way of the fasteners 2094 to frame 2208. In this embodiment, door 2090 would be formed from a rigid material, for example, by an aluminum stamping.

[00423] With reference now to FIGS. 121-124, vehicle 1800 includes a removable bezel 2300. It should be appreciated that there are two bezels provided, which are substantially identical yet mirror imaged and thus will be referred to as bezels 2300L on the left side of the vehicle and 2300R on the right side of the vehicle. First, and with reference to FIG. 122, engine 802 is shown coupled to a transmission, shown as a

continuously variable transmission (or "CVT") 804. As shown in FIG. 122, air intake to the engine would include air through bezel 2300R to conduit 828 through filter box 826 to conduit 824 to air box 822 and to throttle 840. This is also described above with reference to FIGS. 35-38. Meanwhile, cooling air for CVT 804 includes input to bezel 2300L through conduit 830 to the CVT intake.

[00424] As shown best in FIG. 123, rear utility bed 1832 includes a contoured well 2302 having a lower surface 2304 having an aperture 2306 (FIG. 126) therethrough. As shown in FIG. 124, the top of conduit 828 includes a resilient flange 2310 having a ramped surface 2312 defining an annular slot 2314. It should be appreciated that conduit 828 may be inserted through aperture 2306 (FIG. 125) from an underside thereof, whereby ramped surfaces 2312 allow the resilient deflection of flange 2310 to the position where annular slot 2314 encompasses portion 2304 as shown in FIG. 124. This also positions a top 2320 of conduit 828 above lower surface 2304 and thus, any water accumulating in the rear utility bed, particularly in the contoured wells 2302, does not make its way to either the engine or CVT due to its sealed nature as discussed above. Bezel 2300 may also include a filter screen 2324 (FIG. 121) providing a first level of filtering into either of the engine air filter or CVT cooling.

[00425] Due to the ready removability of bezels 2300, filters 2324 may be easily cleaned. Moreover, due to the removability of bezels 2300, a top surface of vehicle 1800 may now defined by a front of a dash and a rear of the rear utility bed such that the height is at "H," rather than at a top of bezel 2300R (FIG. 95). This decreases the envelope of the vehicle for shipping, as the cab frame 1850 is also readily removable.

[00426] With reference now to FIGS. 125 and 126, rear utility bed 1832 is shown coupled to upper frame members 380 by way of support strap 430. As shown in FIG. 126, support strap 430 includes upright portions 470 and a transverse portion 472 where uprights 470 are coupled to frame member 380 as described above with regard to FIG. 18. As shown in FIG. 126, upright portions 470 include elongate slots 2330 and circular apertures 2332. When in place, apertures 2330 and 2332 overlie an elongate opening 2334 providing an access from inside of utility box 1832. In this way, a strap or

a bungee cord could be utilized for retaining items in the rear utility bed where the hook on the bungee cord could be positioned through elongate slot 2330 and then moved to position the hook portion through aperture 2332. This would allow tension forces in the bungee cord to be transferred to the frame through strap portion 430 rather than directly to the rear utility bed.

[00427] In a similar manner, and with reference still to FIG. 126, brackets 2340 are provided having a strap portion 2342, an upper tab portion 2344, and a lower L-bracket portion 2346. An elongate slot 2348 and aperture 2350 are provided in the strap portion. Utility box 1832 includes a boss 2360 having mounting apertures 2362, and a rear wall 2364 of utility bed 1832 includes an elongate opening at 2366. Thus, brackets 2340 may be coupled to bosses 2360 and slot 2348 and aperture 2350 overlying opening 2366 and also provide for receipt of cable straps or bungee cords as described above. Finally, rear fascia 2368 (FIG. 128), is coupled to brackets 2340 by way of fasteners 2369 (FIG. 128) positioned through apertures 2346a.

[00428] As shown in FIG. 126A, an H-shaped reinforcing member 2352 is shown which couples to a bottom of utility bed 1832. The H-shaped reinforcing member 2352 includes longitudinal frame members 2352a and a cross member 2352b. Longitudinal frame members 2352a fasten to bosses 2354. Cross member 2352b extends under utility bed 1832. The entire H-shaped reinforcing member 2352 is sandwiched between the utility bed 1832 and the frame 12.

[00429] As shown in FIG. 126B, a heat shield 2356 is shown which can mount under bosses 2358. Heat shield could be comprised of a foam material or any other suitable heat resistant materials.

[00430] As shown in FIGS. 127 and 128, rear utility bed 1832 includes an access panel 2370 having a vertical plate portion 2370a and a horizontal plate portion 2370b, which is receivable in an opening 2372 of cargo bed 1832 providing access to multiple features of the power train including the air cleaner 826 (FIG. 122) and spark plugs 2374 (FIG. 127). As shown in FIG. 126, strap portion 430 and particularly transverse portion 472 also includes mounting brackets 2380, 2382 for mounting various features

such as hydraulic or electrical lines, which provides for an easy method of mounting, and keeps the lines up-and-away from the engine and/or transmission. This mounting location also provides for access of these lines through opening 2372 (FIG. 127).

[00431] With reference now to FIGS. 128-130, access to rear shock absorbers will now be described. As shown in FIG. 128, the rear shock absorbers include a gas purge reservoir 2390 coupled to cab frame 1850. A removable panel 2392 is provided which, when removed, provides access to rear shock absorber 2394, see FIG. 130.

[00432] With reference now to FIGS. 131 and 132, utility vehicle 1800 includes an access panel 2400 positioned between the driver and passenger seats. This is provided in the back wall partially between the seat backs 1836a and 1838a. This access panel 2400 can be removed to access a front of the engine, which can provide access to oil dipstick 2402 and oil filter 2404 (FIG. 122).

[00433] With reference to FIGS. 93 and 133-134, cab frame 1850 will be described in greater detail. With reference first to FIG 93, cab frame 1850 includes a front portion 2410, rear portion 2412, and rear supports 2414. Rear portion 2412 includes an upper portion 2412a (FIG. 96), side portions 2412b and 2412c (FIG. 95) and cross tube 2412d (FIG. 99). As shown best in FIG. 134, front portion 2410 includes first and second frame portions 2420, 2422 coupled together by way of a cross bar 2424. Frame portions 2420 and 2422 each include tube portions 2420a, 2412a, which would extend forward of the operator and be coupled to the frame. Frame portion 2420 and 2422 further include longitudinally extending sections 2420b and 2422b, which extend rearwardly and over the operator's head. Corresponding brackets 2426 on frame portions 2420, 2422 and corresponding brackets 2428 on cross tube 2424 allows coupling together with fasteners, to define the front frame portion 2410. Frame tube portion 2420 further includes rear brackets 2430 (FIG. 93) for coupling rear frame portion 2412.

[00434] With reference to FIGS. 133 and 134, a visor 2440 is shown having mounting portions 2442 on either side thereof having apertures at 2442a, 2442b, 2442c, and 2442d to receive fasteners 2444 there through and couple to brackets 2428 by way

of threaded body clips 2446. Visor 2440 also includes rectangular openings 2448 for attachment of an optional roof as described herein. Visor 2440 further includes resilient hooks 2450 on a lower side thereof (FIG. 135) for gripping cross tube 2424.

[00435] With reference now to FIGS. 136-138, a roof 2460 will now be described.

5 As shown best in FIG. 137, an underside of roof 2460 includes rearwardly extending gripping fingers 2462 and forwardly extending gripping fingers 2464. As shown in FIG. 138 gripping fingers 2462 extend through aperture 2448 of visor 2440 and gripping fingers 2464 grasp rear cross tube 2412a. A sealing surface is provided at 2472 of visor 2440, which can be used with a windshield, as further described herein.

10 **[00436]** With reference now to FIG. 139, a spare tire holder is shown at 2500. Spare tire holder 2500 includes four clamp assemblies 2502 coupled to rear supports 2414 of cab frame 1850. The clamps 2502 each comprise a base portion 2504 (FIG. 140) having counter bored holes at 2506 which communicate with threaded apertures in the counterpart clamp 2508. It should be appreciated that each of the base portions
15 2504 includes four such counter bores 2506 to receive four threaded fasteners to retain each counterpart clamp 2508. It should also be appreciated that the two components 2504, 2508 could be coupled together at one of the edges and utilize only two such fasteners. It should also be appreciated any type clamp retainable to rear supports 2414 could be utilized.

20 **[00437]** As shown in FIG. 139, spare tire holder 2500 further includes holder assembly 2510 which comprises two frame members 2512 and 2514 each of which terminate in a coupling end 2520 (FIG. 140) for coupling to clamps 2502 as described herein. Holder 2510 further includes two upright frame tube members 2522 and 2524 which in turn are coupled together by a central channel member 2526. As shown best in
25 FIG. 140, a threaded stud 2528 extends upwardly from channel portion 2526 and receives a locking member 2530 and a retaining ring 2532. Locking member 2530 generally includes a central shank portion 2540 which is internally threaded to receive stud 2528 and a handle portion 2542 having two extending portions 2542a and 2542b each of which have a lug nut wrench 2542c (FIG. 140) and 2542d (FIG. 139).

[00438] It should be appreciated that locking member 2530 and retaining ring 2532 are removed to add a spare tire and rim over holder 2500 such that the center aperture through the rim is positioned over stud 2528. It should be appreciated that the frame tubes 2522 and 2424 upstand, as shown in FIG. 140 such that they contact the inside of the rim upon placement of the spare tire and rim. The retaining ring and lock member 2530 are then positioned over the stud 2528 with retaining ring 2532 including a frusto-conical surface 2532a which centers itself with the rim aperture whereupon lock member 2530 may be threaded in position to a taught and locked position.

[00439] It should also be appreciated that clamps 2502 are coupled to base members 2530 by way of locking pins 2550 such that removal of the pin uncouples the clamp on the base member. While almost any type of retaining pin or fastener combination could be used to retain base members 2520 to clamps 2502, as shown, pins 2550 are referred to as "PIP pins" and are available from Aerofast, Inc.

[00440] Thus it is anticipated that once the spare tire holder 2500 is assembled to the utility vehicle that the clamps 2502 remain in place even when the spare tire holder is not in use. That is, the holder member 2510 may be easily removed from the vehicle by pulling the four retaining pins 2550 which removes the entirety of the spare tire holder 2500, leaving clamps 2502 coupled to rear supports 2414. Once the clamps are located, holder 2510 is easily placed back in place by aligning base members 2520 with the corresponding clamps 2502. It should also be understood that holder 2510, with or without spare tire, could be swung out of the way of the utility bed by removing two of the retaining pins which are located on the same rear support 2414. That is, and with reference to FIG. 139, removal of the two retaining pins on the right rear support 2414 would allow the support 2510 to pivot about the two left retaining pins and rotate towards the driver's side of the vehicle. Holder 2510 is also rotatable in the opposite sense by removing the opposite two retaining pins.

[00441] With reference now to FIGS. 141 and 142, a revised steering gear 2560 is shown, which is substantially similar to the steering gear shown in FIG. 49 and attached to front bracket 284. However, in this embodiment, steering gear 2560 includes flange

portions 2562 and 2564 which include threaded studs 2566. In this manner, steering gear can be placed directly against an inside of bracket 284 and held in place by counterpart fasteners 2568. Due to the small envelope of space available, the steering gear can be placed in position with studs 2566 positioned in apertures 284a (FIG. 16a) and fasteners 2568 placed on the front side of bracket 284. This prevents the requirement to have a wrench on the back side of the steering gear 2560 in order to retain bolt heads, if bolts are used in place of the studs.

[00442] With reference now to FIGS. 143 and 144, engine 802 is shown mounted to engine mounts 120 by way of engine support 2570. As shown best in FIG. 144, engine support 2570 includes a crossbar 2572 having intermediate brackets 2574 and end brackets 2576. Intermediate brackets 2574 include plate portions 2574a having mounting apertures 2574b. Brackets 2576 include opposing plate portions 2576a and 2576b to receive therebetween a resilient mount member 2580. As shown in FIG. 144, engine 802 includes integrated shear plates 2582 including apertures 2582a. As shown in FIG. 144, apertures 2582a align with apertures 2574b such that fasteners 2584 may be received through apertures 2574b and 2582a to receive counterpart fasteners 2586. Engine 802 and support member 2570 may now be positioned with resilient supports 2580 over engine mounts 120 with apertures 2580a aligned with apertures 120a, whereupon fasteners 2588 may be positioned through apertures 2580a, 120a, to receive counterpart fasteners 2590.

[00443] An alternative engine coupler 2570' is shown in FIG. 144A, with the engine shown mounted to the frame. Engine support 2570' includes a cylindrical crossbar 2572' supported at the ends by resilient supports 2580'.

[00444] With reference now to FIG. 145, alternate front and rear suspensions are shown at 2600 and 2602. Front suspension 2600 is similar to front suspension 70 yet includes a spring over needle shock 2604. As shown in FIG. 146, the spring over needle shock 2604 includes a needle shock 2606 having the main cylinder 2608 coupled to piston rod 2612 having a yoke at 2614. Upper retainer 2616 is slidable over main cylinder 2608 to receive a first spring 2618. Intermediate retainer 2620 is then

positioned against spring 2618 and receives a second spring 2622 thereover. Lower retainer 2624 retains spring 2622 from a lower end thereof.

[00445] With reference again to FIG. 145, rear suspension 2602 is similar to that of suspension 72, yet includes a shock 2630 which is an externally adjustable bypass shock with an external spring 2632. The remainder of the rear suspension is identical to that shown in FIGS. 29-33E. With reference now to FIGS. 147-154, shock 2630 will be described.

[00446] As shown in FIGS. 147-149, shock 2630 generally includes tubular body 2650, upper cap 2652 having check valves 2654 and 2656, end cap 2658, and piston rod 2660. A gas purged reservoir 2662 would be coupled directly to cap 2652 and would be profiled as an IFP-style reservoir (internal floating piston). Shock 2630 is profiled as a bypass shock, which allows position sensitive damping, so that in the small input ride region you have one damping characteristic and then when you get very deep into the shock stroke, you can step-up to a higher level of damping for increased bottom-out resistance without having the same high resistance in the small input range. This is accomplished by providing bypass channels bypassing the piston. In this embodiment, the tubular body 2650 is kept clean to allow for the over spring 2632 (FIG. 145). This is accomplished by placing the bypass channels, as well as the reservoir channel, directly in the shock tube body 2650 as described below.

[00447] With reference first to FIG. 151, shock tube 2650 includes a plurality of channels shown generally at 2670, however, shown individually as channels 2670a through 2670e. Tube 2650 could be an extrusion or could be a tube with the channels 2670 machined through the inner diameter of the tube. Regardless, the channels go through the entirety of the tube from a top end to a bottom end of tube 2650. With reference now to FIGS. 152 and 153, channels 2670a-2670d include corresponding passageways 2676a-2676d. It should be appreciated that each of the passageways 2676a-2676d are drilled completely through the main tube 2650 from an outside surface 2678 through an inner diameter 2680 (FIG. 153). The outer portion of the passageways are then drilled and plugged, which allows each of the channels 2670a-2670d to

communicate with the inside of tube 2650 through their corresponding passageways 2676a-2676d.

5 **[00448]** As shown best in FIG. 153, channel 2670e has a corresponding passageway 2676e at a position adjacent to an end of 2658. It too extends from an outside diameter 2678 through inner diameter 2680 allowing channel 2670e to communicate with an inner portion of tube through its corresponding passageway 2676e. This is shown best in the cross sectional view of FIG. 154. The outside passageway portion would also be drilled and plugged to seal to seal the outside tube. Alternatively, the passageways could be drilled from the inside of tube 2650 to a point
10 where they intersect the corresponding channels.

[00449] With reference now to FIGS. 150 and 151, upper cap 2652 is shown having an outer diameter 2690 having an inner annular surface 2692 profiled to be received over outer diameter 2678. Cap 2652 includes apertures 2694a-2694e, which correspond with channels 2670a-2670e, as best shown in FIG. 151. It should be
15 appreciated that apertures 2694a and 2694b are associated with check valve 2654 (see phantom lines in FIG. 150) while apertures 2694c and 2694d are associated with check valve 2656 (see phantom lines in FIG. 150). As shown in FIG. 150, apertures 2694a and 2694b correspond with check passage 2654a and apertures 2694c and 2694d correspond with check passage 2656a.

20 **[00450]** As shown best in FIG. 154, reservoir 2662 is shown with apertures 2694e communicating with passageway 2700. While not shown in the cross-section of FIG. 154, reservoir 2662 is an internal floating piston type reservoir, which would have a passageway coupled to passageway 2700 through valve stack 2702, which has a variable orifice. Due to the location of passageway 2676e (FIG. 154), fluid flow through
25 channel 2670e is always to the backside of piston 2706. The principle of the bypass operation will now be described by way of reference to FIGS. 155A and 155B.

[00451] With reference first to FIG. 155A, when piston 2706 is in the zone between passageways 2676a and 2676b and moving downwardly, fluid flows into passageway 2676b, upwardly through channel 2670b and into passageway 2694b, through check

valve 2654 into channel 2670a and through passageway 2676a to the backside of piston 2706. Once piston clears passageway 2676b, the bypass function is eliminated increasing the damping levels at the end of travel.

[00452] With reference now to FIG. 155B, when piston 2706 is in the position intermediate passageways 2676c and 2676d and moving upwardly, fluid moves through passageway 2676d into channel 2670d through check valve 2656 and then downwardly through channel 2670c to the backside of piston 2706 through passageway 2676c as shown by the diagrammatical arrows. Once piston 2076 moves beyond passageway 2676d, the shock becomes stiffer as mentioned above.

[00453] Thus, as described above, shock 2630 provides a soft zone between passageways 2676a, 2676b, and between 2676c and 2676d as described above. Between those zones, fluid is bypassed from one side of the piston 2706 to the opposite side; however, beyond the extreme points a stiffer shock is provided presenting bottoming out of pistons 2706. Furthermore, all valves, that is 2654, 2656, and 2702, are externally accessible for adjustment. Finally, as all of the channels 2670a, 2670e, are internal to the shock tube 2650, an external spring 2632 (FIG. 145) may be provided, alleviating the requirement to have a second shock that functions to carry the coil over spring.

[00454] With reference now to FIGS. 156 and 157, an intrusion bar 2800 is shown for coupling to front posts 2422a of cab frame. As shown intrusion bar 2800 includes a transverse bar 2802 coupled to vertical uprights 2804. Opposite ends of transverse bar 2802 include couplers 2806, which are fixedly attached to transverse bar 2802 and include a coupling plate 2806a having slotted apertures at 2806b. Clamp halves 2808a and 2808b include square apertures 2810, 2812, respectively, for receiving carriage bolts 2814. Fasteners 2816 may be positioned on an opposite side of coupling plate 2806a to receive the threaded end of carriage bolts 2814. An upper coupler 2820 is provided having a coupling plate 2820a and slotted apertures 2820b, which receive clamp halves 2808a and 2808b in a like manner as described above.

[00455] Thus, intrusion bar may be installed such that transverse bar 2802 is coupled by way of clamp assemblies 2808 to the front frame tubes 2422a and 2420a of the cab frame and an upper end of vertically extending tubes 2804 may be coupled by clamp assembly 2808 to cross-tube 2410. Intrusion bar 2804 as installed, does not interfere with the visibility of the driver or passenger, yet adds further protection from obstacles such as tree branches and the like while operating the vehicle in the woods.

[00456] With reference now to FIGS. 158-160, a rear windshield is shown at 2850, which couples to and conforms to, rear portion 2412 of cab frame 1850. As shown in FIGS. 159 and 160, rear panel 2850 includes a transparent portion 2852, which could be any transparent material, but as shown is a Plexiglas type material. A plurality of snap couplers 2854 are provided having attachment arms 2854a for coupling to the rear windshield 2852 and latching arms 2852b, which are arcuate in configuration and can latch to cab frame portions 2412a, 2412b, and 2412c as shown in FIG. 158.

[00457] Windshield 2852 further includes openings at 2856, which receive sealing membranes 2858, which are perforated to provide two sealed openings at 2858a as described herein. Membranes 2858 also include a peripheral groove 2858b around the perimeter of membrane 2858, which is received in apertures 2856 in a sealed manner. Windshield 2850 further includes seal portions 2860a-2860f, which may be coupled to the outer perimeter of windshield 2852 for sealing and noise reduction.

[00458] Thus, as attached as shown in FIG. 158, the seal portions 2860a-2860f are positioned intermediate glass 2852 and cab frame portion 2412 and membranes 2858 are positioned proximate to transverse frame portion 2412d (FIG. 99), whereby seatbelt retractors may be attached to frame portion 2412d and the belts may extend through apertures 2858a.

[00459] With reference to FIGS. 161-165, a windshield assembly 2900 may be coupled to the utility vehicle 1800 and sealed in place against cab frame members 2420, 2422, and visor 2440. As best shown in FIG. 165, windshield assembly 2900 is comprised of transparent windshield member 2902, upper seal 2904, side seals 2906,

front clamps 2908, rear clamps 2910, lower seal 2912, lower contoured portion 2914, seal 2916, and fasteners 2918 and 2920.

[00460] With reference to FIG. 164, clamp 2908 includes a semi-circular portion 2920 to conform to cylindrical uprights 2420 and 2422, and includes a lead-in section 2922 leading to the semi-cylindrical portion 2920. An enlarged section or rib 2924 is provided just beyond lead-in section 2922 defining a rearwardly facing surface 2926 and a forwardly facing surface 2928. Clamp 2908 further includes an inner groove at 2930, which is profiled to receive seal 2906. Rear clamp 2910 includes clamp arms in a semi-cylindrical configuration and has a recess at 2940 and profiled to receive enlarged portion 2924; a latching surface 2942, which catches on surface 2928; and surface 2944, which catches on surface 2926.

[00461] With reference to FIG. 165, contoured portion 2914 has an upper edge 2950, side flanges 2952 having apertures 2952a, a lower contoured surface 2954, and side tabs 2956. Lower seal 2912 is S-shaped in cross-section defining a first slot 2960 and a second slot 2962. Slot 2962 is profiled to be received over upper edge 2950 of contoured portion 2914 and slot 2960 is profiled to receive windshield 2902 therein.

[00462] The majority of the windshield assembly 2900 may be assembled prior to installation on the utility vehicle as described below. First, all of the seal members 2904, 2906, and 2912, may be positioned around the periphery of the windshield 2902. Lower seal 2912 may then be positioned over upper edge 2950 of contoured portion 2914. Left and right members 2908 may then be positioned with slots 2930 extending over seals 2906. A lower seal 2916, for example, a foam seal with double-back adhesive, may be applied to the bottom of contoured portion 2914. This assembly may be held in position by friction fit or double-back adhesive or by a cured adhesive. The windshield assembly as described may now be applied to the vehicle.

[00463] With reference to FIG. 136, the cab frame 2802 normally includes aluminum cast inserts 2980 having hexagonally-shaped apertures 2982, which communicate with a rounded bore for receipt of a bolt. Thus in the situation where no windshield is used, a fastener such as a hexagonal nut may be positioned in the

hexagonal opening 2982 and a bolt may be positioned through corresponding inserts 2980 to hold the cab frame 1850 to the vehicle. In the case where windshield assembly 2900 is to be positioned on the utility vehicle, the bolts normally used to retain the cab frame and extending through apertures 2982 are removed and fastener assembly 2918 (FIG. 165) is utilized.

[00464] Fastener assembly 2918 includes a bolt 2918a, which received a first hexagonal nut 2918b and which can also receive a second hexagonal nut 2920. Thus, once the original bolts are removed from inserts 2980, hexagonal nuts 2918b are then positioned in the corresponding apertures 2982 (FIG. 136). The windshield assembly is now positioned into the configuration shown in FIG. 162 where upper seal 2904 is nested against sealing surface 2472 (FIG. 138), which also positions apertures 2952a (FIG. 165) in alignment with apertures 2982 (FIG. 136) and with hexagonal nuts 2918b positioned therein. Bolts 2918a may now be positioned through the corresponding inserts 2980, threadably received into bolts 2918b, which coupled the two inserts 2980 together. This also positions the free end of the bolts 2918a through apertures 2952a of contoured portion 2914, whereupon fasteners 2920 may be threadably received onto the ends of bolts 2918a fixing the contoured portion 2914 and windshield 2904 into position. It should be appreciated that the front clamps 2908 also conform to be received over the cab frame tubes 2420 and 2422 as shown in FIG. 161. The rear clamps 2910 may now be positioned on the backside of cab frame tubes 2420 and 2422 to a position where they snap together; that is, into the configuration of FIG. 164.

[00465] In the embodiment of FIGS. 161-165, clamps 2908 and 2910 are comprised of a resilient material such as plastic. An alternative version is shown in FIG. 166, where a front clamp 2994 and a rear clamp 2996 are provided as die cast aluminum components having a latching structure as shown, but where the remainder of the window elements are substantially identical to that shown and described with reference to FIGS. 161-165.

[00466] With reference now to FIGS. 167-171, a third embodiment of the windshield will be described. As shown in FIG. 167, a third windshield assembly is

shown at 3000, which generally includes a windshield 3002, front clamp 3004, rear clamp 3006 (FIG. 170), hinge assembly 3008, and latch assembly 3010. In this embodiment, front clamp 3004 is substantially similar to clamp 2908 (FIG. 165) and includes a channel at 3012 (FIG. 167), which defines a groove similar to that of 2930 as shown in FIG. 165. However, in this embodiment, the windshield 3002 is not positioned in the groove, rather a slider 3014 (see FIG. 168) is positioned in the groove and the windshield 3002 is positioned in front of channel 3012. Hinge mechanism 3008 includes a bracket 3020 (FIG. 168) coupled to windshield by way of fasteners 3022 and which retains a pin 3024 to which slider 3014 is coupled.

[00467] Thus, slider 3014 is rectangular in configuration and is received in the groove defined by channel 3012. It should be appreciated that two such channels 3012 are positioned on opposite sides of the vehicle and sliders 3014 are profiled to be retained in the channels. Thus sliders 3014 maintain a translational movement while the windshield may pivot about pin 3024. In that regard, multiple positions are available for windshield 3002 as defined by the position of the windshield and the position it is latched relative to latch 3010. As shown in FIGS. 167 and 169, latch 3010 includes a base plate 3030 (FIG. 169), which is coupled to the vehicle adjacent to the left and right uprights of the vehicle cab frame. The latch includes a first wall 3032 extending upwardly having a slot at 3034 (FIG. 167). A second wall 3040 is provided forward of wall 3032 and includes a slot 3042 (FIG. 169). A quarter-turn latching assembly 3050 is coupled to the windshield having a latch 3052 (FIG. 169) and a latch handle 3054. Thus turning latch handle 3054 rotates latch 3052 allowing latch 3052 to lock within either of slots 3034 or 3042.

[00468] Thus, when the windshield is desired to be fully closed, the windshield is slid upwardly and latch 3052 is positioned in latch openings 3034 and latch handles 3054 are rotated to position where latch 3052 is in an upward position latching the windshield in place. When it is desired to have some venting of air into the vehicle, the windshield can be moved from the fully closed position by again rotating latch handle 3054, and latch 3052 may be released from aperture 3034 and the windshield slid to the position of FIG. 167 positioning latch 3052 into aperture 3042. In this position, a vented

opening can be created between a bottom of windshield 3002 and the vehicle hood allowing some vented air into the vehicle, as shown best in FIG. 169.

[00469] With reference to FIG. 171, a third position of windshield 3002 is possible where a latch assembly 3060 is provided adjacent to a front of the vehicle to receive
5 latches 3050 and lock the windshield in a fully open position. As shown, sliders 3014 are moved to a vertically downward position in channels 3012, yet retaining their rearward end of the windshield in position. The windshield 3002 is easily moved from the fully open position to a vented to closed position by again rotating latch handles to unlatch the windshield from the front end, whereupon the windshield can be pushed
10 rearwardly, which causes the sliders to ascend in the channels and the windshield can be rotated such that latches 350 are coupled to either of the fully closed or vented position.

[00470] While this invention has been described as having an exemplary design, the present invention may be further modified within the spirit and scope of this
15 disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains.

What is claimed is:

1. A utility vehicle (10), comprising:
 - a plurality of ground-engaging members ;
 - a frame (12) supported by the ground-engaging members (14, 16);
 - 5 a drivetrain (30) supported by the frame;
 - an operator's area (60) defined by side by side seats and operator controls;
 - a cab frame (84) covering the operators area and defined by at least first and second front support portions (610a, 612a), at least first and second rear support portions (622b), and longitudinally extending sections (610b, 612b) coupling the front
 - 10 and rear support portions; and
 - the operator's area having a driver seat (62) having a driver restraint harness and a passenger seat (64) having a passenger restraint harness, the driver seat and the passenger seat being in a side-by-side arrangement, the cab frame being configured to support a driver restraint harness for the driver seat and a passenger restraint harness
 - 15 for the passenger seat, the driver and passenger restraint harnesses comprising a shoulder retractor (1428; 1440; 1442) coupled to the cab frame rearward of the respective driver and passenger seats.
2. The utility vehicle of claim 1, wherein the shoulder retractors are coupled to the first and second rear support portions.
- 20 3. The utility vehicle of claim 1 or 2, wherein the driver and passenger seats comprise seat backs and seat bottoms, and the shoulder retractors are laterally positioned outside of the profile of the seat backs.
4. The utility vehicle of any of claims 1-3, wherein the shoulder retractors are vertically positioned above a top of the seat backs.
- 25 5. The utility vehicle of any of claims 1-4, wherein the cab frame further comprises a cross bar (624) extending between the first and second rear support portions, and the shoulder retractors are coupled to the cross bar.

6. The utility vehicle of claim 5, wherein the shoulder retractors are coupled to the cross bar vertically positioned below a top of the seat backs.

7. The utility vehicle according to claim 5 or 6, wherein plural shoulder retractors are provided for each seat.

5 8. The utility vehicle according to any one of claims 1-7, further comprising at least one hip retractor coupled to the frame on one side of each seat.

9. The utility vehicle according to claim 8, comprising plural hip retractors coupled to the frame on opposite sides of each seat.

10. A utility vehicle (10), comprising:

10 a plurality of ground-engaging members (14, 16);

a frame supported by the ground-engaging members;

a drivetrain supported by the frame; and

an operator area (60) having a seating portion supported by the frame and including a driver seat (62) having a driver restraint harness and a passenger seat (64)

15 having a passenger restraint harness, the driver seat and the passenger seat being in a side-by-side arrangement, the frame being configured to support a driver restraint harness for the driver seat and a passenger restraint harness for the passenger seat, the driver restraint harness being coupled to one of the driver seat and the frame in at least one of a first coupling location, a second coupling location, a third coupling
20 location, a fourth coupling location, a fifth coupling location, and a sixth coupling location, and the passenger restraint harness being coupled to one of the passenger seat and the frame in at least one of a first coupling location, a second coupling location, a third coupling location, a fourth coupling location, a fifth coupling location, and a sixth coupling location.

25

11. The utility vehicle of claim 10, wherein the first and second coupling locations for the driver restrain harness are rearward of a driver supported on the driver seat, and the

first and second coupling locations for the passenger restraint harness are rearward of a passenger supported on the passenger seat.

12. The utility vehicle of claim 10 or 11, wherein the third and fourth coupling locations for the driver restraint harness are laterally spaced apart from a seat bottom of the driver seat, and the third and fourth coupling locations for the passenger restraint harness are laterally spaced apart from a seat bottom of the passenger seat.

13. The utility vehicle of claim 10, wherein the fifth and sixth coupling locations for the driver restraint harness are positioned below and generally forward of the seat bottom of the driver seat, and the fifth and sixth coupling locations for the passenger restraint harness are positioned below and generally forward of the seat bottom of the passenger seat.

14. The utility vehicle of claim 10, further comprising a driver latching mechanism for the driver restraint harness, the driver restraint harness being configured to include at least one of a first strap retractably coupled at the first coupling location for the driver restraint harness and the driver latching mechanism, a second strap retractably coupled at the second coupling location for the driver restraint harness and the driver latching mechanism, a third strap retractably coupled at the third restraint harness for the driver restraint harness and the driver latching mechanism, a fourth strap retractably coupled at the fourth coupling location for the driver restraint harness and the driver latching mechanism, a fifth strap retractably coupled at the fifth coupling location for the driver restraint harness and the driver latching mechanism, and a sixth strap retractably coupled at the sixth coupling location for the driver restraint harness and the driver latching mechanism.

15. The utility vehicle of claim 14, further comprising a passenger latching mechanism for the passenger restraint harness, the passenger restraint harness being configured to include one of a first strap retractably coupled at the first coupling location for the passenger restraint harness and the passenger latching mechanism, a second strap retractably coupled at the second coupling location for the passenger restraint harness and the passenger latching mechanism, a third strap retractably coupled at the

third restraint harness for the passenger restraint harness and the passenger latching mechanism, a fourth strap retractably coupled at the fourth coupling location for the passenger restraint harness and the passenger latching mechanism, a fifth strap retractably coupled at the fifth coupling location for the passenger restraint harness and the passenger latching mechanism, and a sixth strap retractably coupled at the sixth coupling location for the passenger restraint harness and the passenger latching mechanism.

16. The utility vehicle of claim 15, further comprising a sensor for at least one of the driver latching mechanism and the passenger mechanism, the sensor being configured to determine when at least one of the driver latching mechanism and the passenger latching mechanism is latched.

17. The utility vehicle of claim 16, further comprising an indicator within the operator area and operably coupled to the sensor to indicate when at least one of the driver latching mechanism and the passenger latching mechanism is latched.

18. A utility vehicle (10), comprising:

a plurality of ground engaging members (14, 16);

a frame (12) supported by the ground engaging members and including a lower frame portion and a cab frame (84) coupled to the lower frame portion to define an operator area;

a seating area (60) supported within the operator area and including a driver seat (62) and a passenger seat (64) in a side-by-side arrangement;

a first opening adjacent the driver seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area;

a second opening adjacent the passenger seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area;

a first frame member (164) extending into the first opening and removably coupled to at least one of the lower frame portion and the cab frame;

a second frame member (164) extending into the second opening and removably coupled to at least one of the lower frame portion and the cab frame;

a first door (1500) extending across at least a portion of the first opening, the first door being coupled to the first frame member when the first frame member is coupled to at least one of the lower frame portion and the cab frame, and the first door being coupled to at least one of the lower frame portion and the cab frame when the first
5 frame member is removed from the utility vehicle; and

a second door (1500) extending across at least a portion of the second opening, the second door being coupled to the second frame member when the second frame member is coupled to at least one of the lower frame portion and the cab frame, and the second door being coupled to at least one of the lower frame portion and the cab frame
10 when the second frame member is removed from the utility vehicle.

19. The utility vehicle of claim 18, wherein the first and second doors are configured to rotate through approximately 90 degrees between an open position and a closed position.

20. The utility vehicle of claim 19, further comprising a stop surface for the first door
15 to maintain the first door at approximately 90 degrees when in the open position.

21. The utility vehicle of claim 19 or 20, further comprising a stop surface for the second door to maintain the second door at approximately 90 degrees when in the open position.

22. The utility vehicle of any of claims 18-21, wherein the first and second doors are
20 generally flush with the lower frame portion and the cab frame when in the closed position.

23. The utility vehicle of claim 22, wherein the first and second doors are tapered toward the operator area.

24. The utility vehicle of claim 23, wherein the first and second doors are comprised
25 of a frame and cover.

25. The utility vehicle of claim 24, wherein the first and second doors are comprised of a side net.

26. A utility vehicle (10), comprising:
 a frame (12);
 ground engaging members supporting the frame (14, 16);
 an operator's compartment (60);
 5 a powertrain (30);
 a rear utility bed (1832) positioned rearward of the operator's compartment;
 a bezel (2300) positioned adjacent an upper edge of the rear utility bed and
 being coupled to and removable from the rear utility bed; and
 a conduit (828) having a first end coupled to the powertrain and a second end
 10 coupled to the bezel;
 wherein air is delivered to the powertrain through the bezel and conduit to the
 powertrain.
27. The utility vehicle of claim 26, wherein the powertrain comprises an engine and
 the conduit delivers air to an engine air intake.
- 15 28. The utility vehicle of claim 27, wherein the powertrain comprises a continuously
 variable transmission (CVT) and the conduit delivers cooling air to the CVT.
29. The utility vehicle of claim 27 or 28, further comprising:
 a cab frame coupled to the vehicle, the cab frame being removable from the
 vehicle for shipping;
 20 the bezel, when in position, is the highest point on the vehicle after the cab frame
 is removed.
30. The utility vehicle of any of claims 26-29, wherein the rear utility bed includes an
 opening through which the conduit protrudes, and wherein the bezel encloses a top of
 the conduit.
- 25 31. The utility vehicle of claim 30, wherein the hose includes a coupling to sealingly
 fit the conduit to the opening, and wherein the top of the hose is positioned higher than
 the opening.

32. The utility vehicle of any of claims 26-31, further comprising an air filter or screen positioned in the bezel, the air filter or screen being removable from the vehicle for cleaning.

33. A utility vehicle, comprising:

5 an operator's compartment (60);

at least one body panel member (1824);

a storage bin (1858) coupled to the body panel member, and having first (1878) and second (1876) enclosures, the first enclosure having a first panel (1884) with at least a partial transparent window (1884b).

10 34. The utility vehicle of claim 33, wherein the first enclosure is defined by the first panel and an inner intermediate panel.

35. The utility vehicle of claim 34, wherein the inner intermediate panel defines the second enclosure.

15 36. The utility vehicle of any of claims 34-35, wherein the storage bin comprises a substantially closed container having one open side, and the first and intermediate panel are positioned in the one open side.

37. The utility vehicle of any of claims 34-36, wherein the first panel and intermediate panel are latched together to define the first enclosure.

20 38. The utility vehicle of any of Claims 34-37, wherein the first panel is rotatable relative to the intermediate panel to access the first enclosure.

39. The utility vehicle of any of claims 34-38, wherein the first enclosure is sized to fit a smart phone with the smart phone screen accessible for view through the transparent window.

25 40. The utility vehicle of any of claims 34-39, wherein the first panel and intermediate panel are rotatable together to access the second enclosure.

41. The utility vehicle of any of claims 34-40, wherein the first panel is sealed to the intermediate panel.
42. The utility vehicle of any of claims 34-41, wherein the intermediate panel is sealed to the container.
- 5 43. The utility vehicle of any of claims 34-42claim 34, wherein the latch arm is coupled to the intermediate panel.
44. A utility vehicle (10), comprising:
a frame (12);
ground engaging members supporting the frame (14, 16);
10 an operator's compartment (60);
a powertrain (30) for driving the ground engaging members; and
a rear suspension (2602) comprising a trailing arm (650), the trailing arm being generally horizontally disposed.
45. The utility vehicle of claim 44, wherein the trailing arm has a flat lower surface.
- 15 46. The utility vehicle of claim 44 or 45, wherein the trailing arm is substantially rectangular in cross-section.
47. The utility vehicle of claim 46, wherein the trailing arm is comprised of a box beam (670).
48. The utility vehicle of claim 46 or 47, wherein the trailing arm is comprised of a
20 longitudinal portion (670a) and a transverse portion (670b), the longitudinal portion and the transverse portion being mitered (670c) and welded together.
49. The utility vehicle according any one of claims 44-48, wherein the rear suspension comprises two shock absorbers (656, 790) coupled between each of the trailing arms and the frame.

50. The utility vehicle according to claim 49, further comprising a rear utility bed positioned rearward of the operator's compartment, the shock absorbers mount to the frame at a position behind the operator's compartment and under the rear utility bed.

51. A utility vehicle (10), comprising:

5 a frame (12);

ground engaging members supporting the frame (14, 16);

an operator's compartment (60) having at least seat comprised of a seat bottom and a seat back; and

10 a fuel tank (2070) positioned under the seat and extending to a forward most position forward of a front of the seat bottom (2064b).

52. The utility vehicle of claim 51, wherein the utility vehicle comprises two side by side seats.

53. The utility vehicle of claim 51 or 52, wherein the utility vehicle a powertrain positioned rearward of the operator's compartment.

15 54. The utility vehicle of claim 53, wherein a driveshaft extends from the power train to drivingly couple with front ground engaging members.

55. The utility vehicle of claim 54, wherein the fuel tank extends over the drive shaft.

56. The utility vehicle of claim 54 or 55, wherein the fuel tank includes a concavity on a lower surface thereof to receive the driveshaft.

20 57. The utility vehicle of any of claims 51-56, wherein the fuel tank is positioned under a passenger seat.

58. A utility vehicle (10), comprising:

a frame (12);

ground engaging members supporting the frame (14, 16);

an operator's compartment (60);

5 body panels (2054, 2056) at least partly defining the operator's compartment with seams (2140, 2150) of the body panels overlapping;

a seat support frame (126) positioned over the overlapping portion; and

a seat (1836, 1838) coupled to the seat support frame.

59. The utility vehicle of claim 58, wherein the overlapping portion defines a
10 rectangular projection.

60. The utility vehicle of claim 59, wherein the seat support frame comprises an open bottom channel profiled for positioning over the rectangular projection.

61. A bypass shock (2630), comprising:

15 an elongate shock cylinder having a substantially tubular shaped body (2650) having a tubular wall, the body having an upper end and a lower end, at least two channels (2670a - 2670e) extending within the tubular wall and between the upper and lower end, and each channel having a passageway (2676a – 2676e) communicating with an interior of the body, where a first of the passageways is closer to the upper end than a second of the passageways;

20 a piston (2706) positioned in the body interior;

a piston rod fixed to the piston and extending beyond one of the upper and lower ends;

an upper cap (2652) enclosing the upper end;

a lower cap (2658) enclosing the lower end;

25 one of the upper and lower caps being provided with a first passage (2654a) communicating with the first and second channels;

a first check valve (2654) positioned in the first passage; and

hydraulic fluid positioned in the cylinder between the piston and the cap containing the passage.

62. The bypass shock of claim 61, wherein the check valve is positioned to allow hydraulic fluid to flow into the first passageway and out of the second passageway when the piston is located between the first and second passageways and moving upwardly.

63. The bypass shock of claim 61 or 62, wherein the check valve is positioned to
5 allow hydraulic fluid to flow into the second passageway and out of the first passageway when the piston is located between the first and second passageways and moving downwardly.

64. The bypass shock of any of claims 61-63, further comprising:
at least two additional channels extending within the tubular wall and between
10 the upper and lower ends, and each channel having a second passage (2656a) communicating with an interior of the body, where a third of the passageways is closer to the upper end than a fourth of the passageways;
the one cap being provided with a second passage communicating with the third and fourth channels; and
15 a second check valve (2656) positioned in the second passage.

65. The bypass shock of claim 64, wherein the first check valve is positioned to allow hydraulic fluid to flow into the first passageway and out of the second passageway when the piston is located between the first and second passageways and moving upwardly.

66. The bypass shock of claim 65, wherein the second check valve is positioned to
20 allow hydraulic fluid to flow into the fourth passageway and out of the third passageway when the piston is located between the first and second passageways and moving downwardly.

67. The bypass shock of any of claims 61-66, further comprising a hydraulic oil reservoir fluidly coupled to an interior of the shock cylinder.

25 68. The bypass shock of any of claims 61-67, further comprising a reservoir channel extending within the tubular wall and between the upper and lower ends, and the reservoir channel having a reservoir passage communicating with an interior of the body.

69. The bypass shock of any of claims 61-68, further comprising a reservoir passage positioned in the one cap.

70. The bypass shock of any of claims 61-69, further comprising a hydraulic oil reservoir fluidly coupled to an interior of the shock cylinder.

5 71. The bypass shock of any of claims 61-70, further comprising a reservoir channel extending within the tubular wall and between the upper and lower ends, and the reservoir channel having a reservoir passage communicating with an interior of the body.

10 72. The bypass shock of claim 71, further comprising a third passage positioned in the one cap for communicating with the reservoir.

73. The bypass shock of claim 72, wherein the first, second and third passages are positioned in the upper cap, and first, second and third valves are in communication with respective first, second and third passages.

15 74. The bypass shock of claim 73, wherein the first and second valves are check valves.

75. The bypass shock of claim 73 or 74, wherein the third valve is a compression adjust valve stack with variable orifice.

76. The bypass shock of any of claims 73-75, wherein the first and second check valves may be set to activate at different pressures.

20

77. A spare tire holder (2500) for a utility vehicle (10), comprising:
a holder frame (2512, 2514) profiled to hold a spare tire and rim;
clamps (2502) for attachment of the holder frame to the vehicle; and
retaining members (2532) for coupling the holder frame to the clamps;

5 whereby the retaining members may be removed to remove the holder frame from the vehicle leaving the clamps, or the retaining members on one side thereof may be removed, allowing the holder frame to pivot about a second side.

78. The holder of claim 77, wherein the holder frame is comprised of a threaded stud and a complementary threaded coupler, the threaded coupler having a handle to apply
10 torque to the threaded coupler.

79. The holder of claim 77 or 78, wherein the handle includes a socket at one end thereof corresponding to a lug nut on the vehicle.

80. A seat for a vehicle, comprising:

a seat bottom including a first portion (1300), a second portion (1302), and a third
15 portion (1304);

first portion intermediate second and third portions (1302, 1304) and has a generally flat orientation for supporting a driver;

second and third portions (1302, 1304) are angled outwardly and upwardly relative to first portion 1300 in order to retain the operator and passenger on seat
20 bottoms 62b, 64b during operation of the vehicle;

the first, second and third portions having an inner layer (1306, 1308, 1310; 1300') surrounded by a waterproof outer cover (1312, 1314, 1316, 1312'); and
an outer covering (1318) surrounding the outer cover.

81. The seat of claim 80, wherein the inner layer of the first, second and third
25 portions are a single integral piece (1300').

82. The seat of claim 80, wherein the first, second and third portions have a discrete inner layer (1306, 1308, 1310).

83. The seat of claim 82, wherein the inner layer (1306) is generally surrounded by outer layer (1312), inner layer (1308) is generally surrounded by an outer layer (1314), and inner layer (1310) is generally surrounded by outer layer (1316).

84. The seat of any of claims 82 or 83, wherein an interface (1320) is defined between first portion (1300) and second portion (1302), and outer layer (1312) is adjacent outer layer (1314); and an interface (1322) is defined between first portion (1300) and third portion (1304), and outer layer (1312) is adjacent outer layer (1316).

85. The seat of any of claims 80-84, wherein the portions (1300, 1302, and 1304) are coupled together by one of a method including: sewing, bonding, molding, radio frequency welding, stapling and adhesive bonding.

86. The seat of claim 85, wherein the inner layers (1306, 1308, and 1310) are comprised of a foam or other polymeric material.

87. The seat of any of claims 80-86, wherein covering (1318) extends around outer layers (1312, 1314, and 1316), such that outer layers (1312, 1314, and 1316) are intermediate cover (1318) and inner layers (1306, 1308, and 1310) respectively.

88. The seat of any of claims 80-87, wherein covering (1318) may be comprised of a water resistant material such as polymeric film material, a polymeric sprayable material, a vinyl material, or other similar material.

89. A coupling assembly (570), comprising:

a washer (572);

a deformable shank (574) having a head (574a), a body portion (574g) and deformable wings (574f); and

fasteners (576, 578).

90. The coupling assembly of claim 89, wherein the deformable shank (574) includes an internal diameter (574b) and an outer diameter portion (574d) interrupted by flat portions (574e).

91. The coupling assembly of claim 89, wherein the washer is a contoured washer (572) having an outer diameter (572a) with an arcuately curved face (572b) providing extreme most points (572c).

92. The coupling assembly of claim 90 or 91, wherein the contoured washer (572) further includes a front face (572d) opposing curved surface (572b) and includes an inner diameter (572e) having flat portions (572f) and a shoulder (572g).

93. The coupling assembly of claim 90 or 91, wherein the fastener (576) includes a bolt head (576a) having a shoulder portion (576b), an inner face (576c) and a threaded portion (576d).

94. The coupling assembly of any of claims 90-93, wherein fastener (578) has a cylindrical body (578a) and a head (578d) defining a camming surface (578e).

95. A vehicle, comprising:

a frame (12); and

a suspension having lower alignment arms (1150) and upper alignment arms (1152), having arms (1190, 1192) where arm 1192 includes a radiused portion (1216) projecting an arm portion (1218) in a relatively horizontal position, the radiused portion 1216 defining a predefined buckling point in the suspension, where the alignment arm buckles rather than damaging the frame (12).

96. The vehicle of claim 95, further comprising a steering arm (1162) where the alignment arm (1152) is provided over the top of steering arm (1162).

97. A utility vehicle, comprising:

longitudinally extending main frame tubes (152);

front frame tubes (200);

U-shaped frame tube (170);

frame tubes (156);

suspension mounts (210, 212) coupled to the longitudinally extending main frame tubes (152), wherein front frame tubes (200) are coupled to the U-shaped frame tube

(170) at a rearward end and to the longitudinally extending main frame tubes (152) at a forward end, and the frame tubes (156) are coupled to the U-shaped frame tube (170) at a forward end and extend rearwardly;

a front shock mounting bracket (250) coupled to the U-shaped frame tube (170);

5 suspension arms (1150) coupled to the suspension mounts (210, 212); and

a shock absorber coupled between the front shock mounting bracket (250) and the suspension arms (1150).

98. The utility vehicle of claim 97, wherein the U-shaped portion 170 includes a center section 170a, and upwardly and rearwardly extending section 170c.

10 99. The utility vehicle of claim 98, further comprising a cab frame (84) wherein a front section of the cab frame is coupled to the rearwardly extending sections 170c.

100. A utility vehicle, comprising:

a frame (12);

side by side seats coupled to the frame and positioned in an operator's area;

15 floor board panels (1630, 1632) positioned below and forward of the side by side seats;

at least one a drain (1680) positioned in one of the floorboards and having a drain opening (1684) to allow fluids, dirt, and debris to exit the operator area when drain (1680) is open; and

20 a cap (1682) that is removably coupled to the floor board panels 1630, 1632.

101. A utility vehicle, comprising:

a frame (12);

an engine:

an air intake system communicating air into the engine;

25 dual bore throttle body couple between the air intake system and the engine;

an operator control for supplying fuel and air to the engine; and

an electronic throttle control system (1640) coupled to the operator control and electronically controlling the dual bore throttle body.

102. A utility vehicle, comprising:

a plurality of ground engaging members;

a frame supported by the ground engaging members and including a lower frame portion and a cab frame coupled to the lower frame portion to define an operator area;

5 a seating area supported within the operator area and including a driver seat and a passenger seat in a side-by-side arrangement;

a first opening adjacent the driver seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area;

10 a second opening adjacent the passenger seat and defined between the lower frame portion and the cab frame for ingress and egress from the operator area;

a first door extending across at least a portion of the first opening, the first door being coupled to the frame;

a second door extending across at least a portion of the second opening, the second door being coupled to the; and

15 the first and second doors being bowed outwardly and away from the seats to increase the room in the seating area.

103. A utility vehicle, comprising:

a first plurality of ground engaging members;

a second plurality of ground engaging members;

20 a frame having at least one elongate frame tube assembly comprised of plural sections (80, 82), the frame supported by the first plurality of ground engaging members and the second plurality of ground engaging members, the plural sections including first frame tubes (152) extending in a generally longitudinal direction, and second frame tubes (150) being angled relative the longitudinal direction;

25 a drive train supported by the frame;

a frame tube coupler (87a, 87b) removably coupling the frame tube sections at a longitudinal position from either end of the frame and between the first plurality of ground engaging members and the second plurality of ground engaging members, wherein the frame tube coupler includes two interengaging coupler members, each
30 coupler member comprising an angled shank portion (500) and a front face (502), the interengaging sections connecting to each other to couple the frame tube sections, each

interengaging section comprising a complementary projection and a recess, the recess being spaced apart from the projection, wherein the projection and the recess are both on a first side of the interengaging section, wherein the projection of each of the interengaging sections is profiled for receipt within the recess of the other of the interengaging sections and the first side of one of interengaging coupler member faces the first side of the other interengaging coupler member when the projection of each of the interengaging sections is received within the recess of the other of the interengaging sections.

104. The utility vehicle of claim 103, wherein each tube connecting section is insertable into respective ends of the frame tube sections.

105. The utility vehicle of claim 103 or 104, wherein the two interengaging coupler members are identical.

106. The utility vehicle of claim 103, wherein each tube connecting section is profiled to connect to a round tube.

107. A utility vehicle, comprising:

a frame;

a cab frame (1850) enclosing a portion of the frame, and including front frame portions and rear frame portions;

a visor (2440) coupled to the front frame portions; and

a windshield assembly (2900, 3000) coupled to the front frame portions of the cab frame and positioned adjacent to the visor.

108. The utility vehicle of claim 107, wherein the windshield assembly comprises a windshield (2902, 3002) and a clamp assembly clamping the windshield to the front frame portions of the cab frame.

109. The utility vehicle of claim 107 or 108, wherein the clamp assembly includes front clamps (2908, 3004) and rear clamps (2910, 3006) which clamp to each other and to the front frame portions of the cab frame.

110. The utility vehicle of claim 109, wherein one of the clamps (3004, 3006) includes a groove (3012), and a slider (3014) is coupled to each side of the windshield (3002) and slides in the groove.

111. The utility vehicle of claim 110, wherein the sliders (3014) are located adjacent a top of the windshield, and can slide from a closed position, where the sliders are adjacent a top of the groove, to a collapsed position where the windshield where the sliders are adjacent a bottom of the groove.

112. A utility vehicle, comprising:

a frame;

a cab frame (1850) enclosing a portion of the frame, and including front frame portions and rear frame portions;

a windshield assembly (2900, 3000) coupled to the front frame portions of the cab frame, the windshield assembly comprises a windshield (2902, 3002) and a clamp assembly clamping the windshield to the front frame portions of the cab frame.

113. The utility vehicle of claim 112, wherein the clamp assembly includes front clamps (2908, 3004) and rear clamps (2910, 3006) which clamp to each other and to the front frame portions of the cab frame.

114. The utility vehicle of claim 113, wherein one of the clamps (2908, 2910; 3004, 3006) includes a groove (2930; 3012).

115. The utility vehicle of claim 114, wherein the windshield (2012) has a seal (2906) along an edge thereof and the windshield and seal are positioned in the groove (2930).

116. The utility vehicle of claim 114, further comprising a slider (3014) coupled to each side of the windshield (3002) and the sliders slide in the groove (3012).

117. The utility vehicle of claim 116, wherein the sliders (3014) are located adjacent a top of the windshield, and can slide from a closed position, where the sliders are adjacent a top of the groove, to a collapsed position where the sliders are adjacent a bottom of the groove.

118. The utility vehicle of claim 116 or 117, wherein the windshield assembly further comprises a first latch (3010) positioned adjacent to the lower end of the front frame portions of the cab frame.

119. The utility vehicle of claim 118, wherein the first latch (3010) includes a first latch position (3034) for a closed windshield position, and a second latch position (3042) for a
5 vented windshield position.

120. The utility vehicle of any of claims 117-119, wherein the windshield assembly further comprises a second latch (3060) positioned adjacent a front of the vehicle, wherein the sliders (3014) can slide to a collapsed position where the sliders are
10 adjacent a bottom of the groove.

121. The utility vehicle of any of claims 112-120, further comprising a visor (2440) coupled to the front frame portions, the windshield assembly abutting the visor.

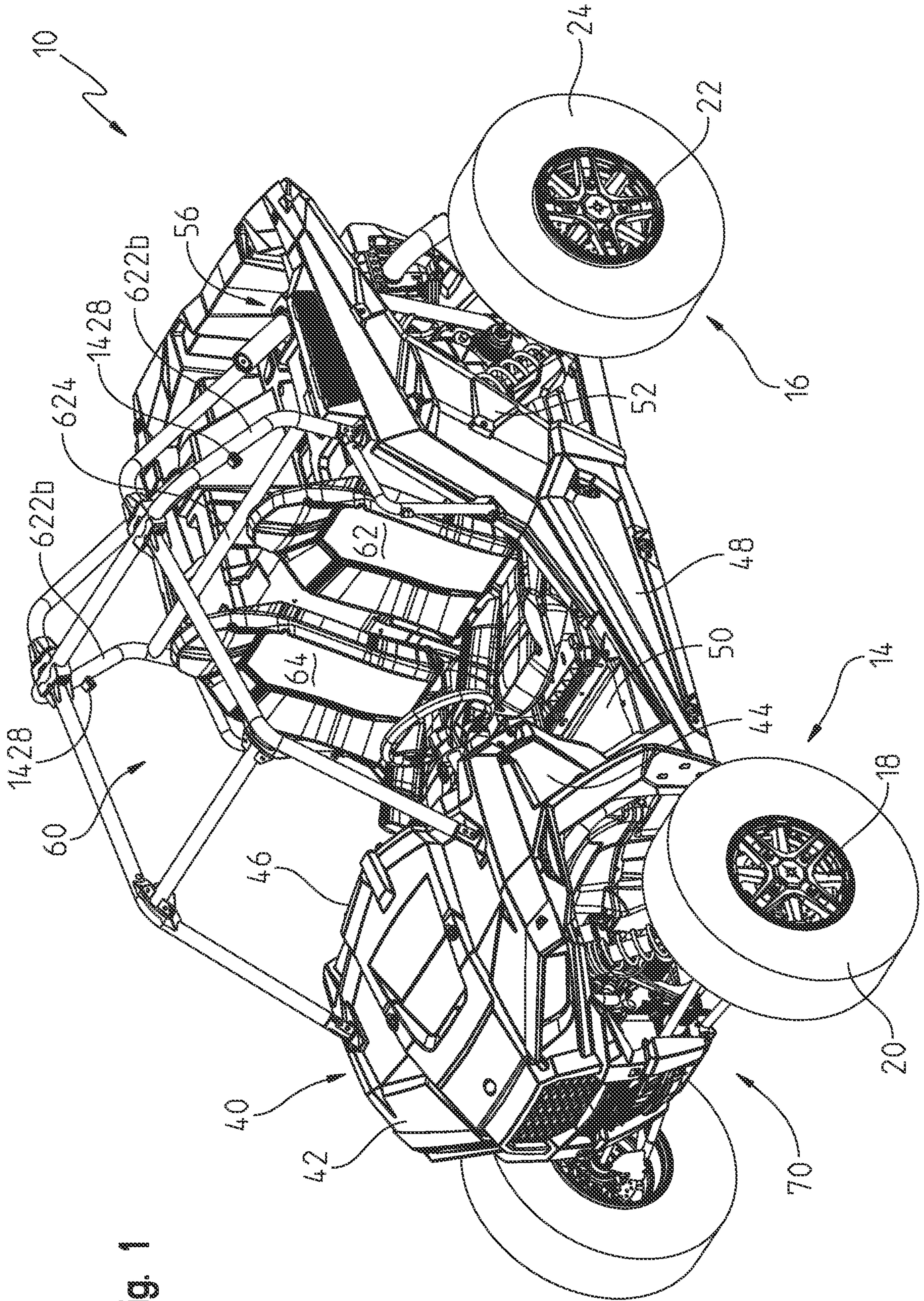


Fig. 1

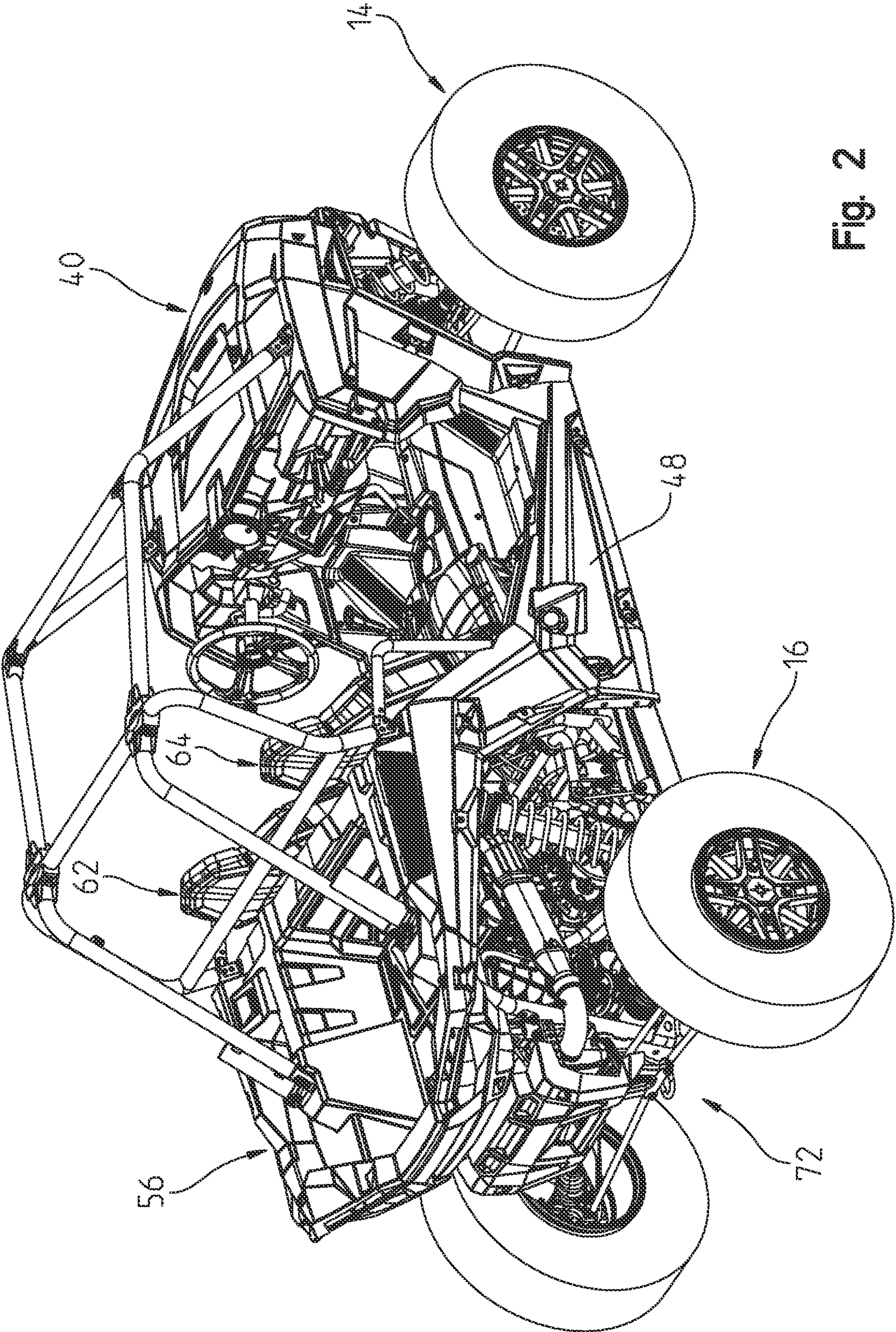


Fig. 2

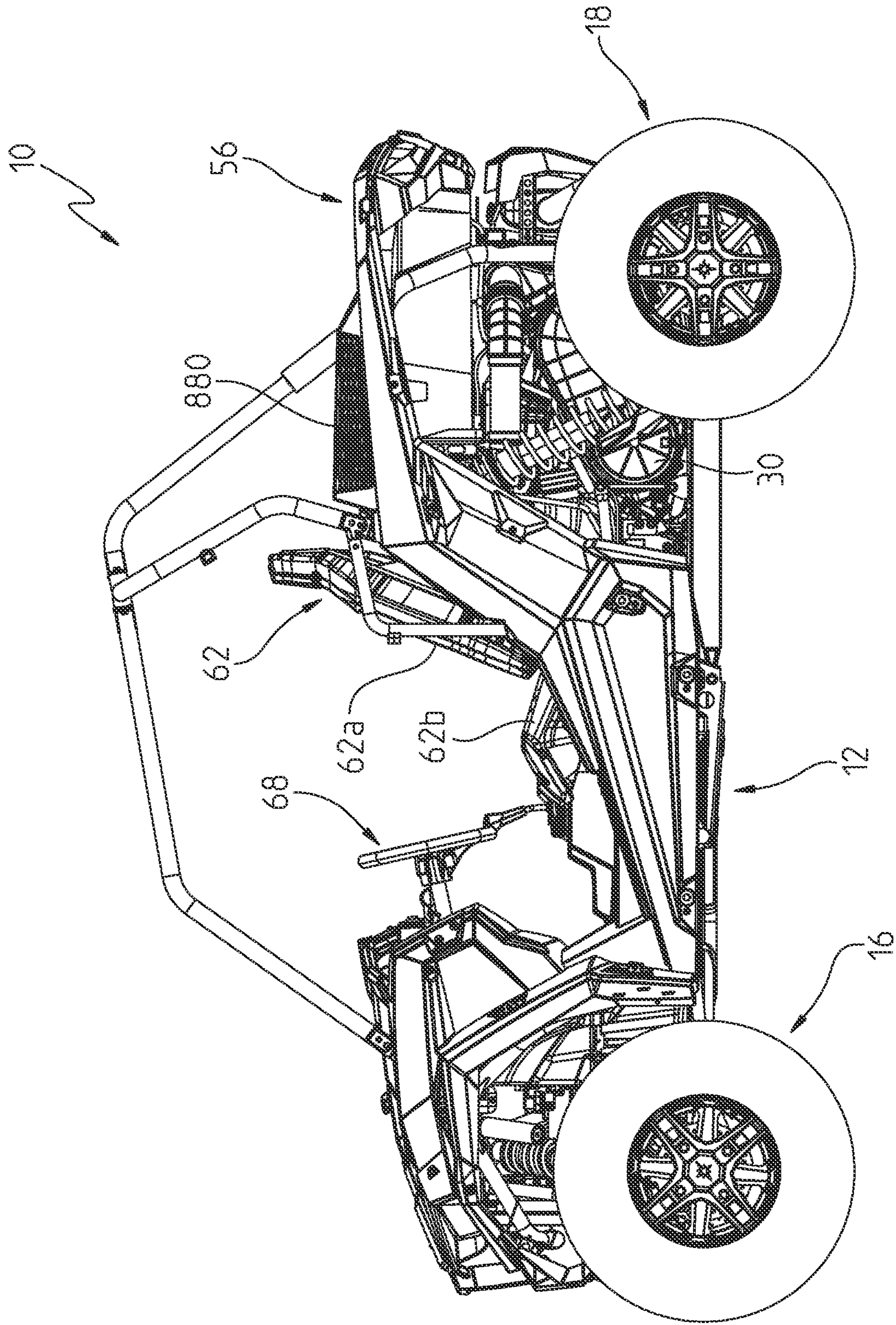


Fig. 3

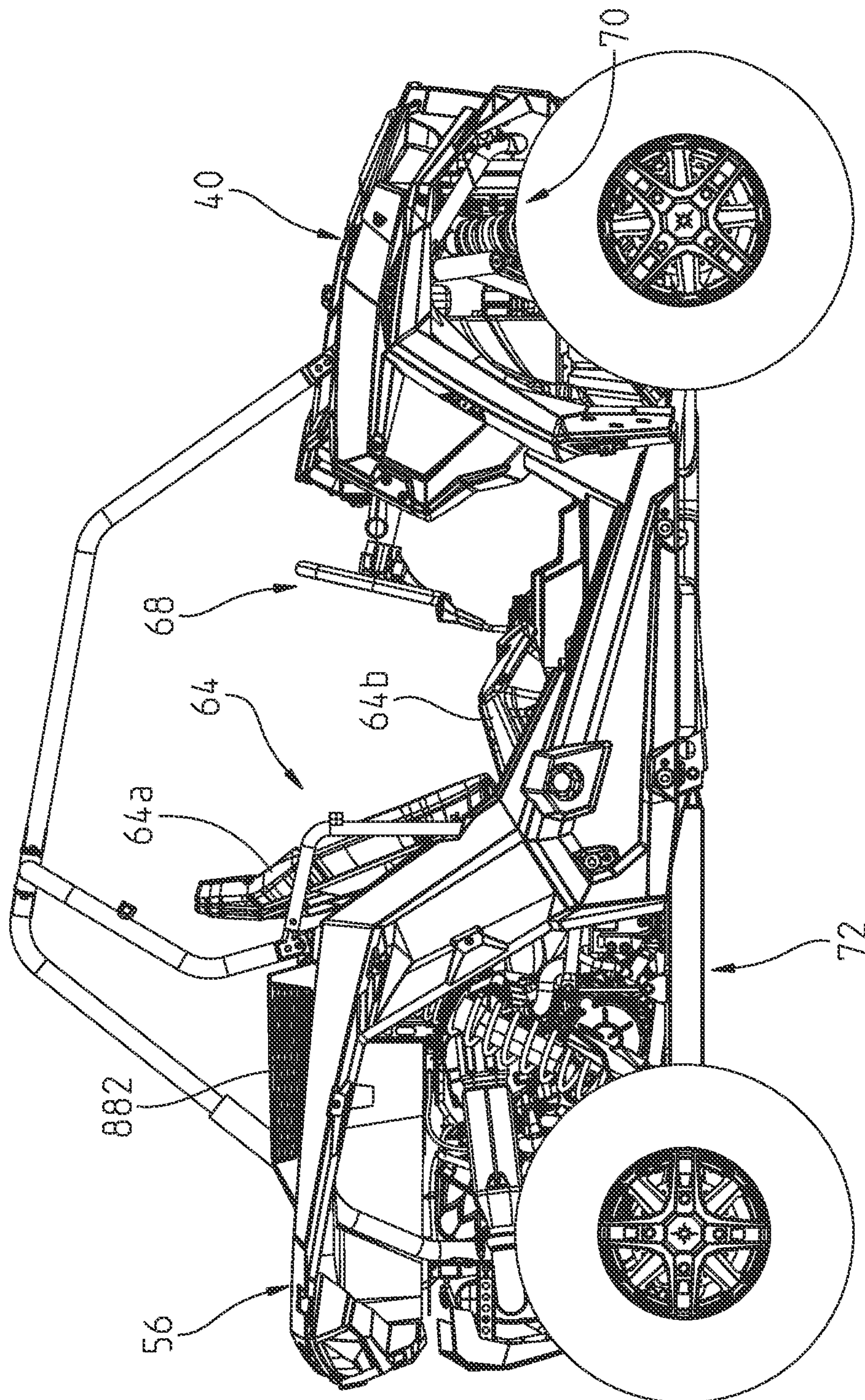


Fig. 4

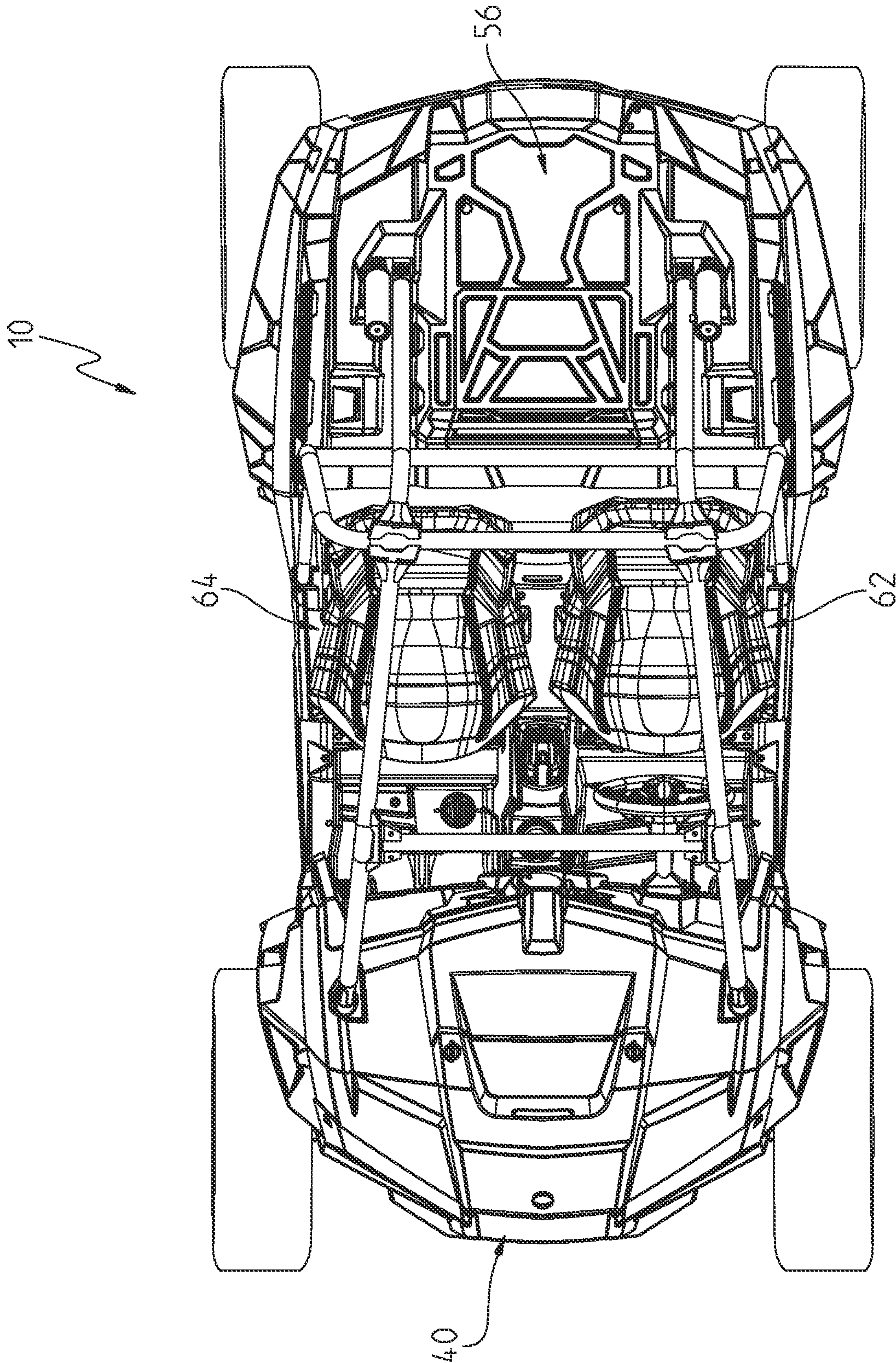


Fig. 5

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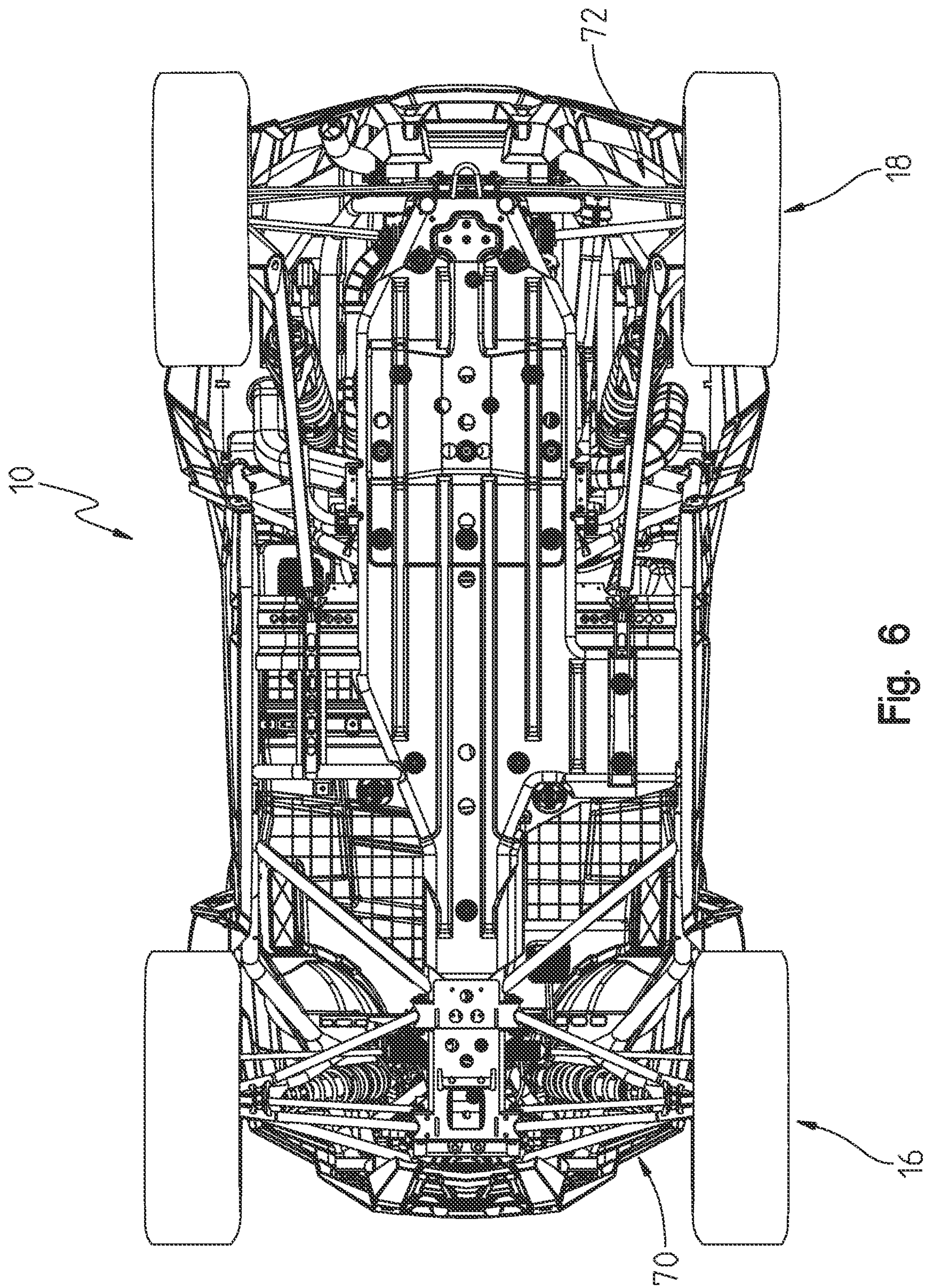


Fig. 6

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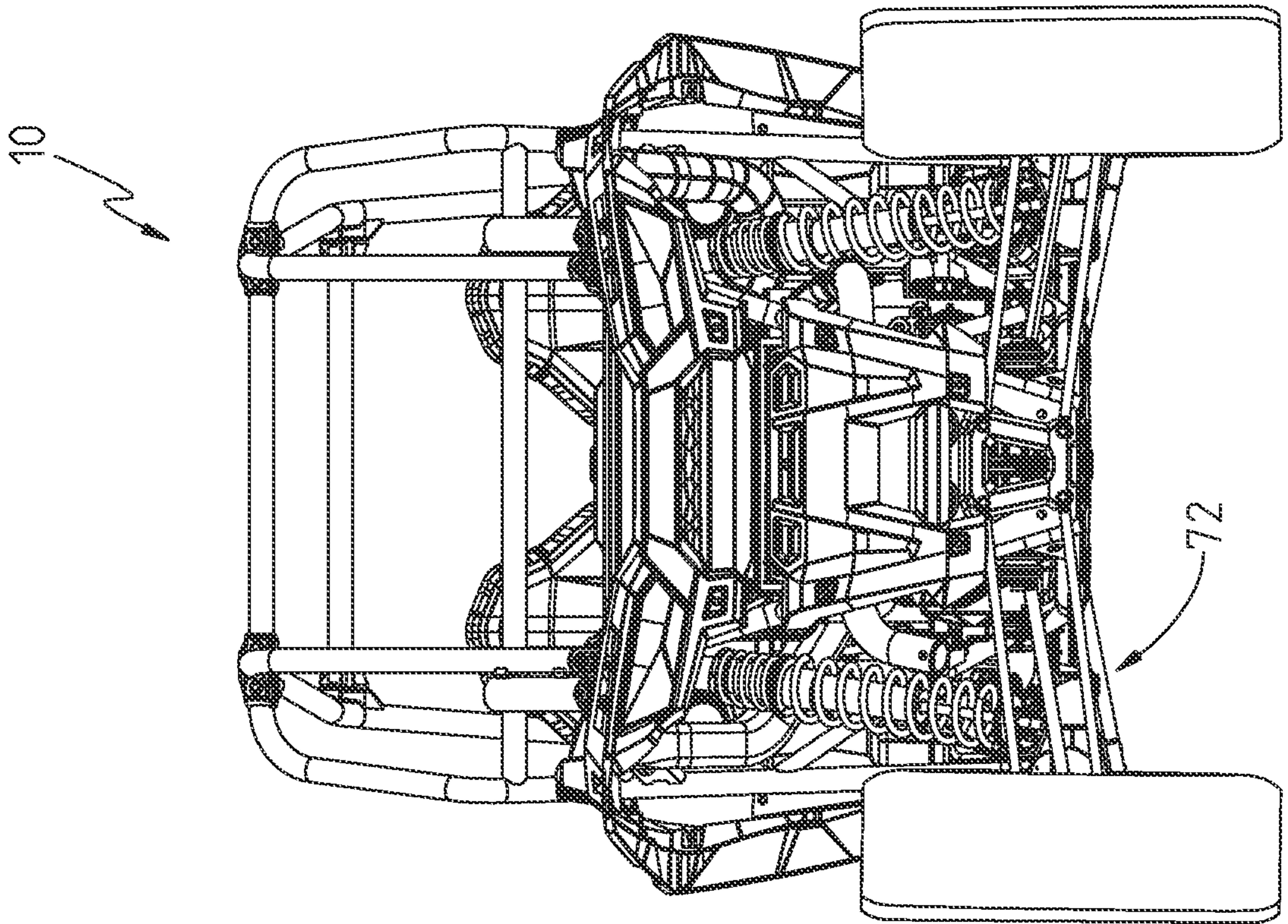


Fig. 8

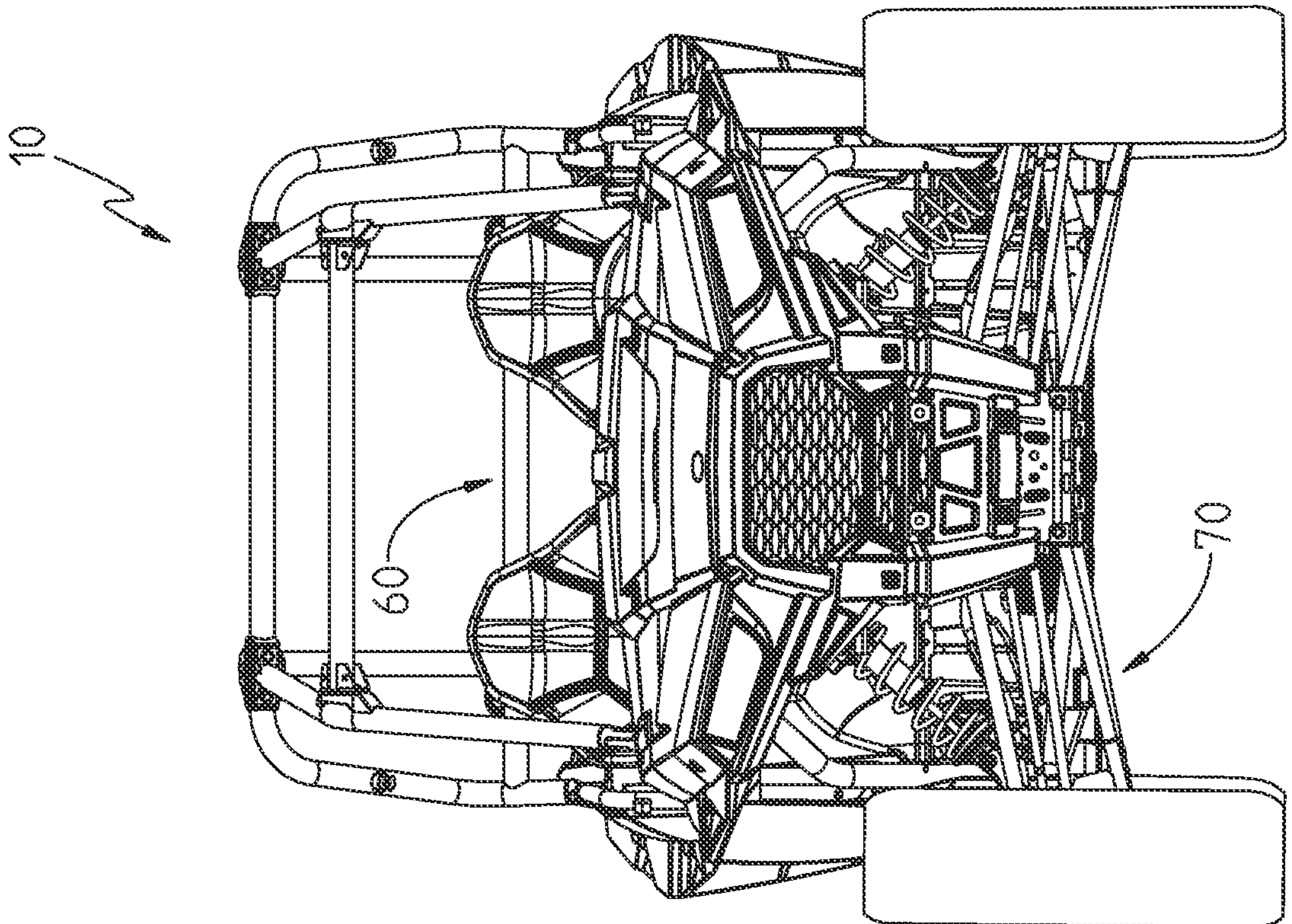
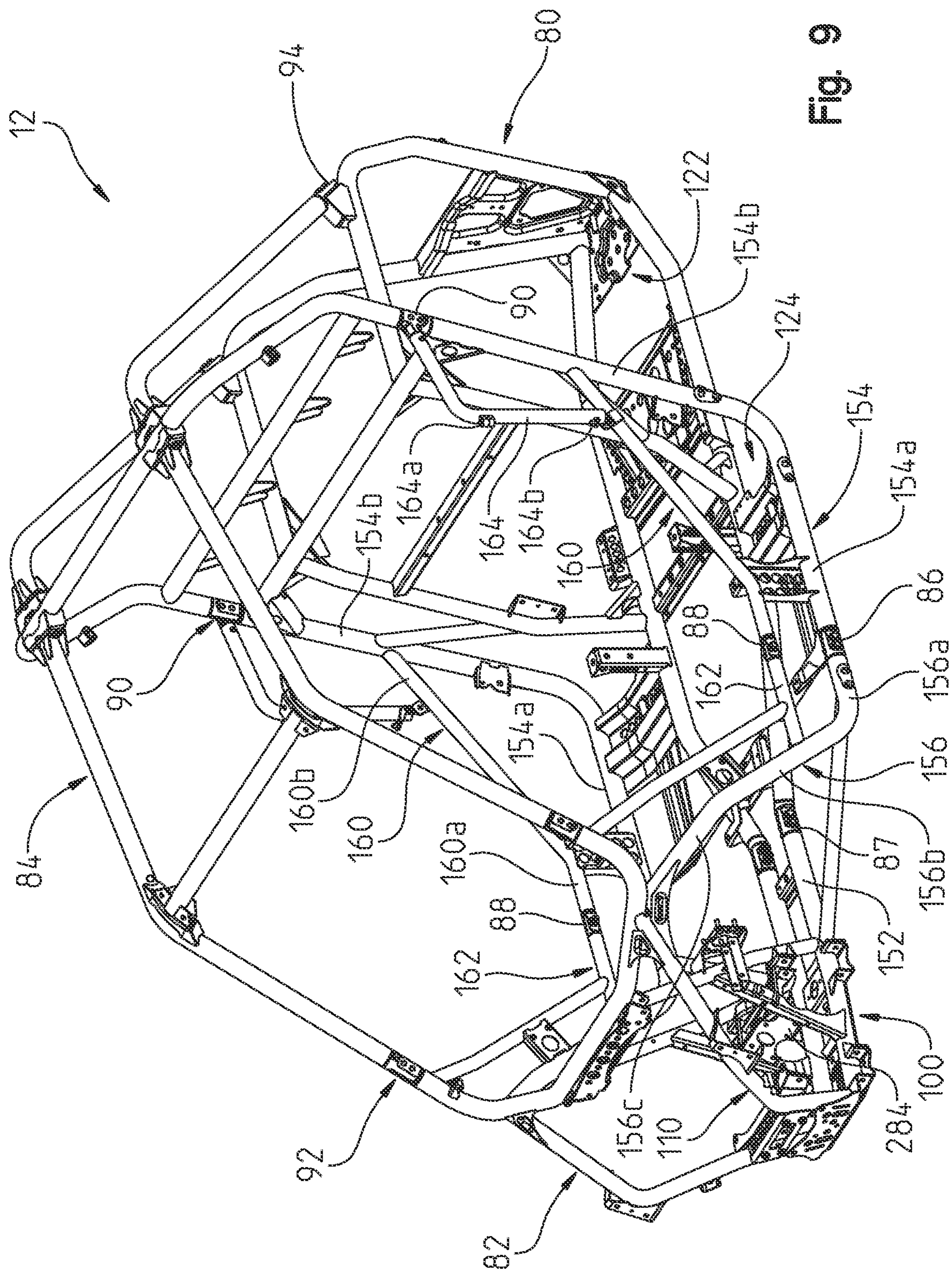
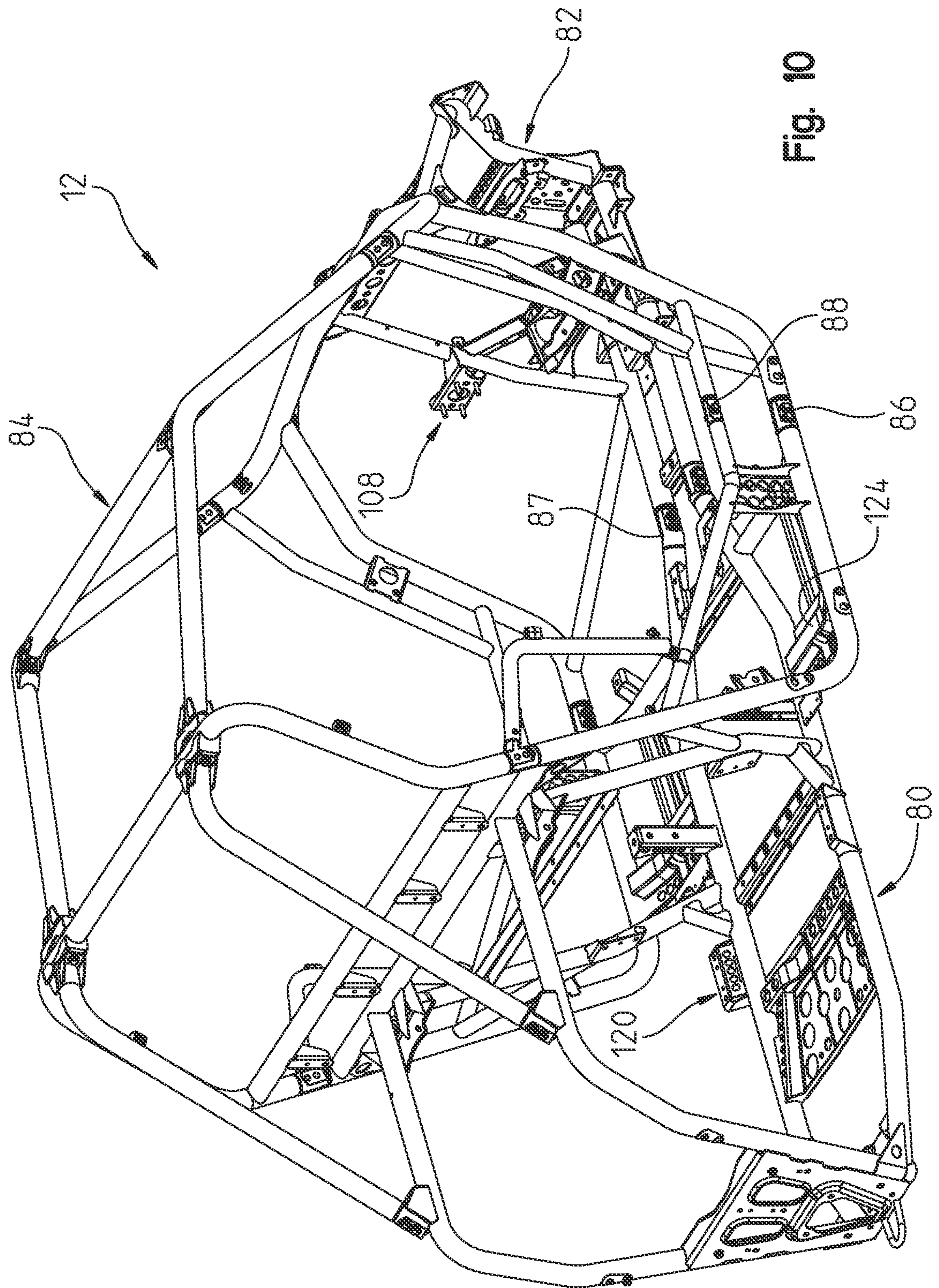
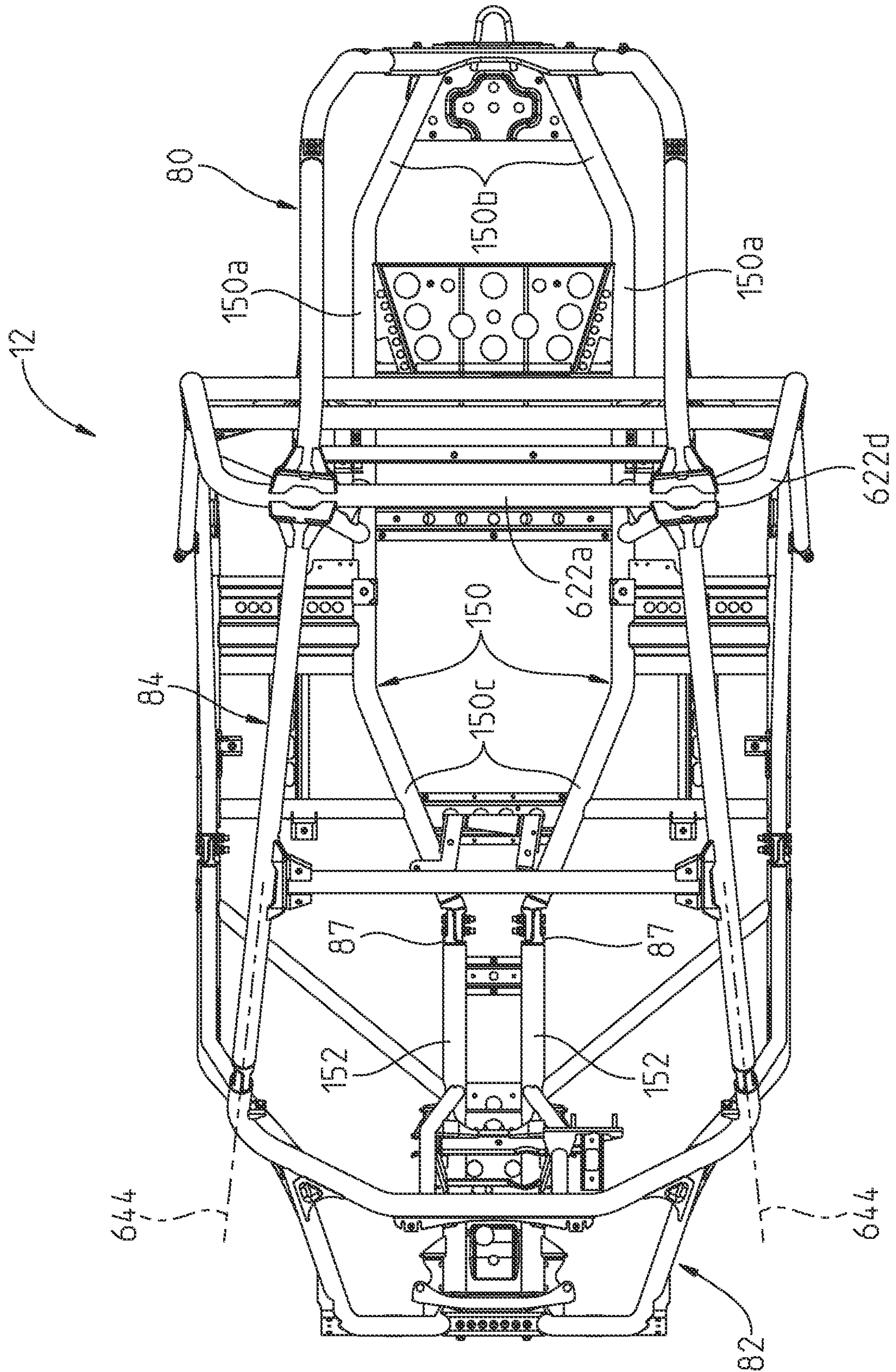


Fig. 7



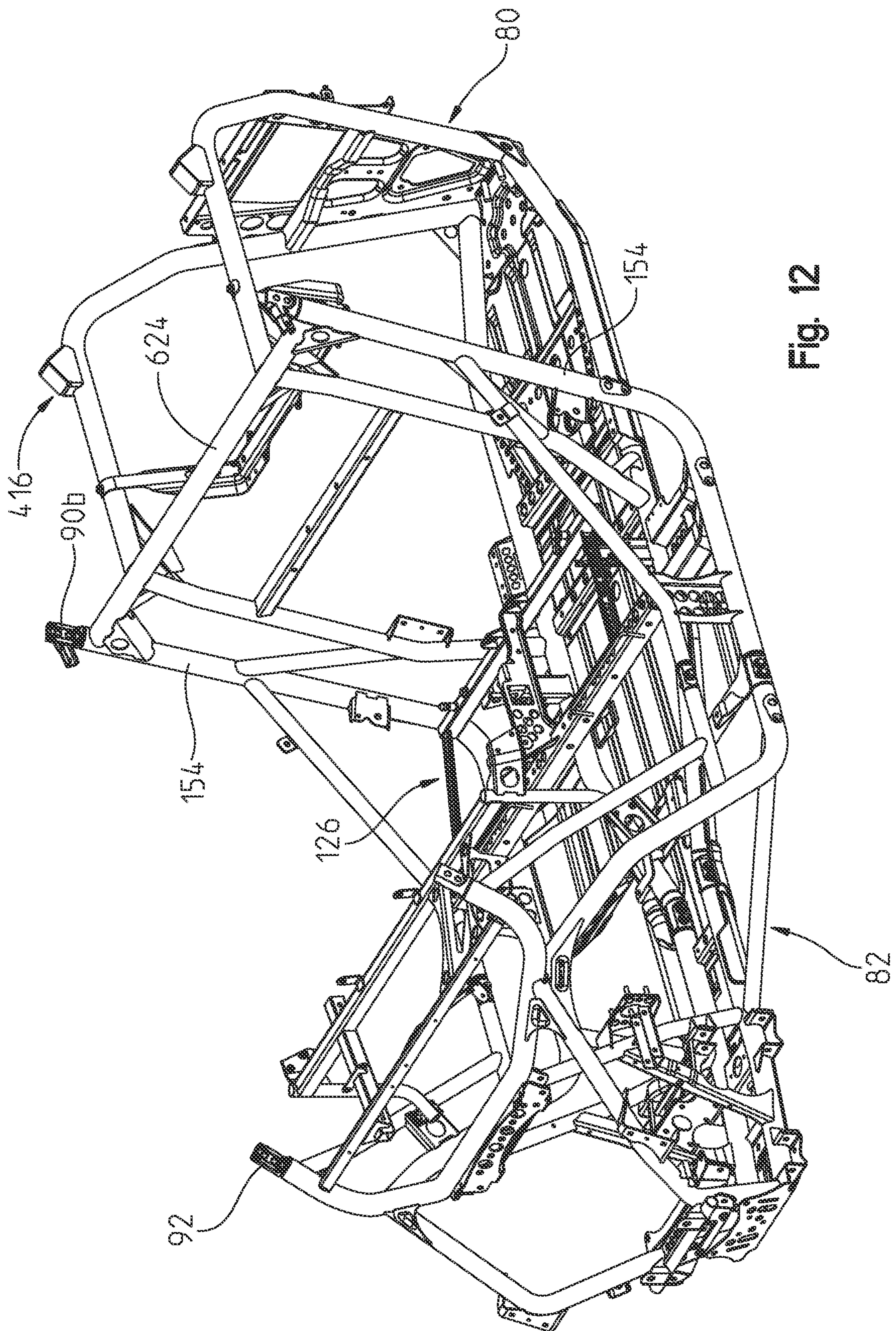
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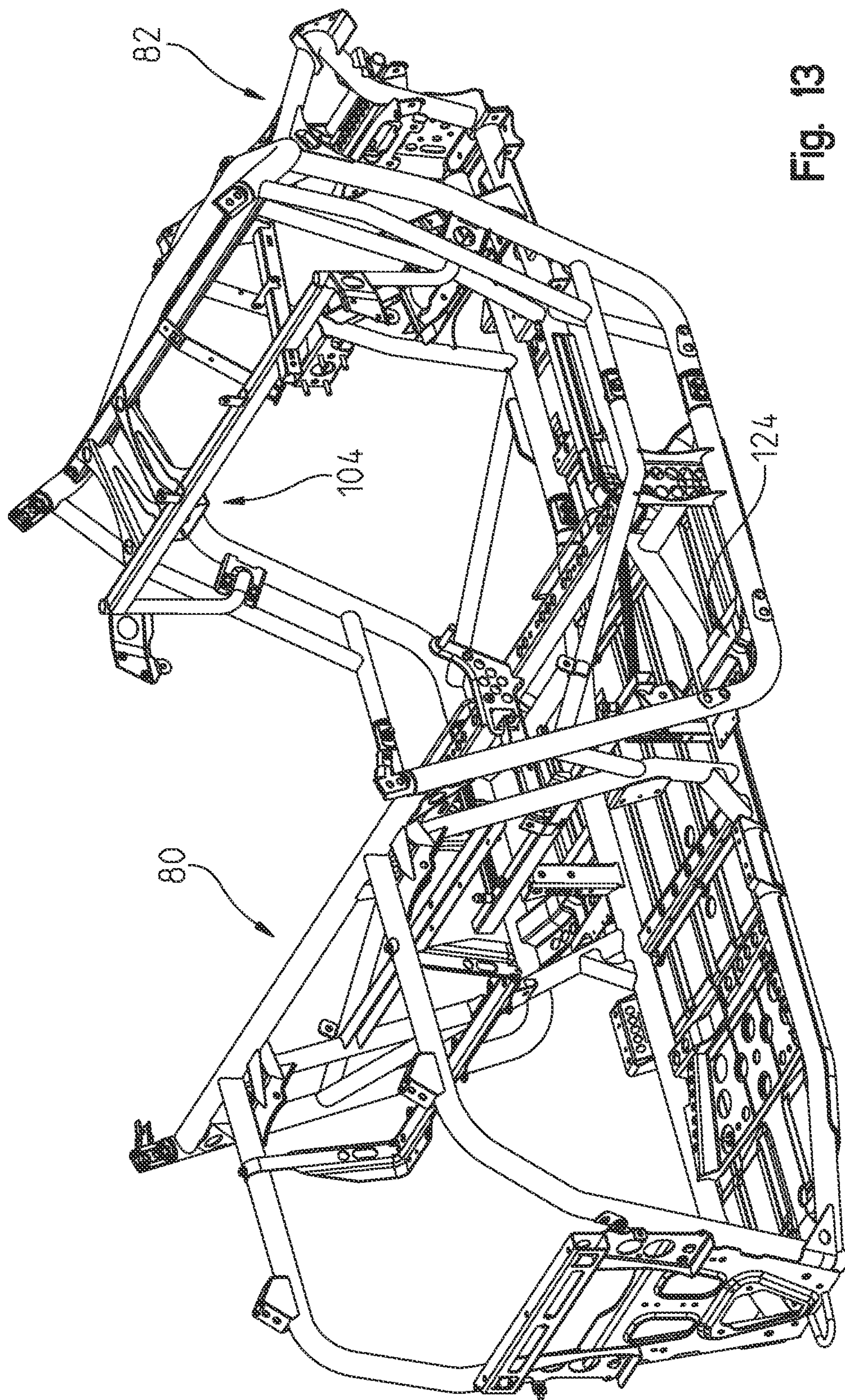


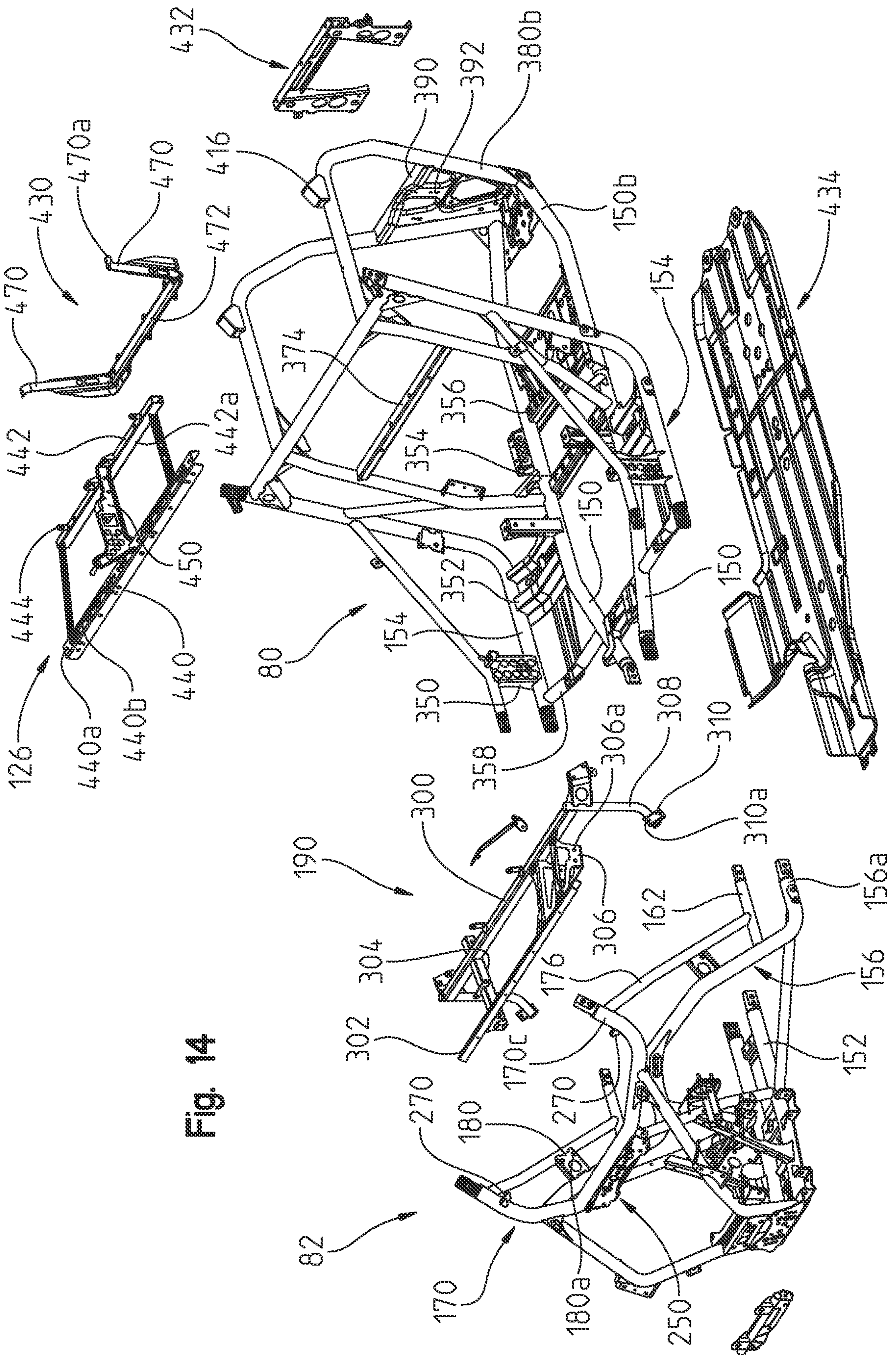
A 10x10 grid of dots forming the letters 'L' and 'O'. The 'L' is on the left, and the 'O' is on the right. The 'O' has a small 'x' above it.

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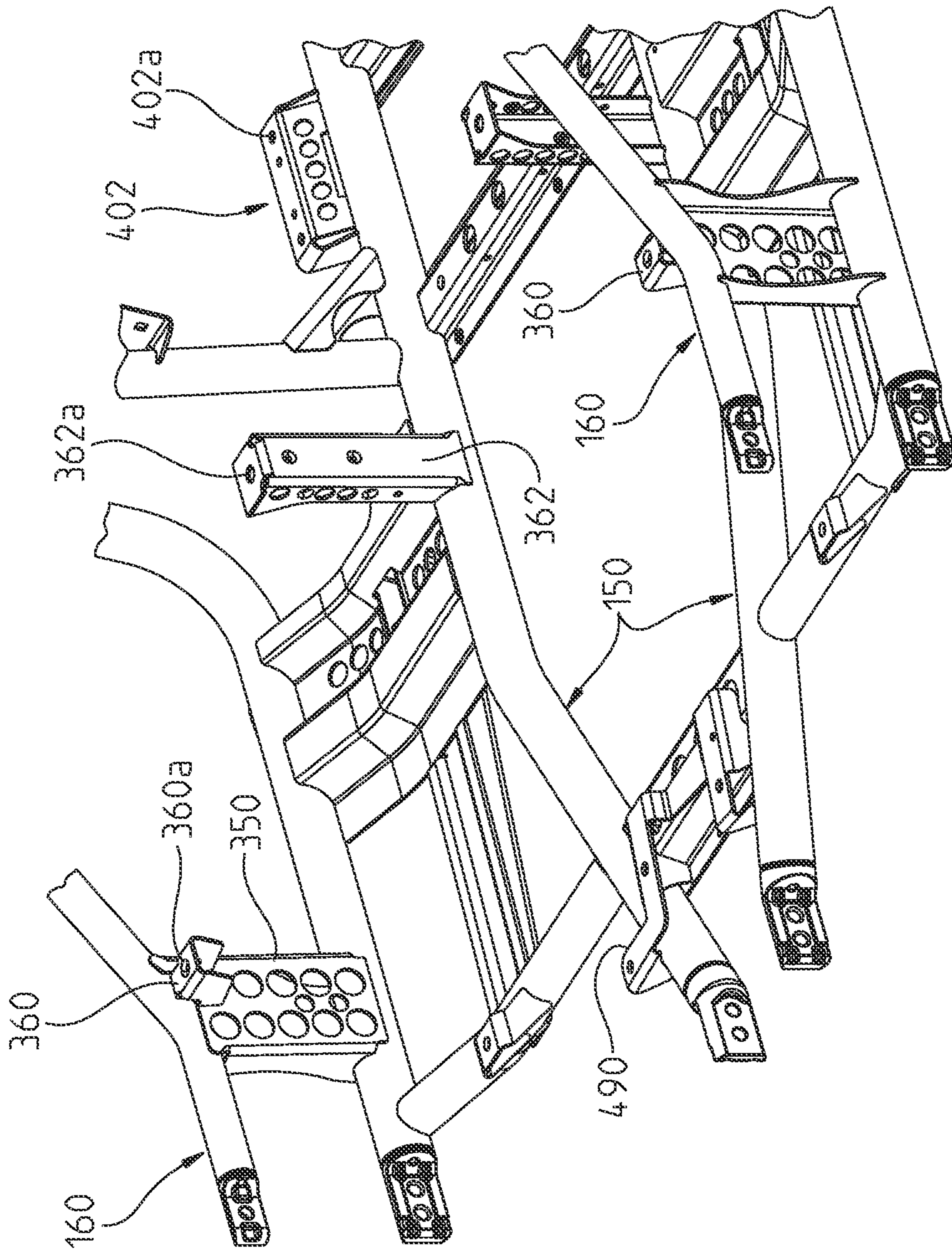


Fig. 14A

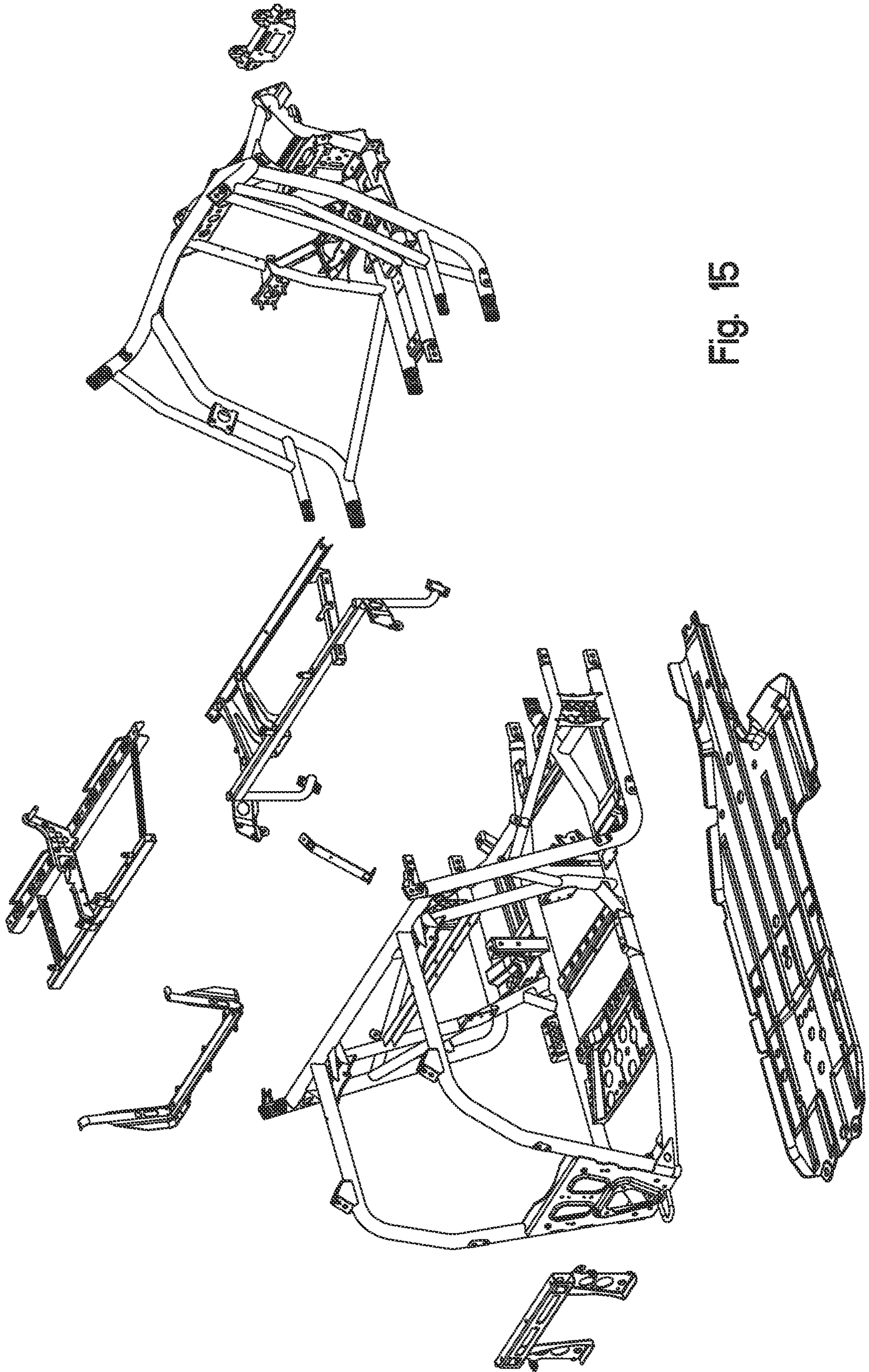
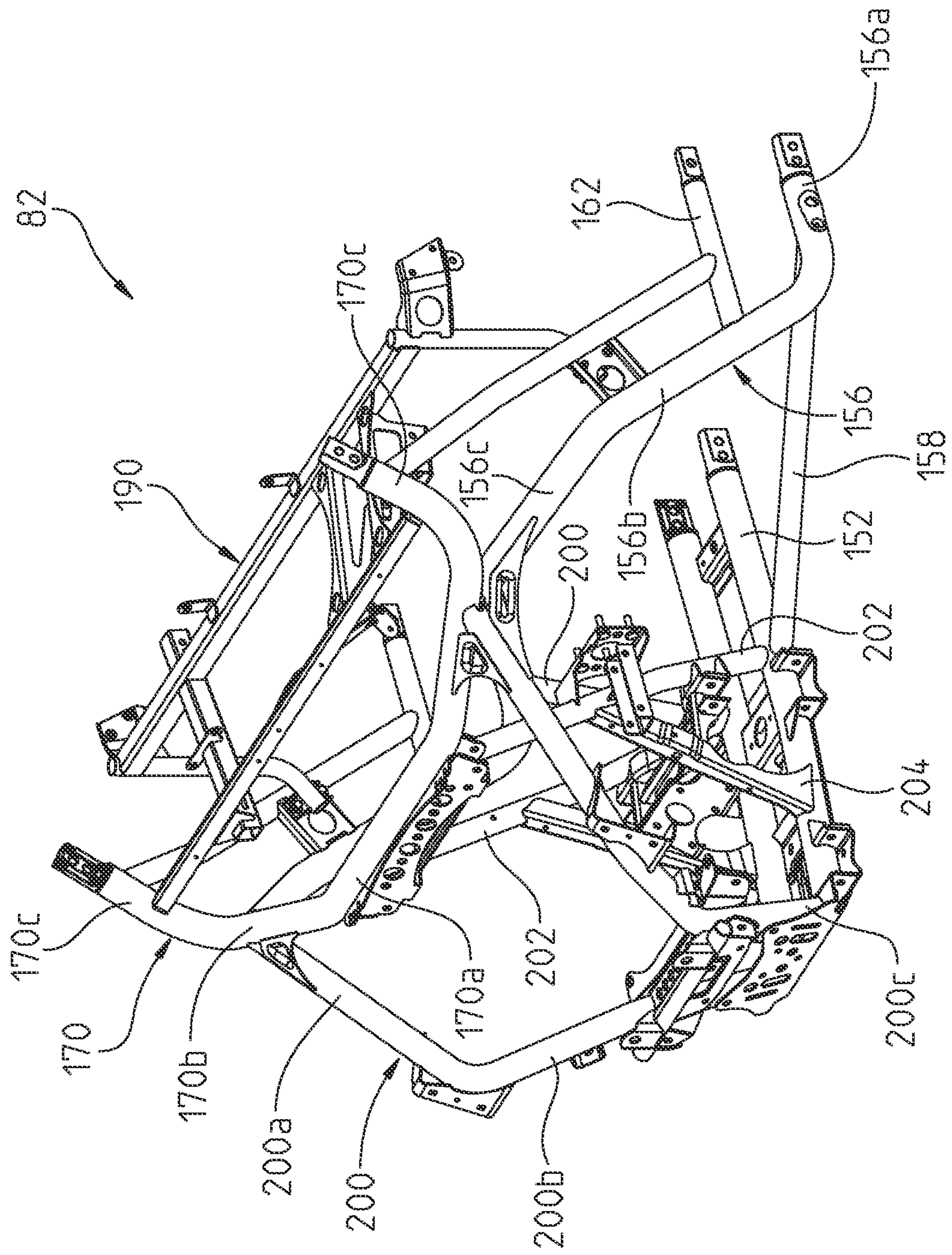


Fig. 15

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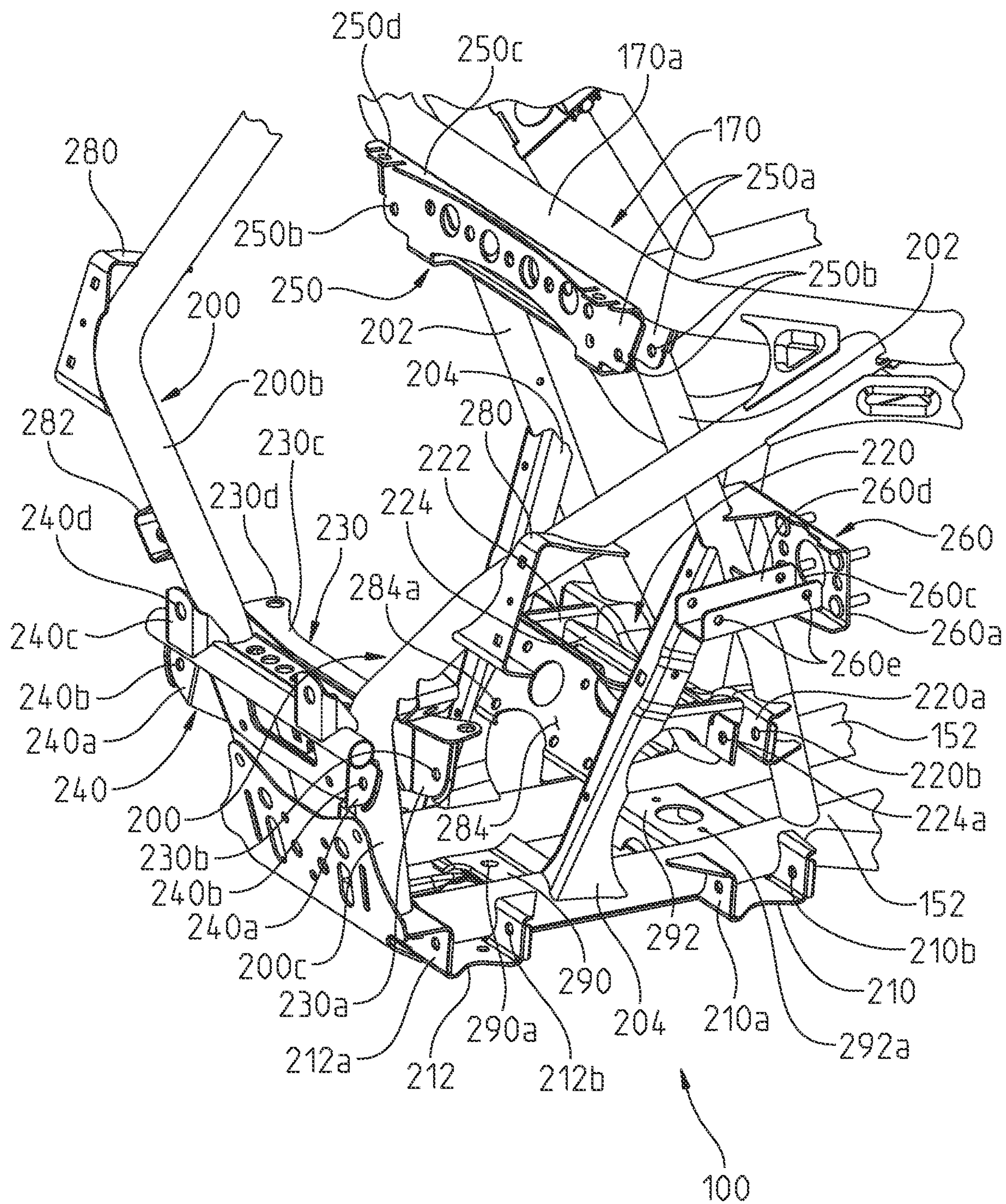


Fig. 16A

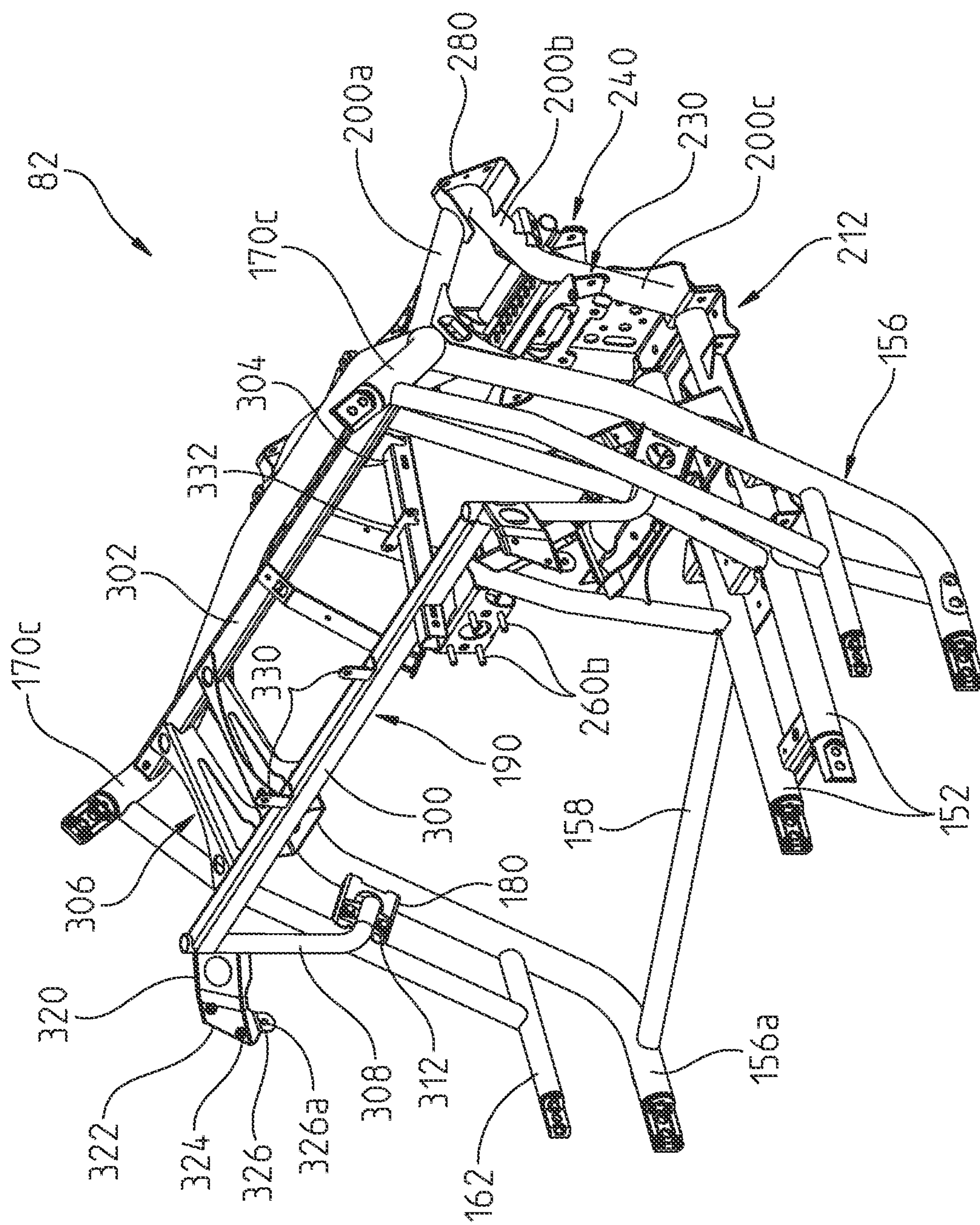


Fig. 17

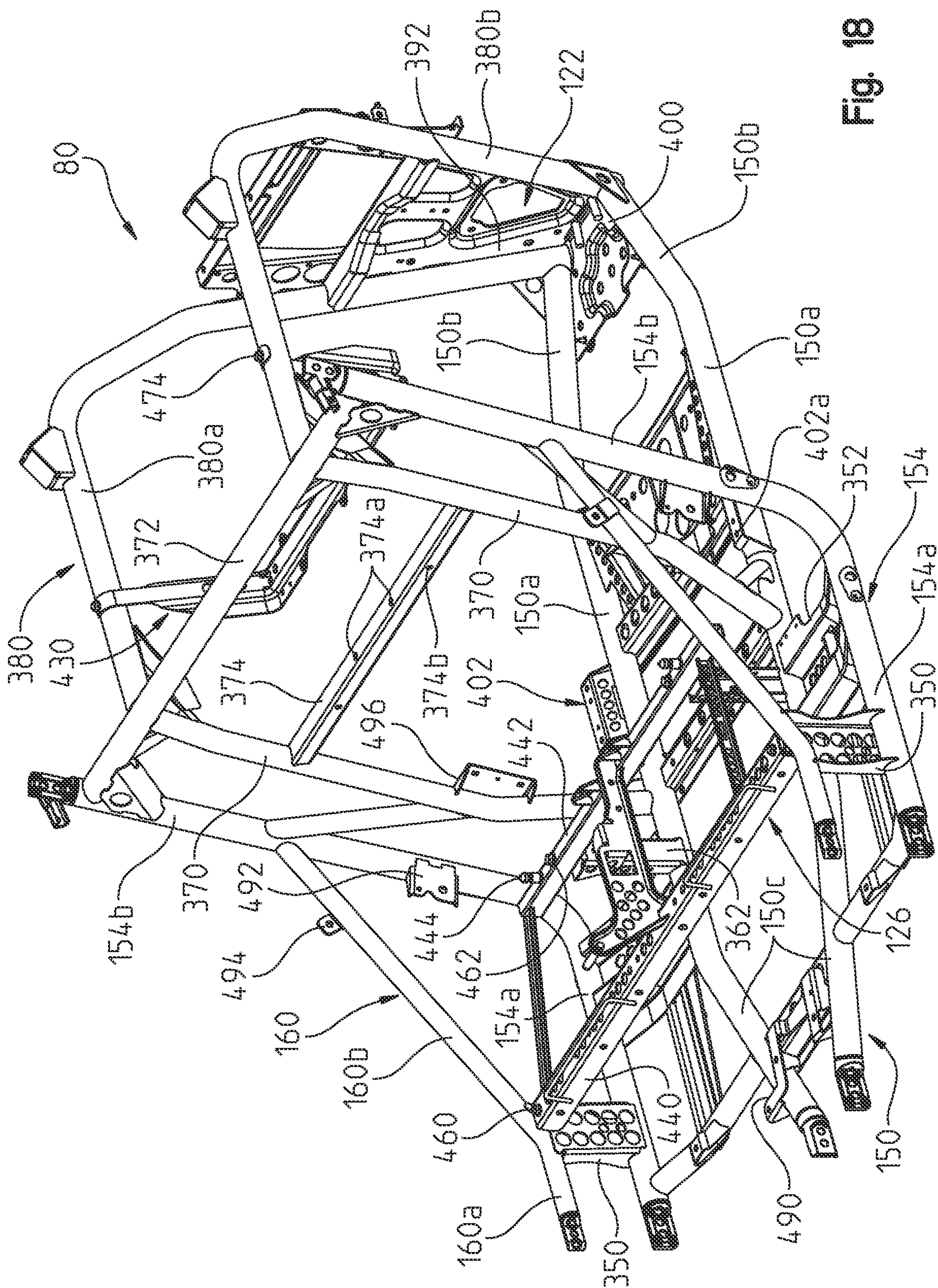
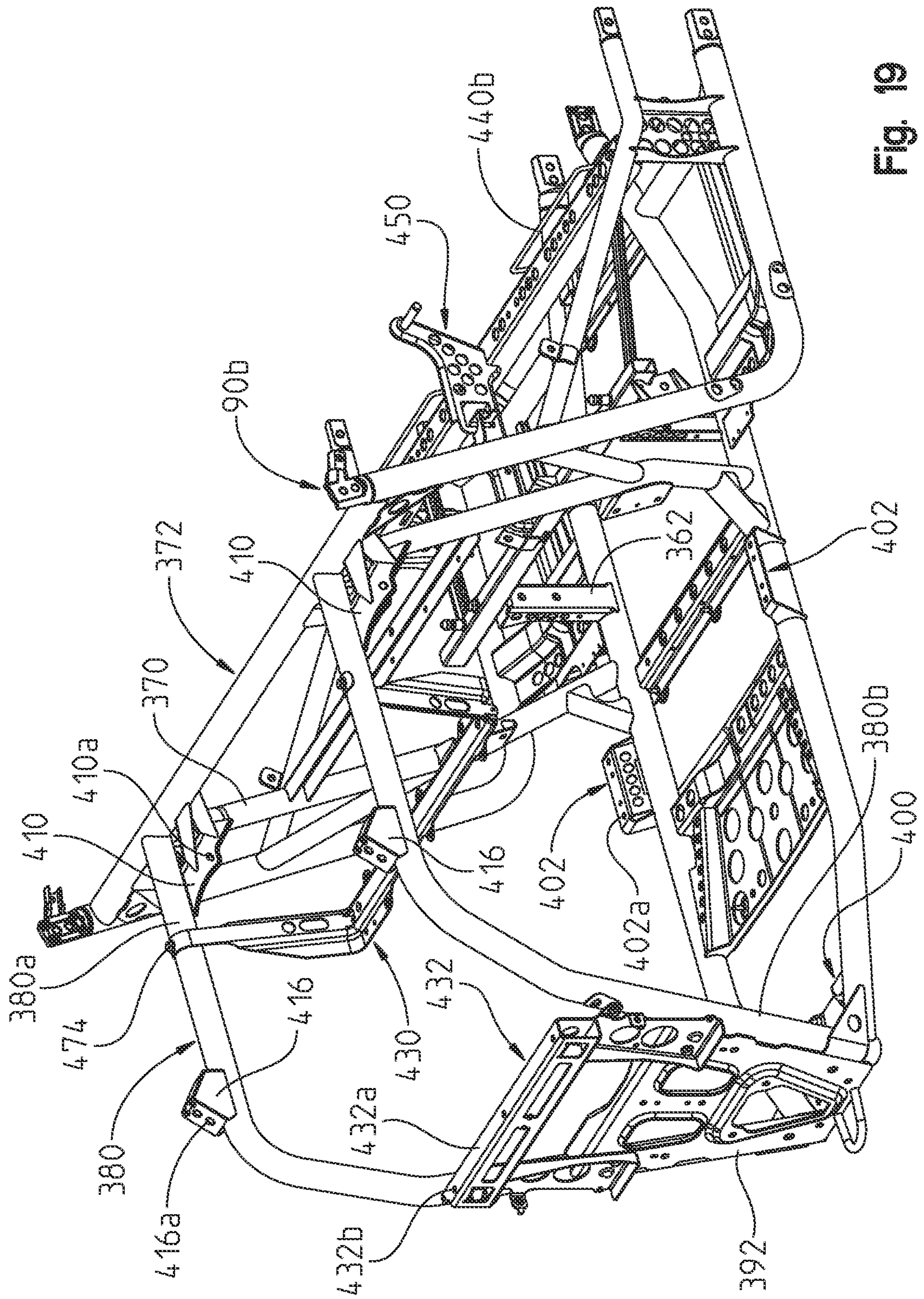


Fig. 18

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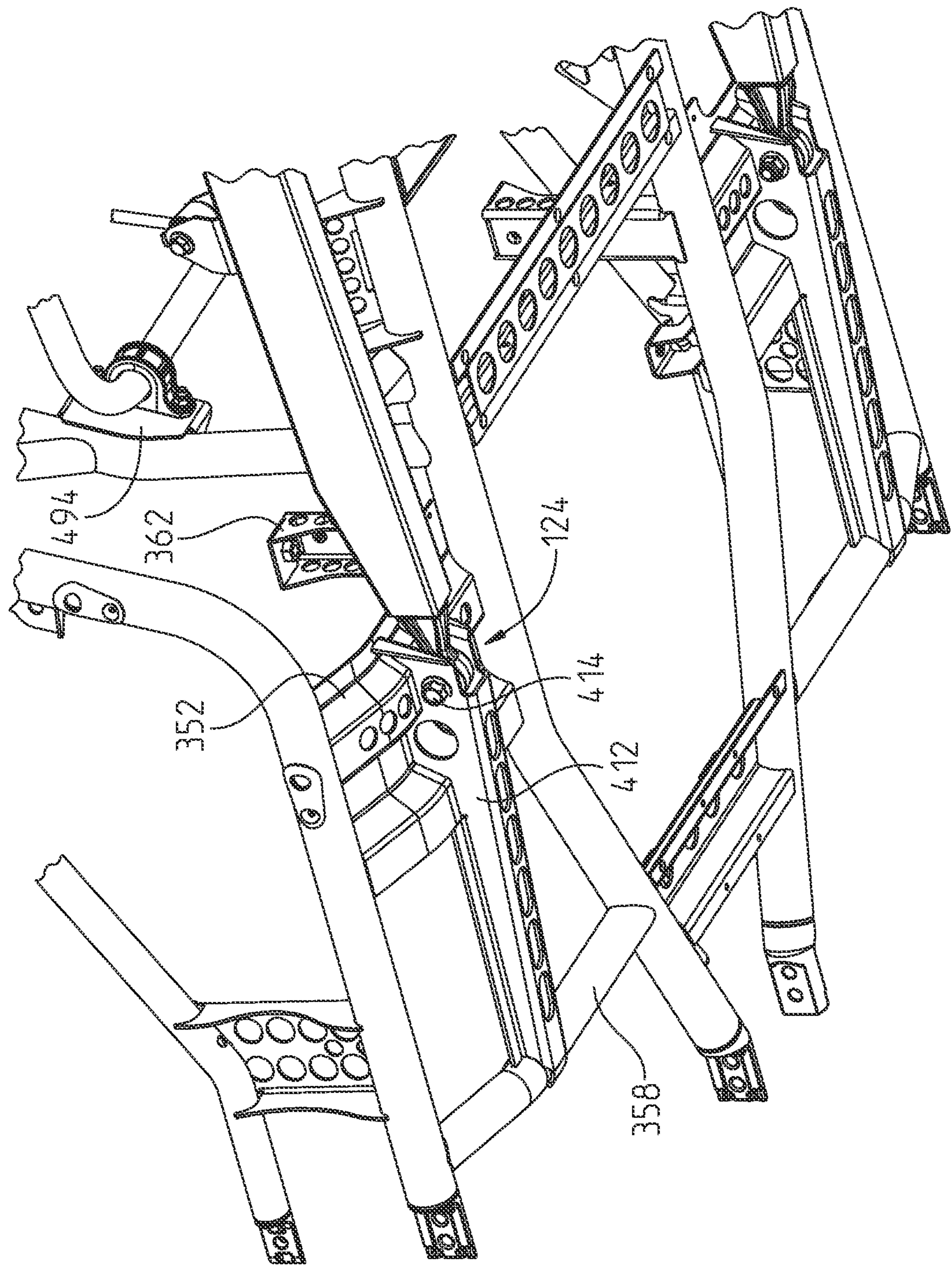
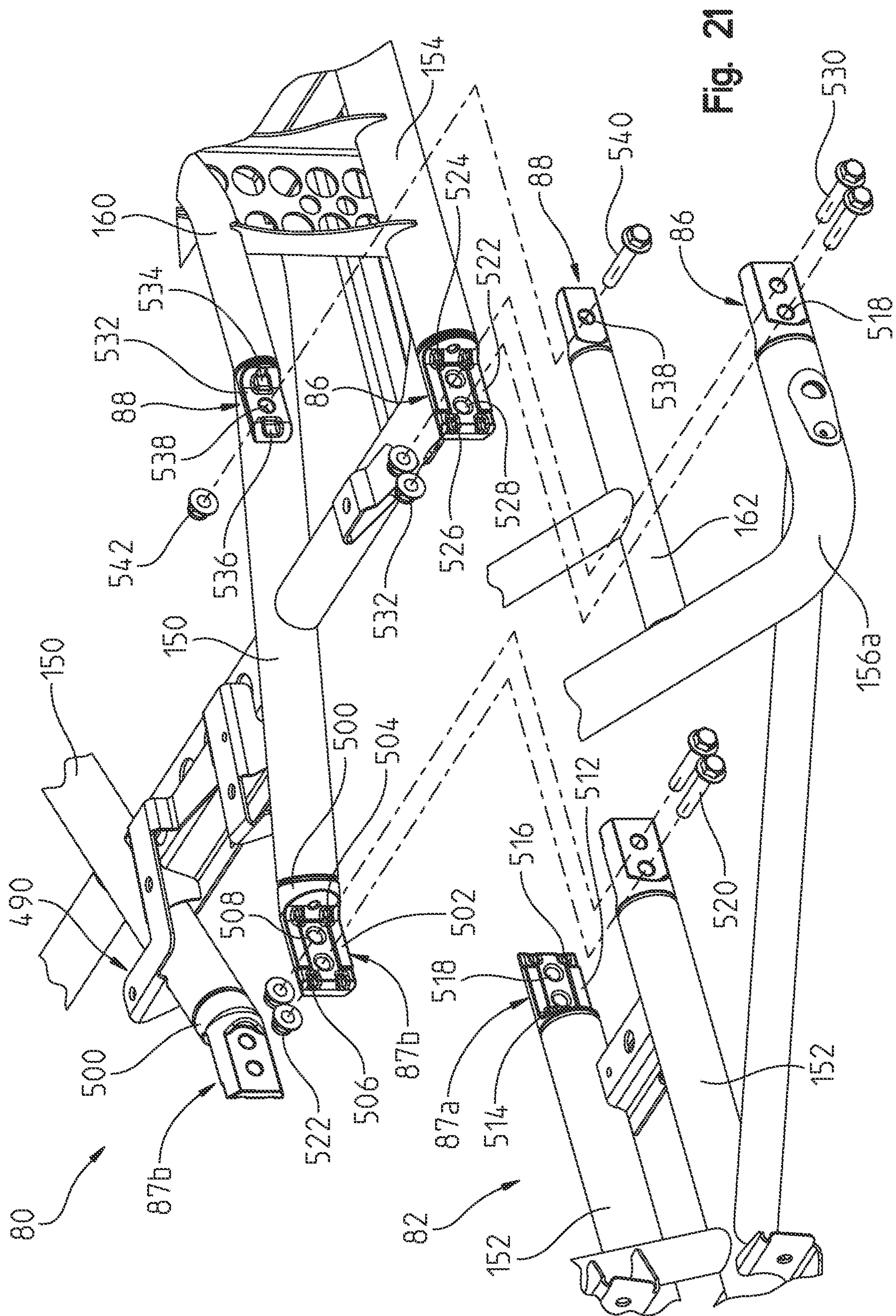
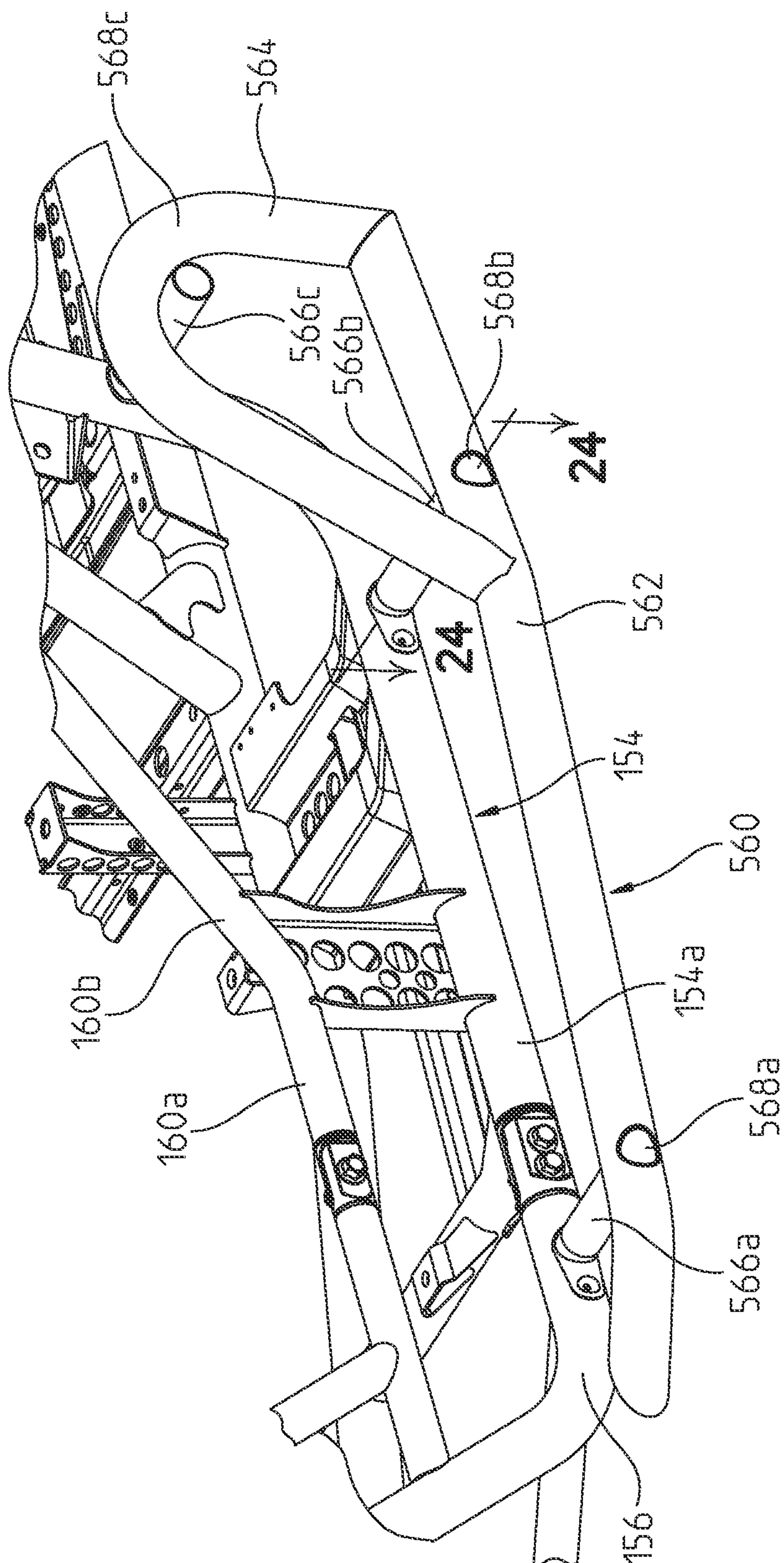


Fig. 20





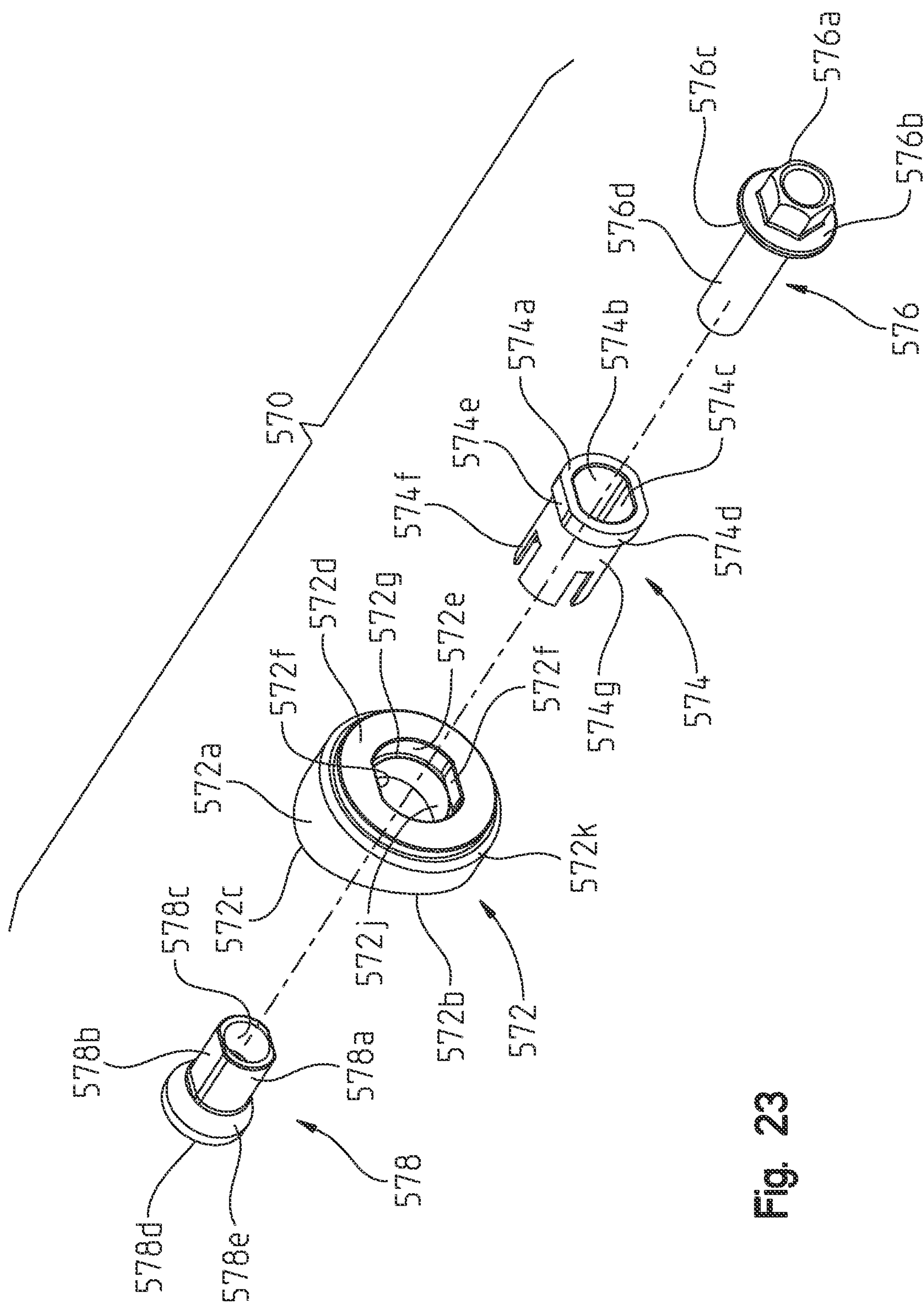


Fig. 23

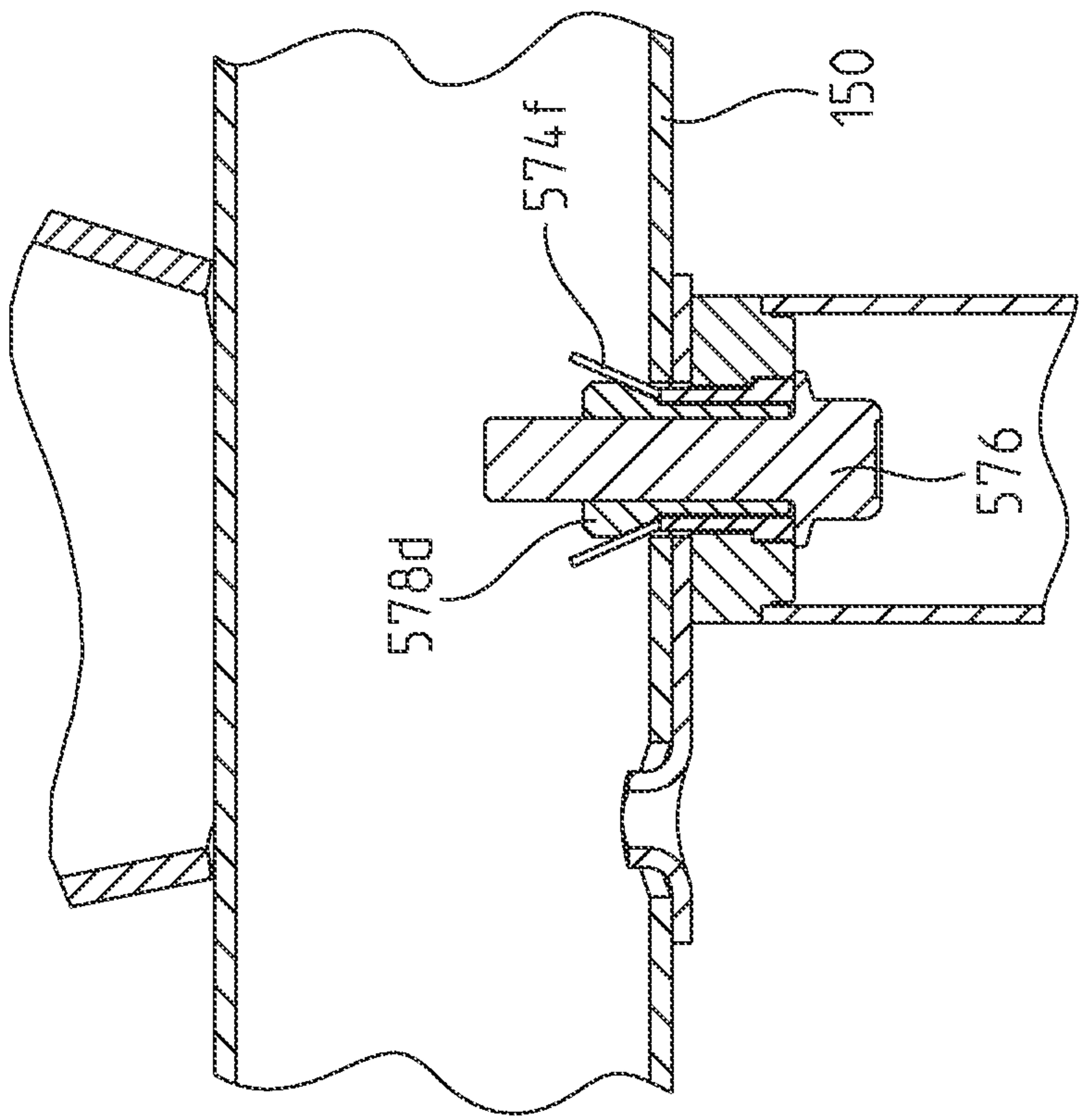


Fig. 25

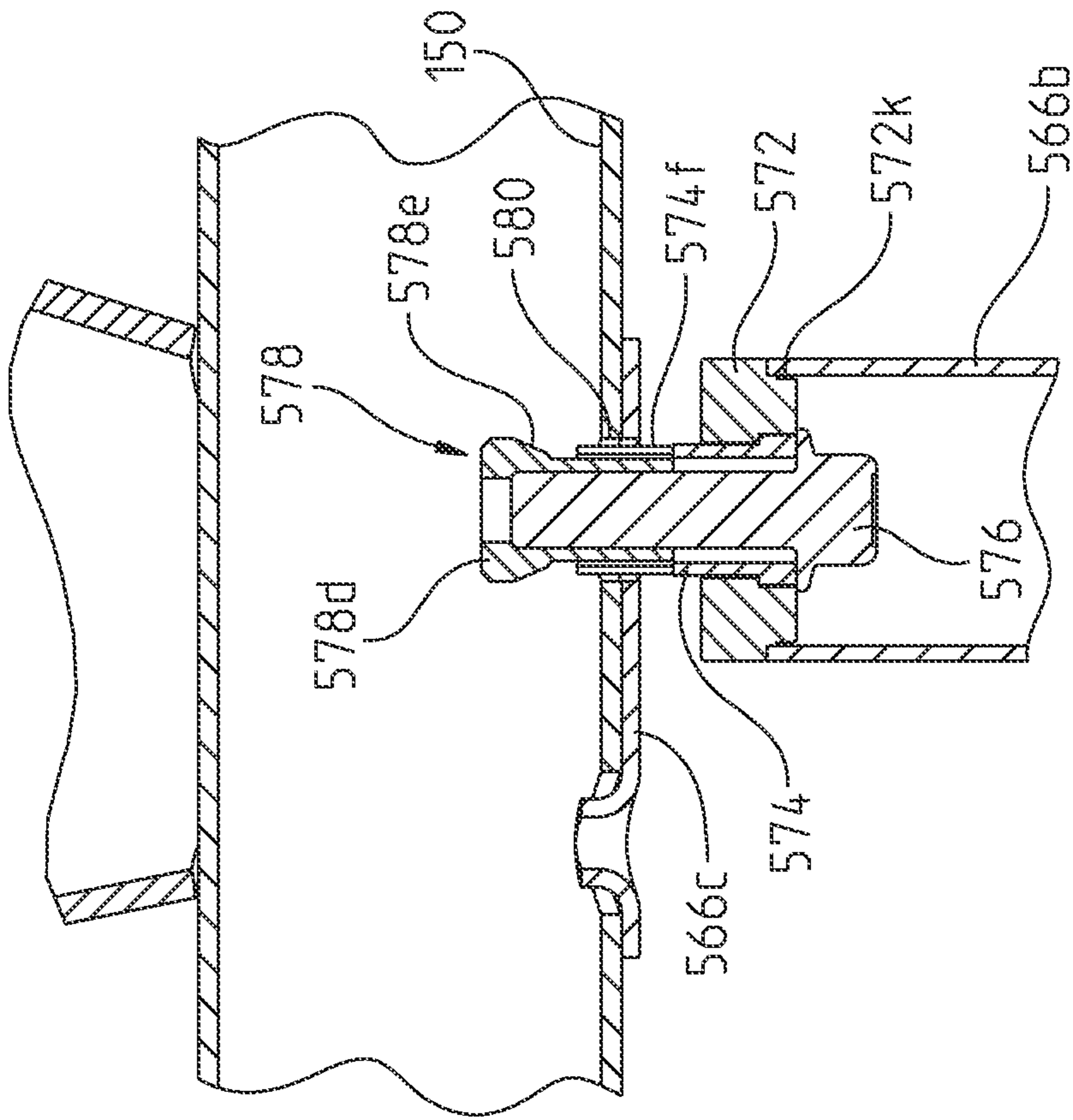


Fig. 24

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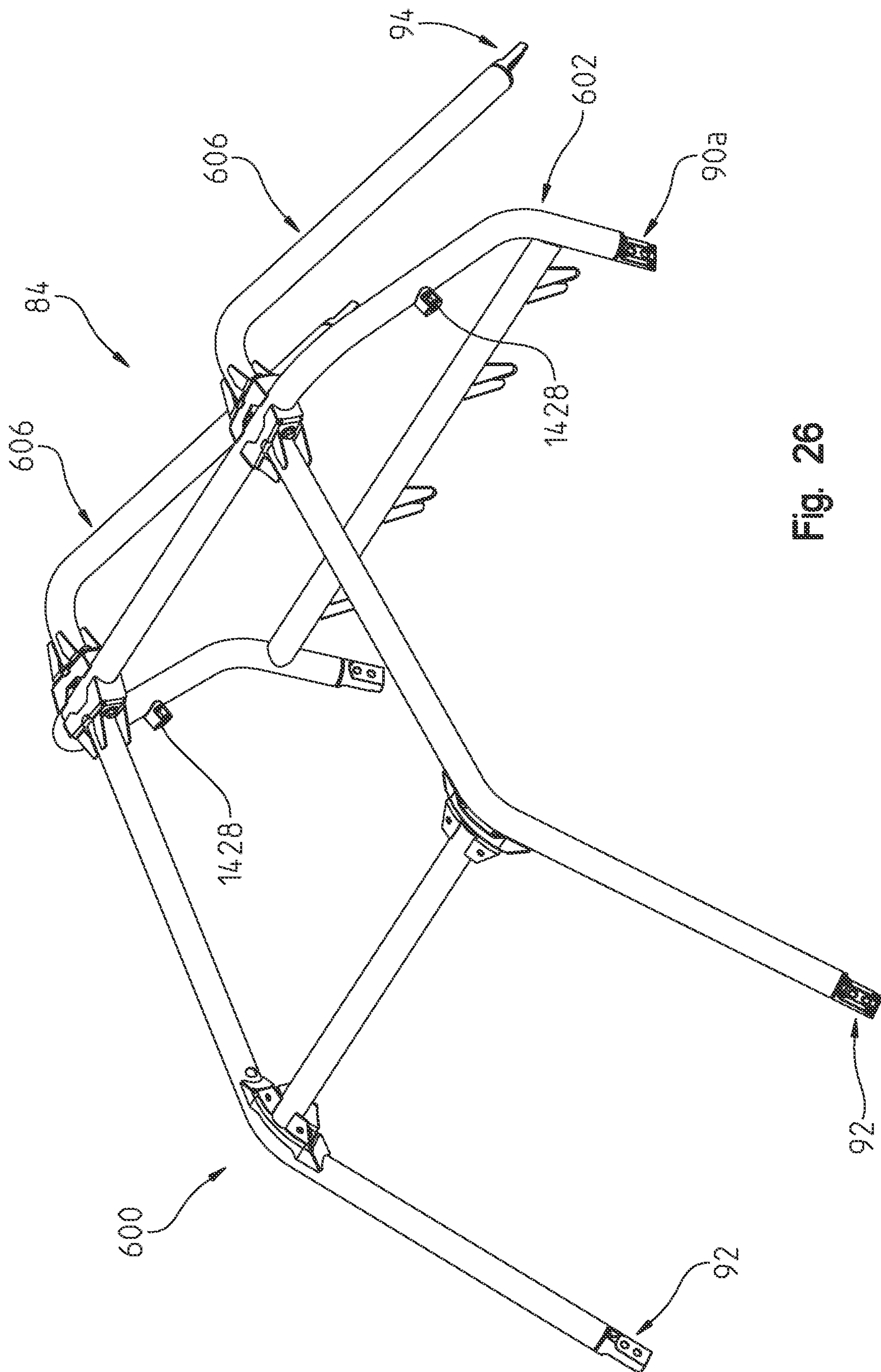


Fig. 26

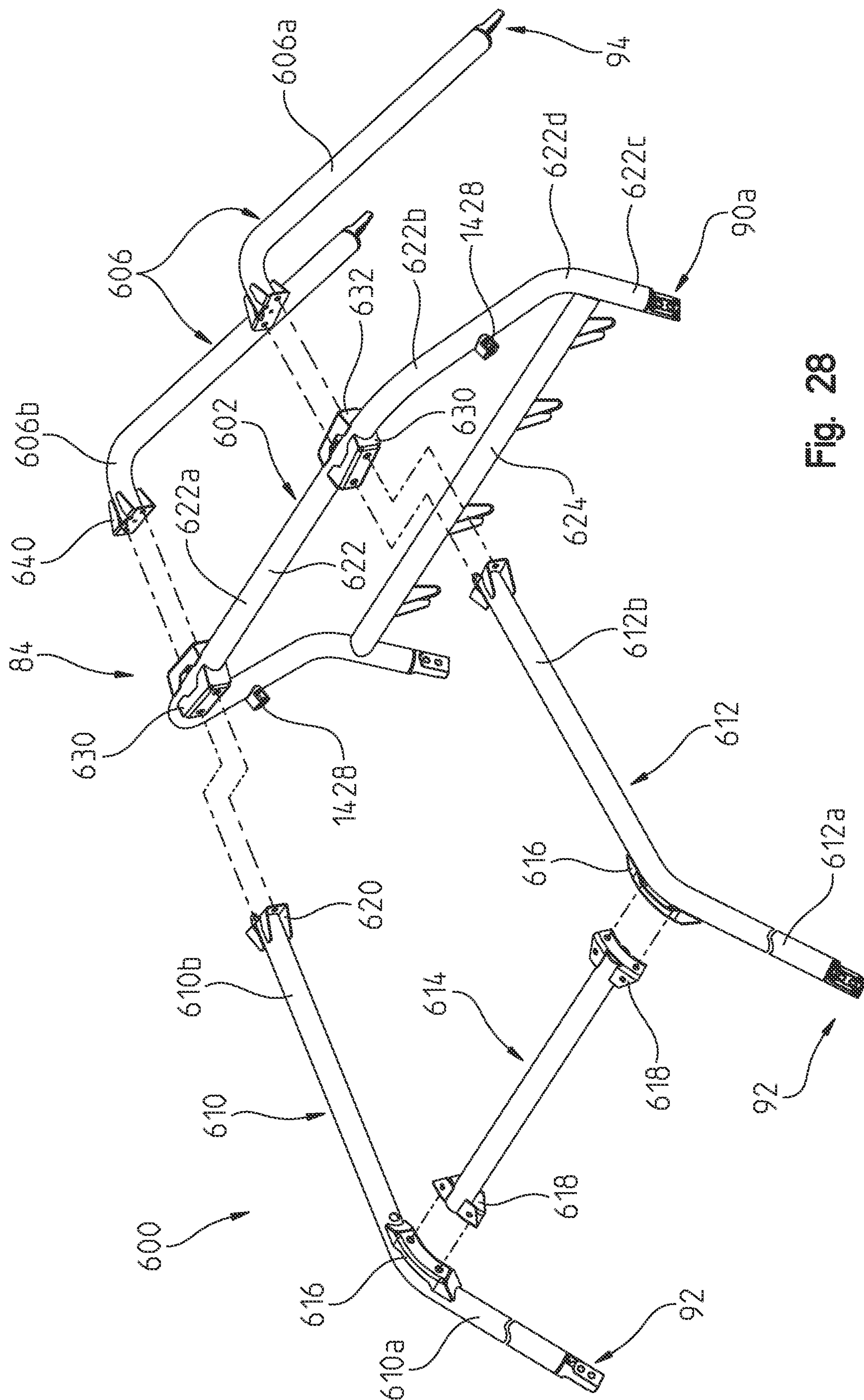
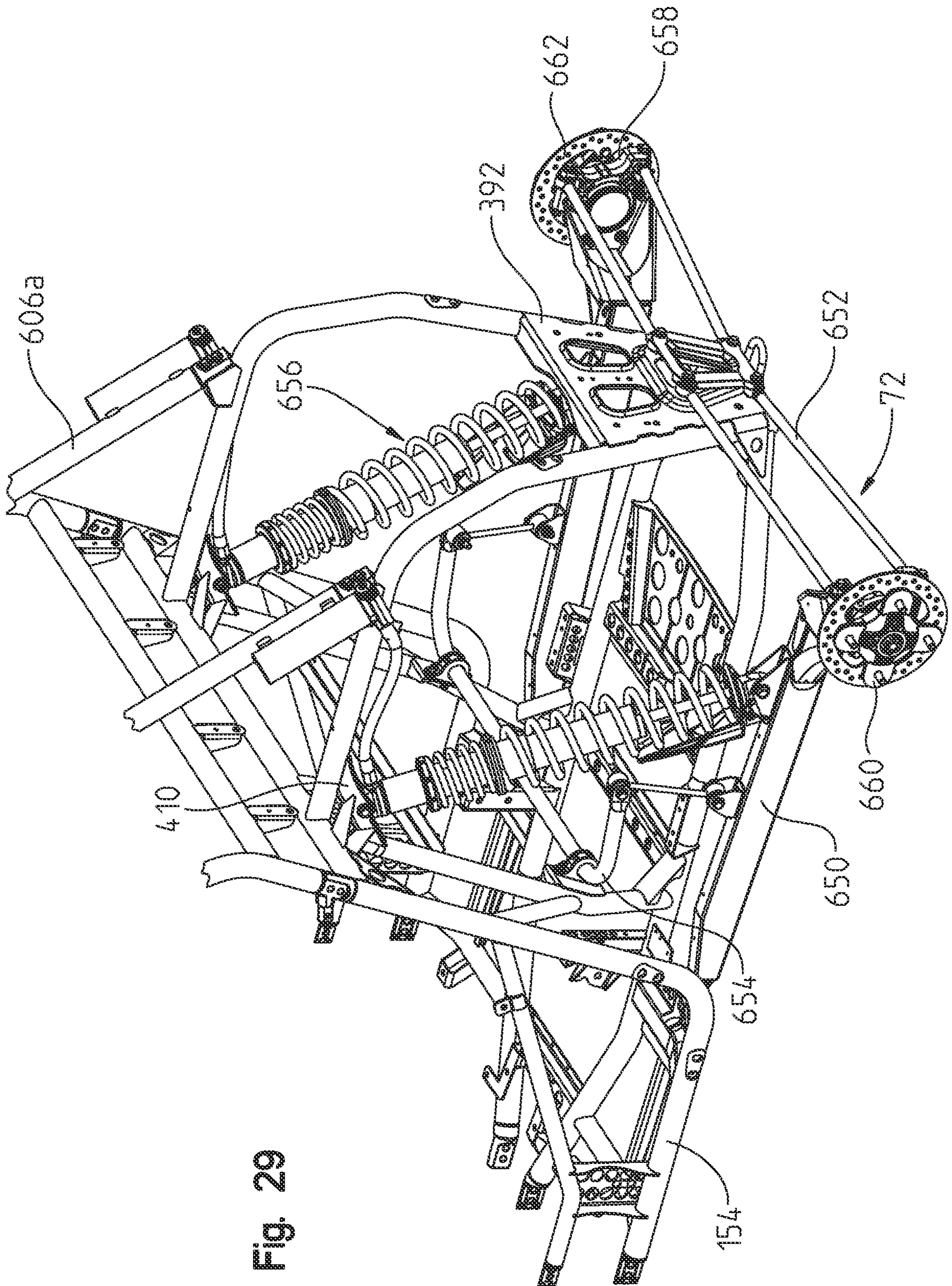
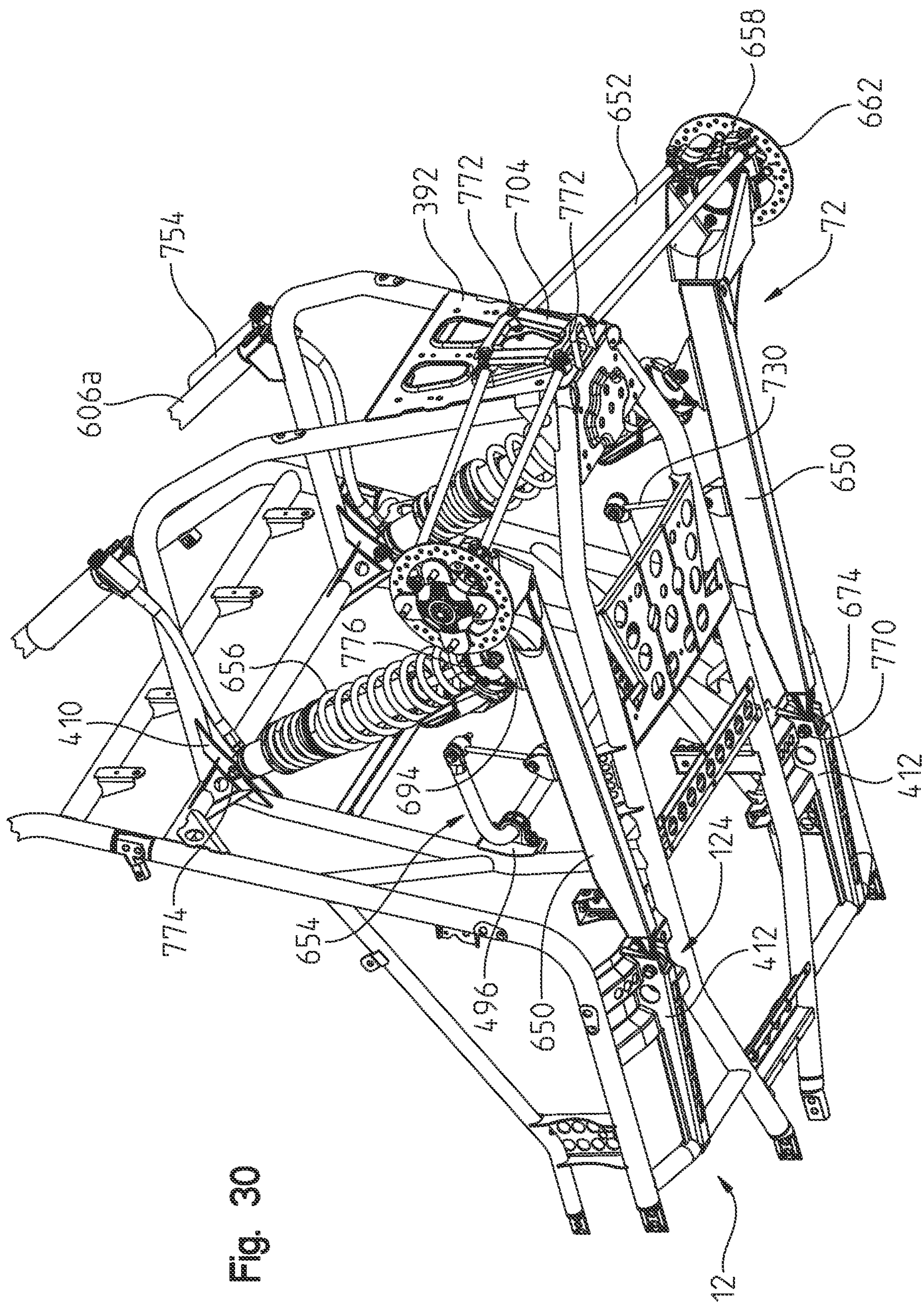
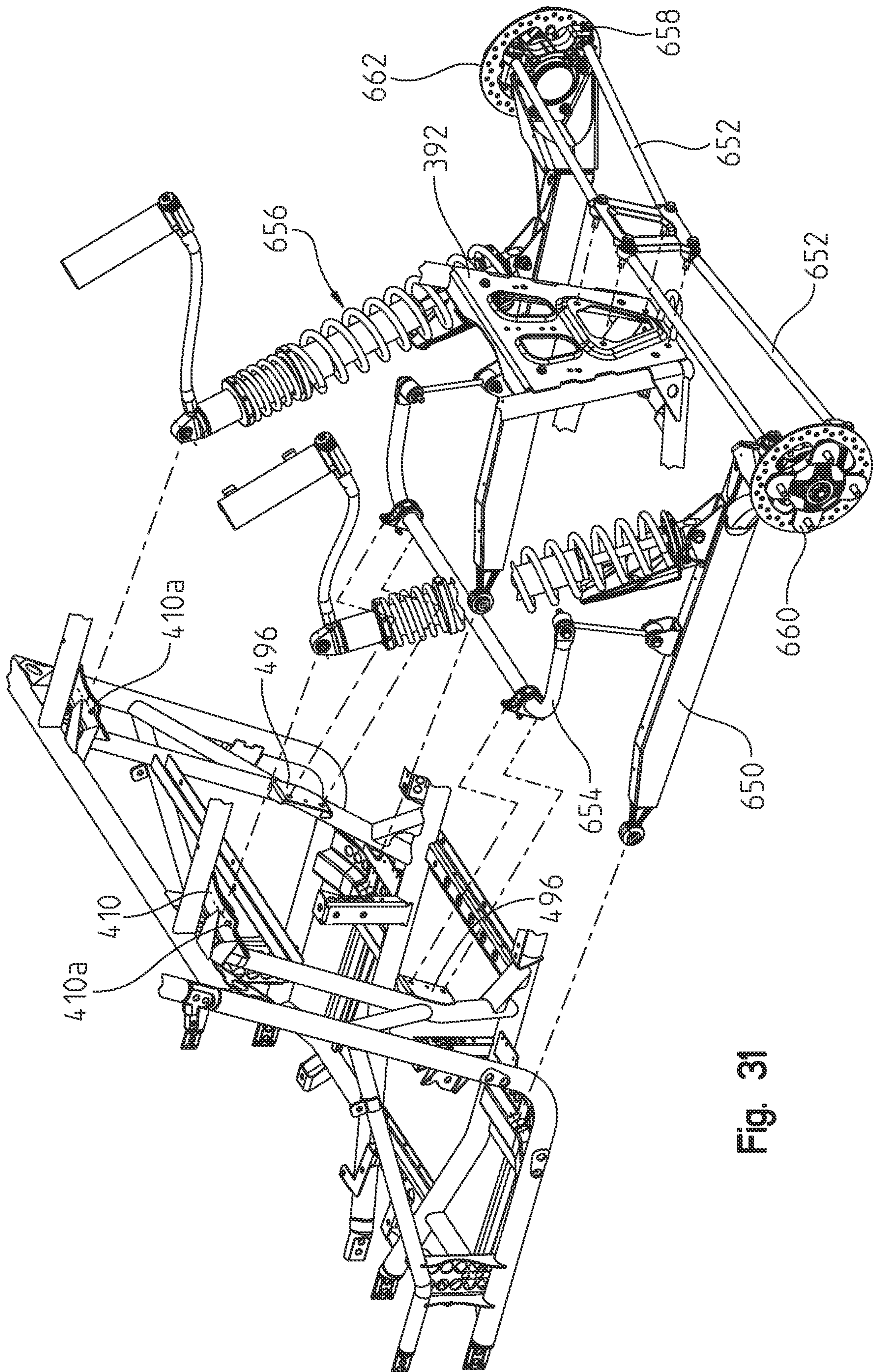


Fig. 28





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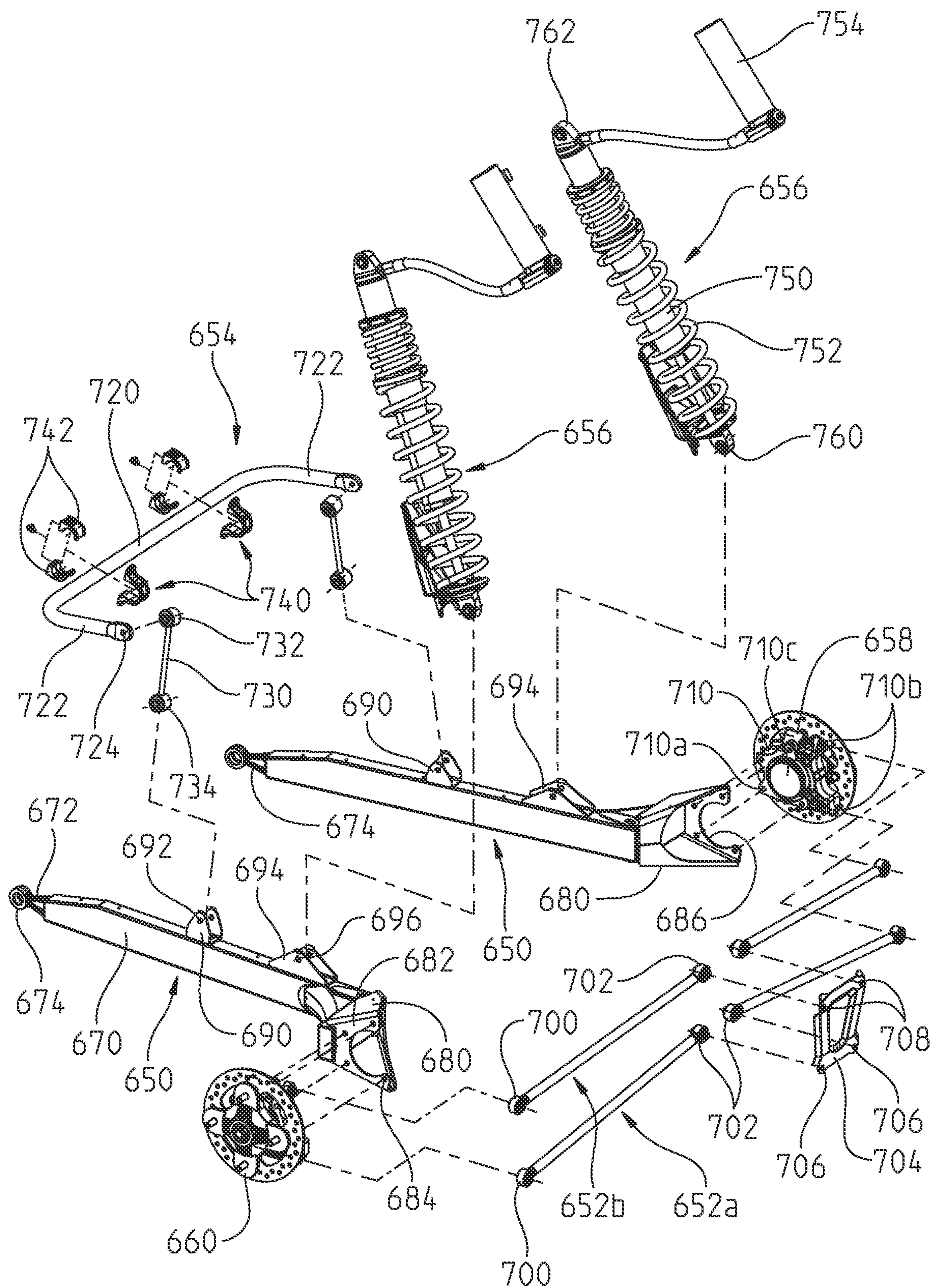


Fig. 32

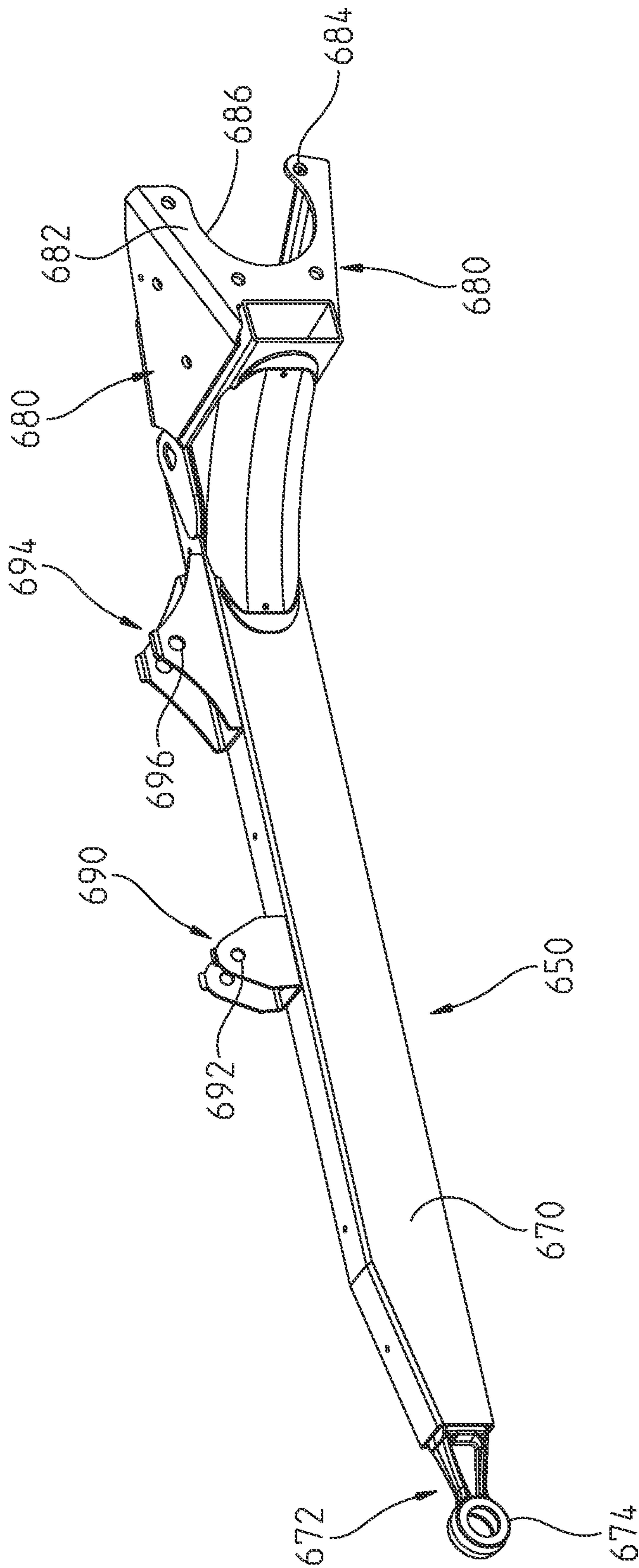


Fig. 32A

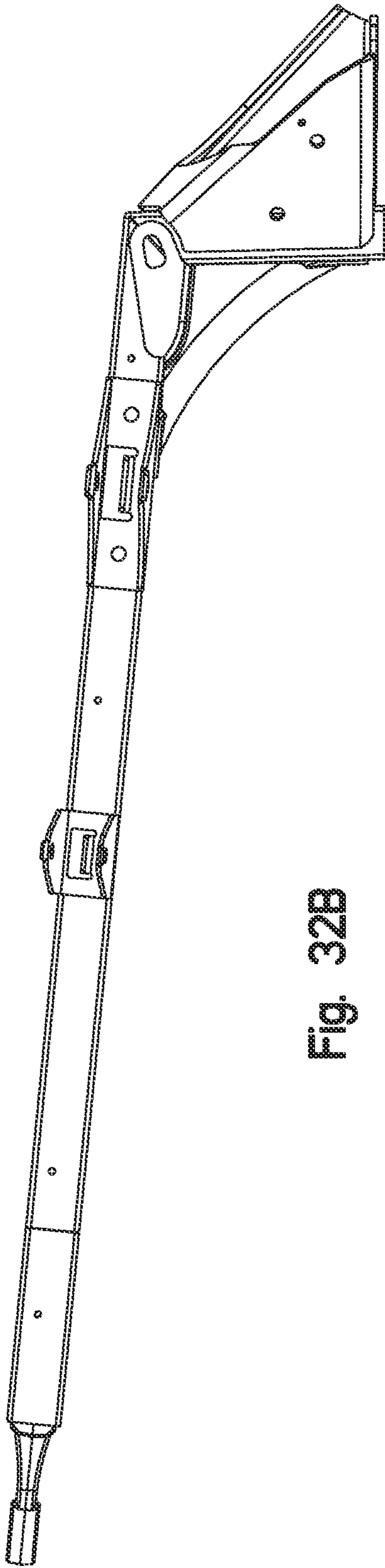


Fig. 32B

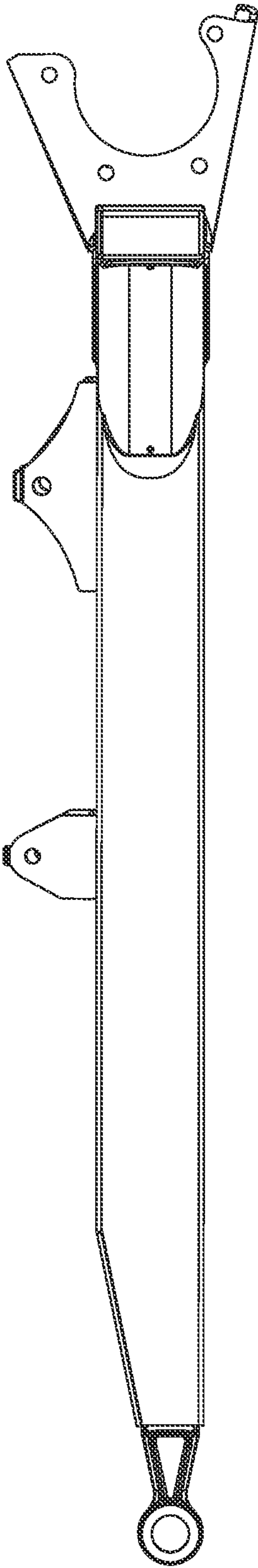


Fig. 32C

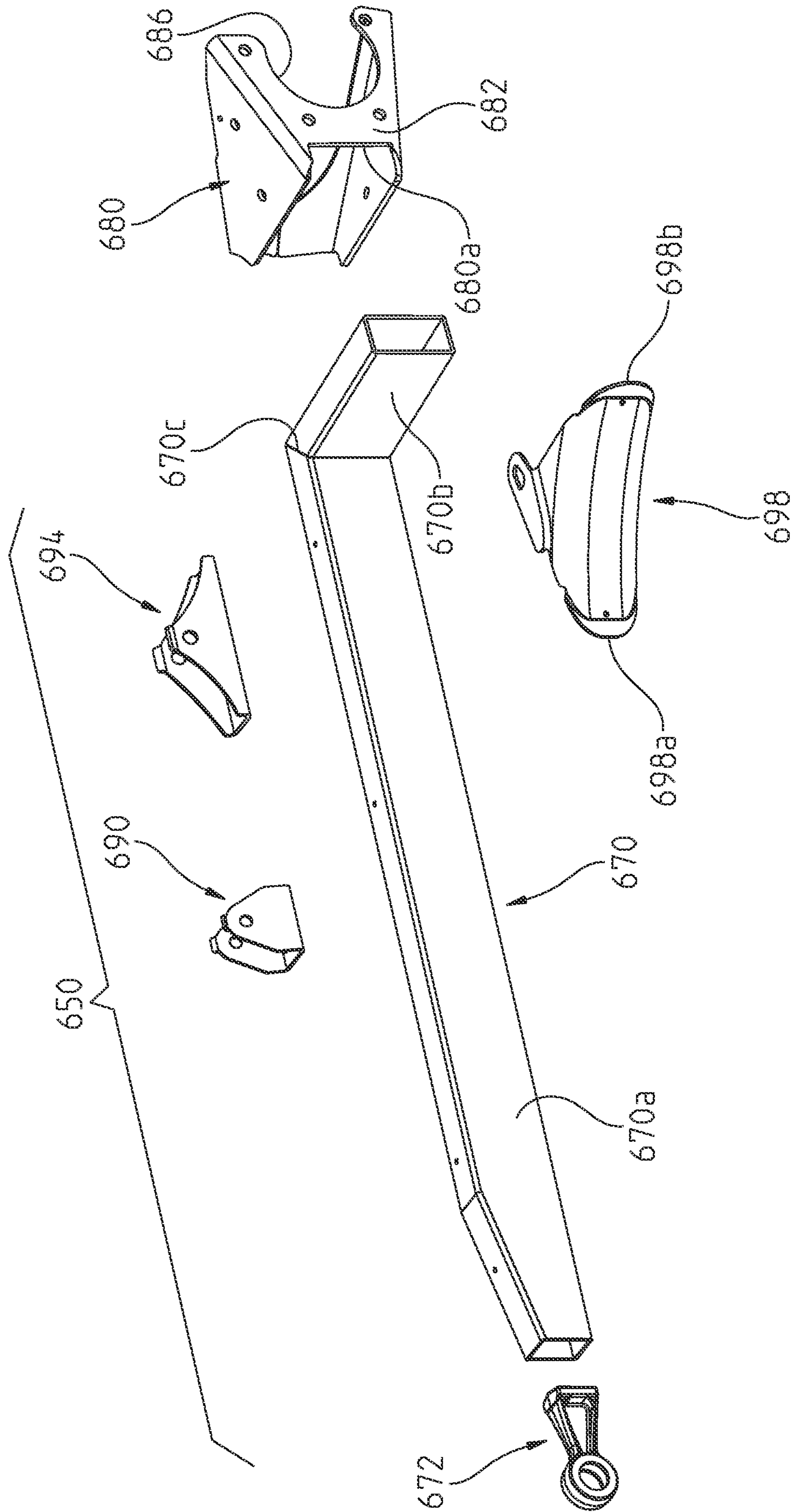
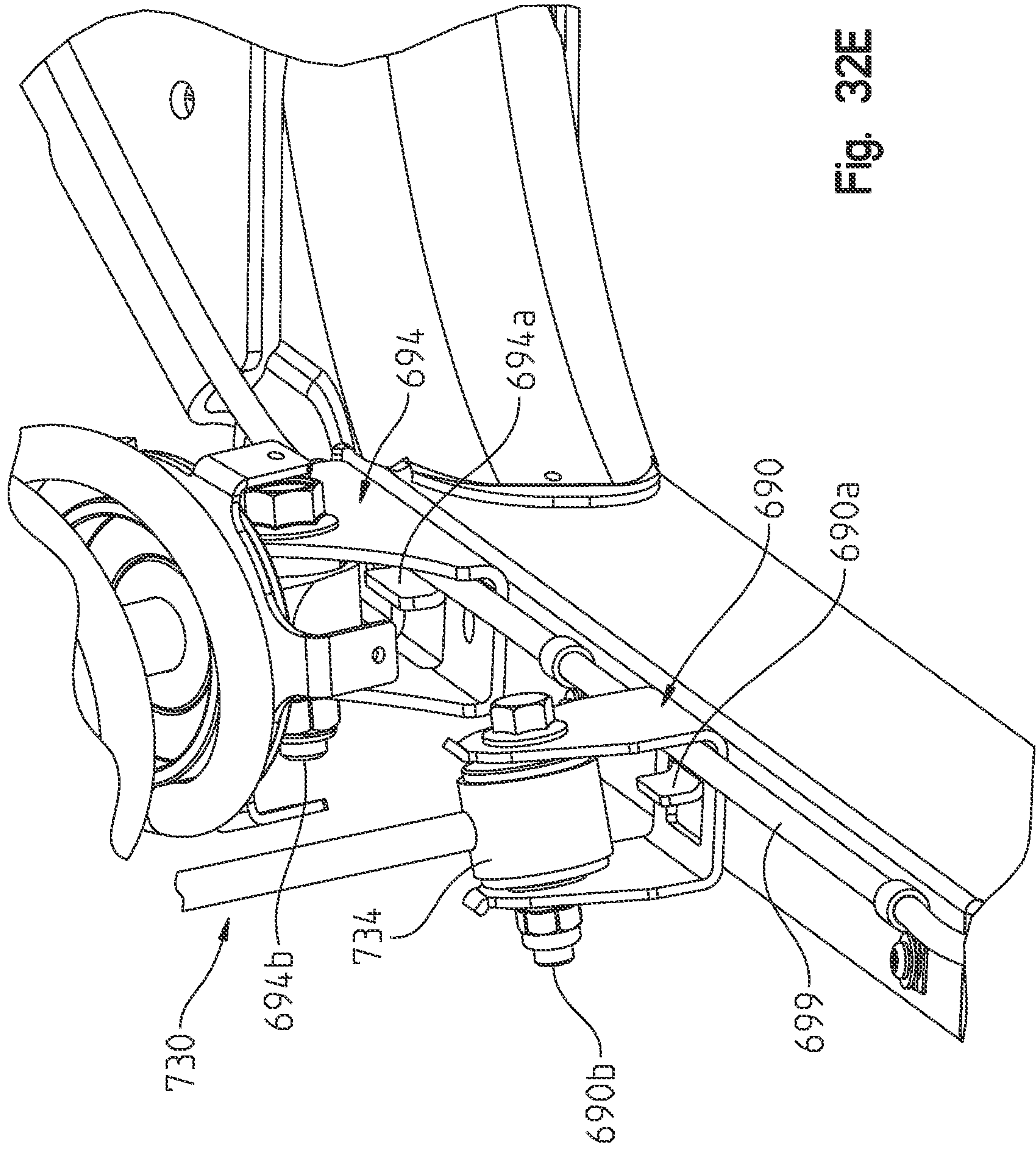


Fig. 32D



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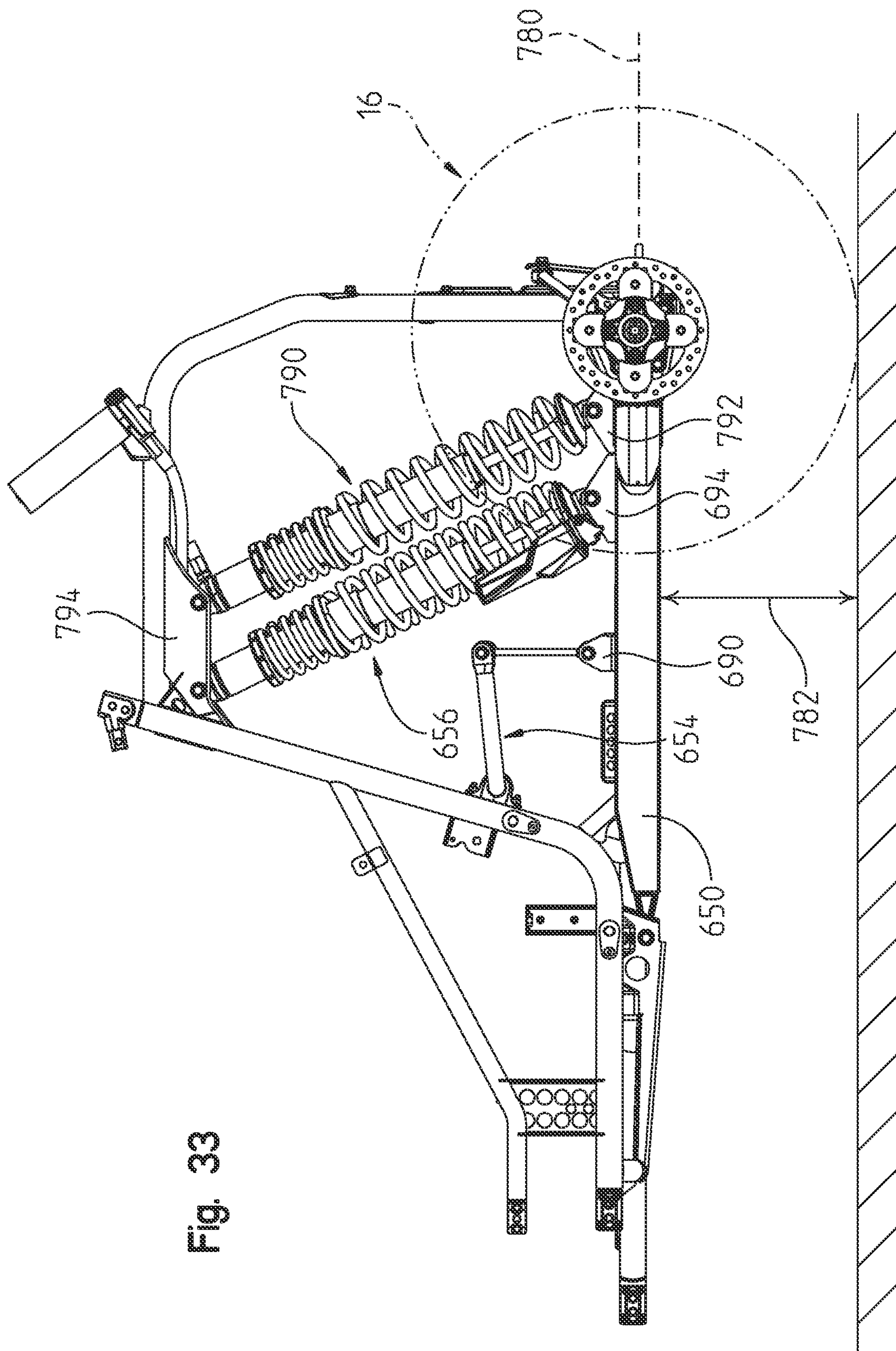


Fig. 33

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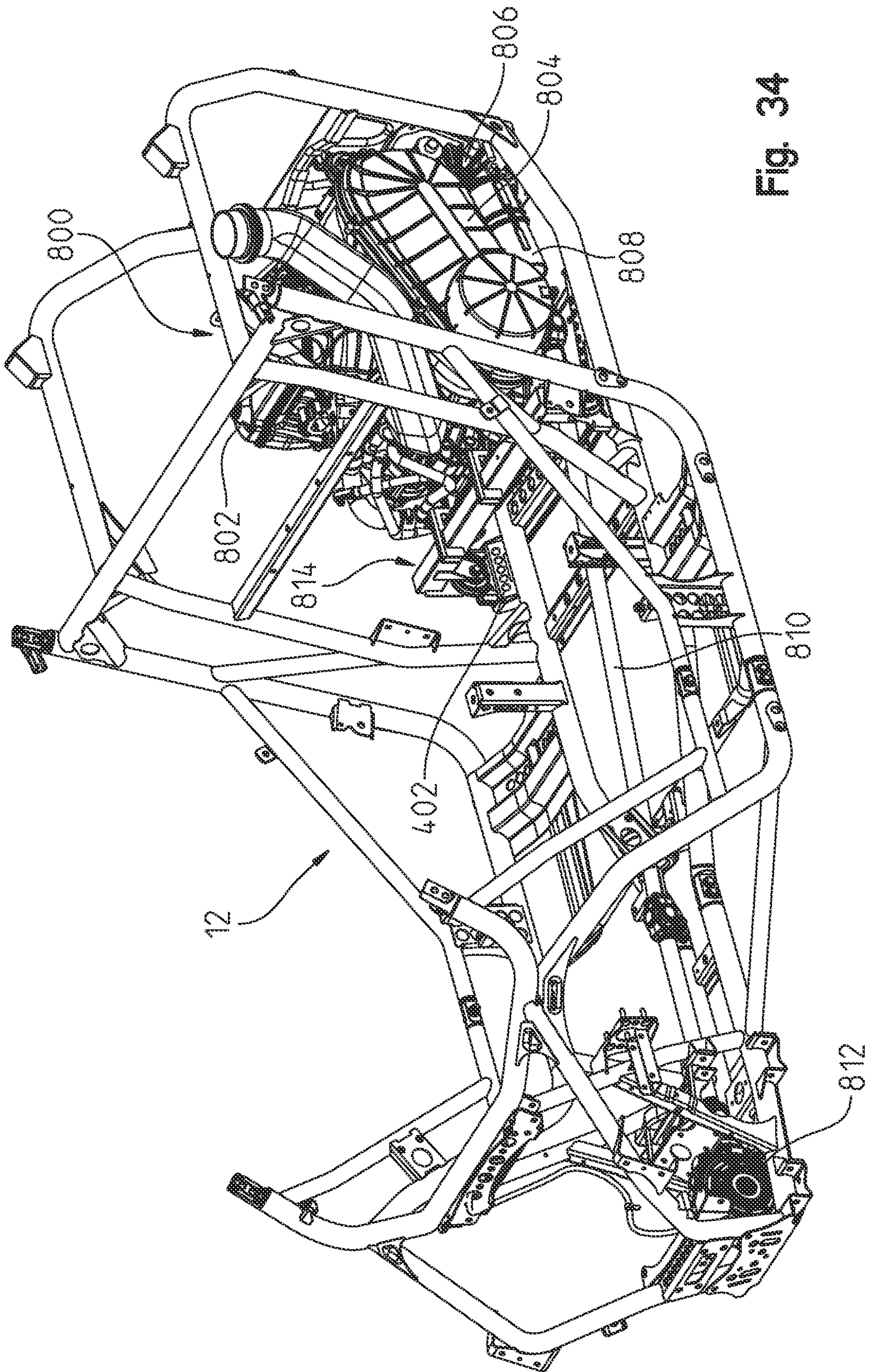
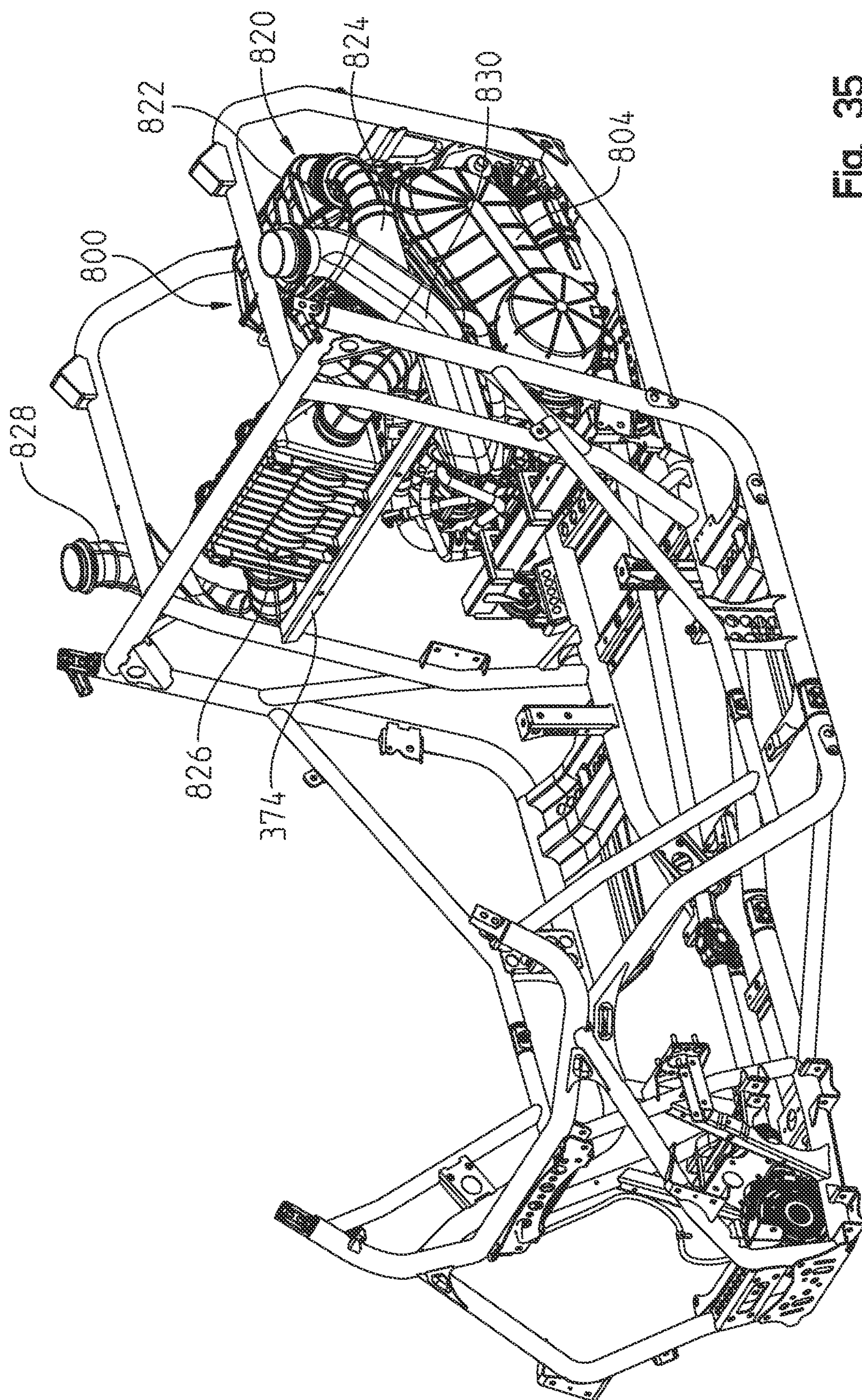


Fig. 34



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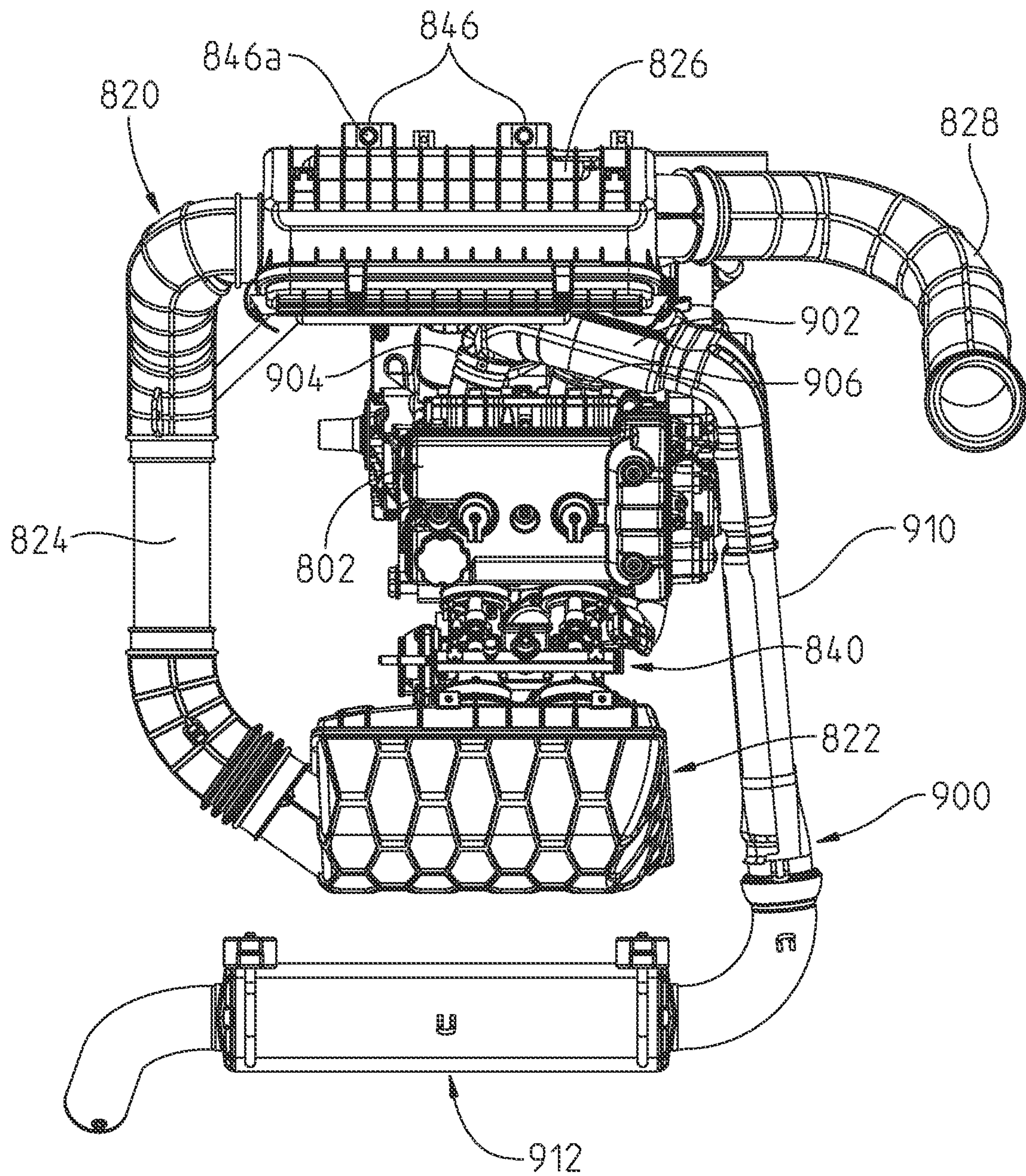


Fig. 36

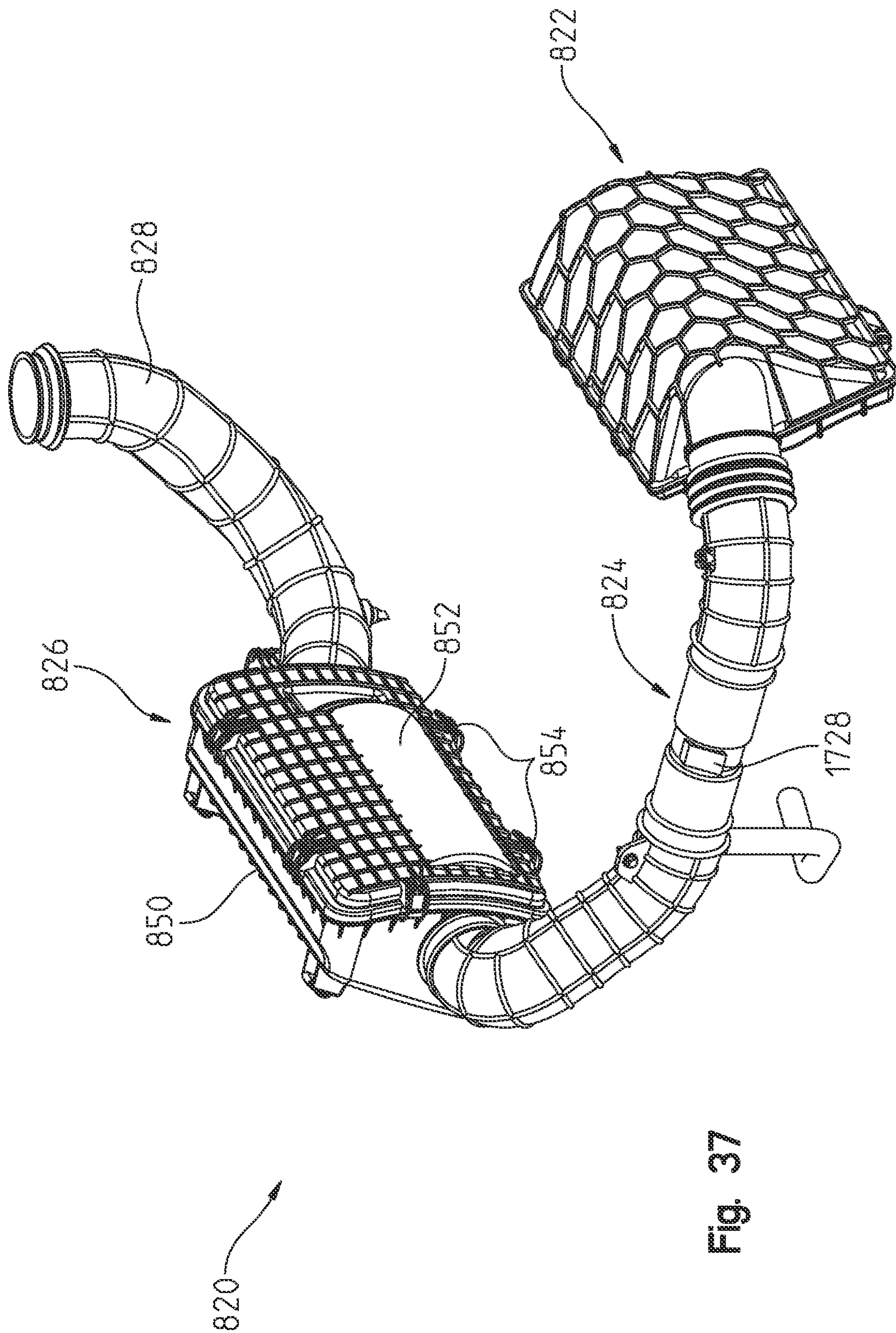


Fig. 37

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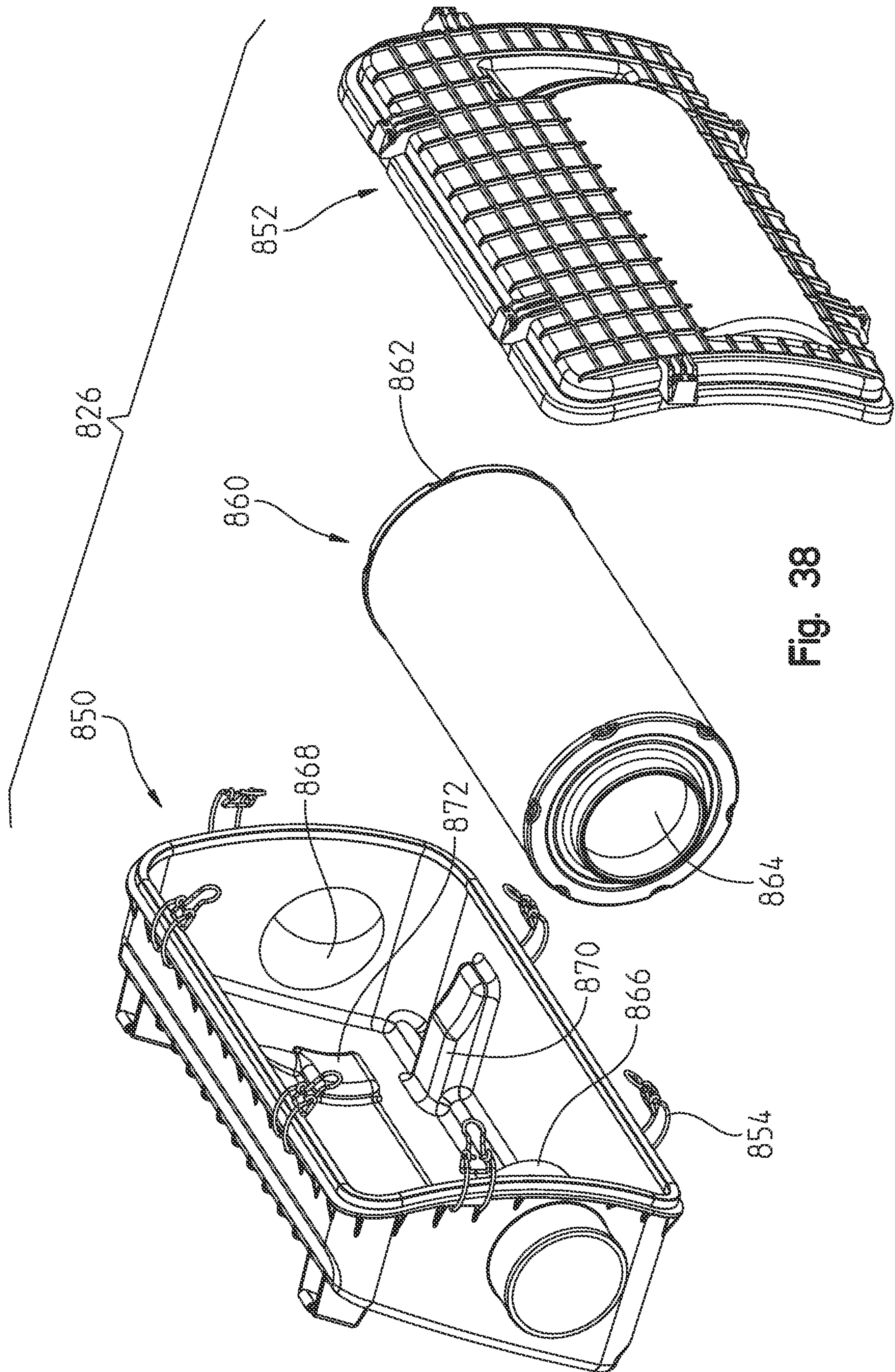
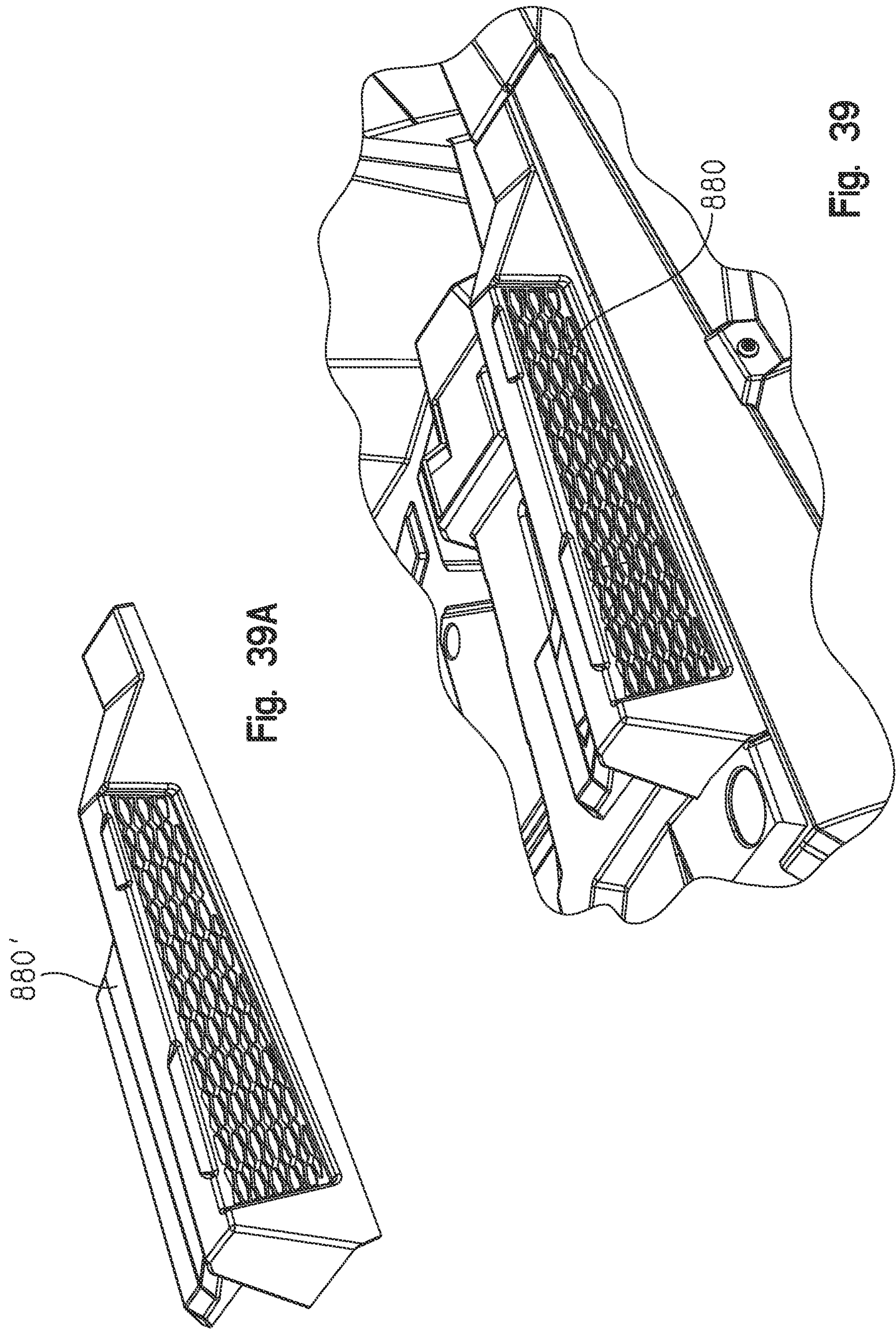


Fig. 38



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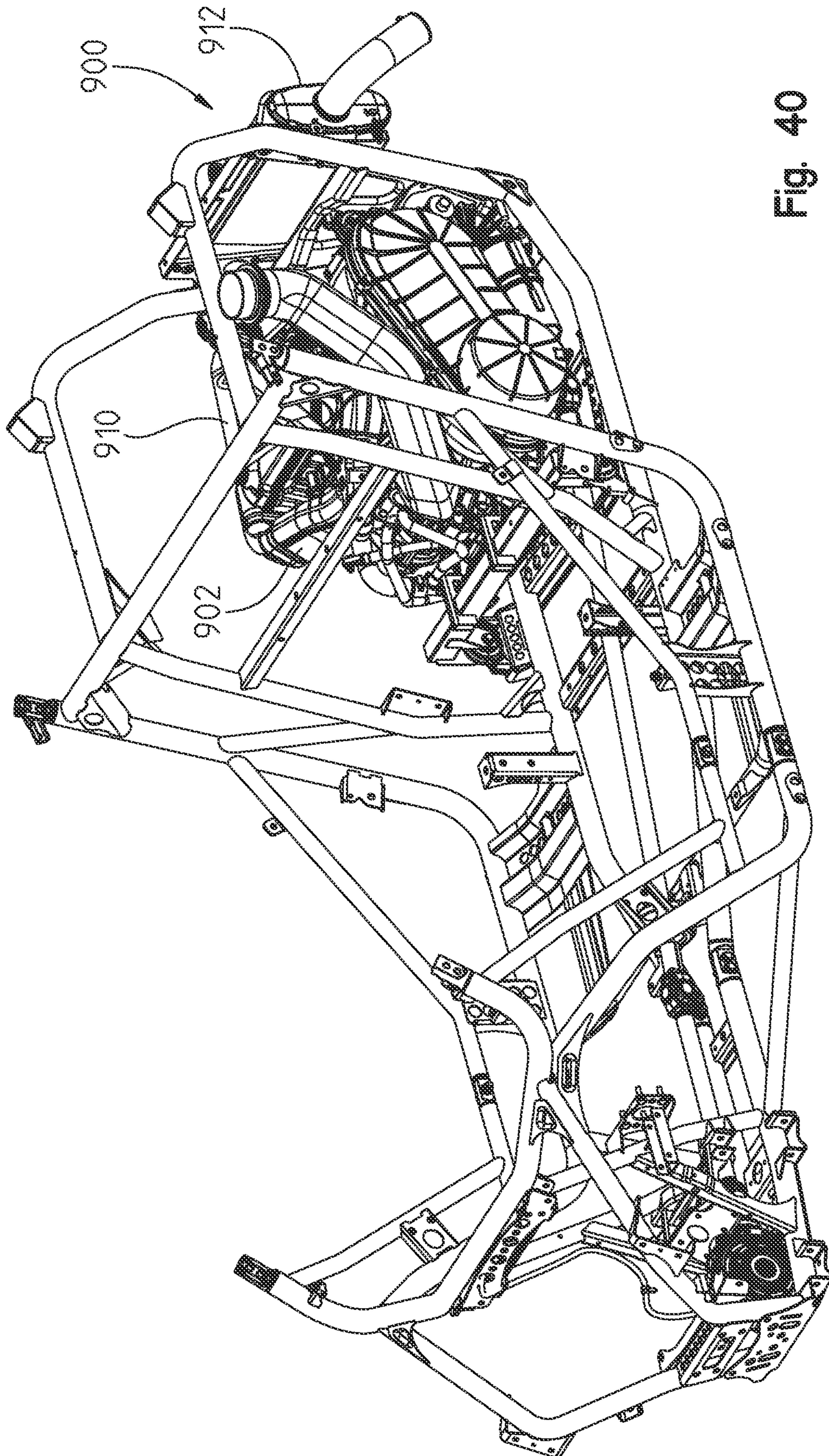


Fig. 40

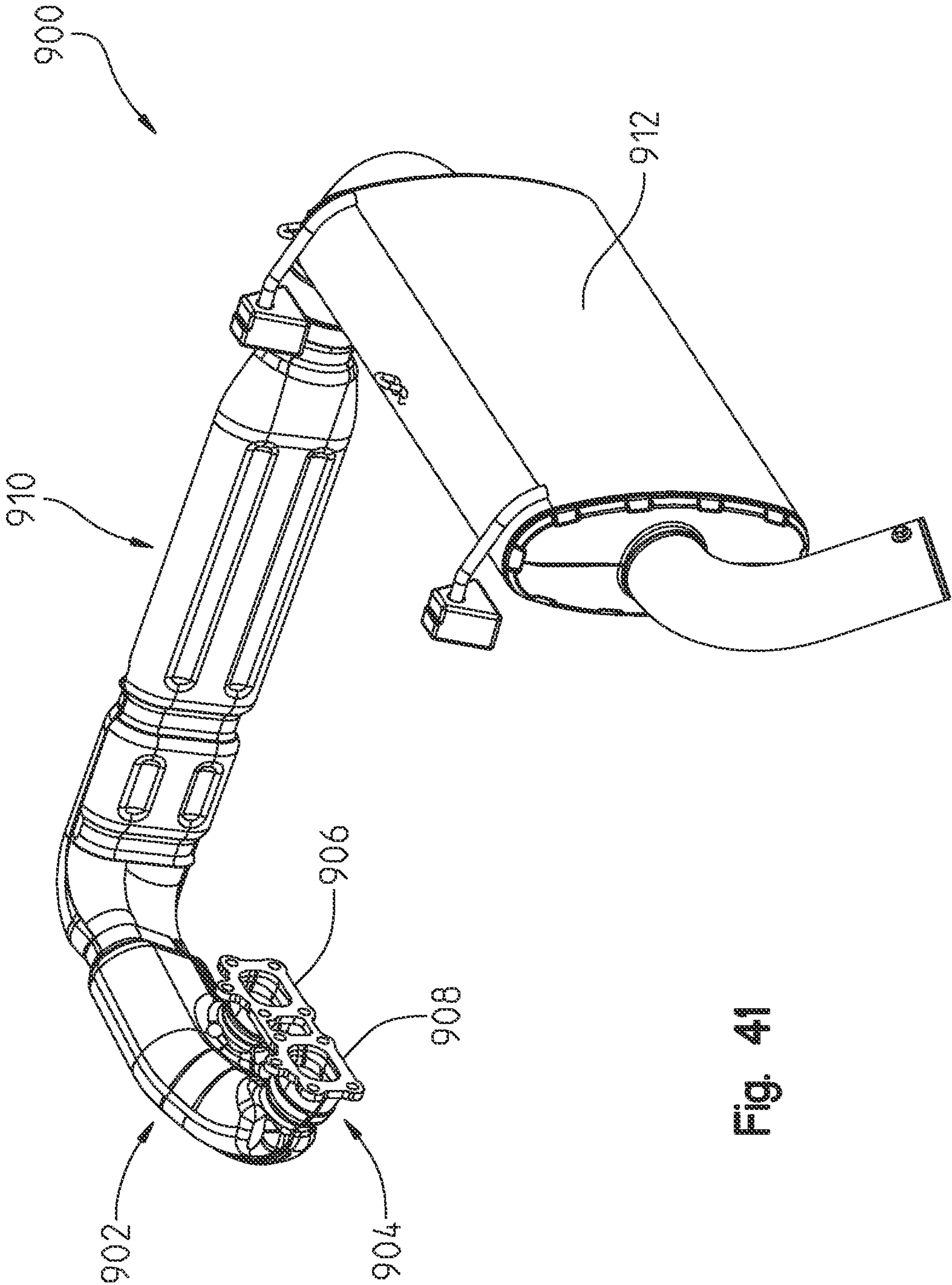


Fig. 41

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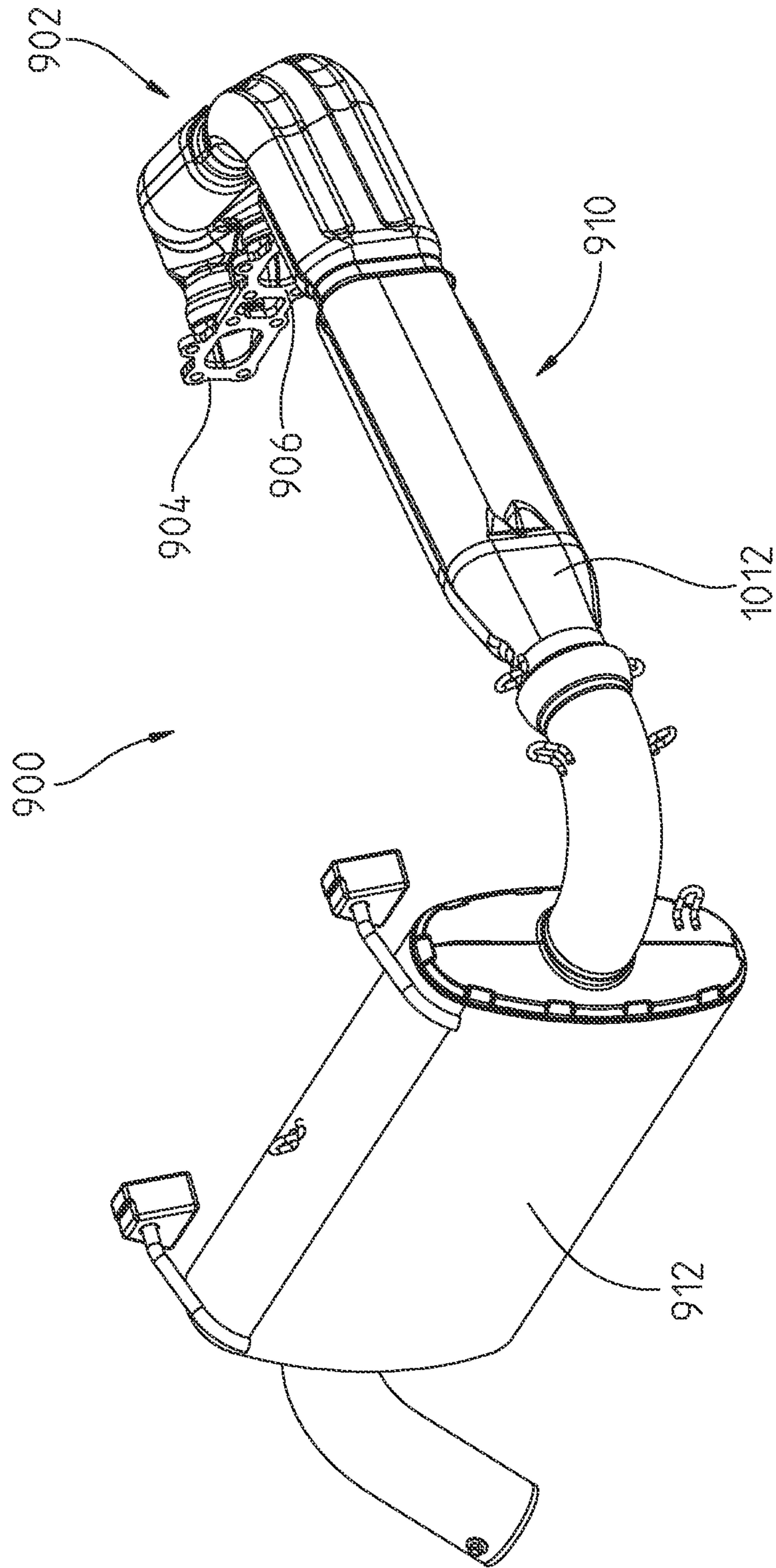


Fig. 42

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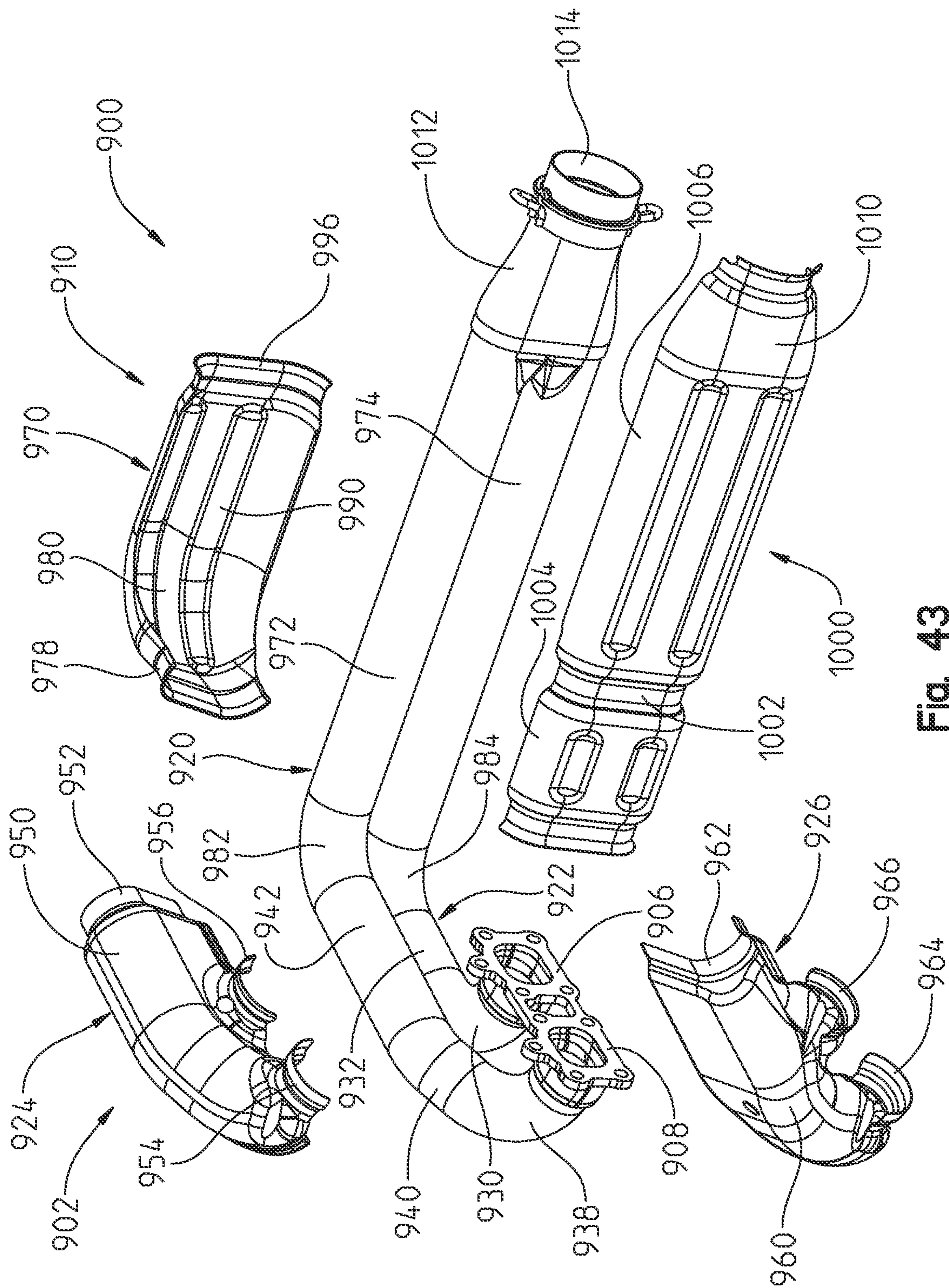


Fig. 43

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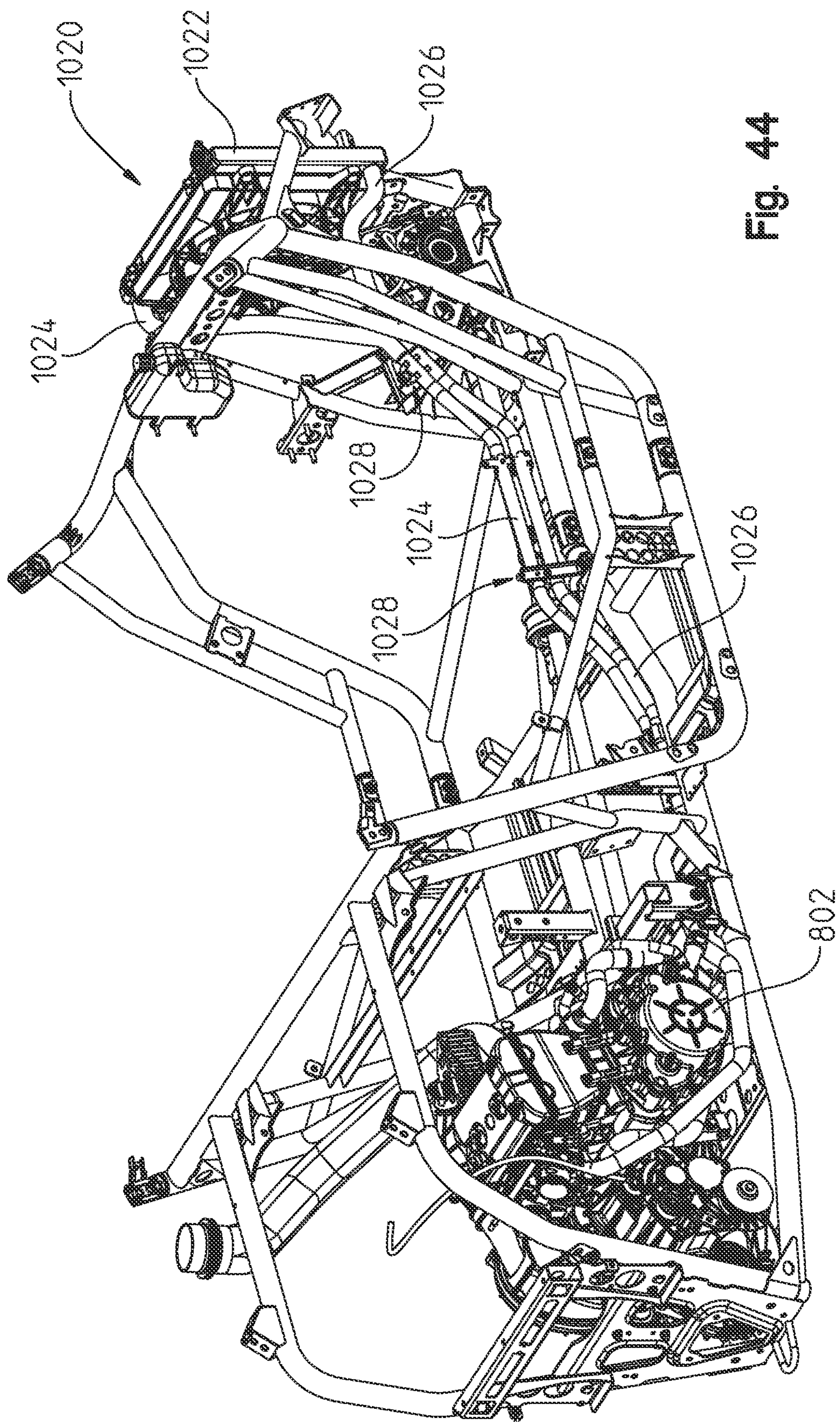


Fig. 44

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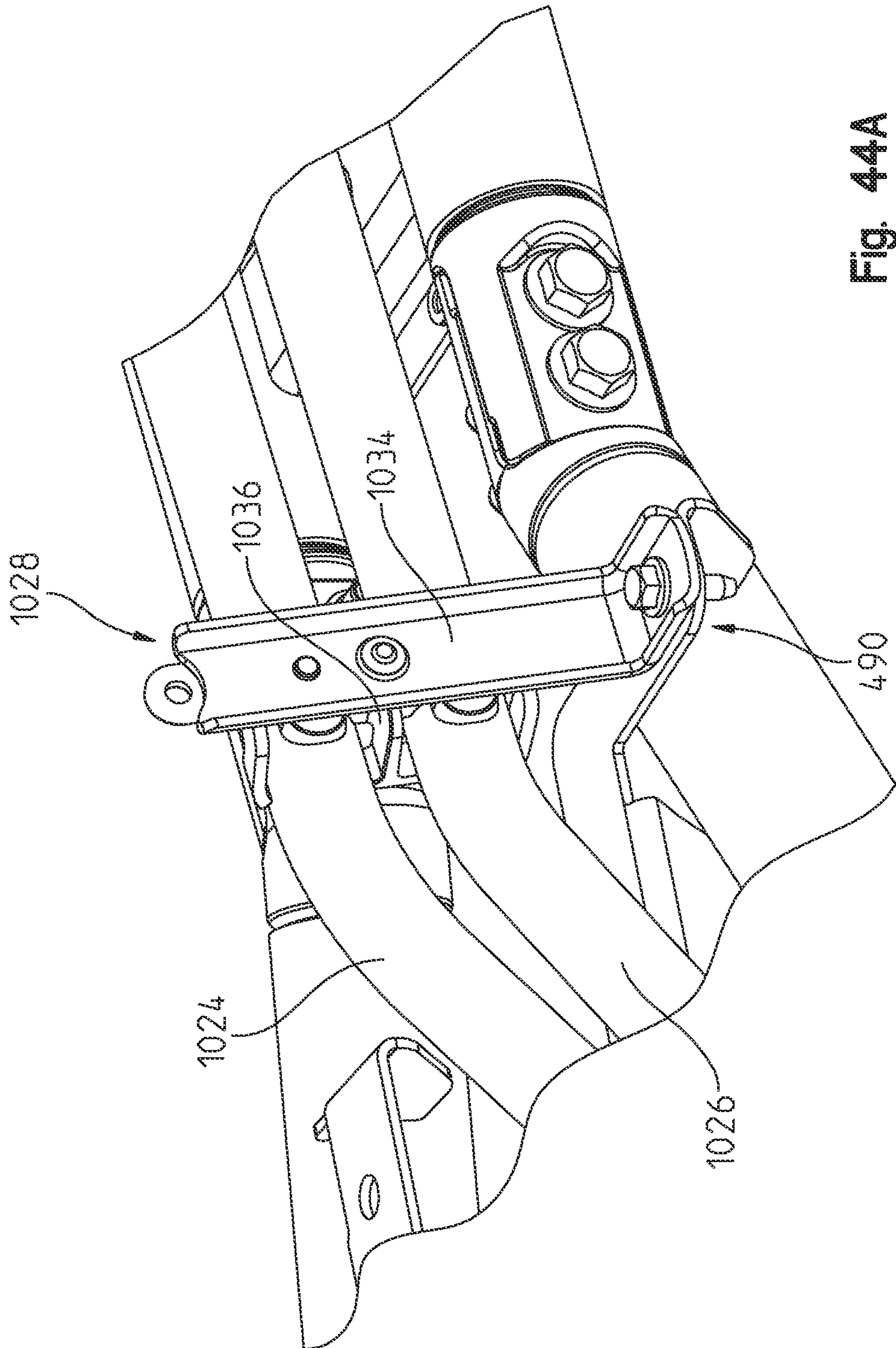


Fig. 44A

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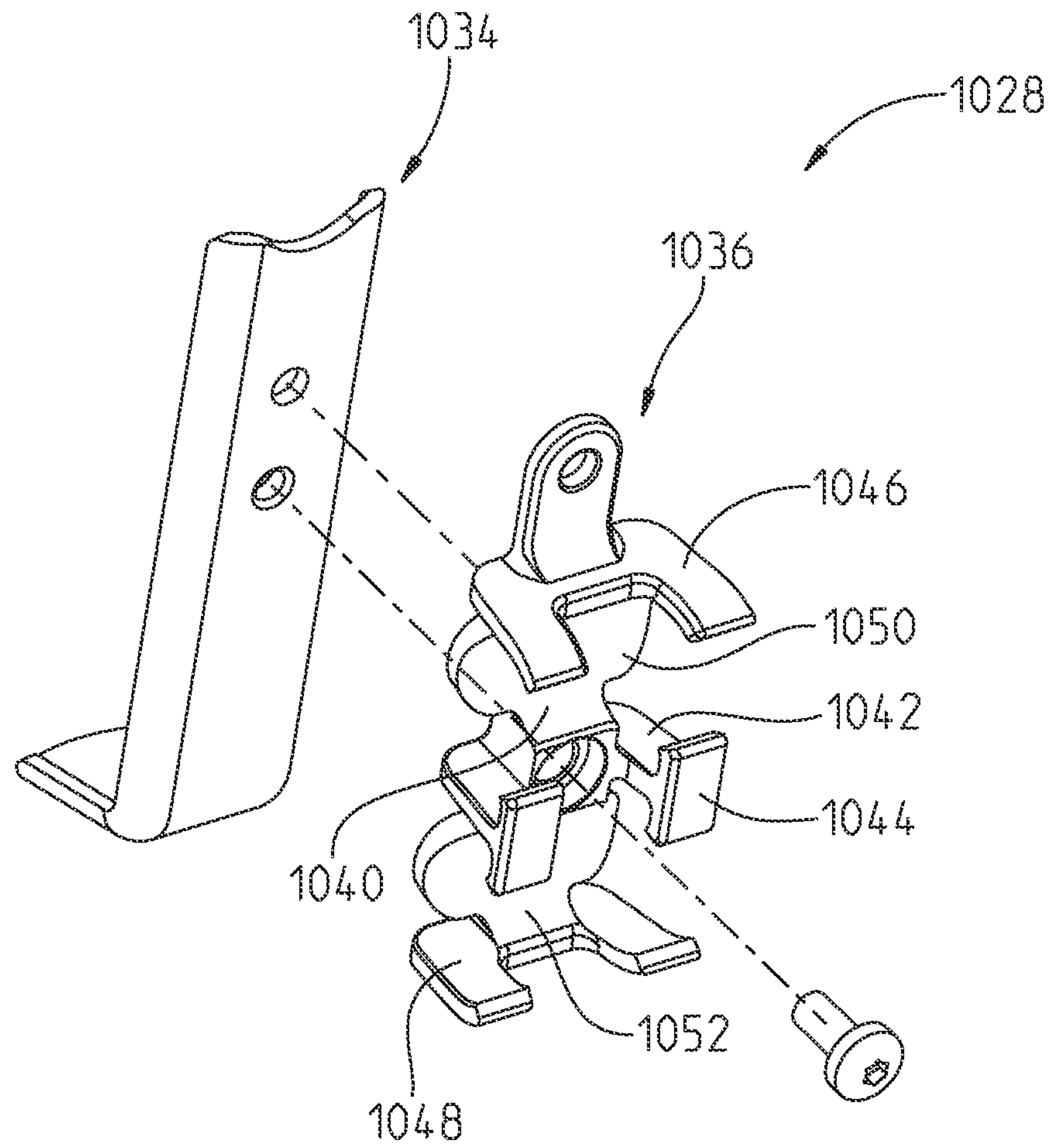


Fig. 44B

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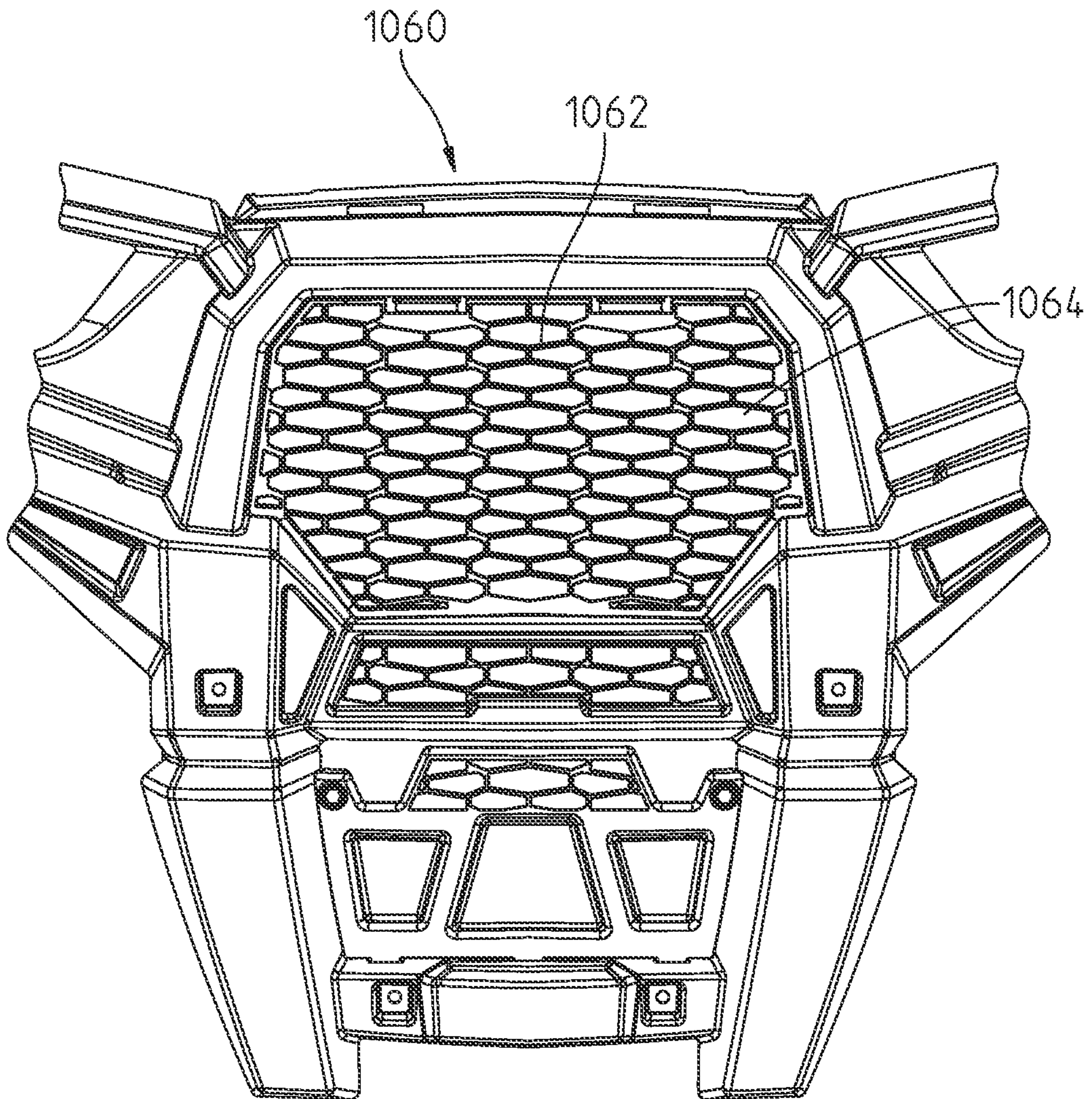


Fig. 45

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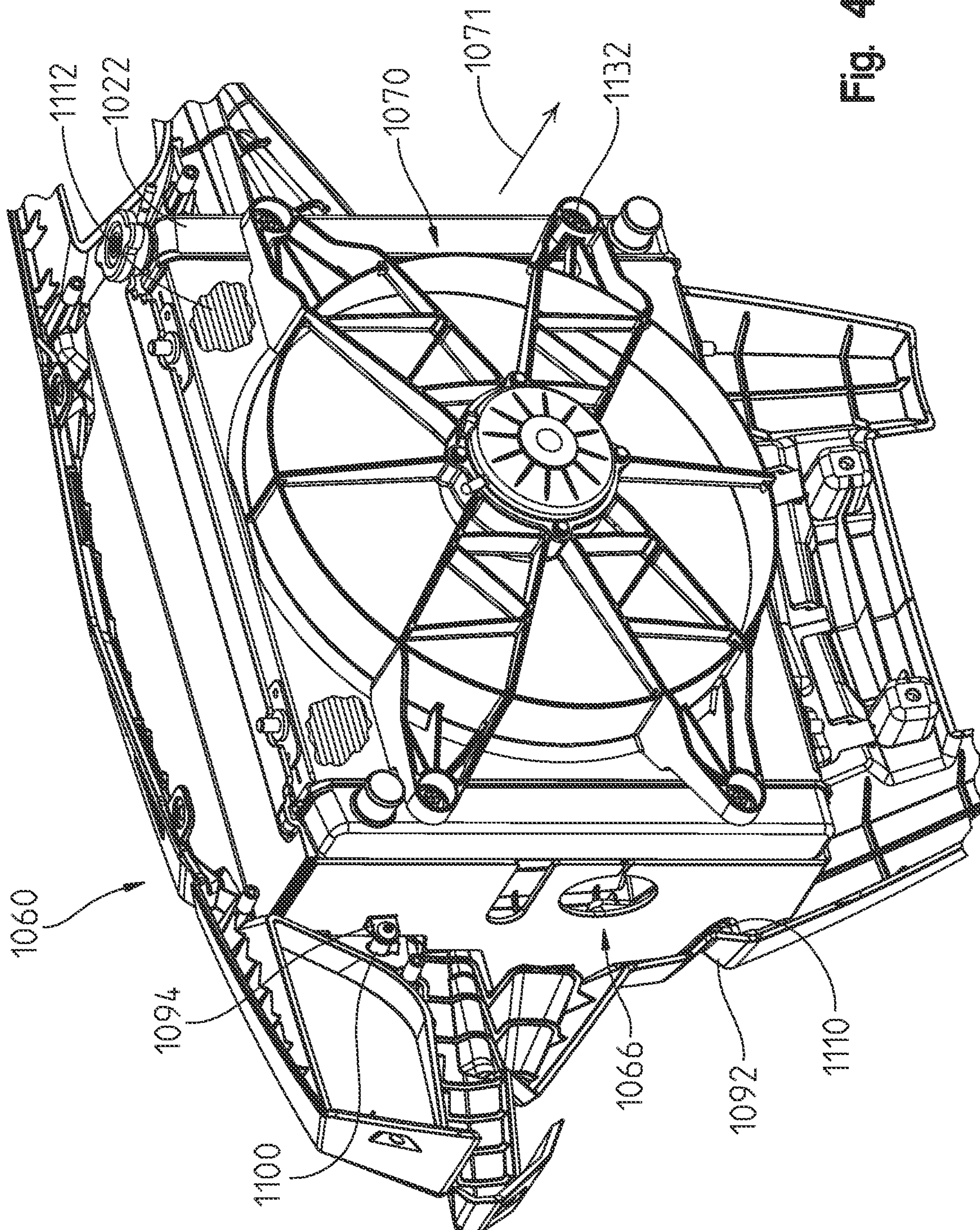


Fig. 46

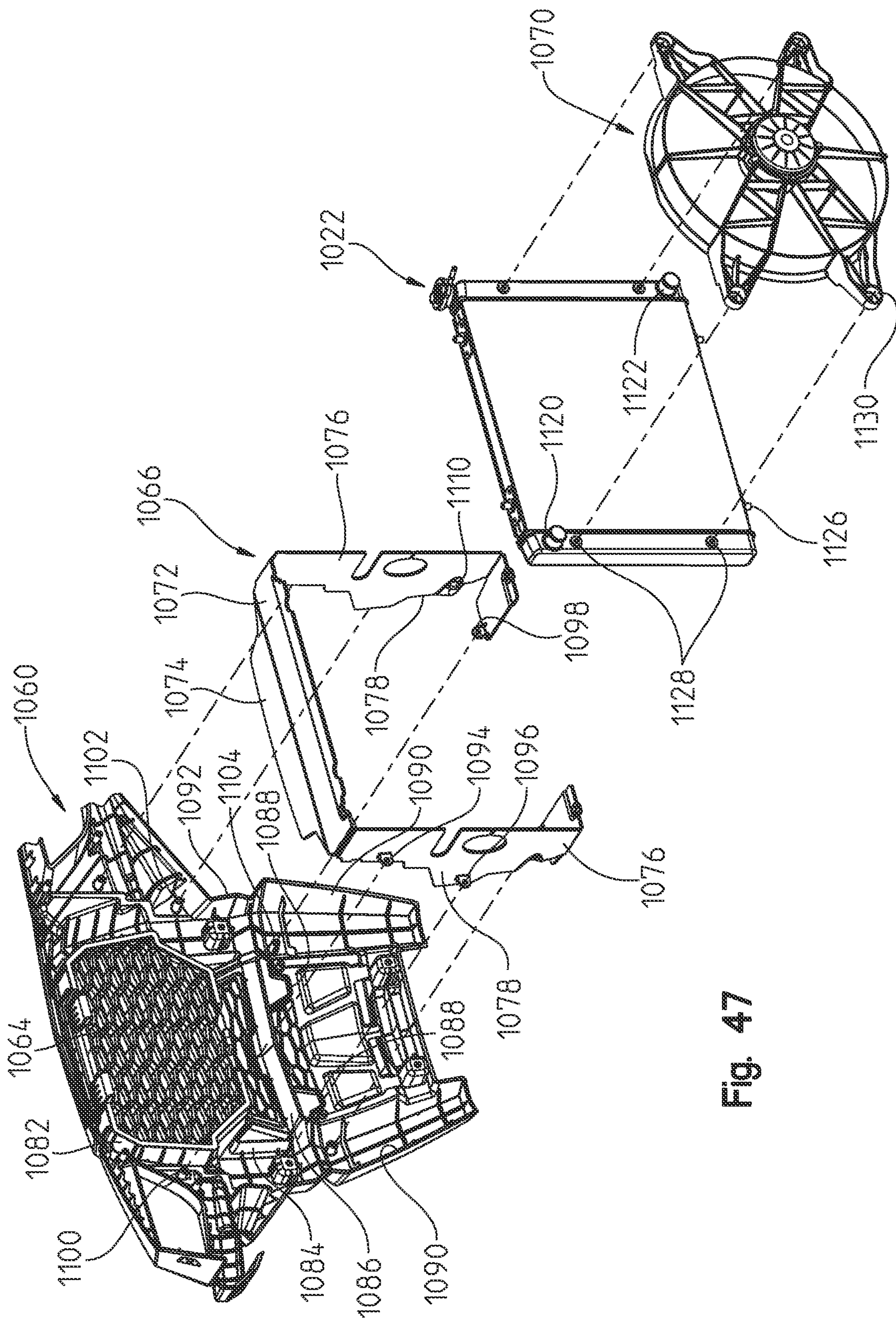
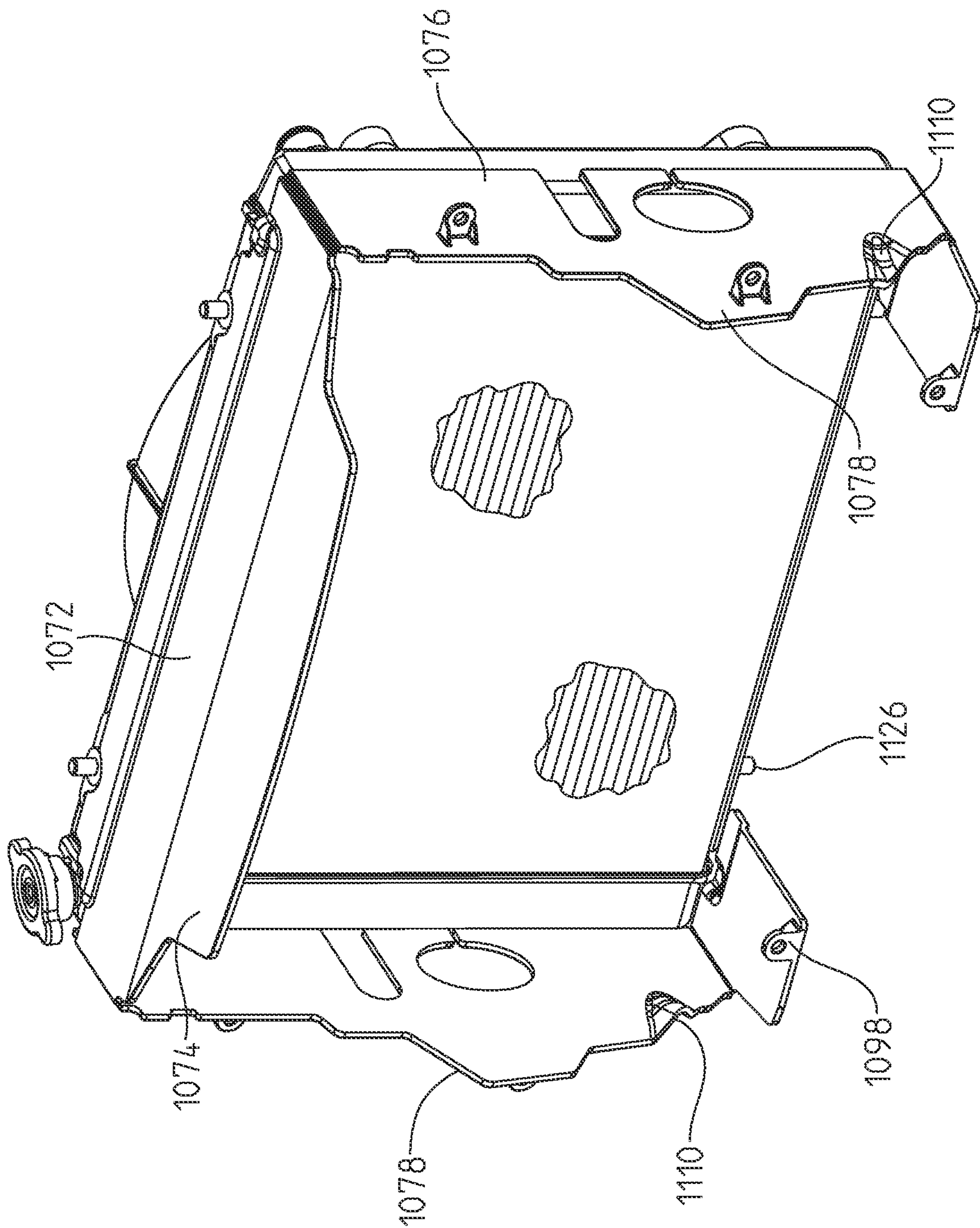
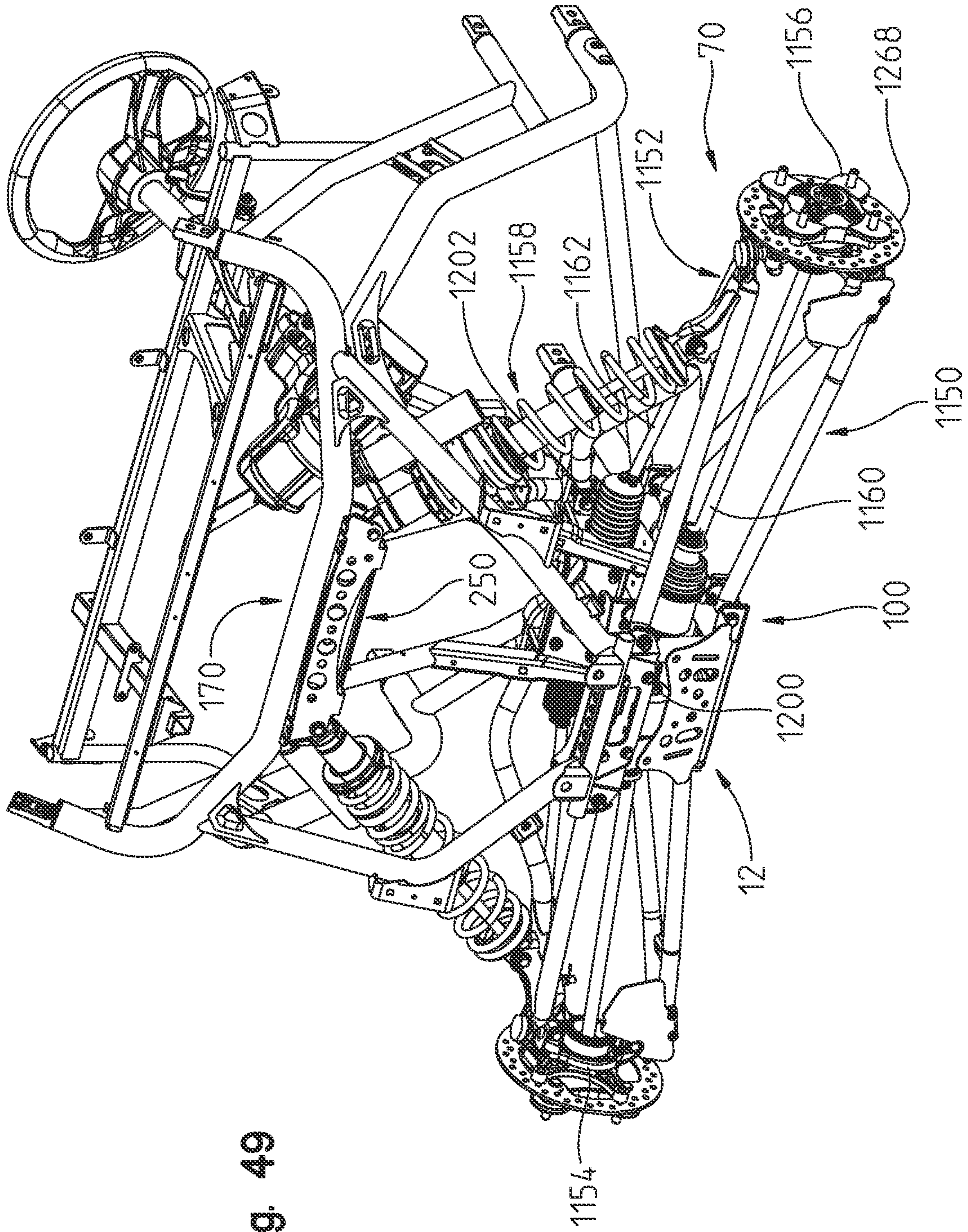


Fig. 47





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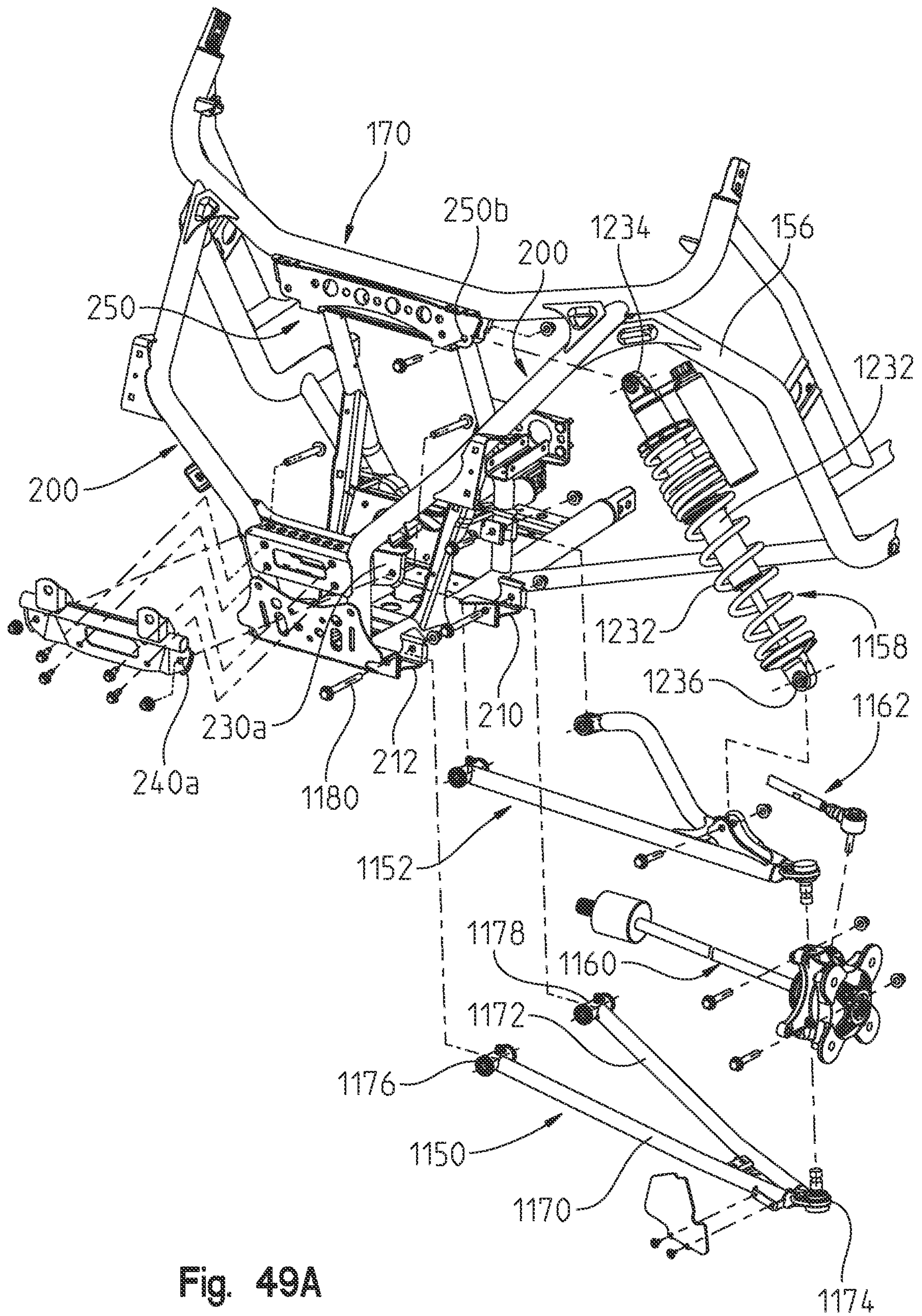


Fig. 49A

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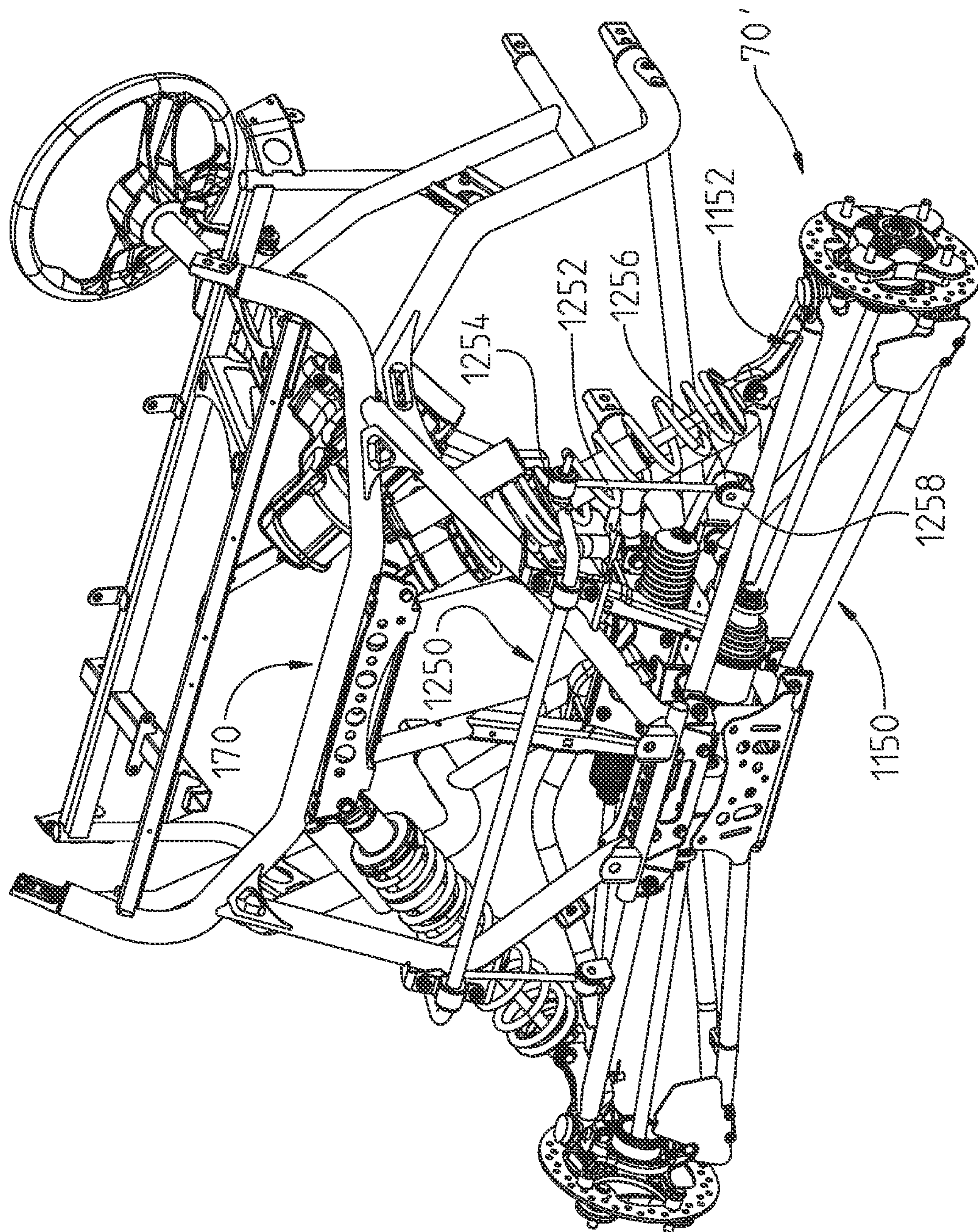


Fig. 49B

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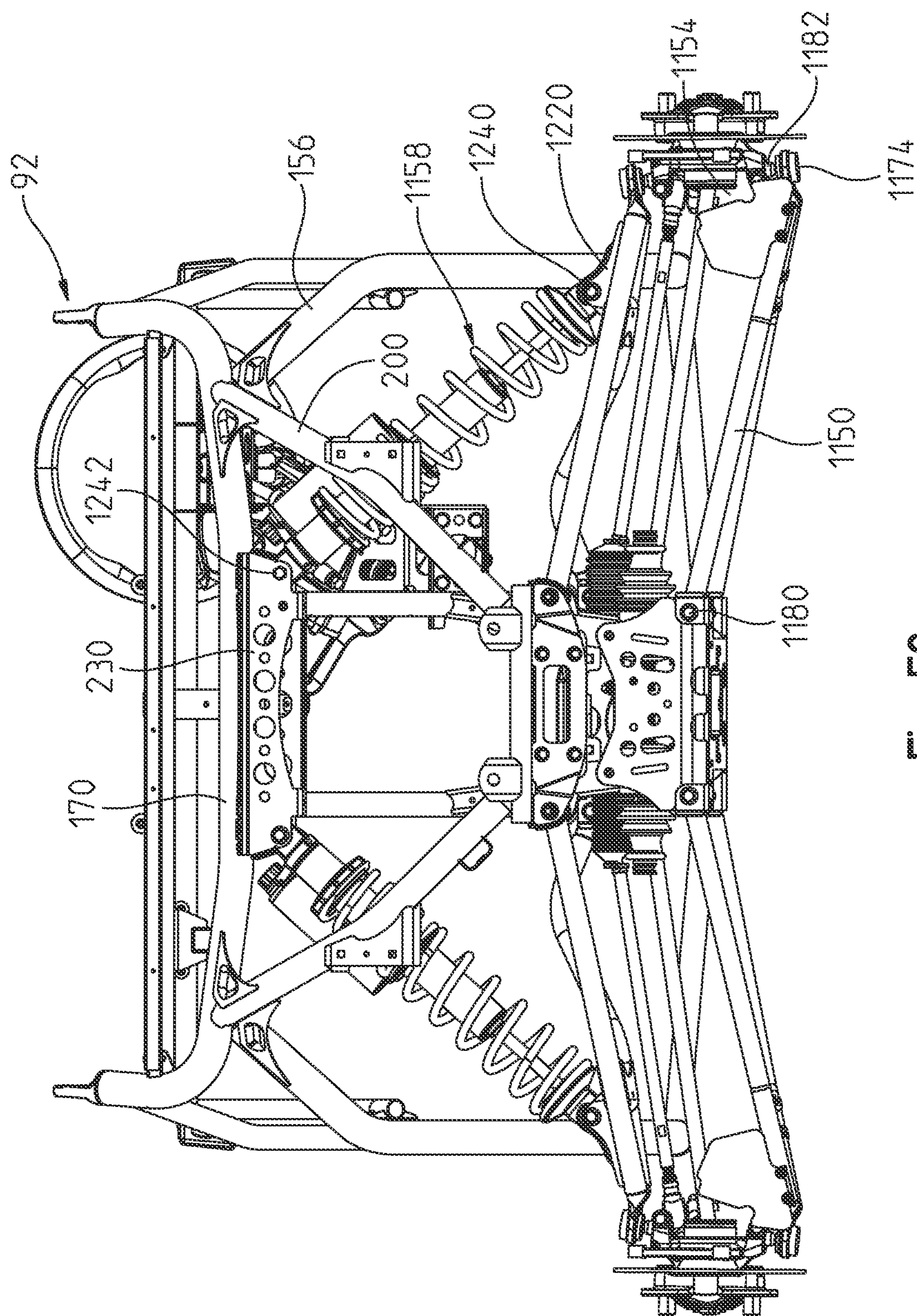


Fig. 50

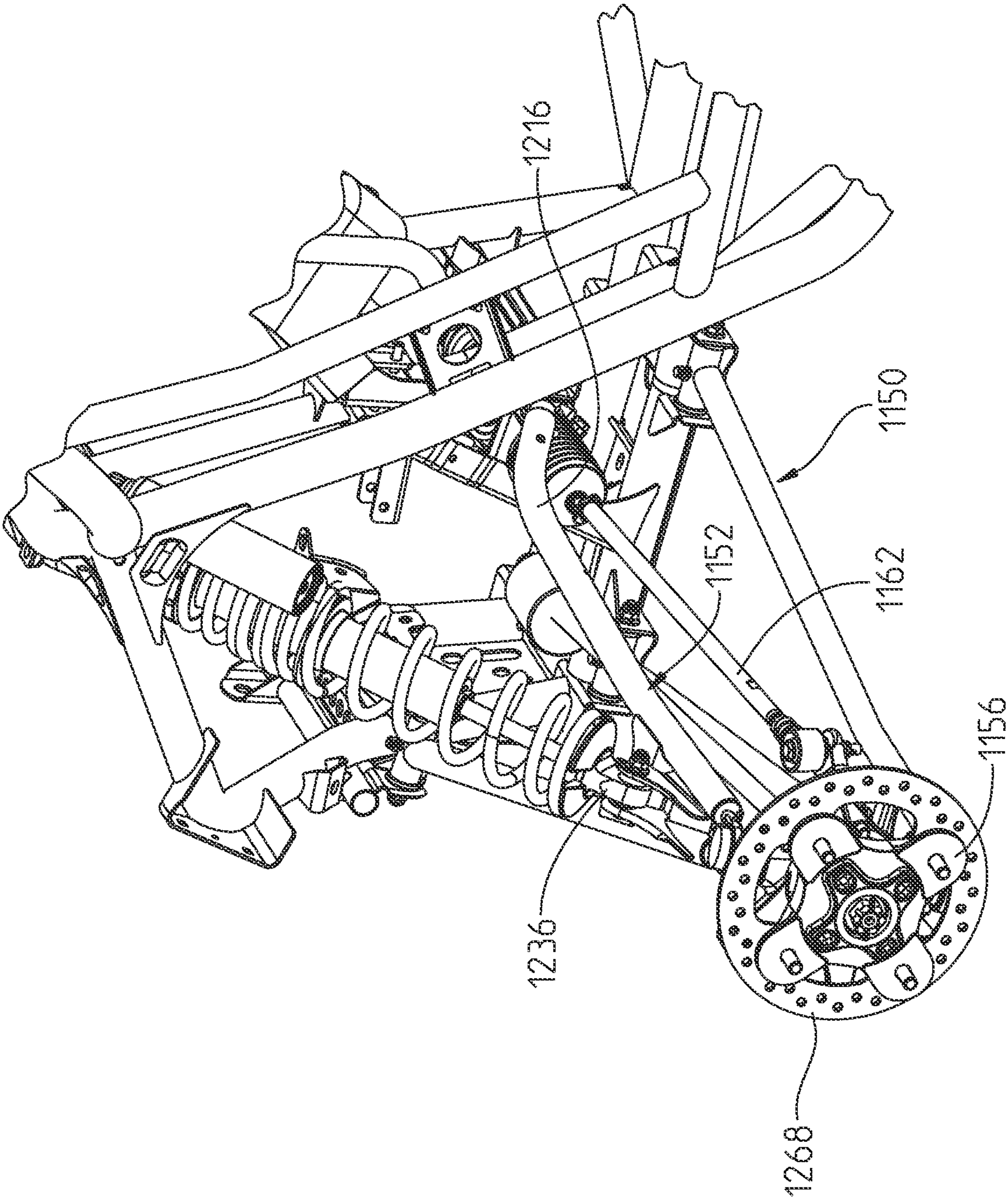


Fig. 51

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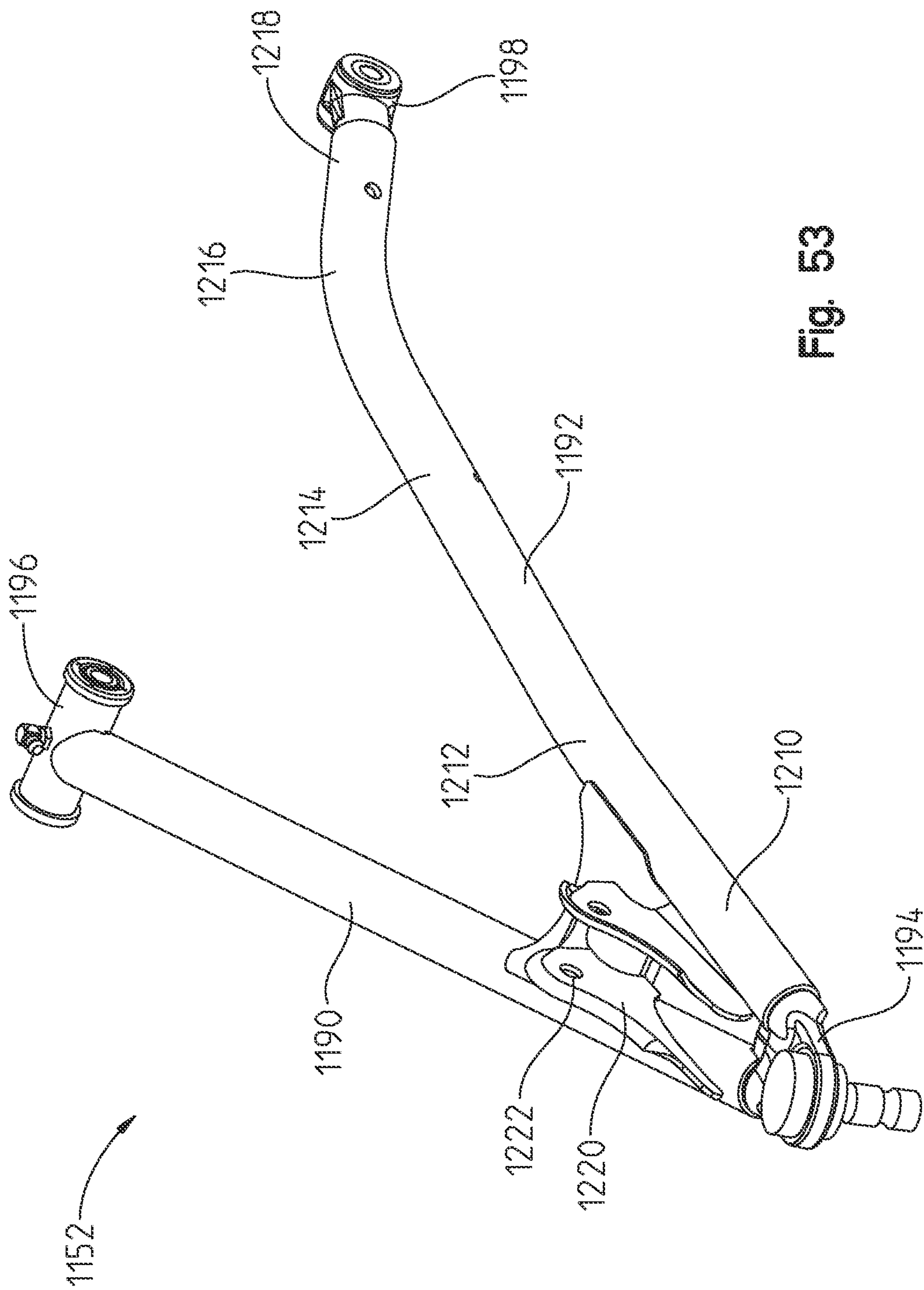


Fig. 53

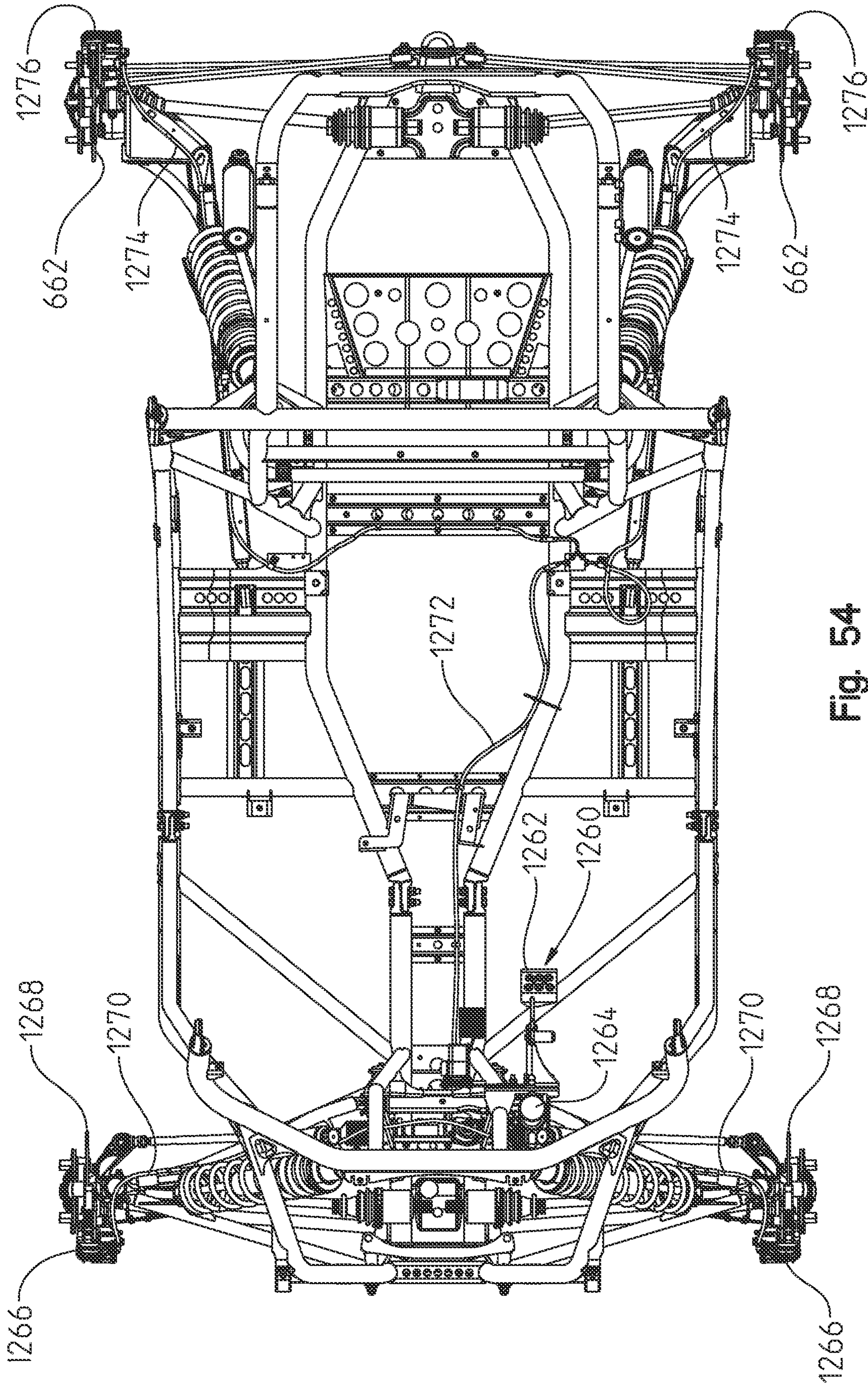


Fig. 54

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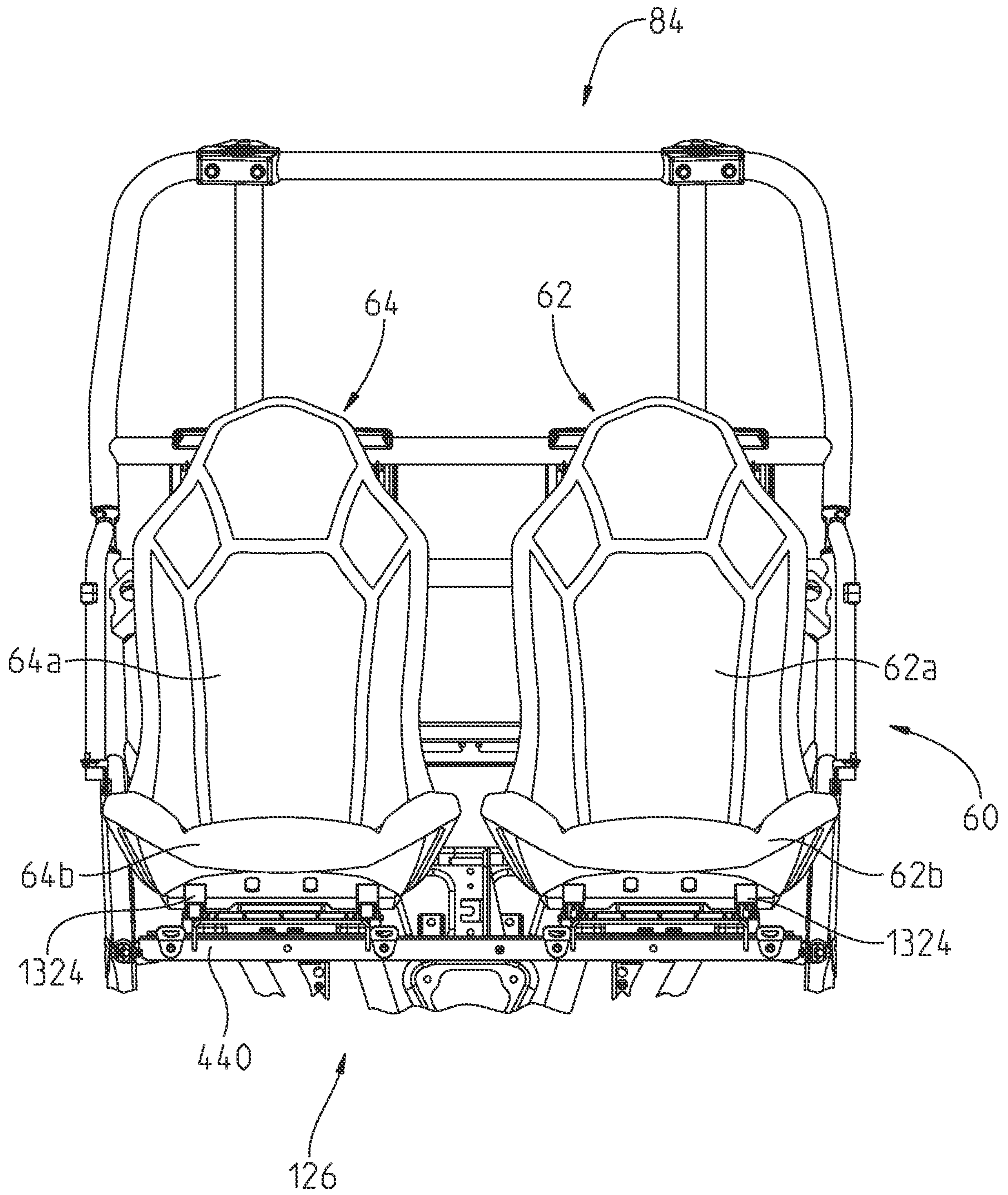


Fig. 55

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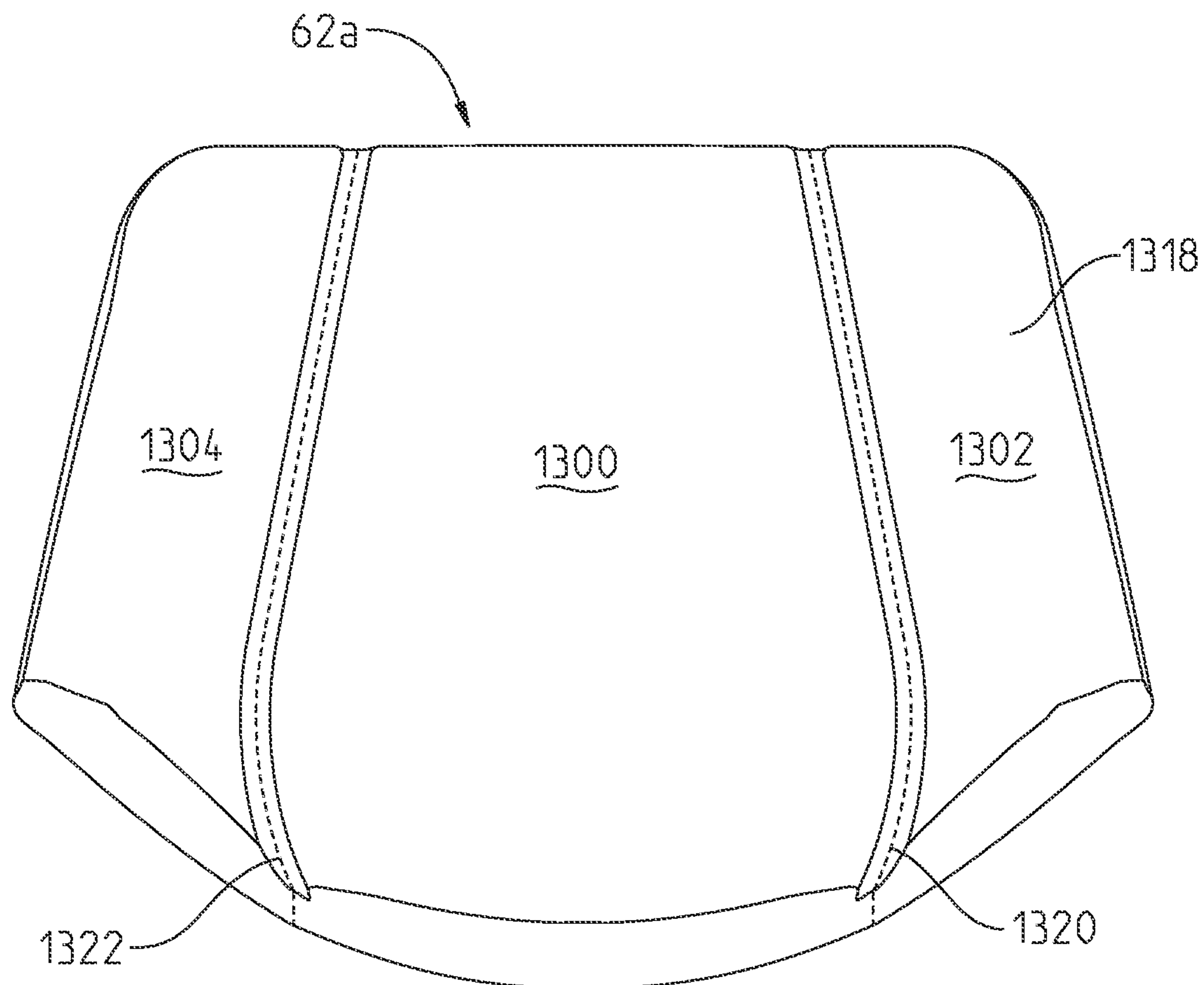


Fig. 56

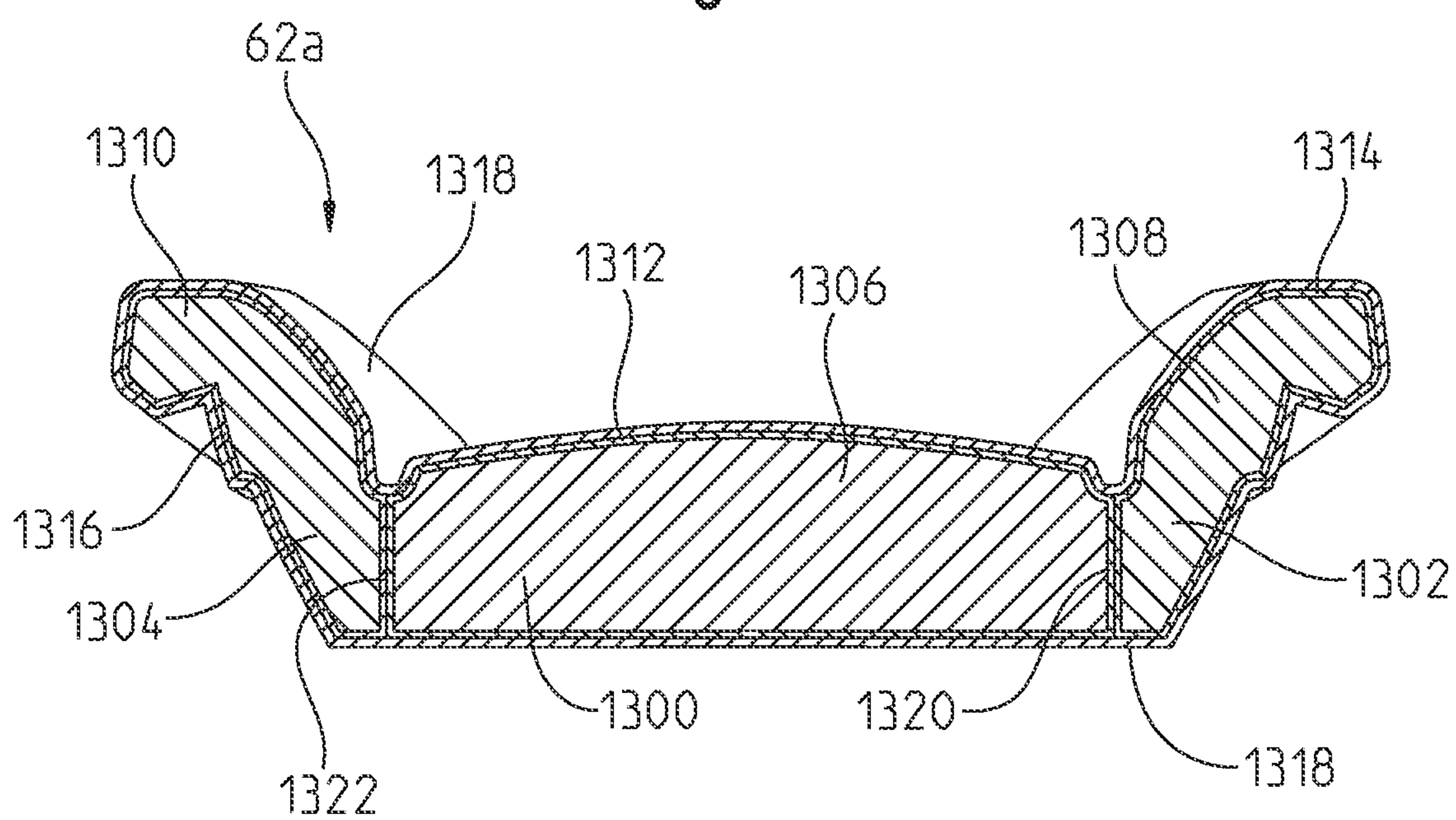


Fig. 57

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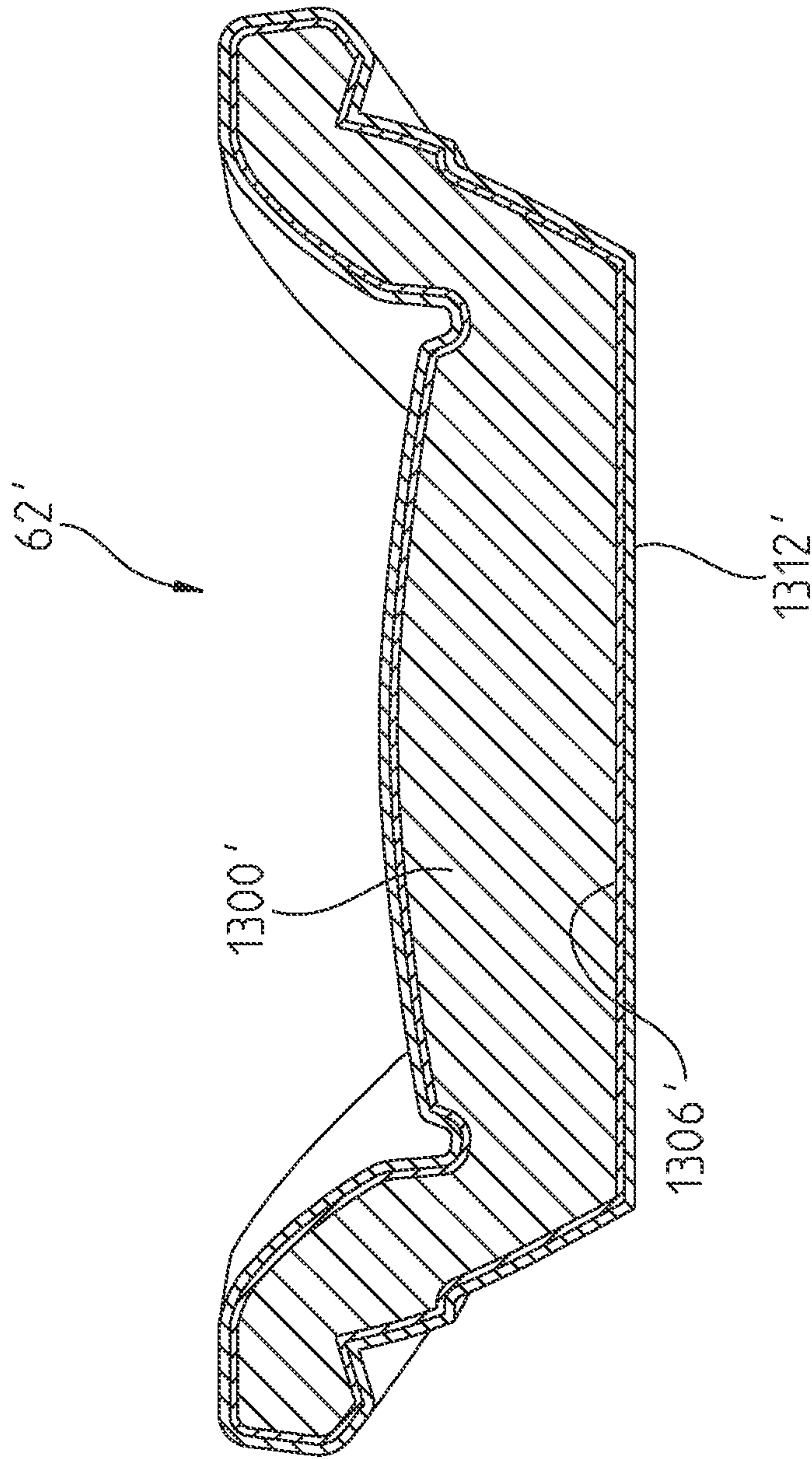


Fig. 57A

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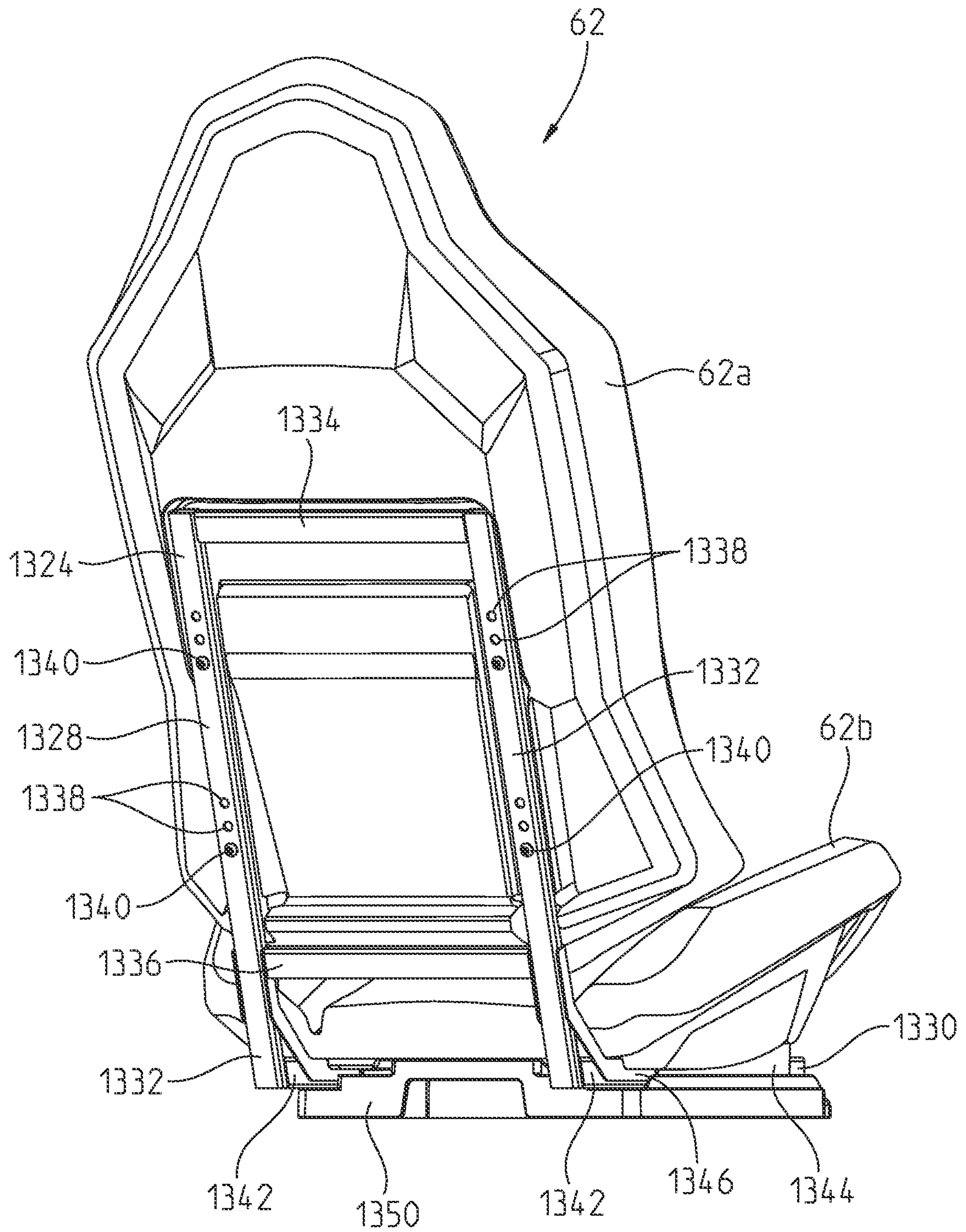


Fig. 58

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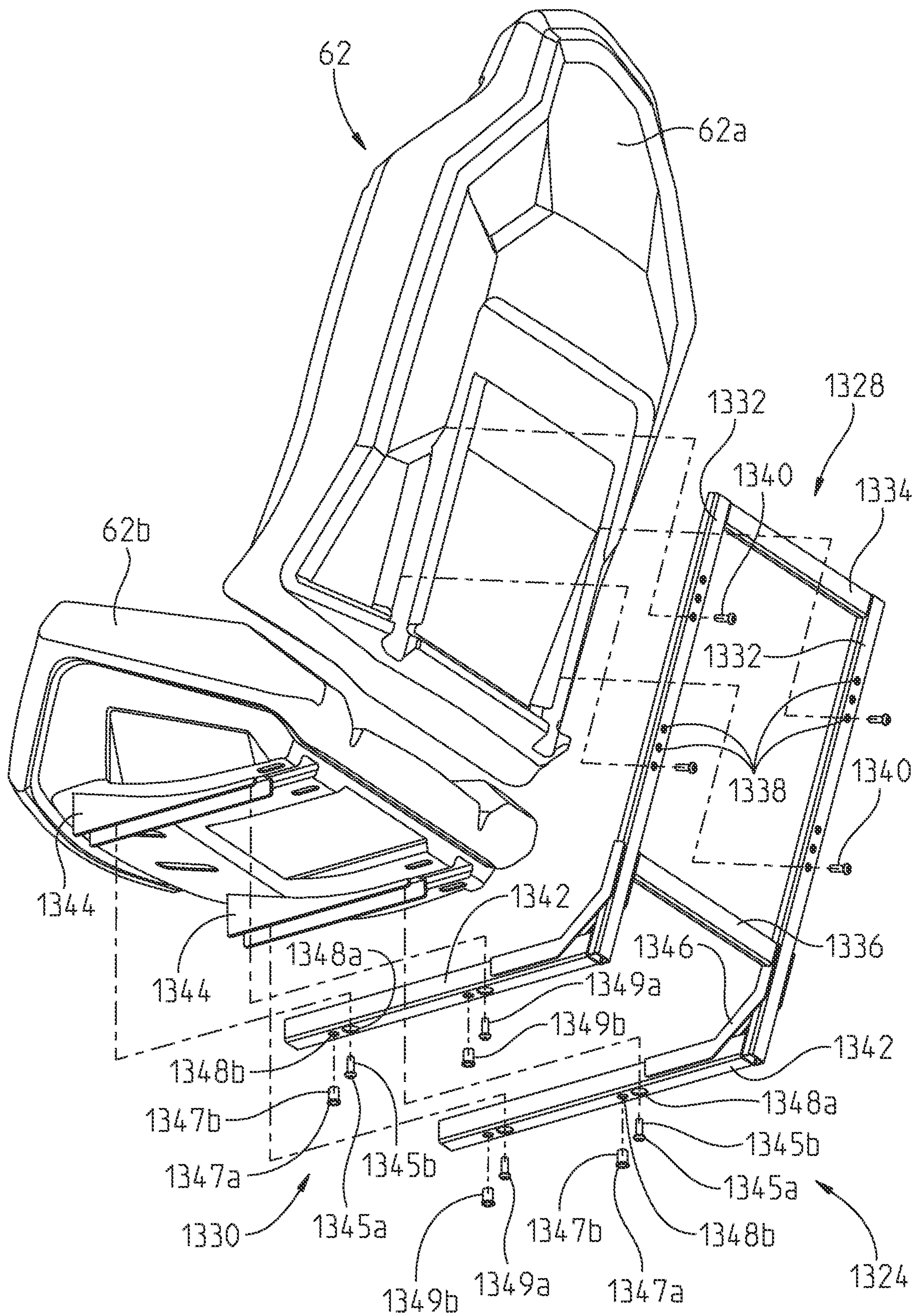


Fig. 59

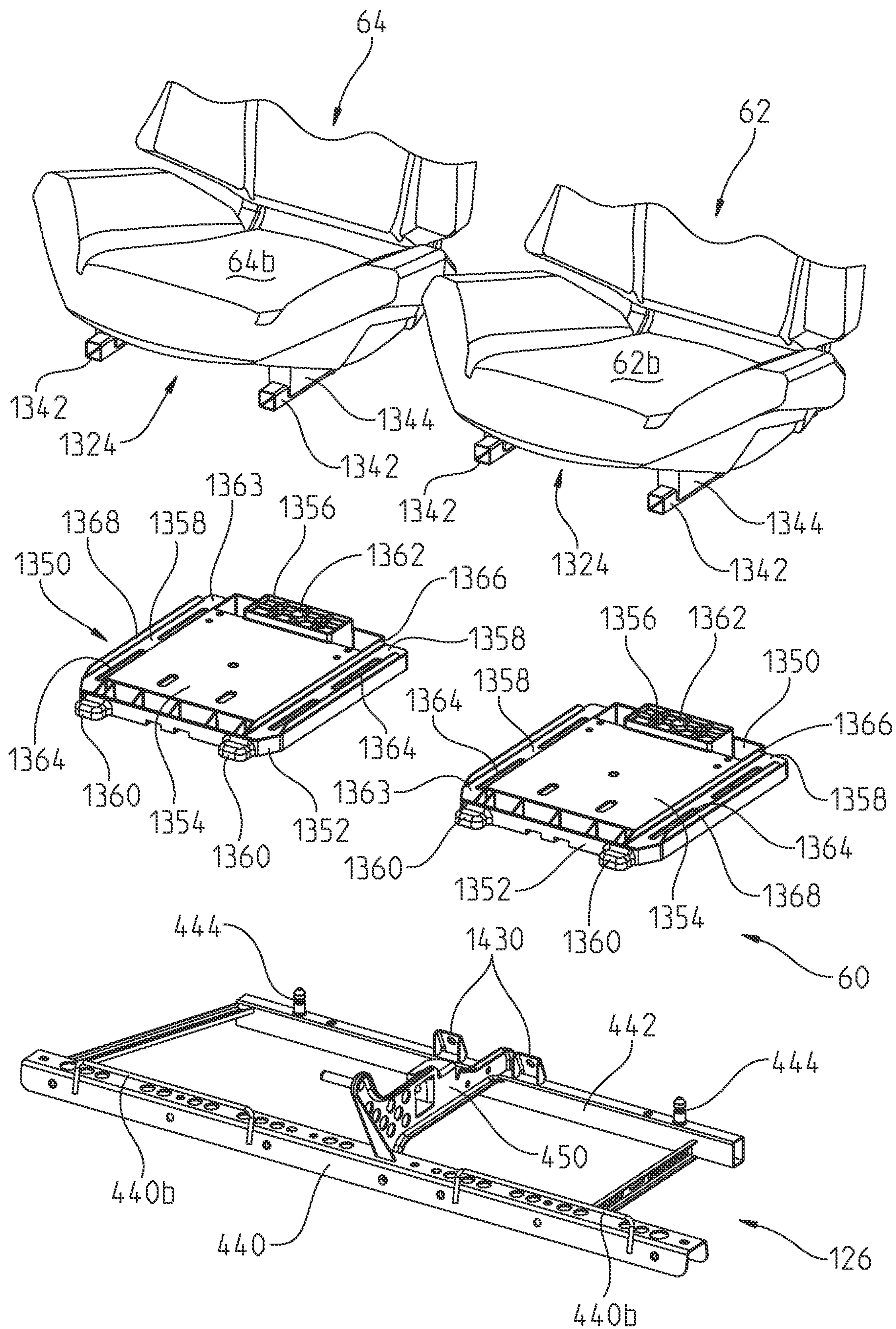


Fig. 60

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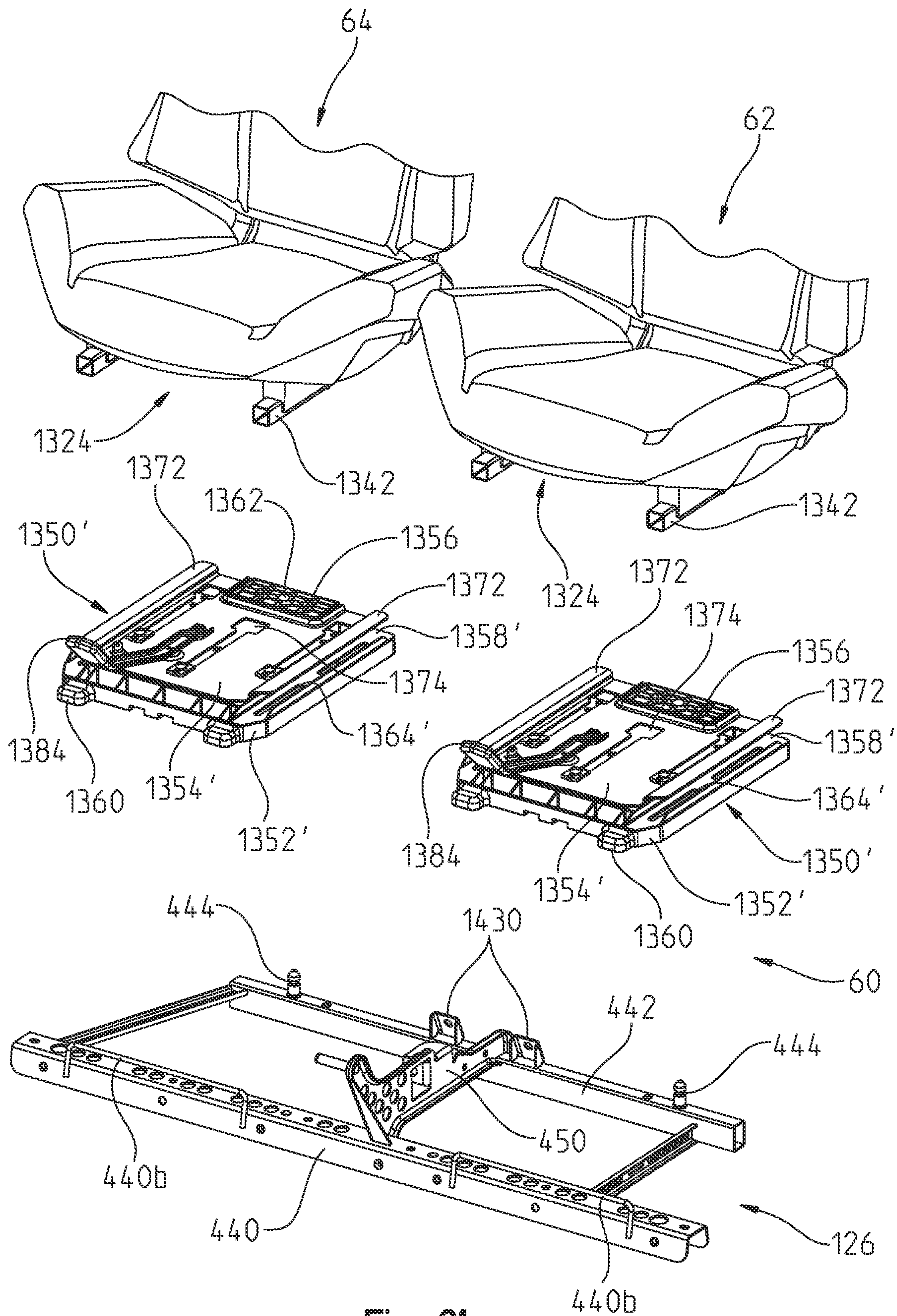
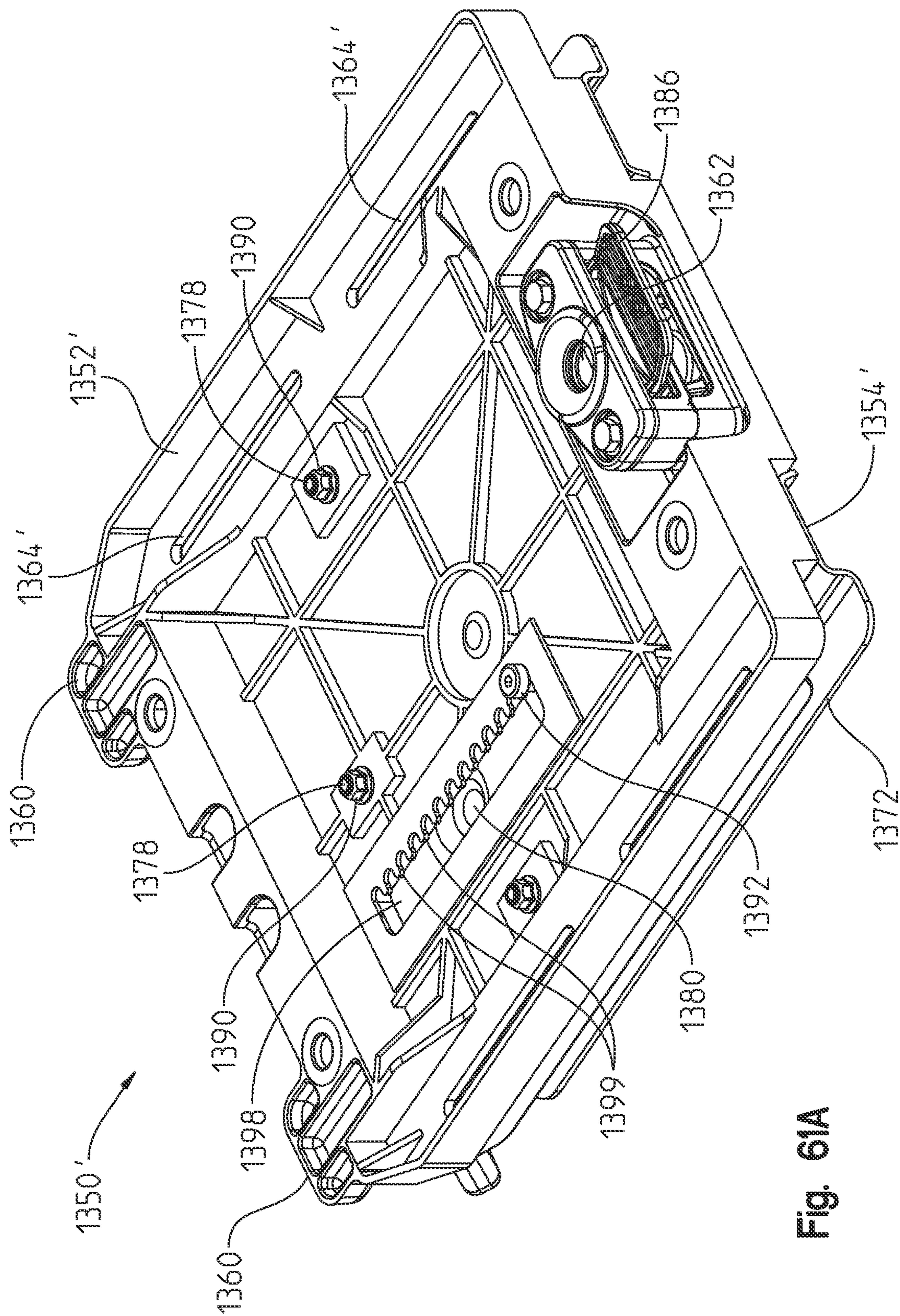
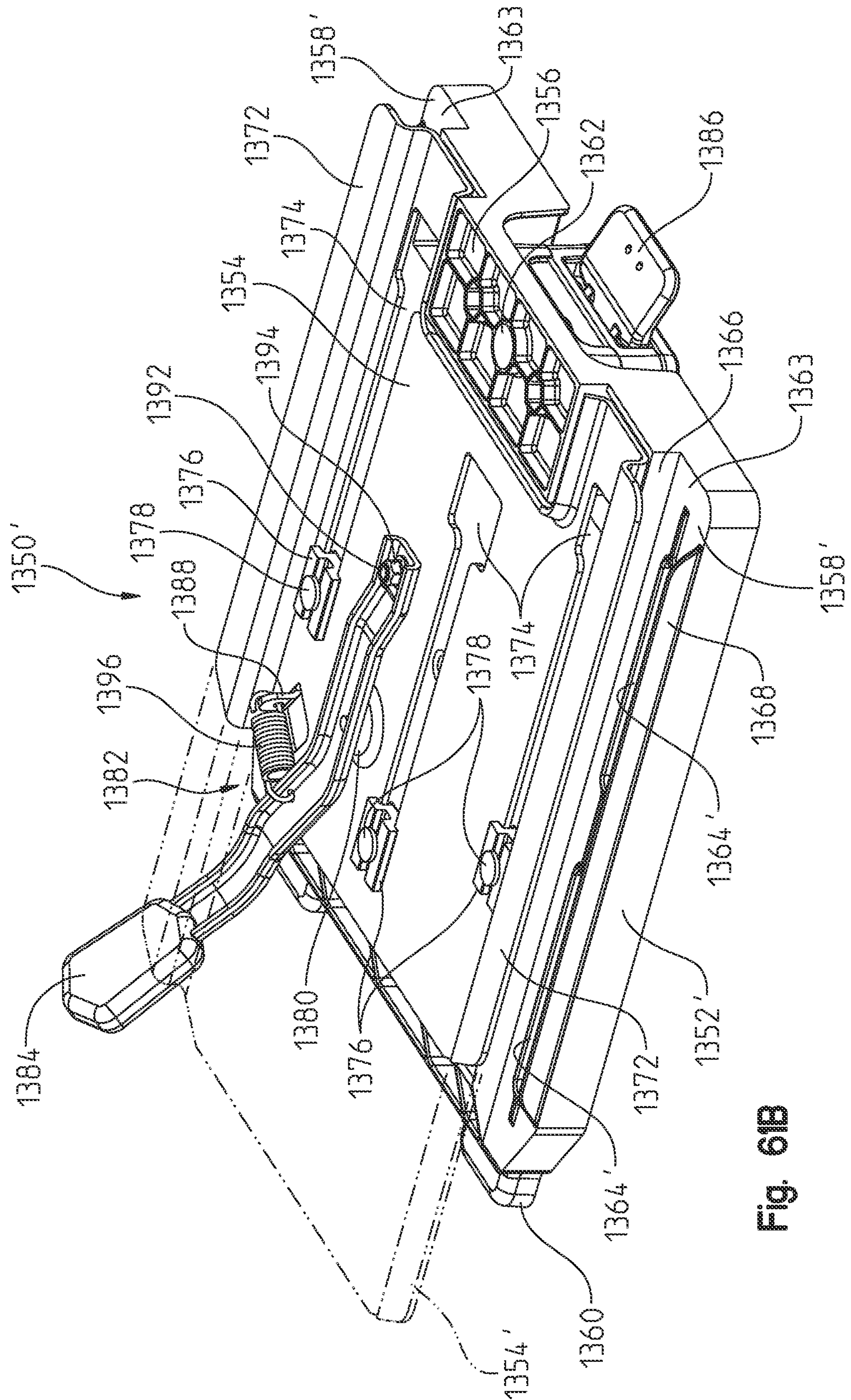


Fig. 61



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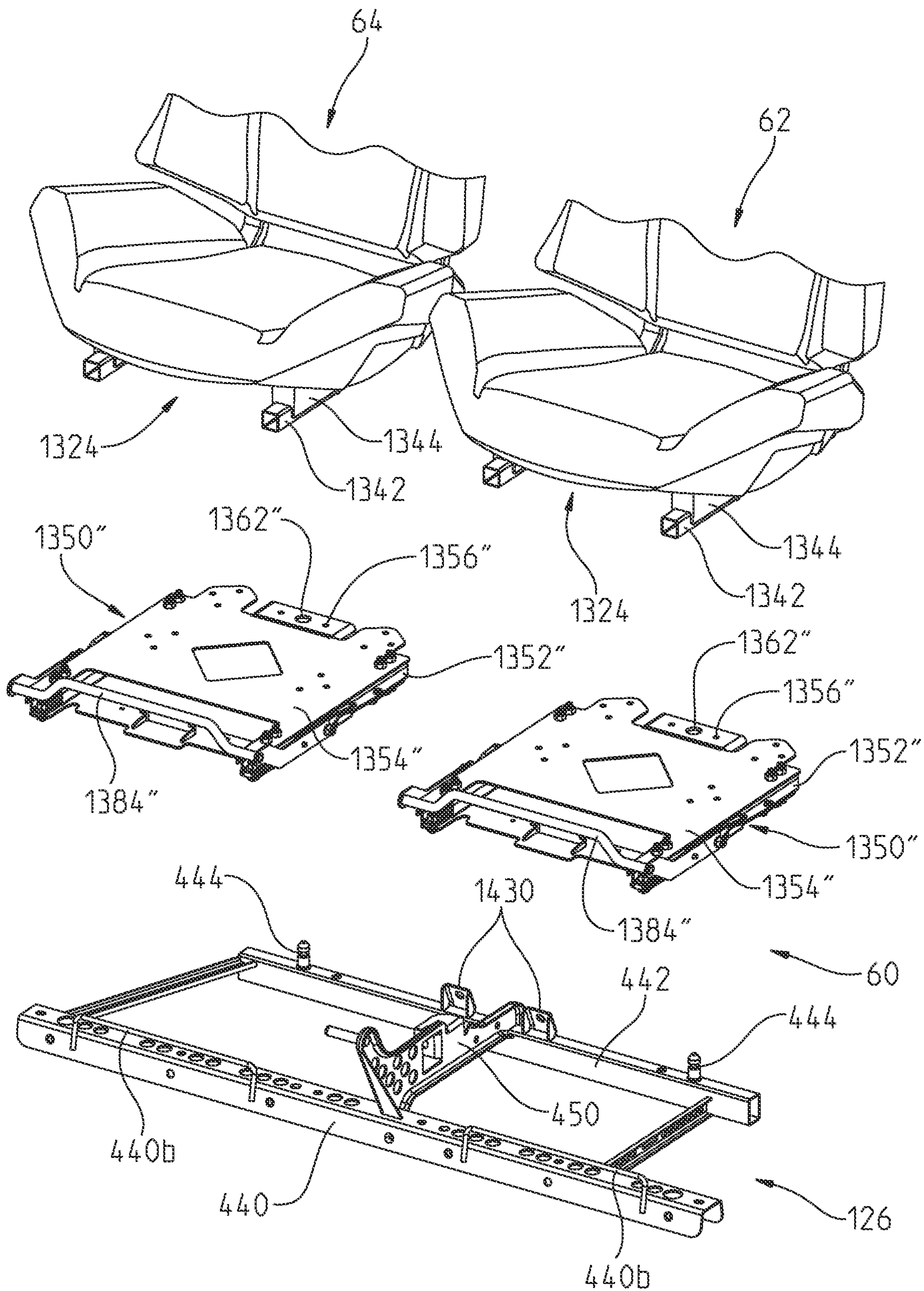


Fig. 62

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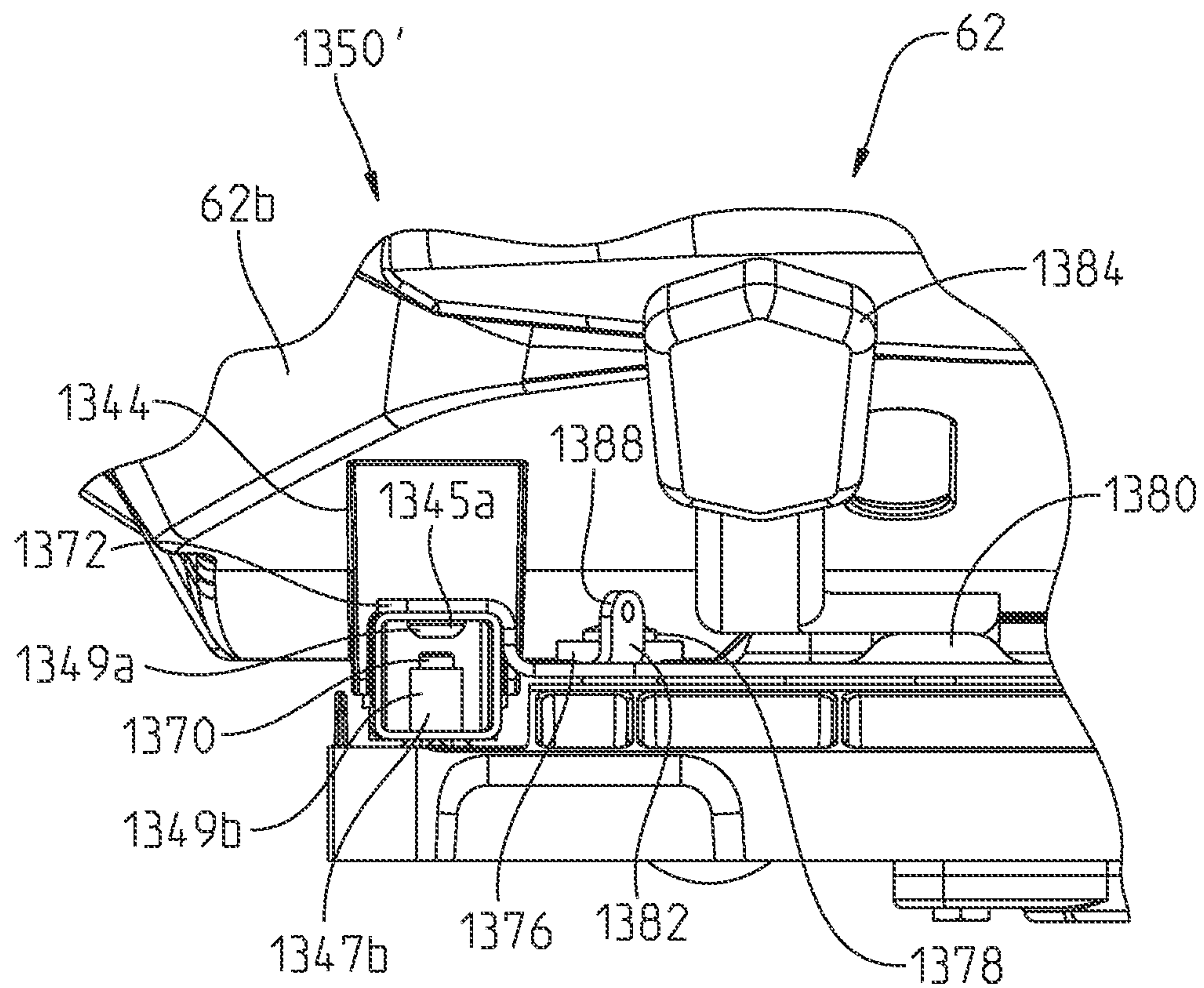


Fig. 61C

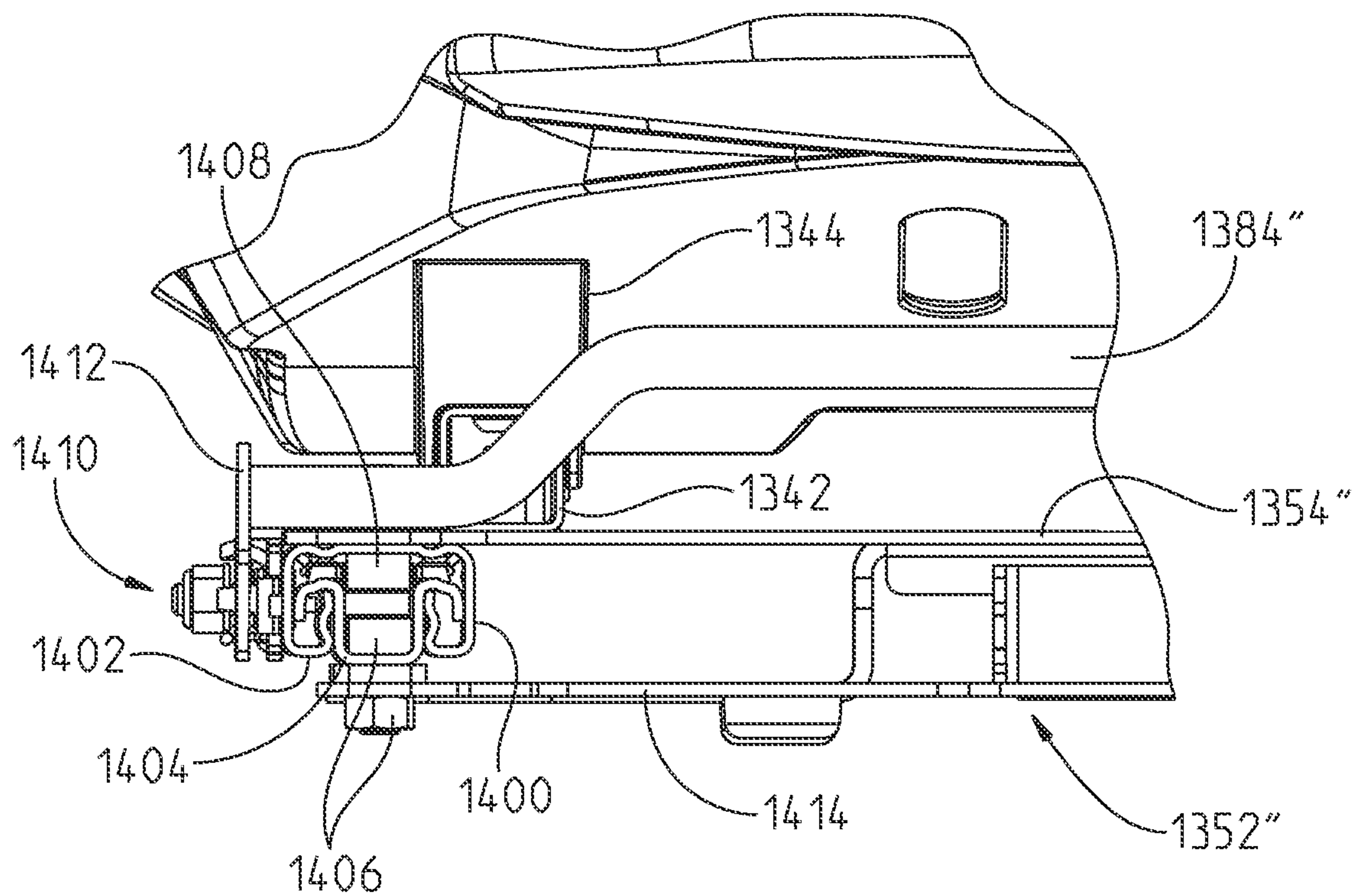


Fig. 62A

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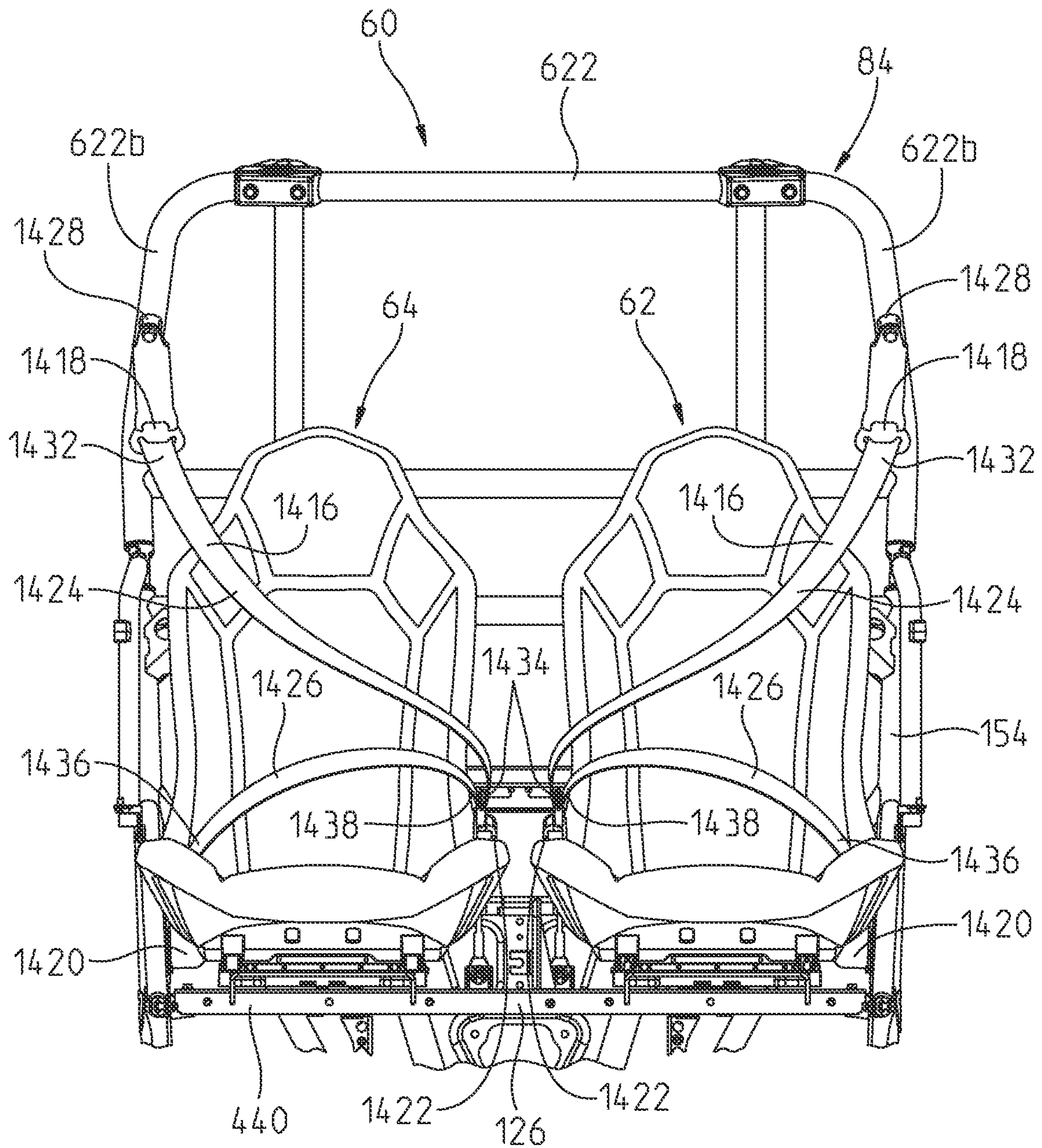


Fig. 63

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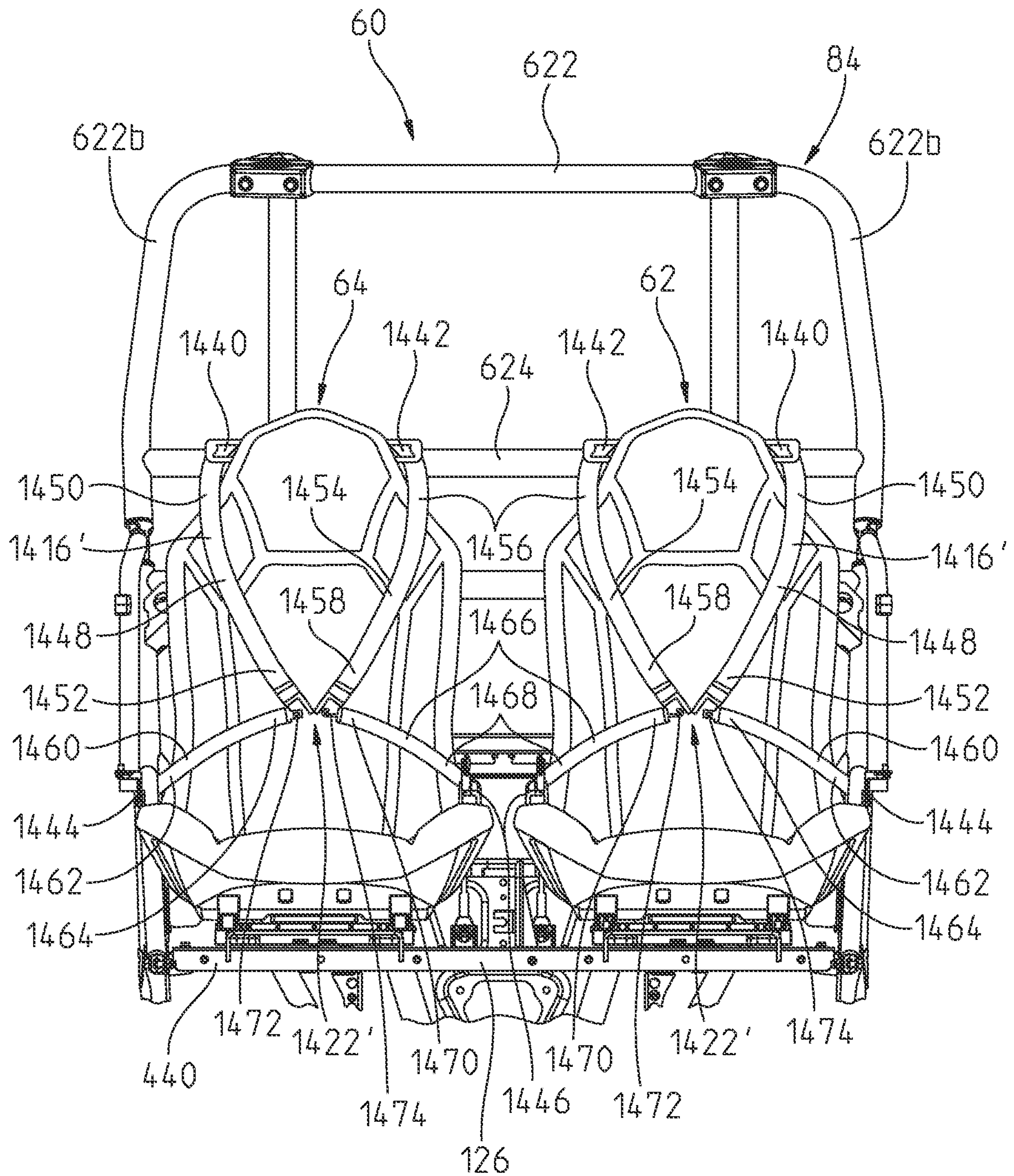


Fig. 64

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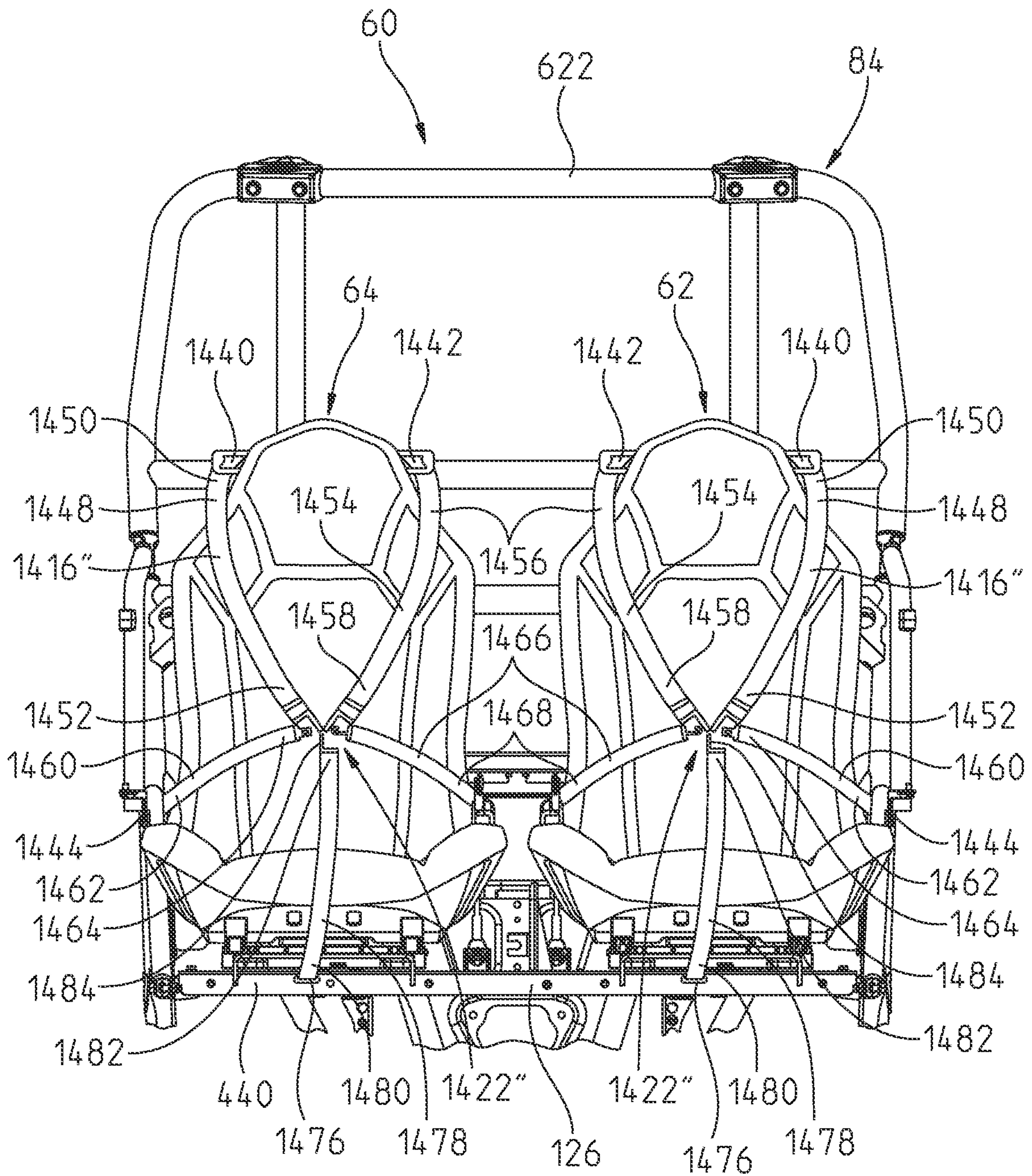


Fig. 65

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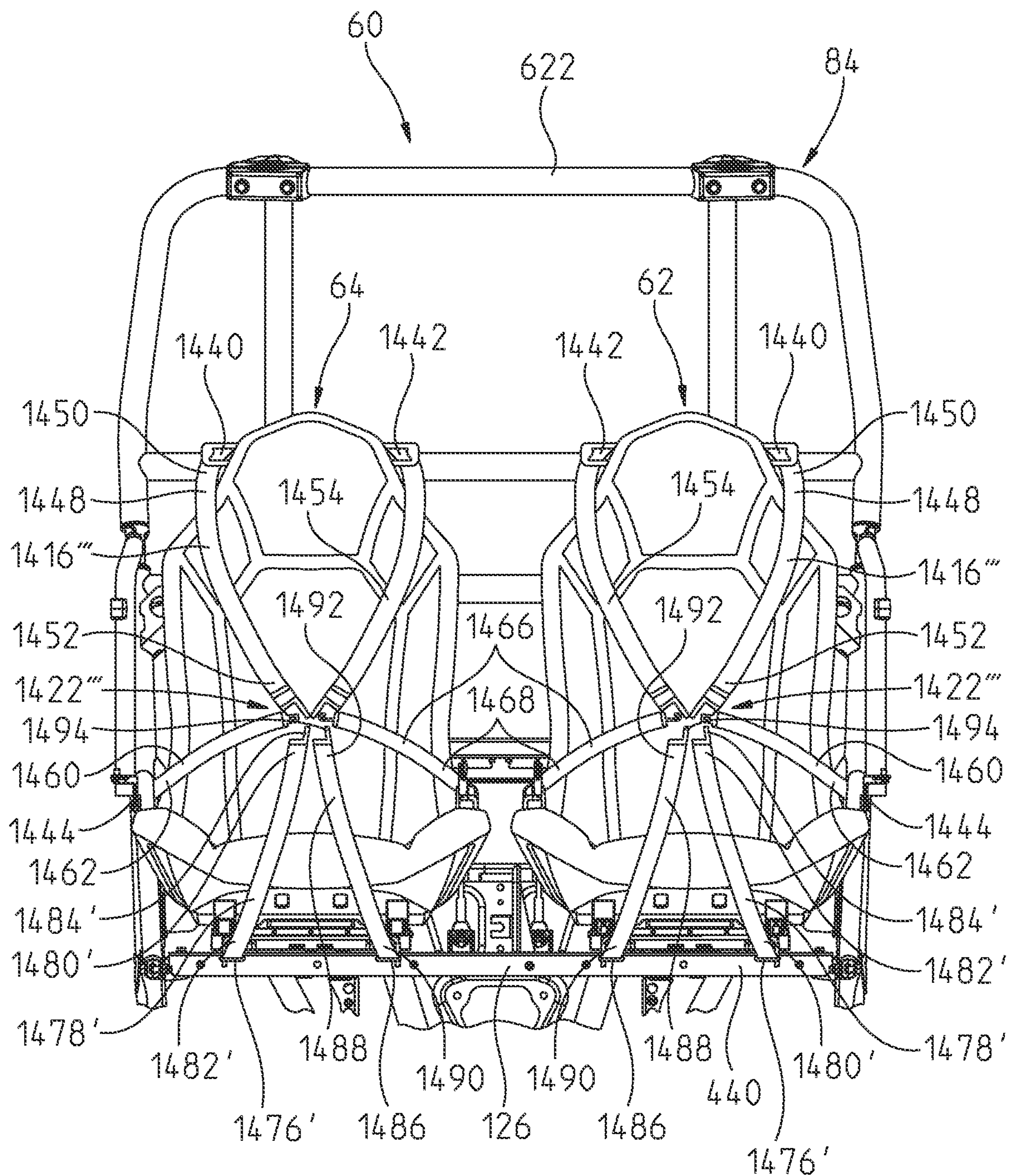


Fig. 66

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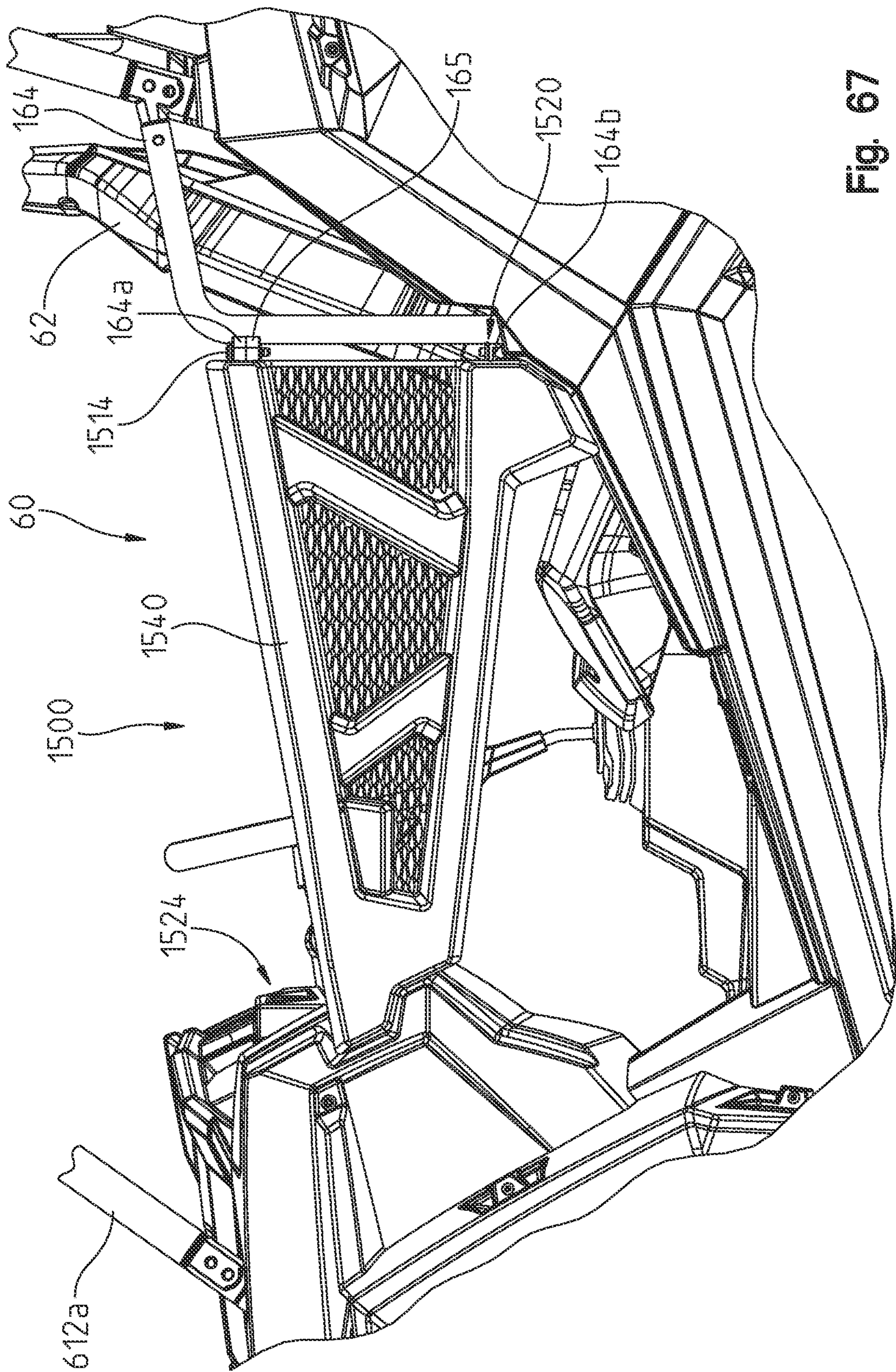


Fig. 67

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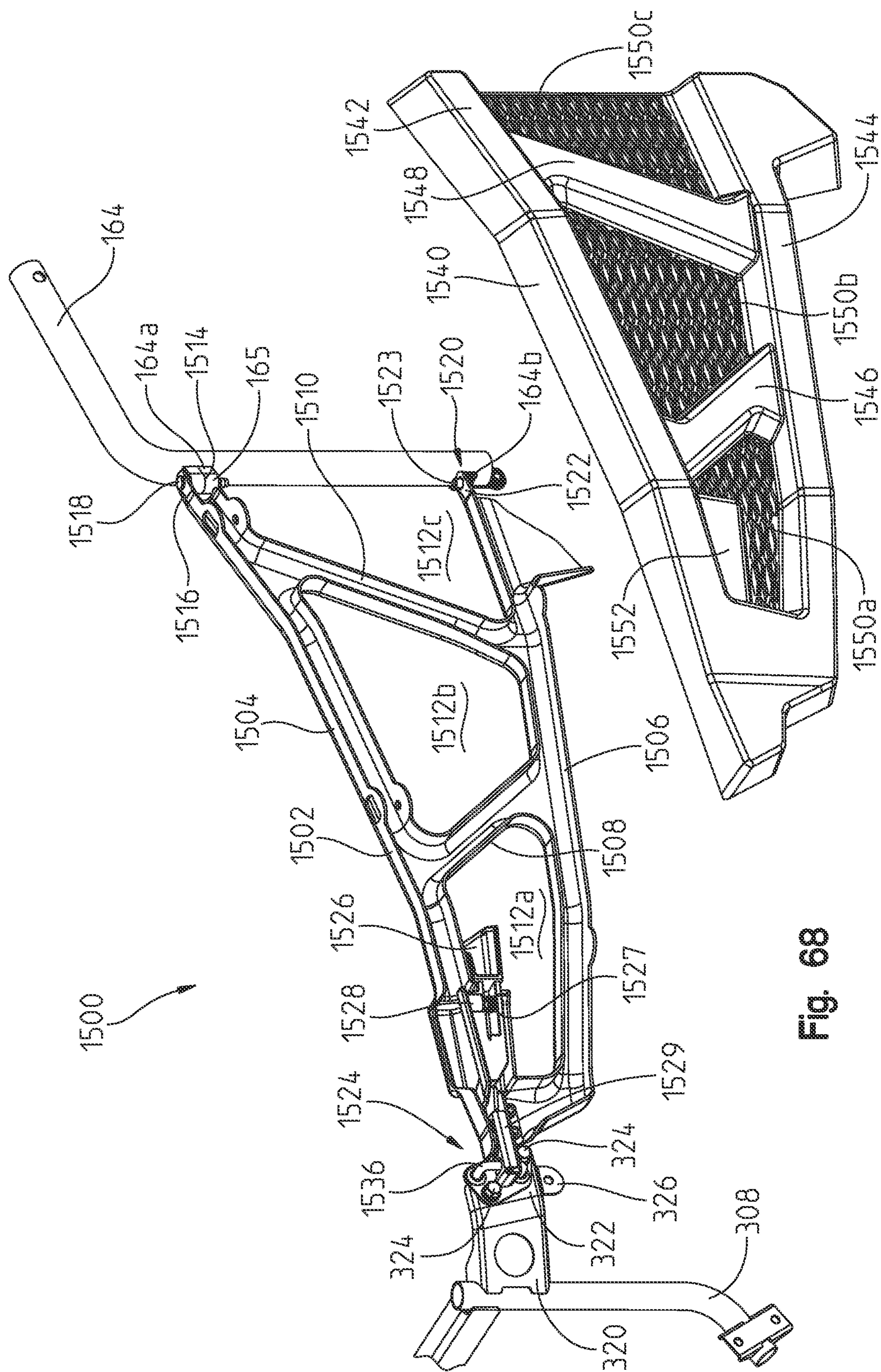
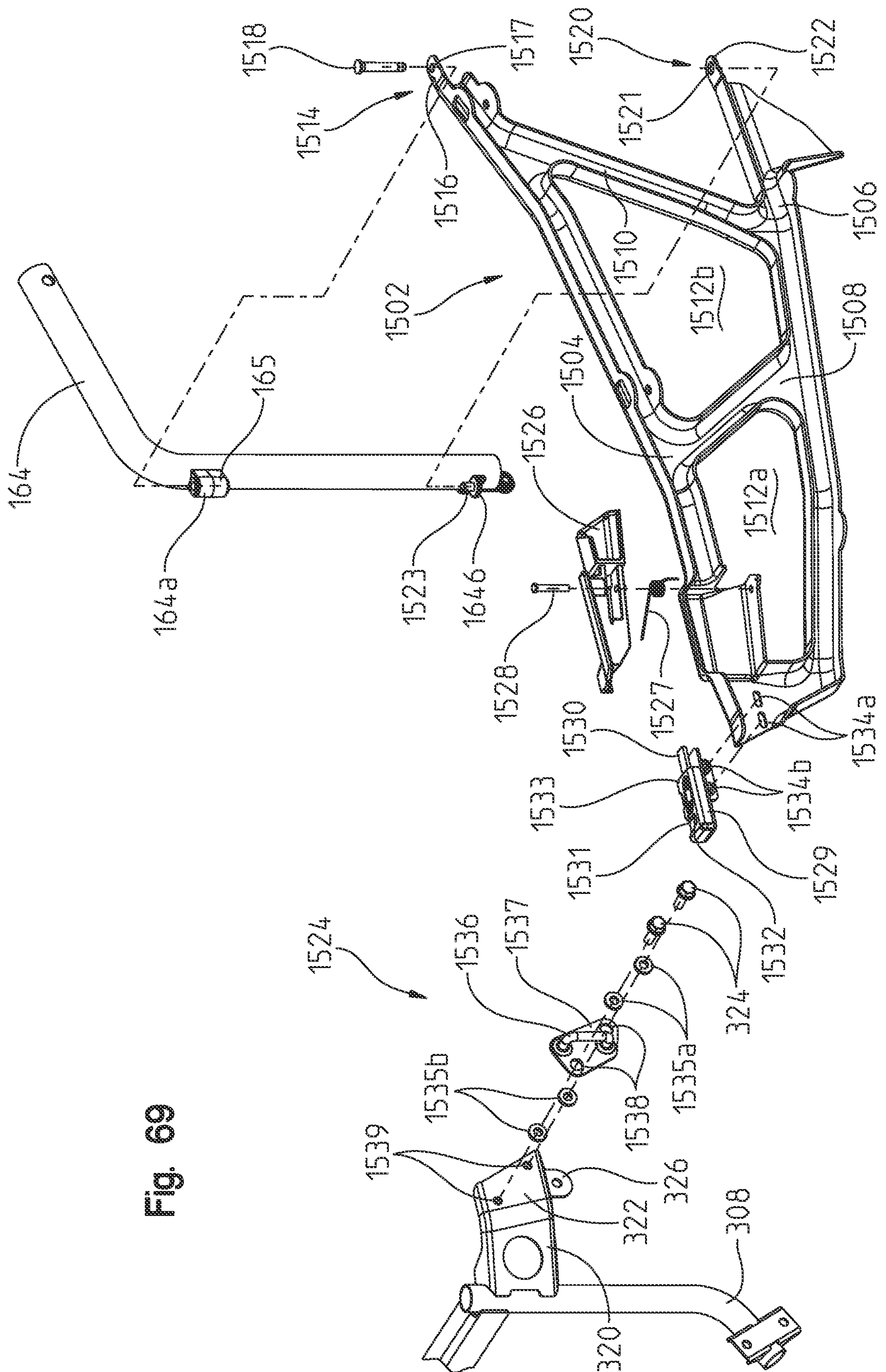
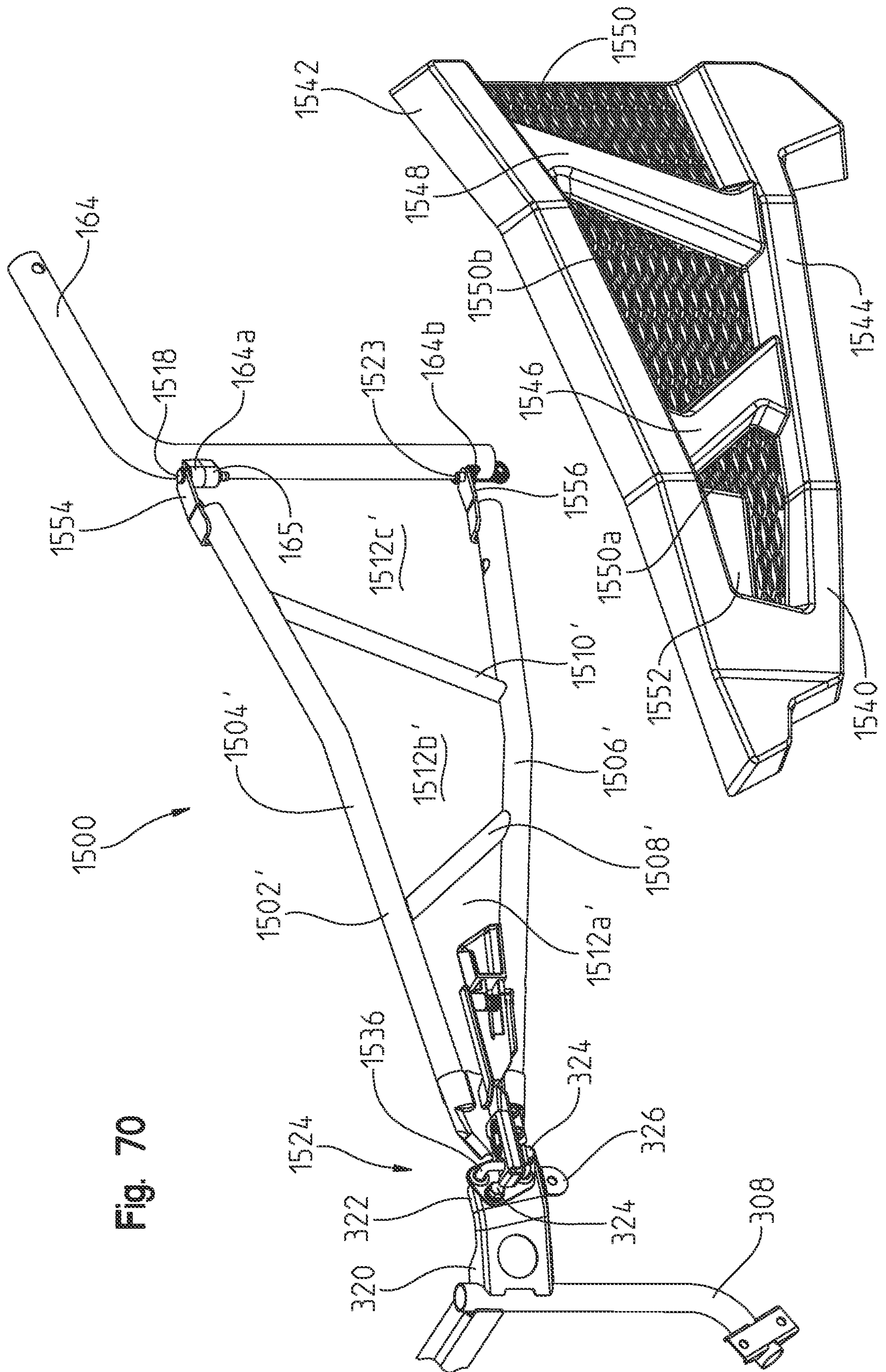


Fig. 68





A 2x2 grid of four 7-segment displays. The top-left display shows the digit '0', the top-right shows '7', the bottom-left shows '0', and the bottom-right shows '9'. Together, they form the number 0709.

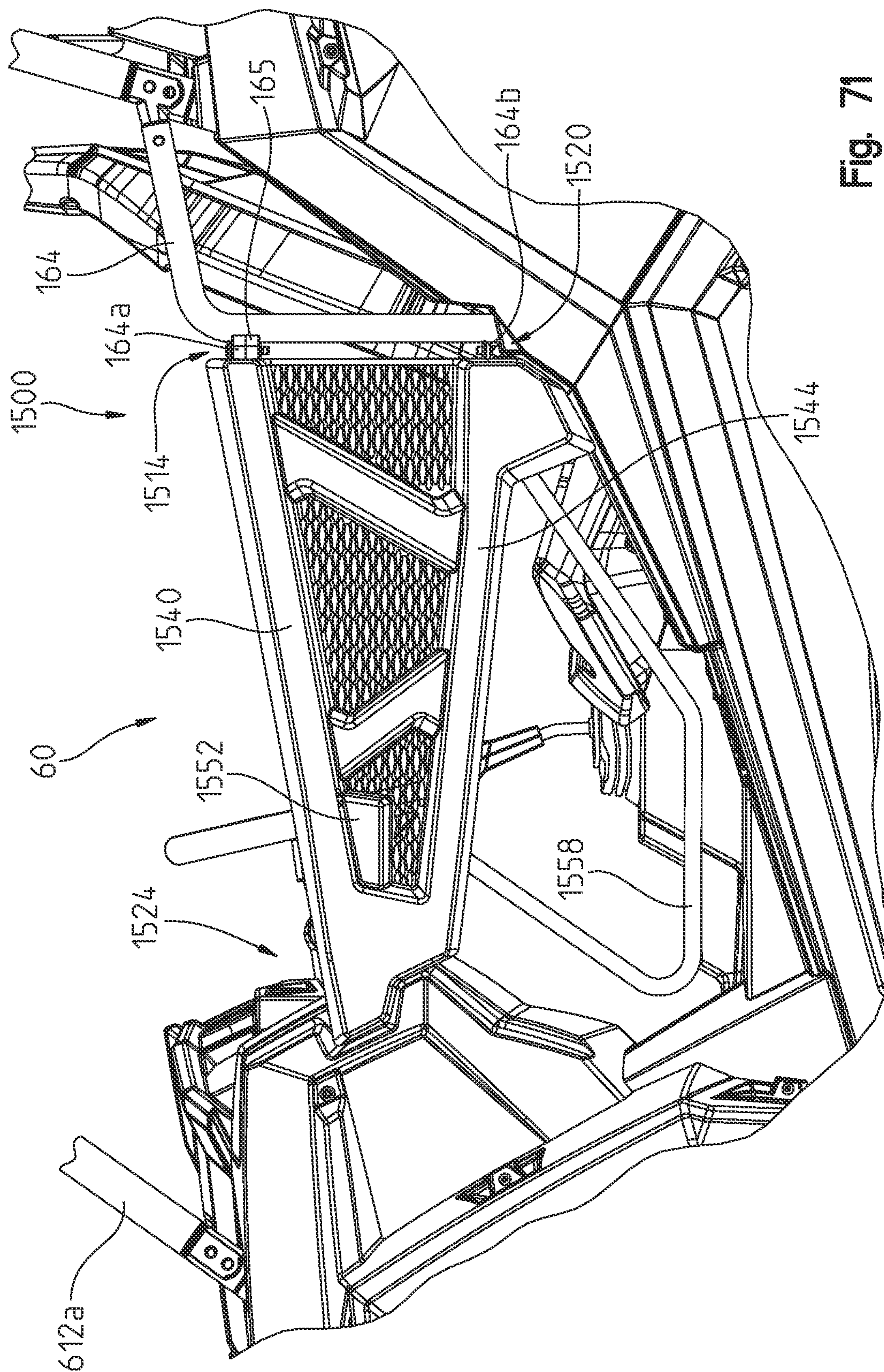


Fig. 71

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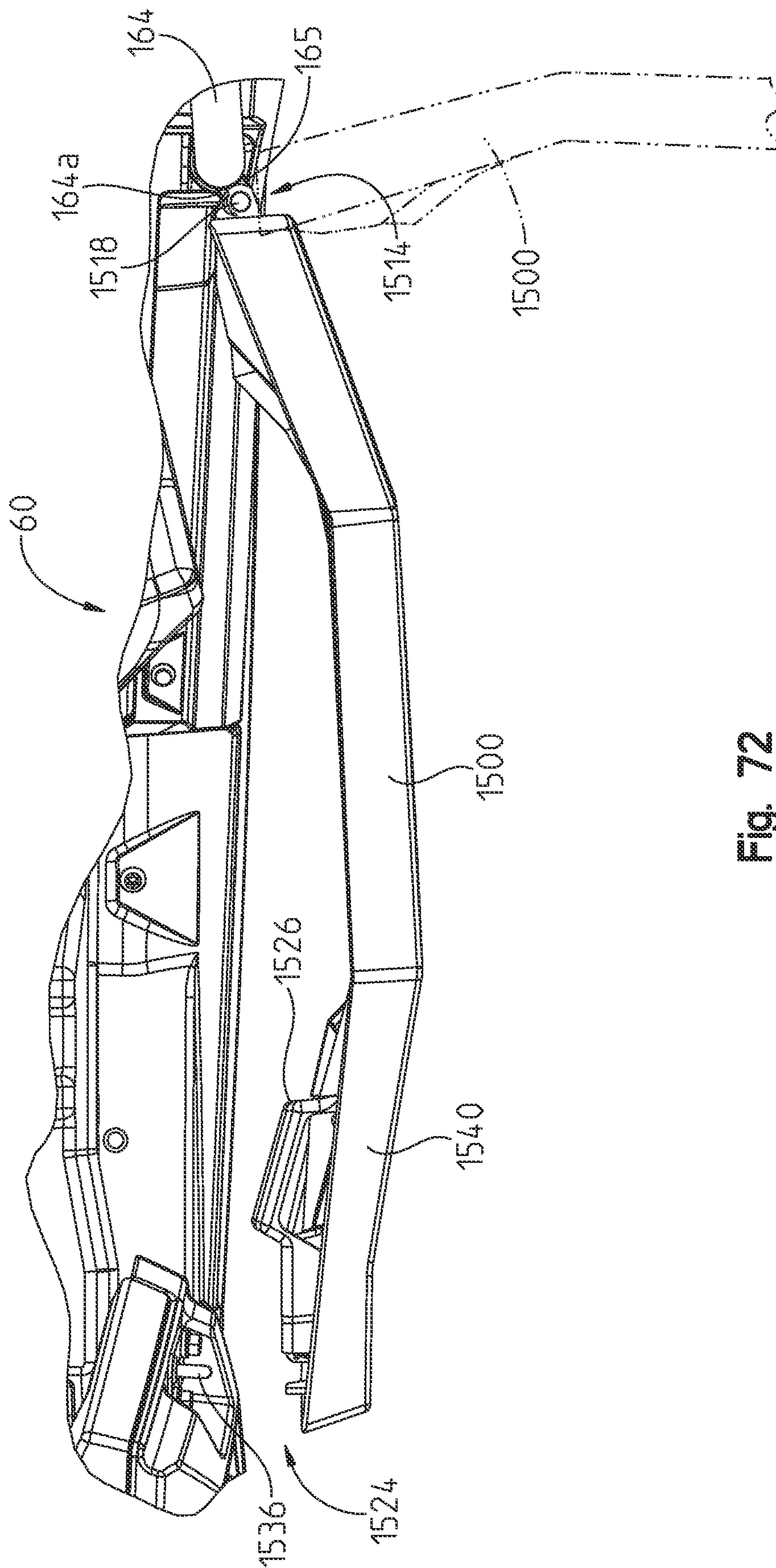
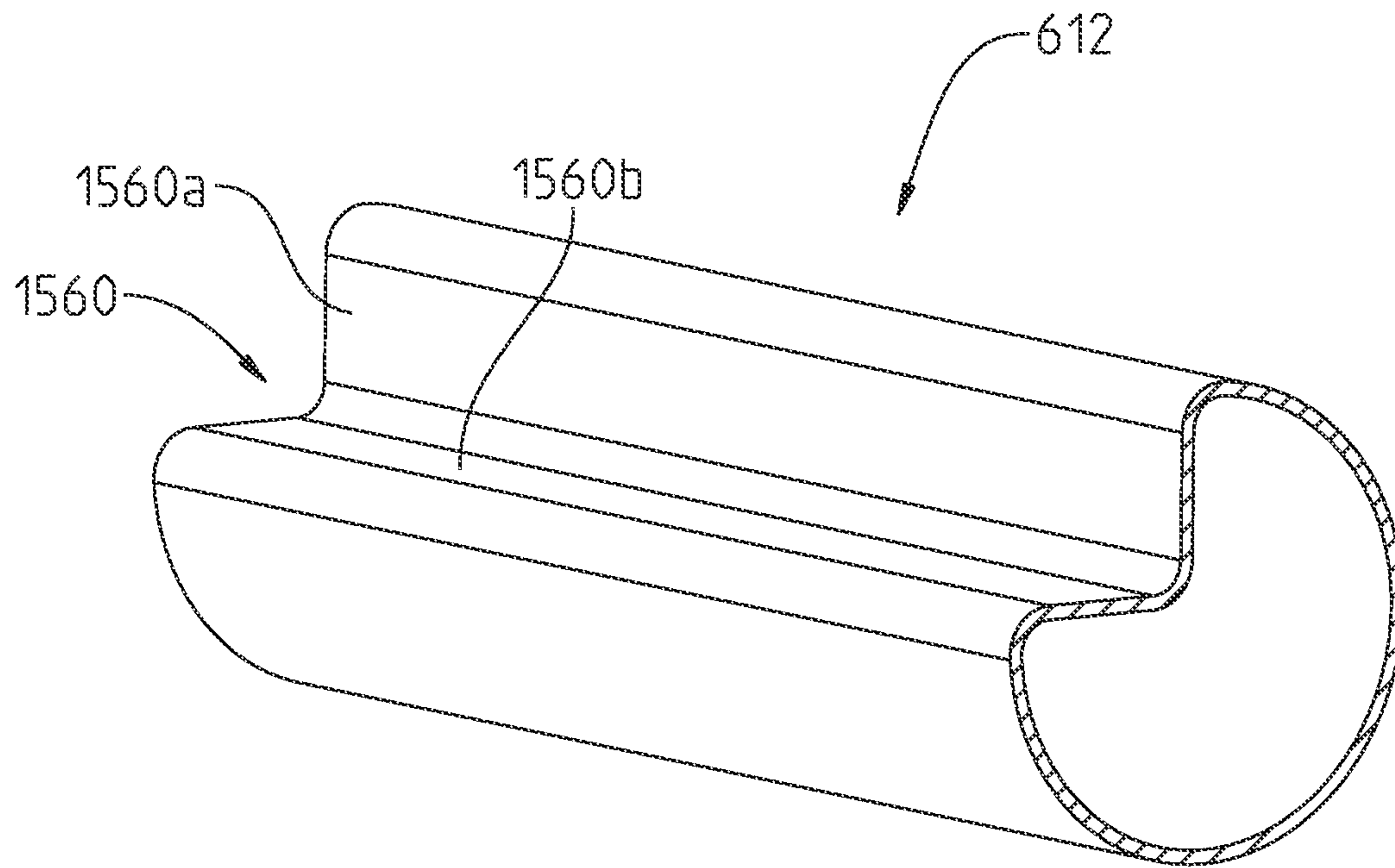


Fig. 72

**Fig. 73**

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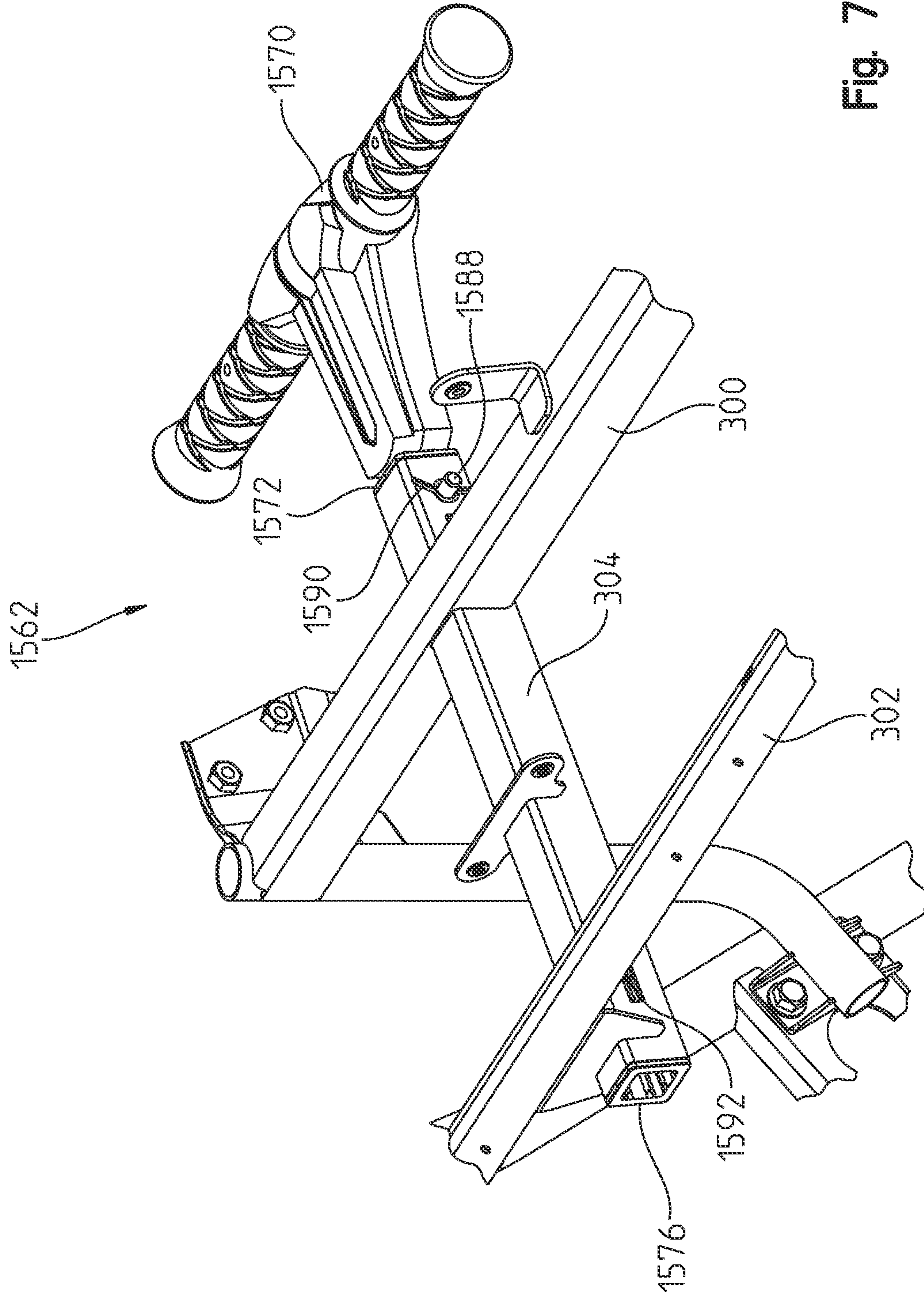


Fig. 74

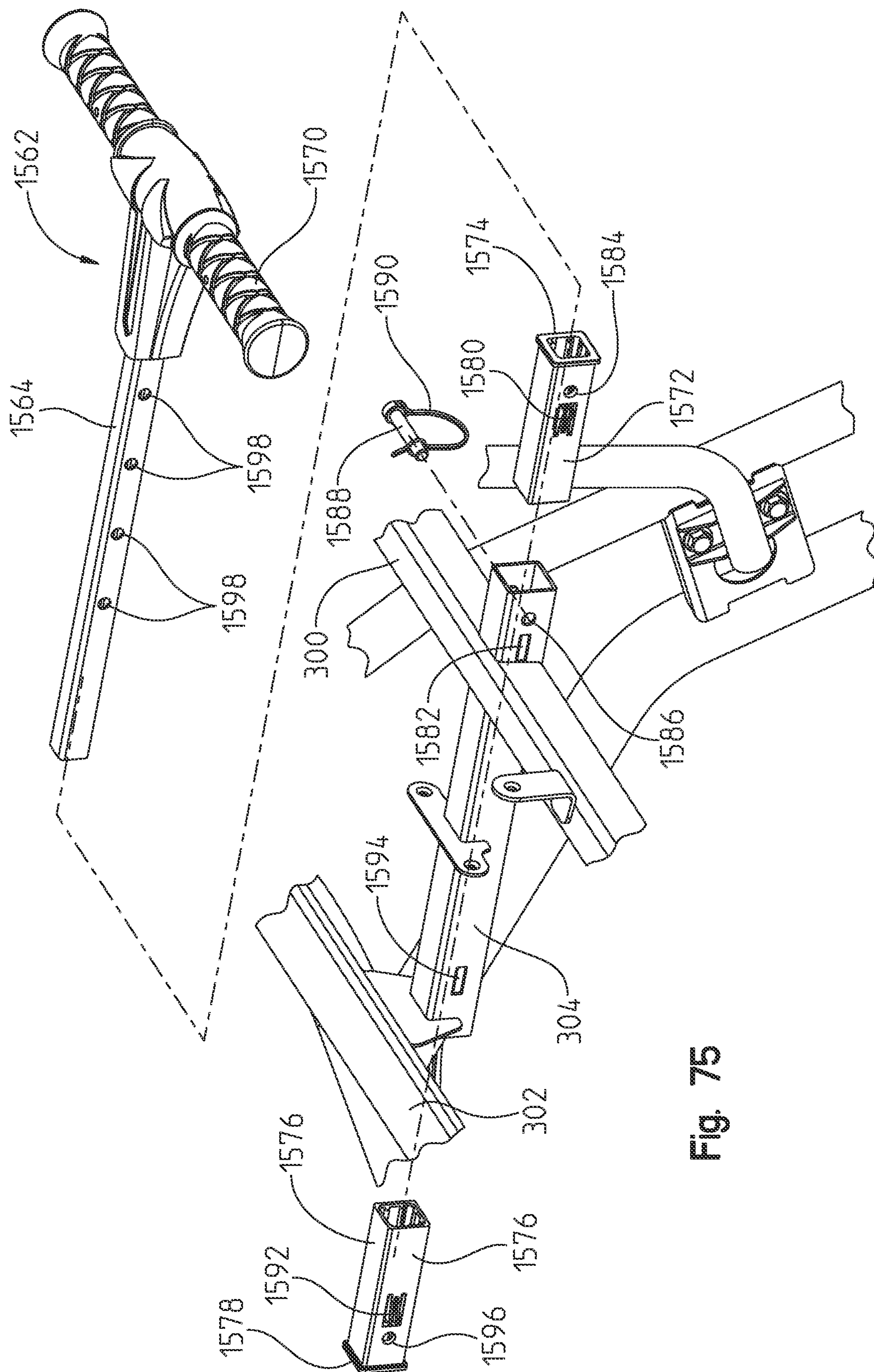


Fig. 75

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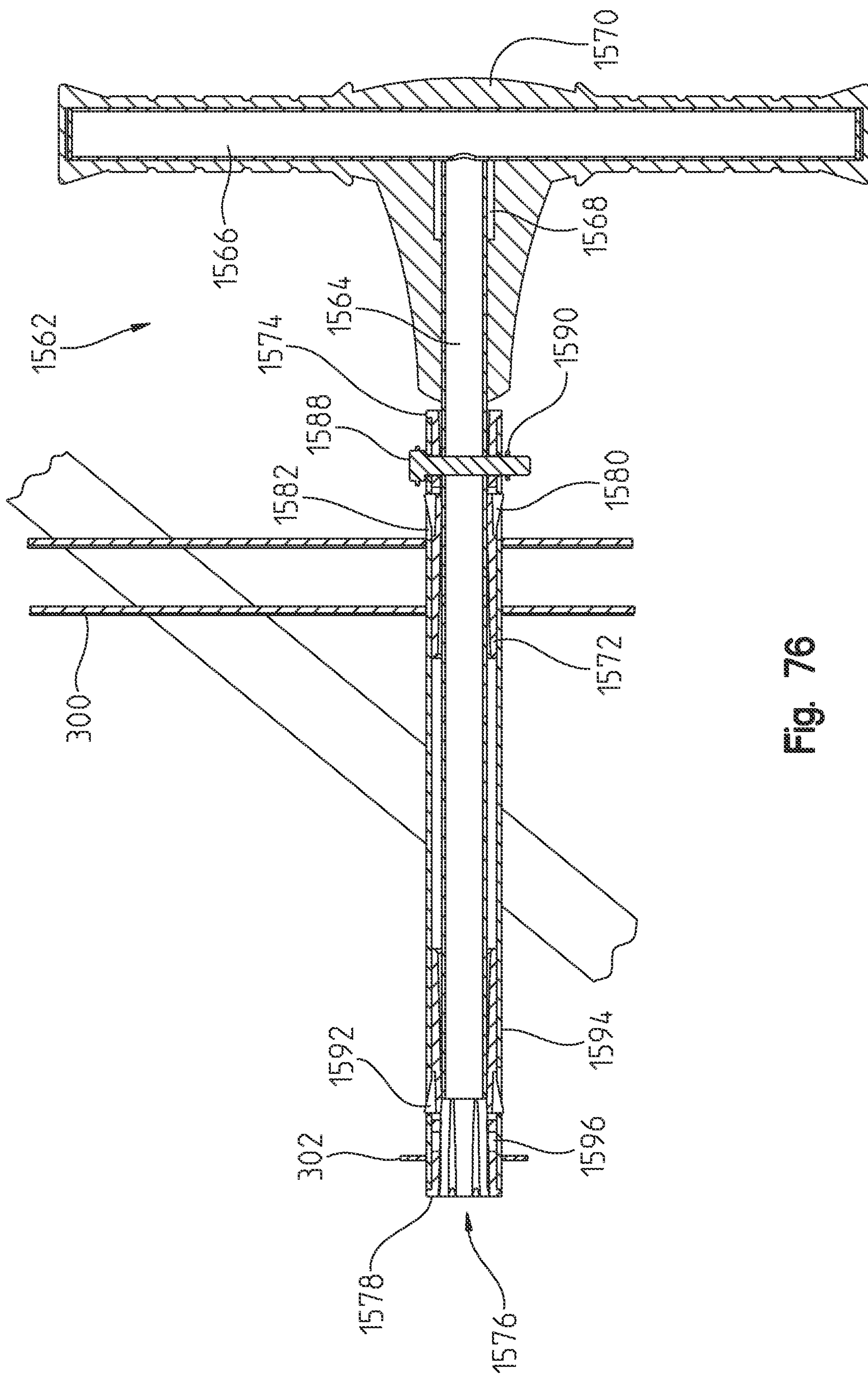


Fig. 76

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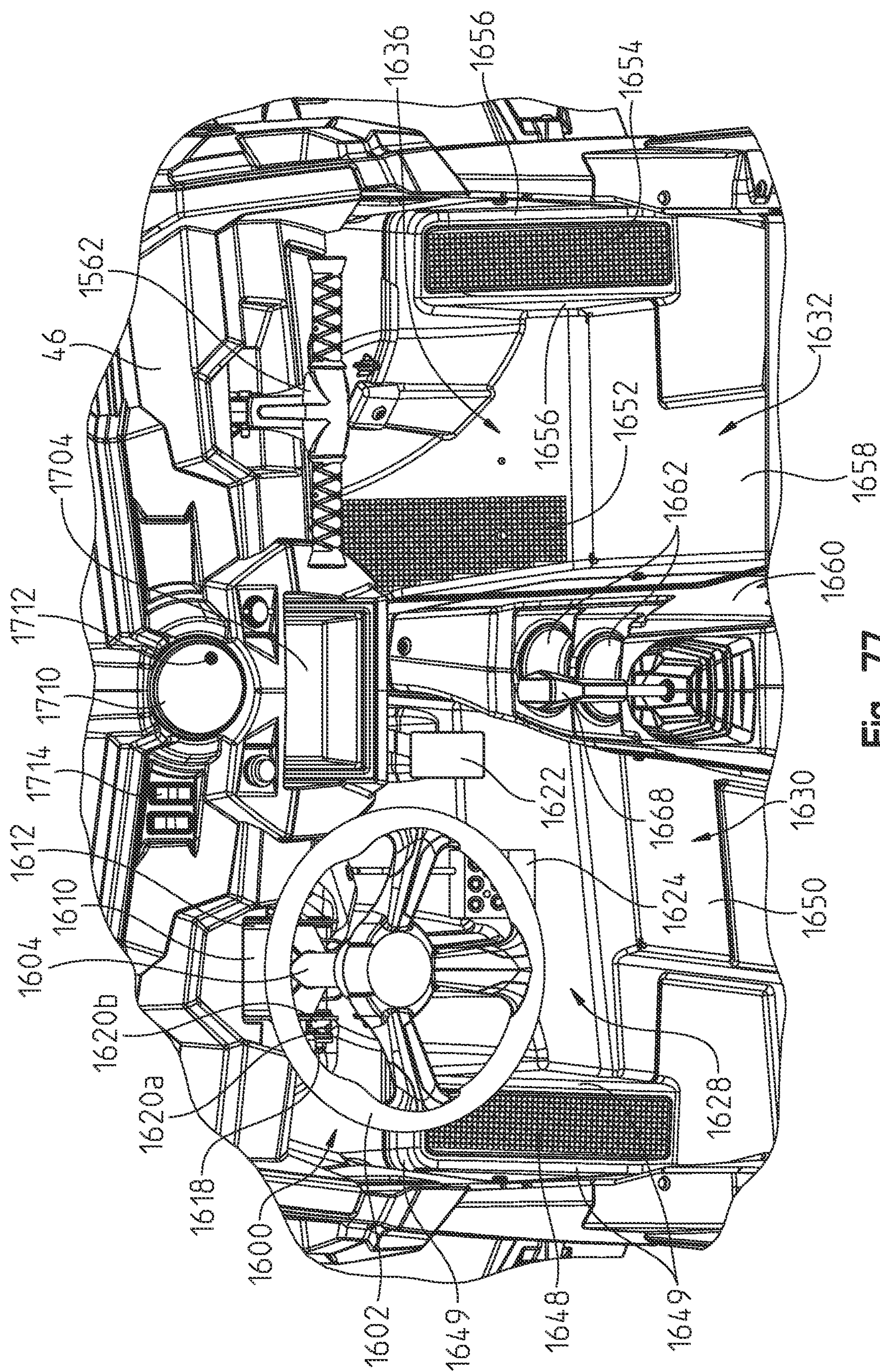


Fig. 77

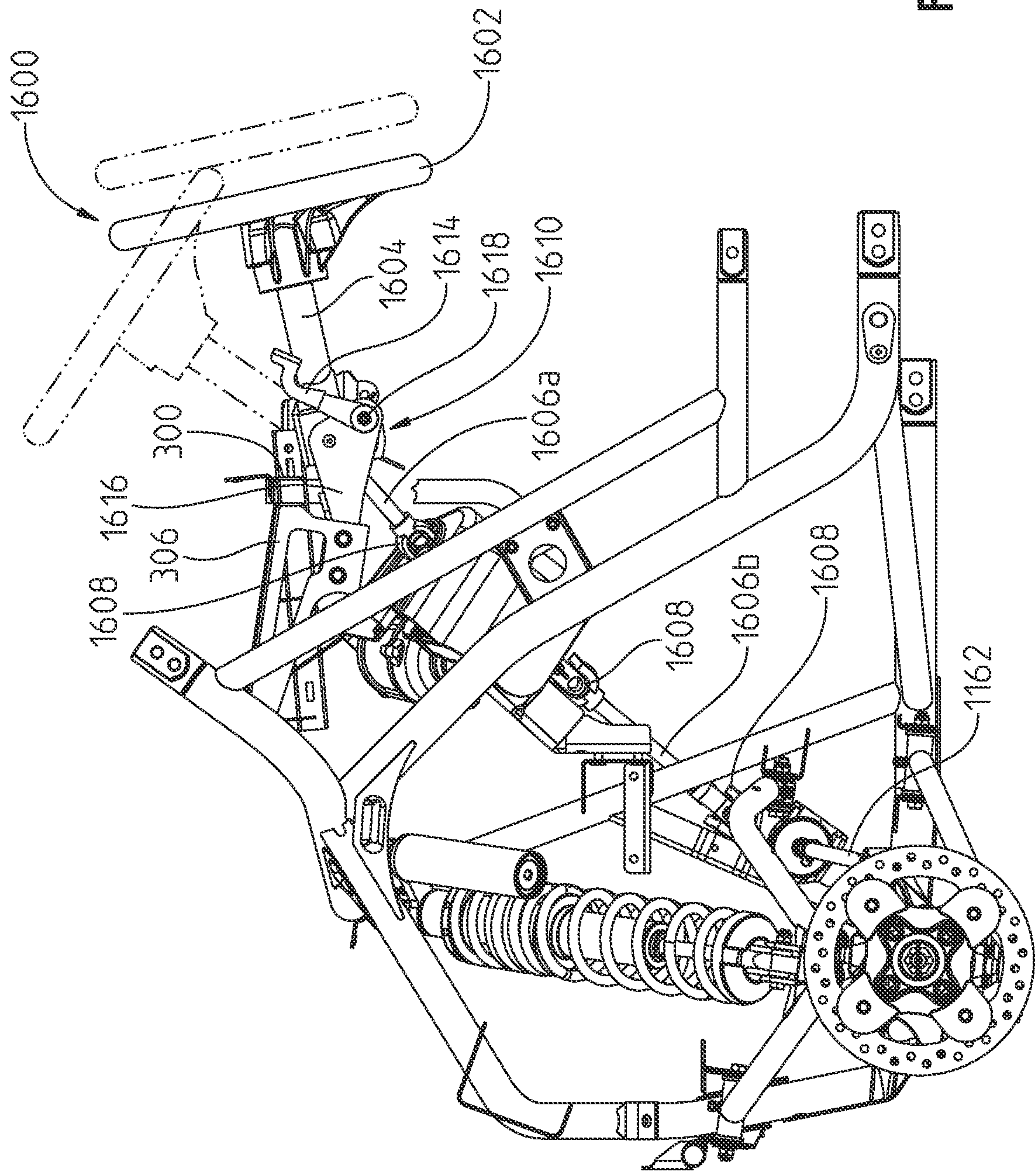


Fig. 78

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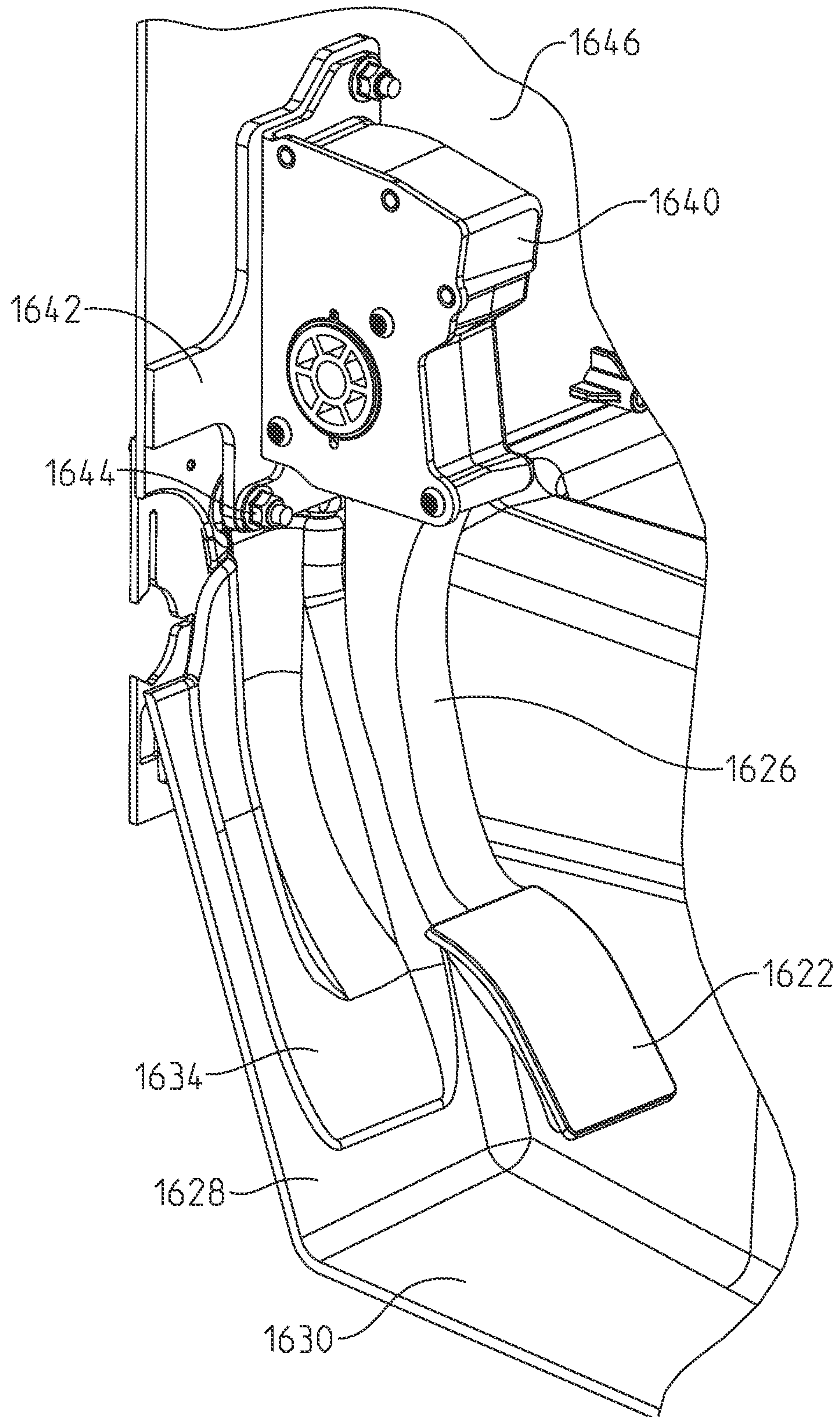


Fig. 79

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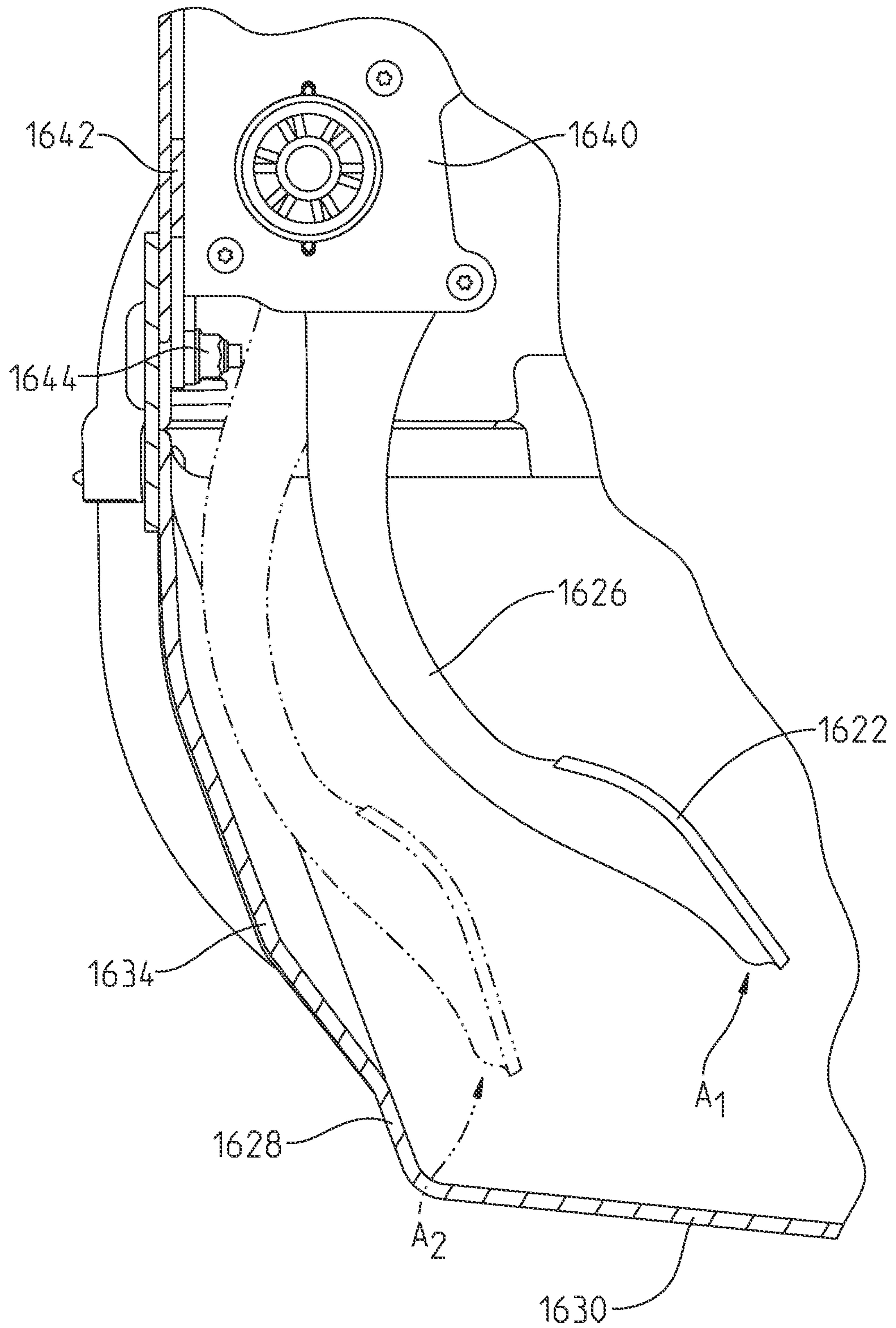


Fig. 80

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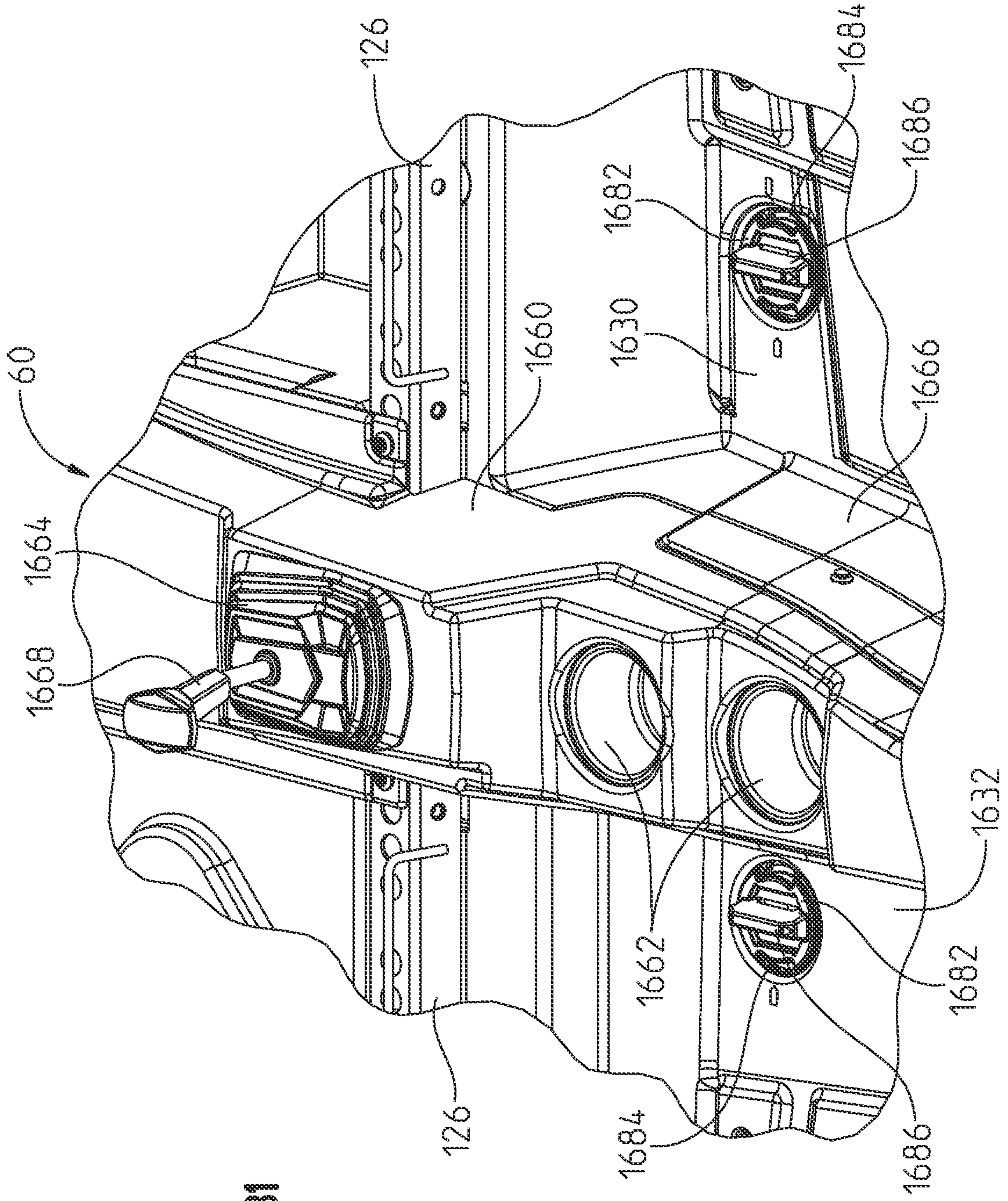


Fig. 81

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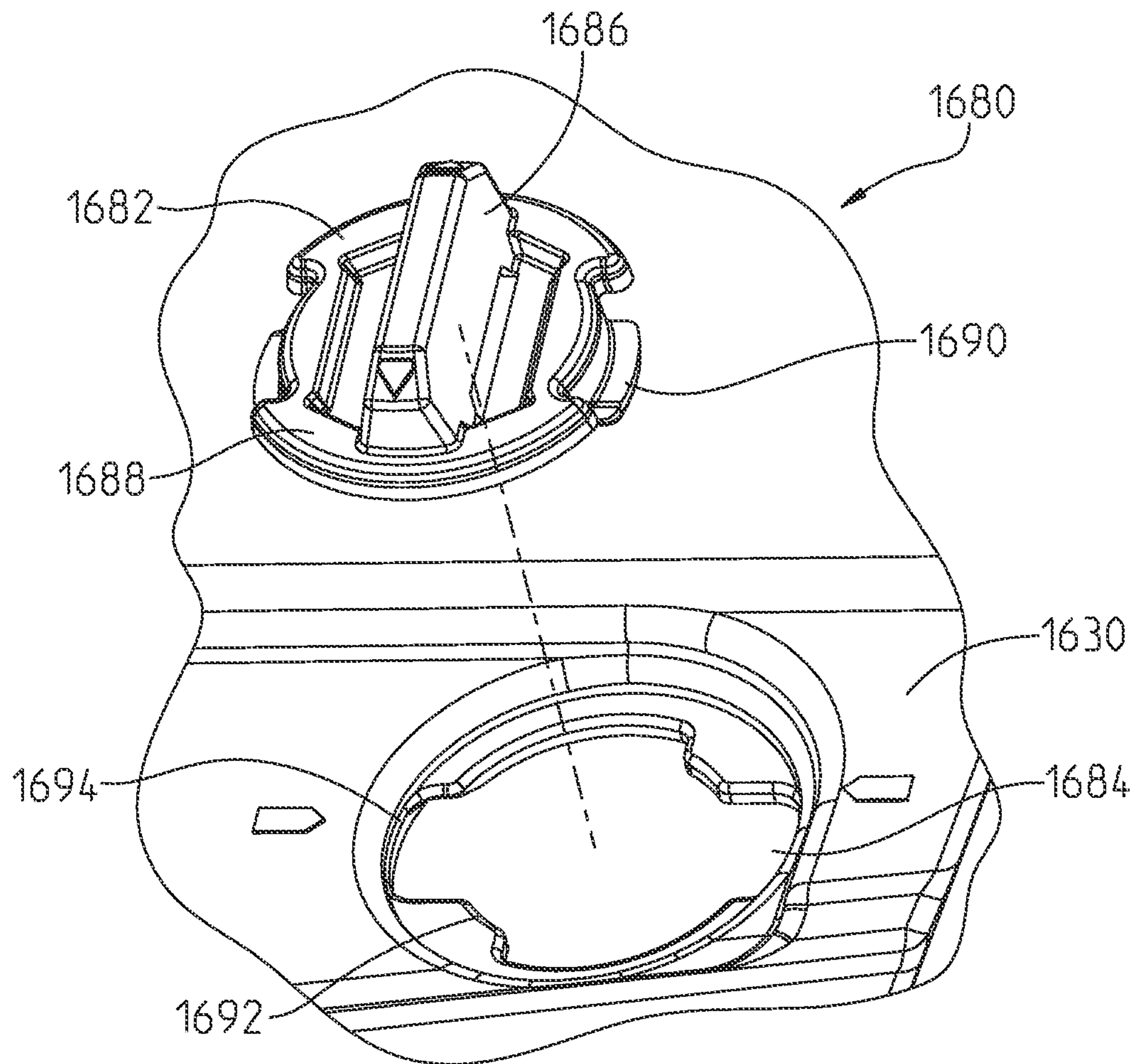
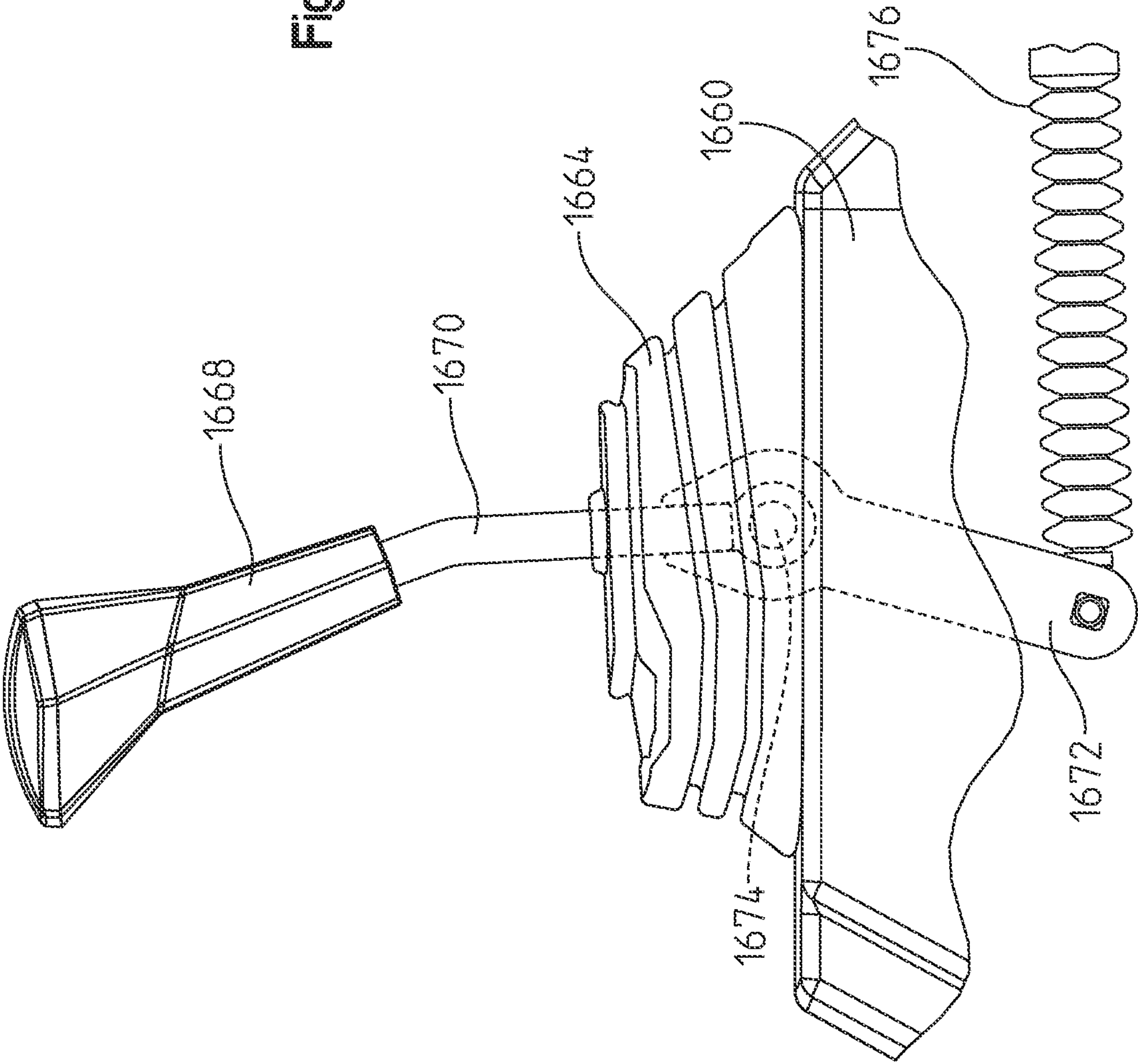


Fig. 82

Fig. 83



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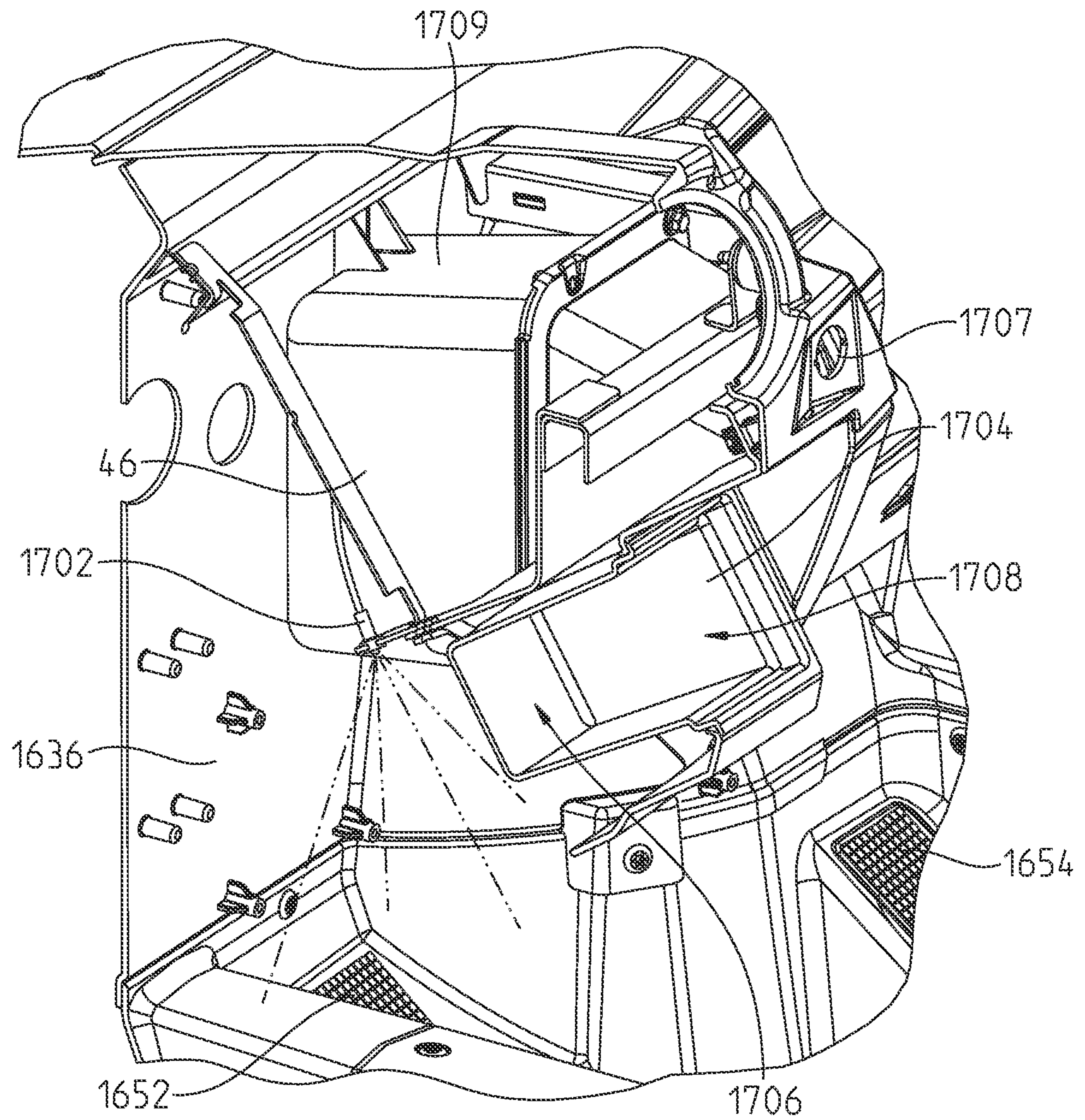


Fig. 84

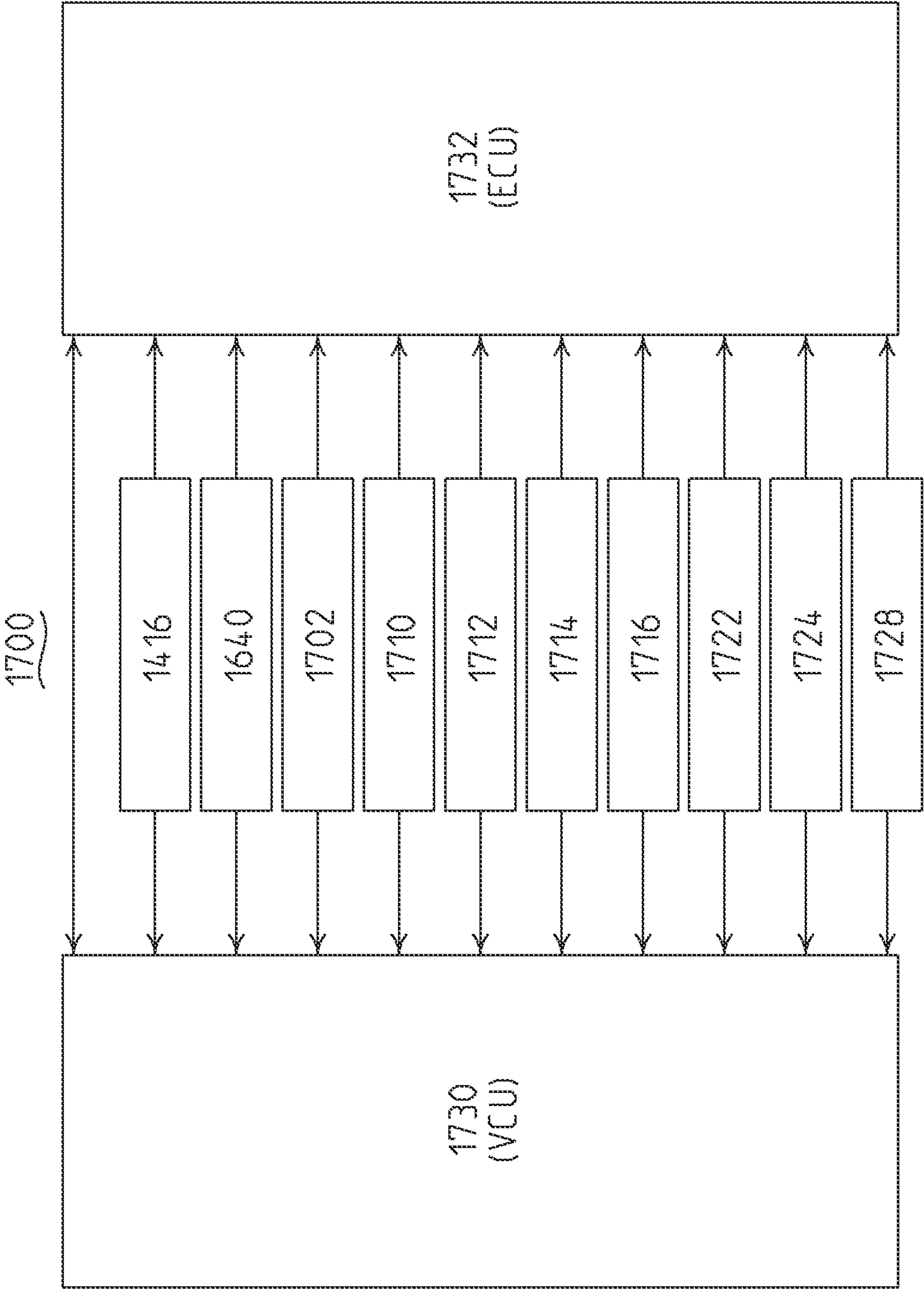


Fig. 85

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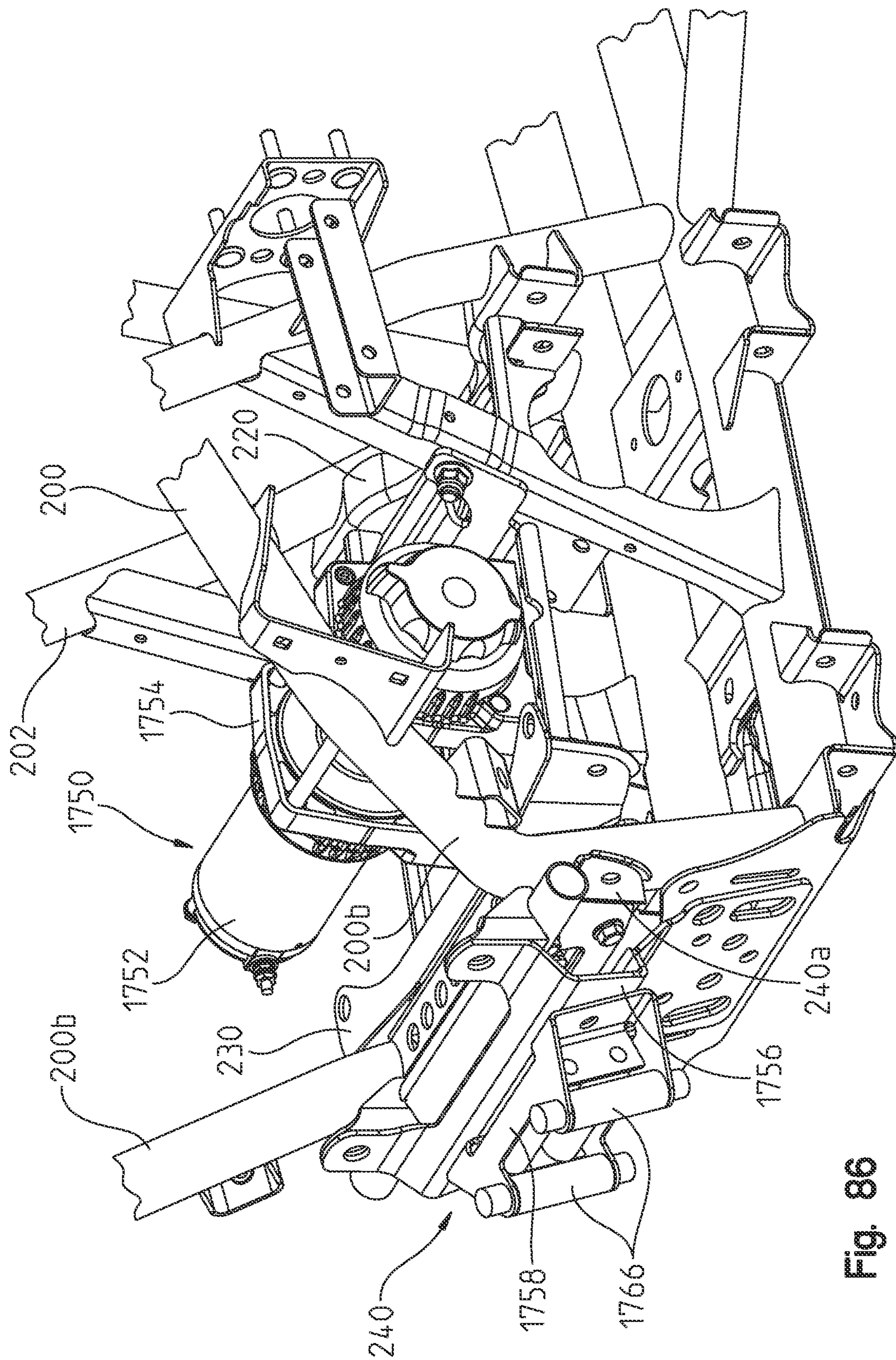


Fig. 86

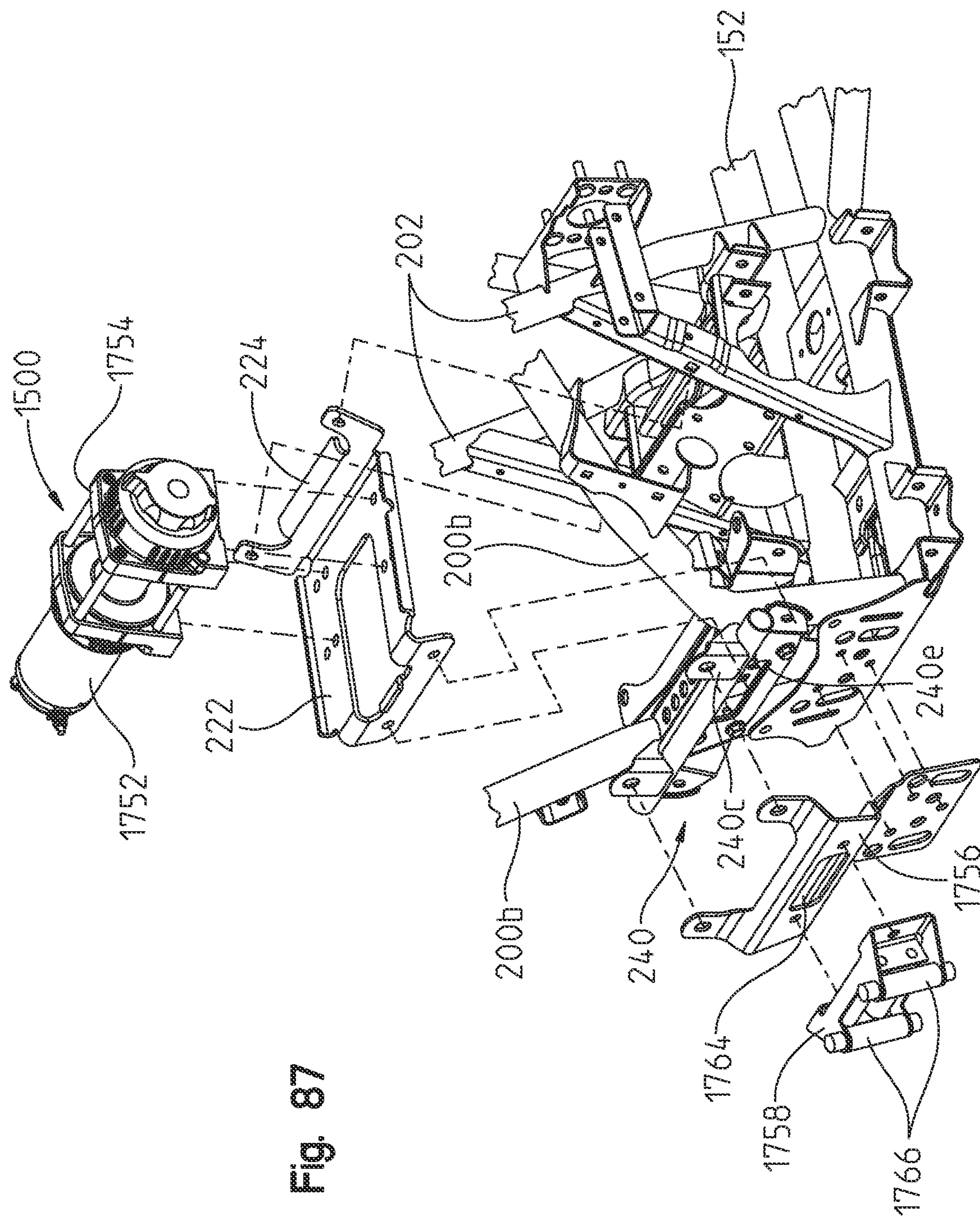


Fig. 87

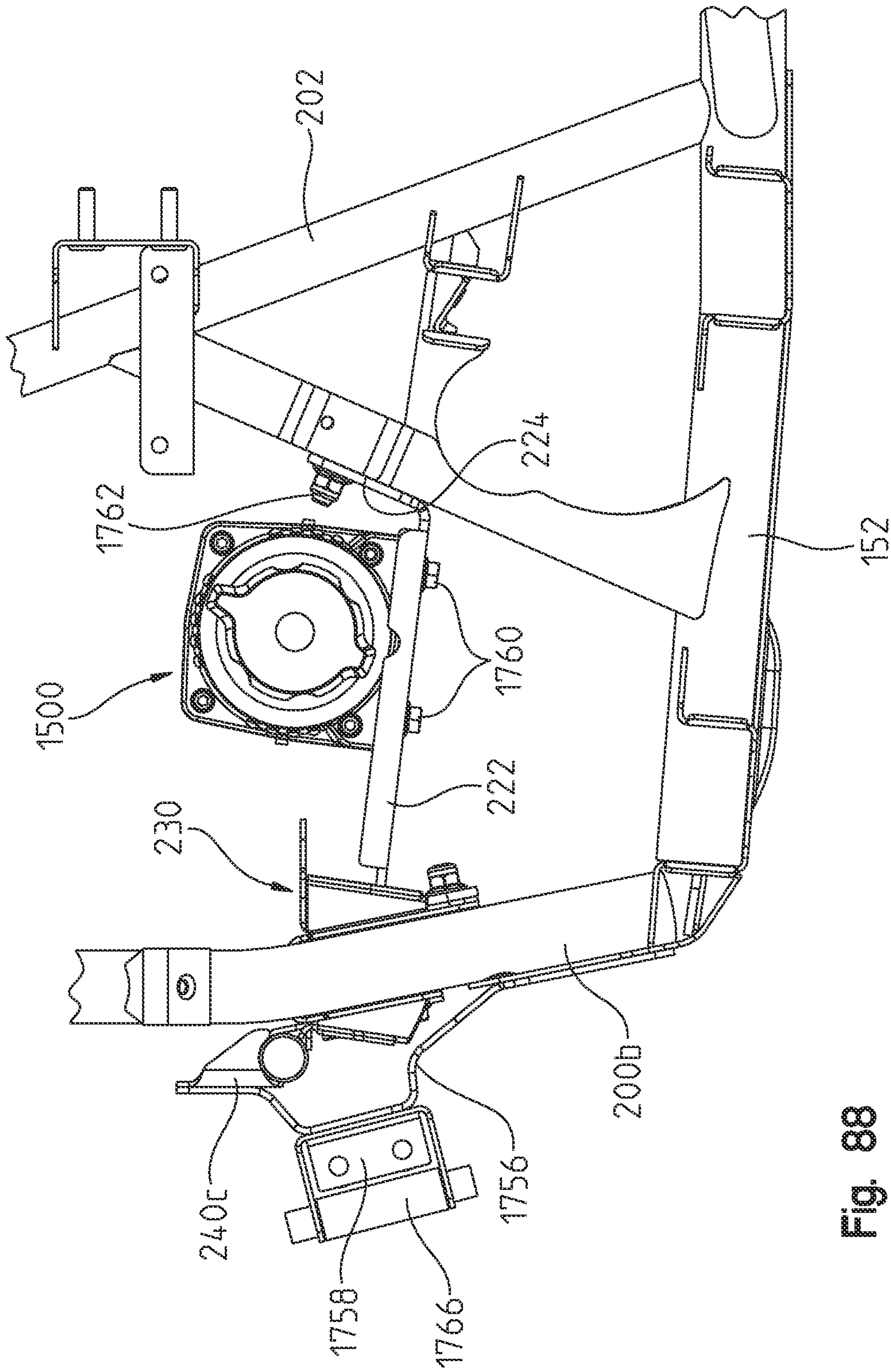


Fig. 88

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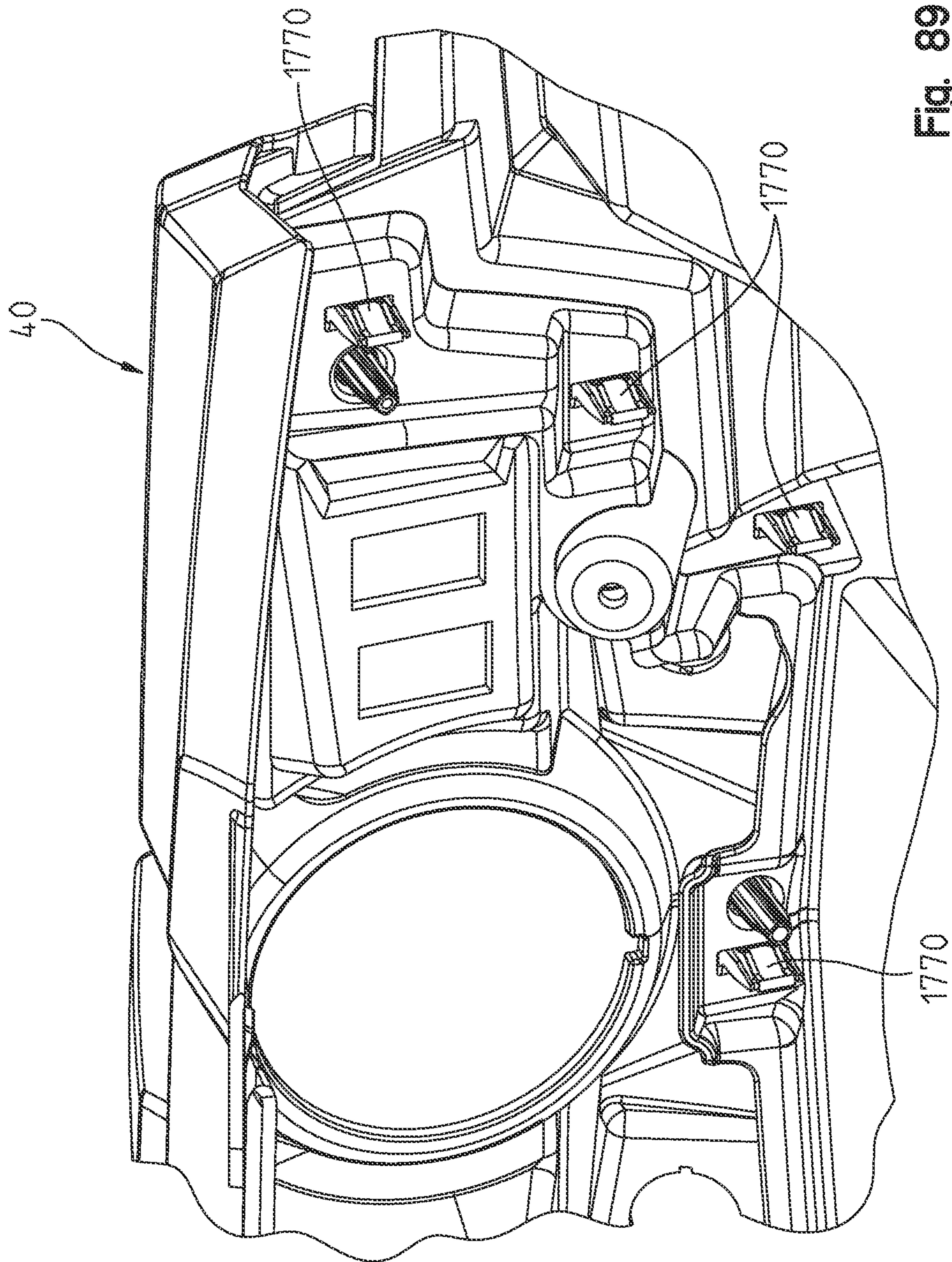


Fig. 89

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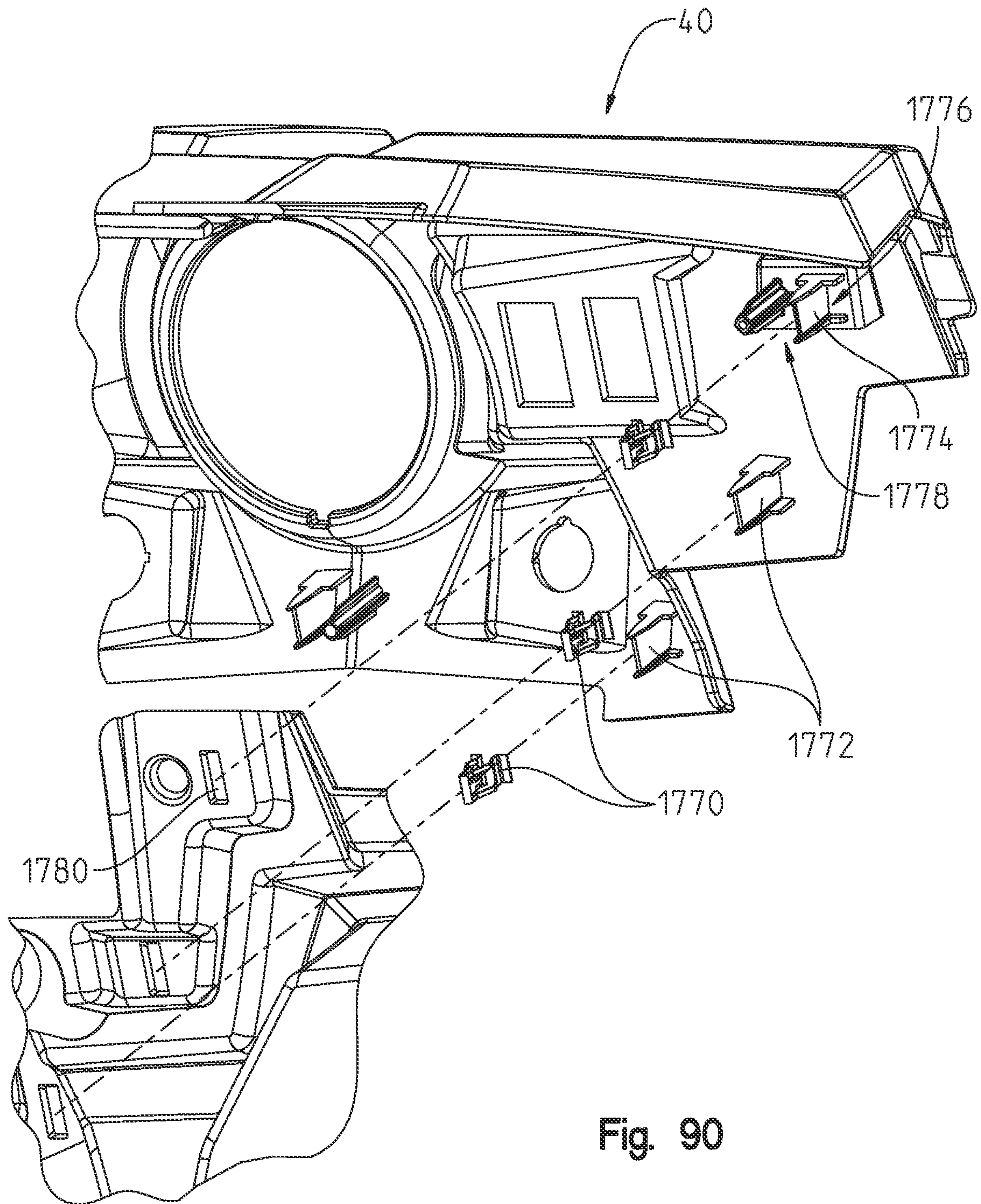
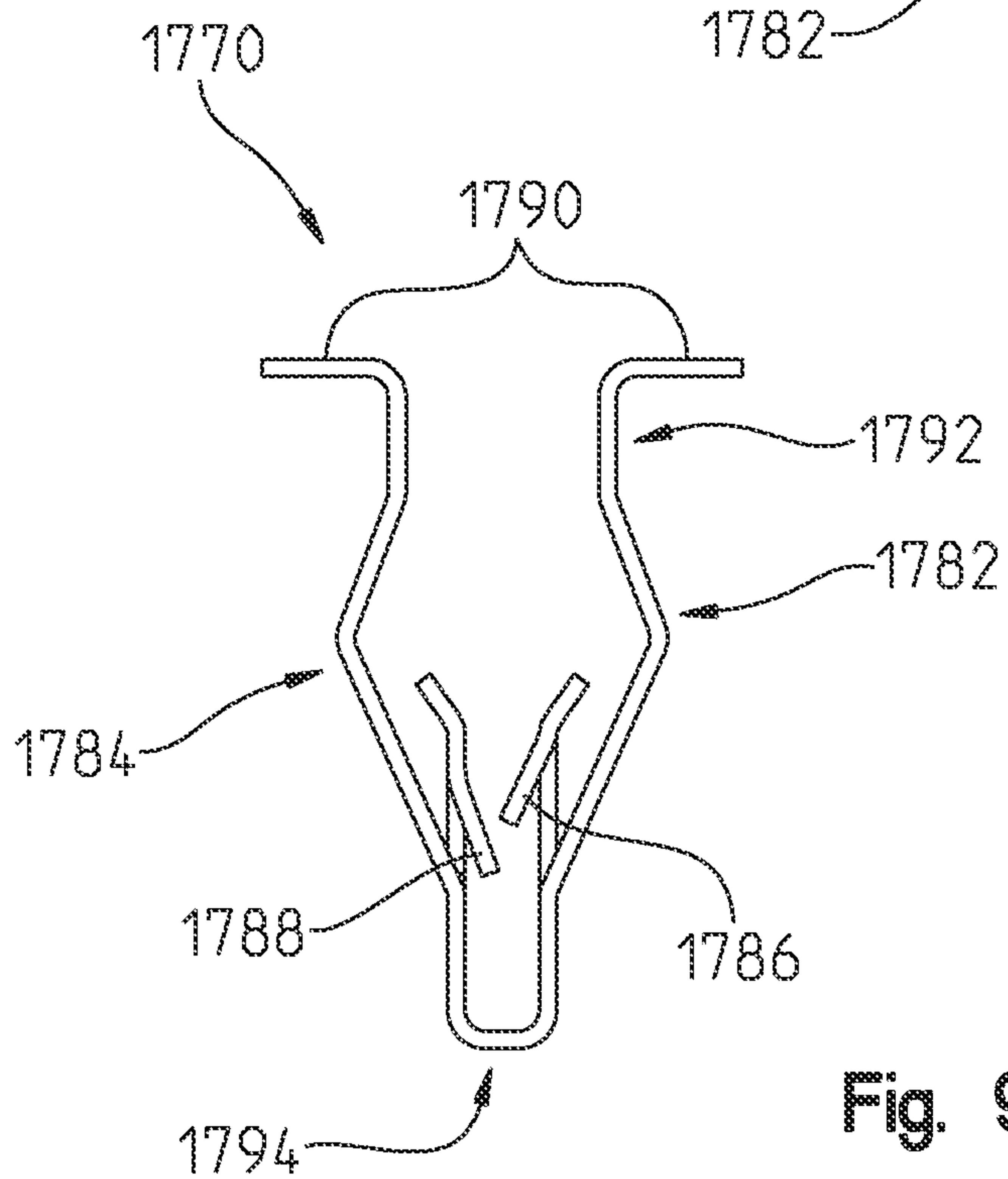
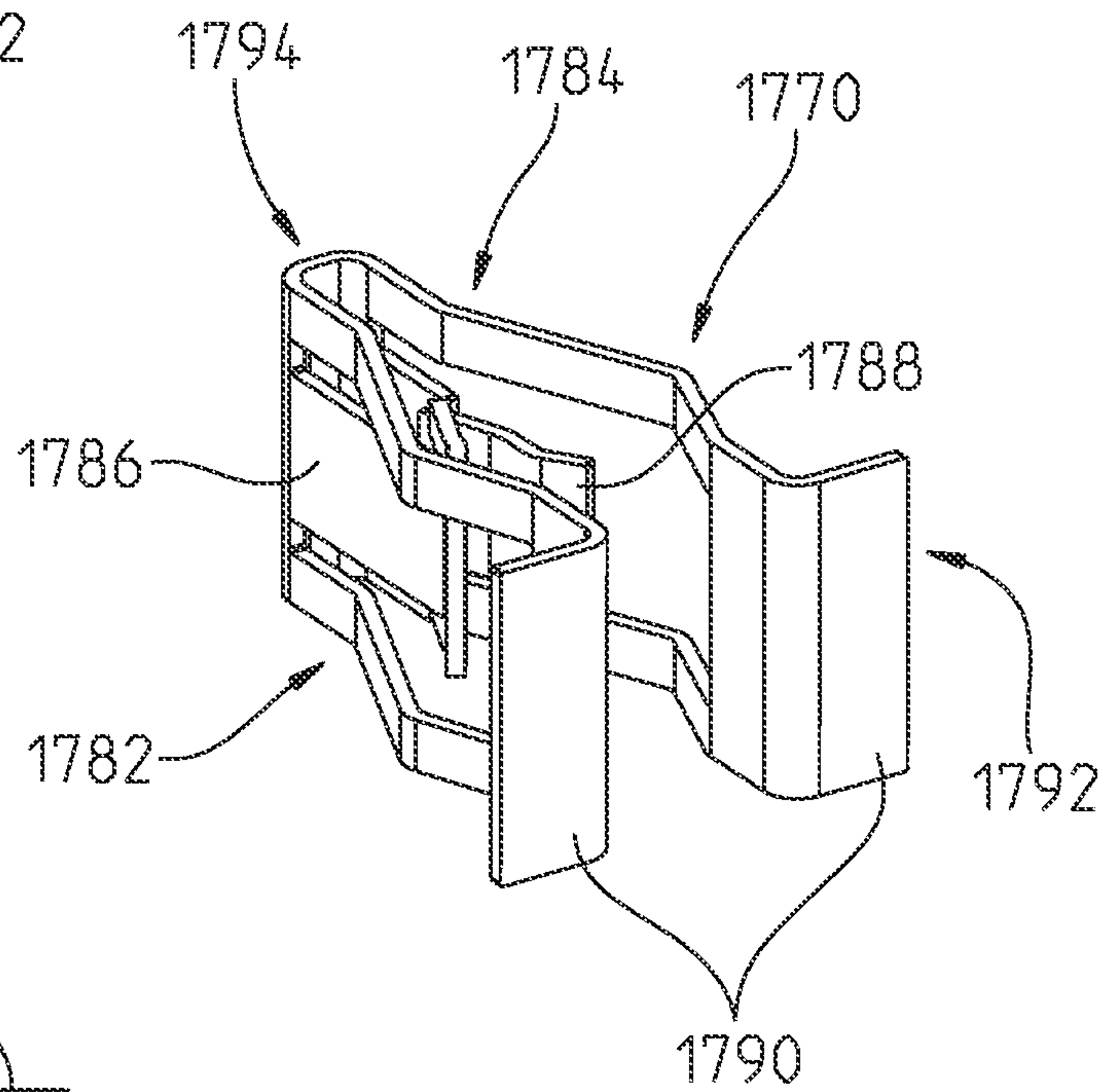
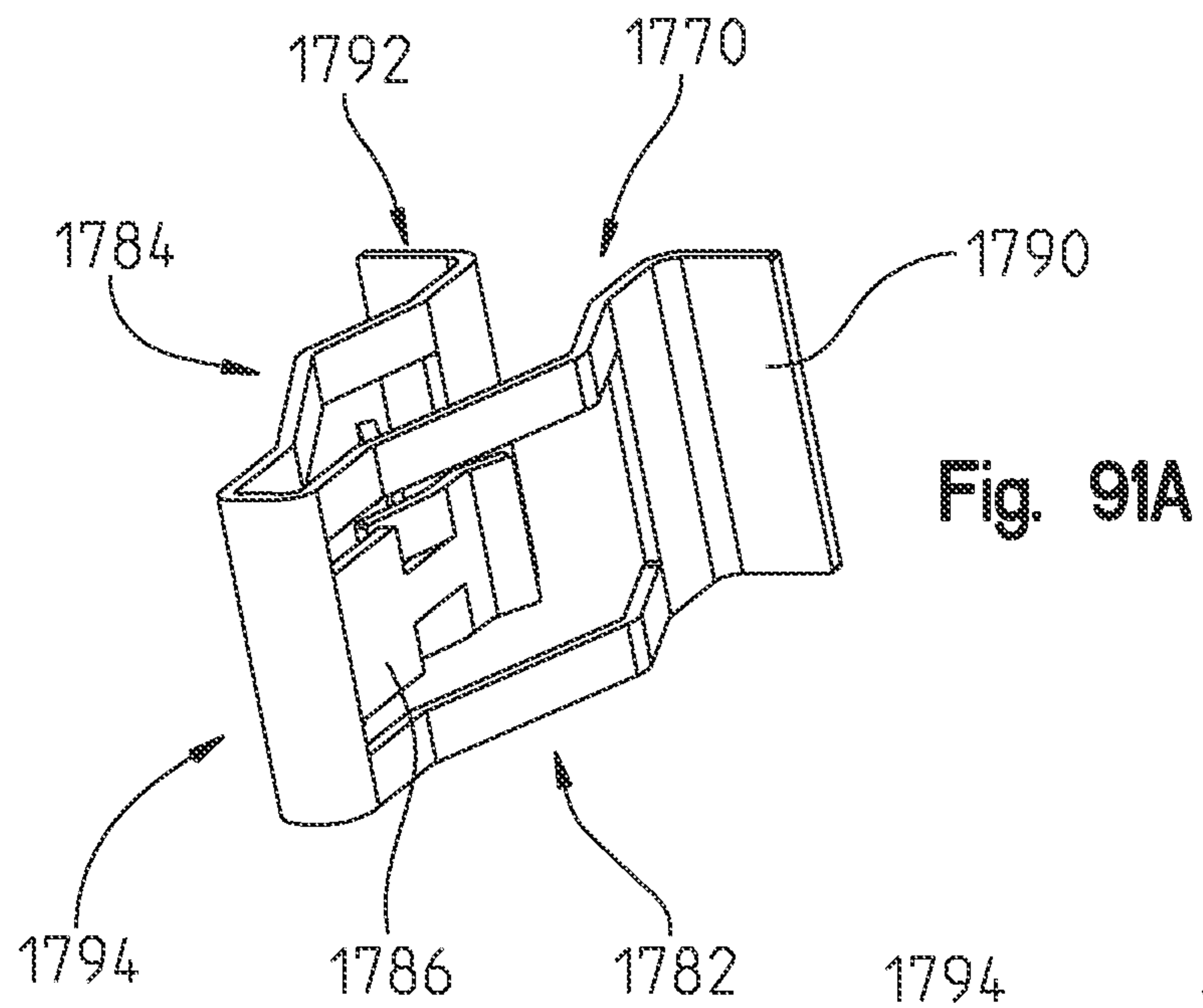
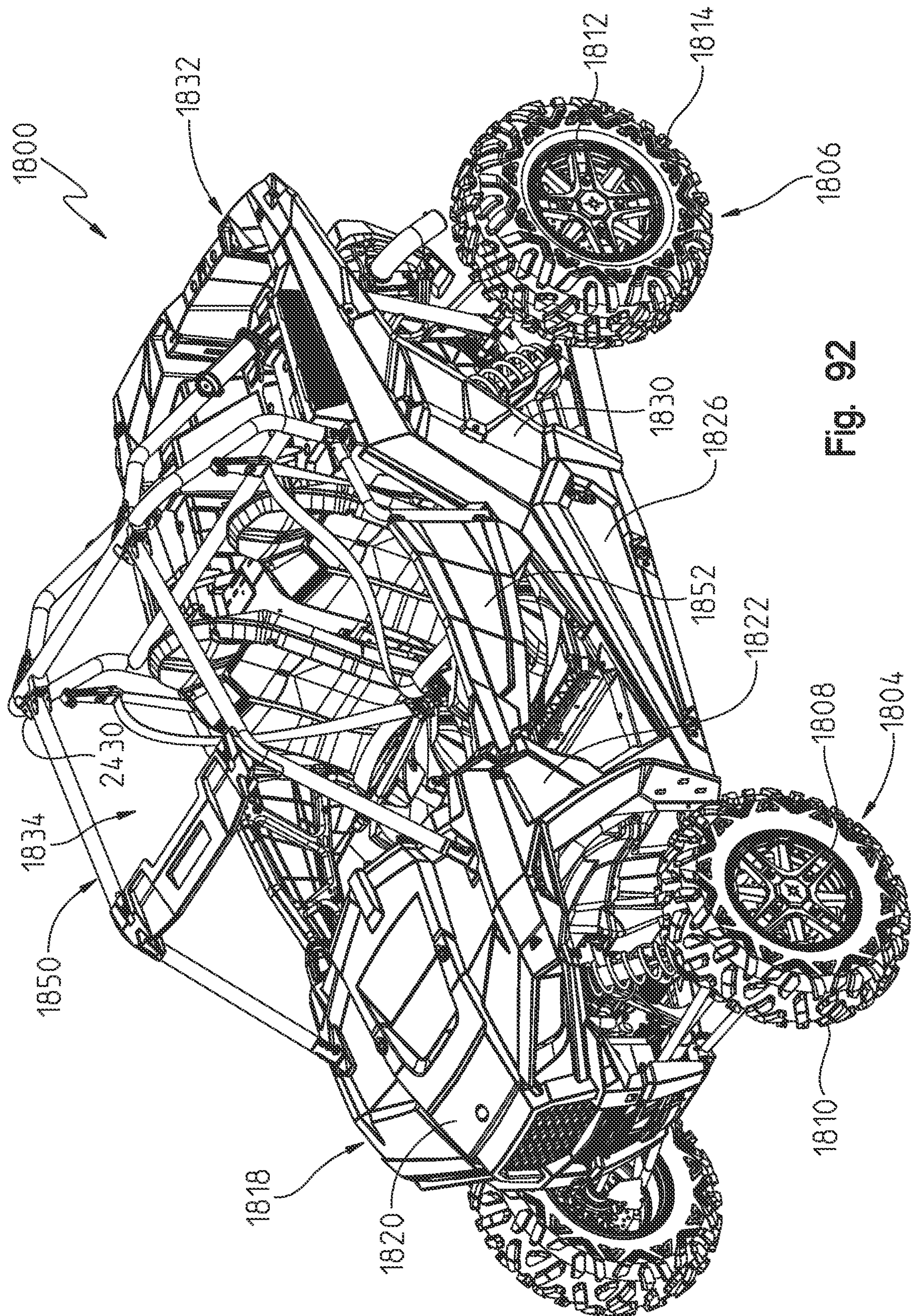


Fig. 90

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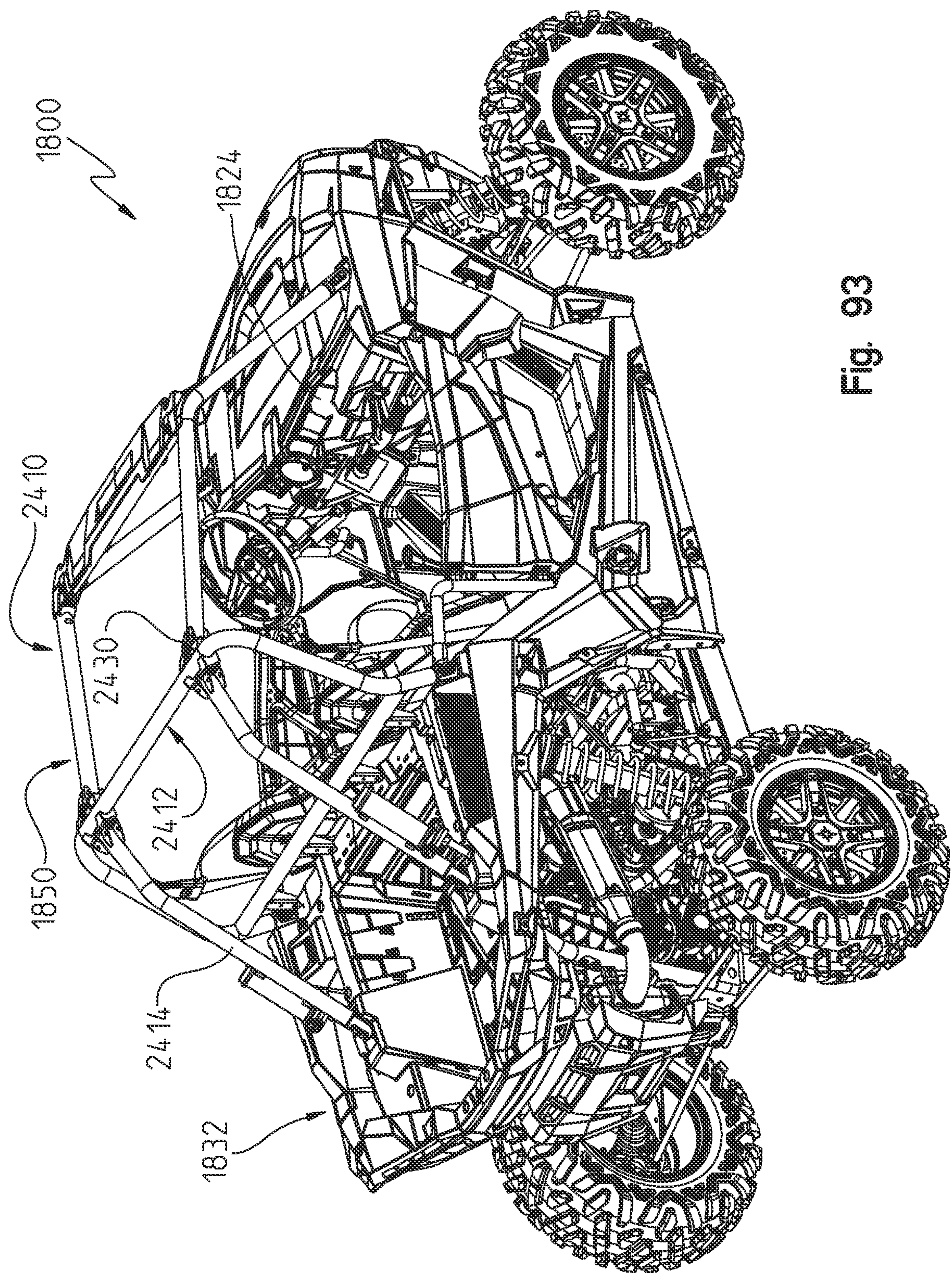


Fig. 93

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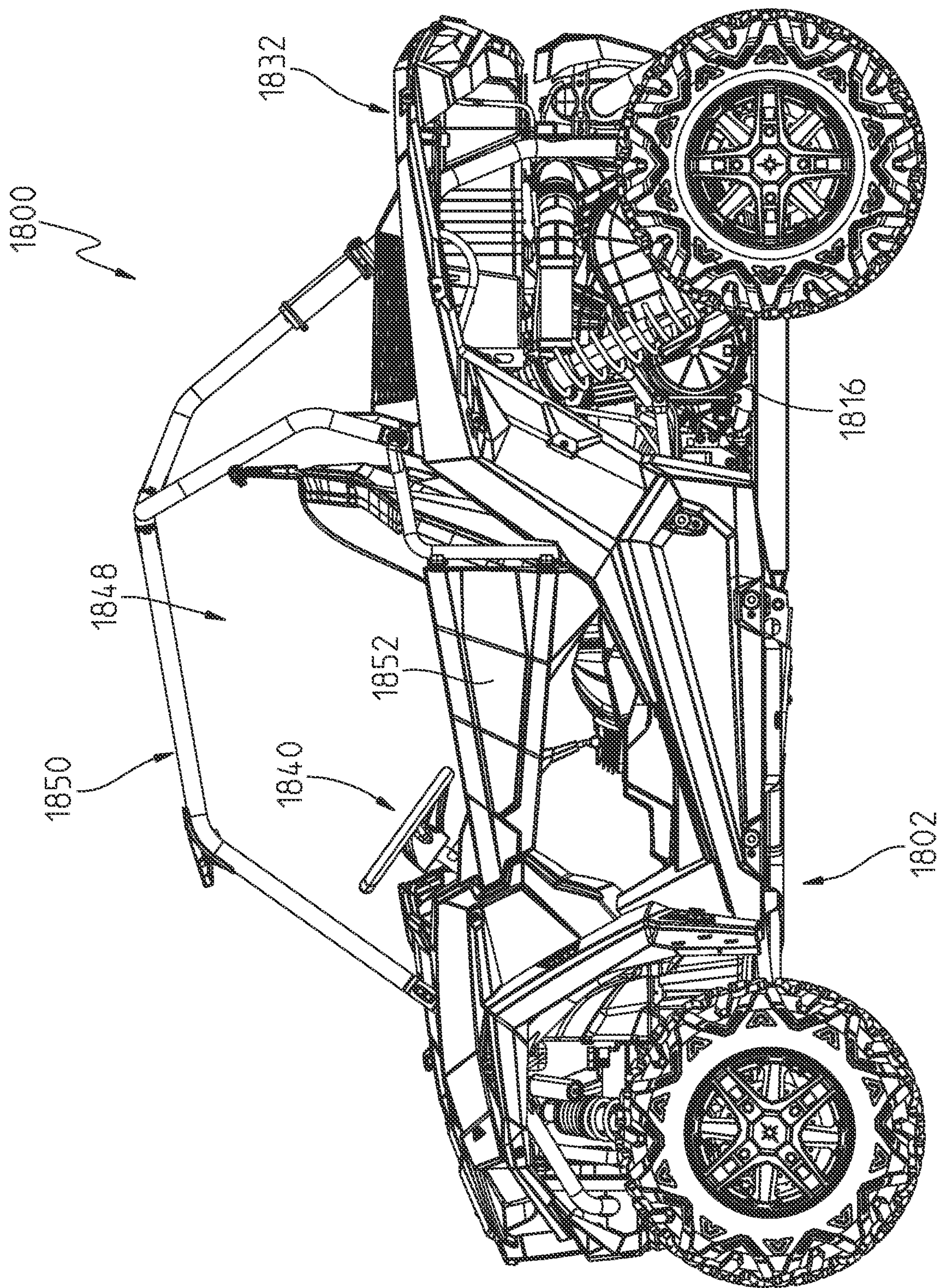


Fig. 94

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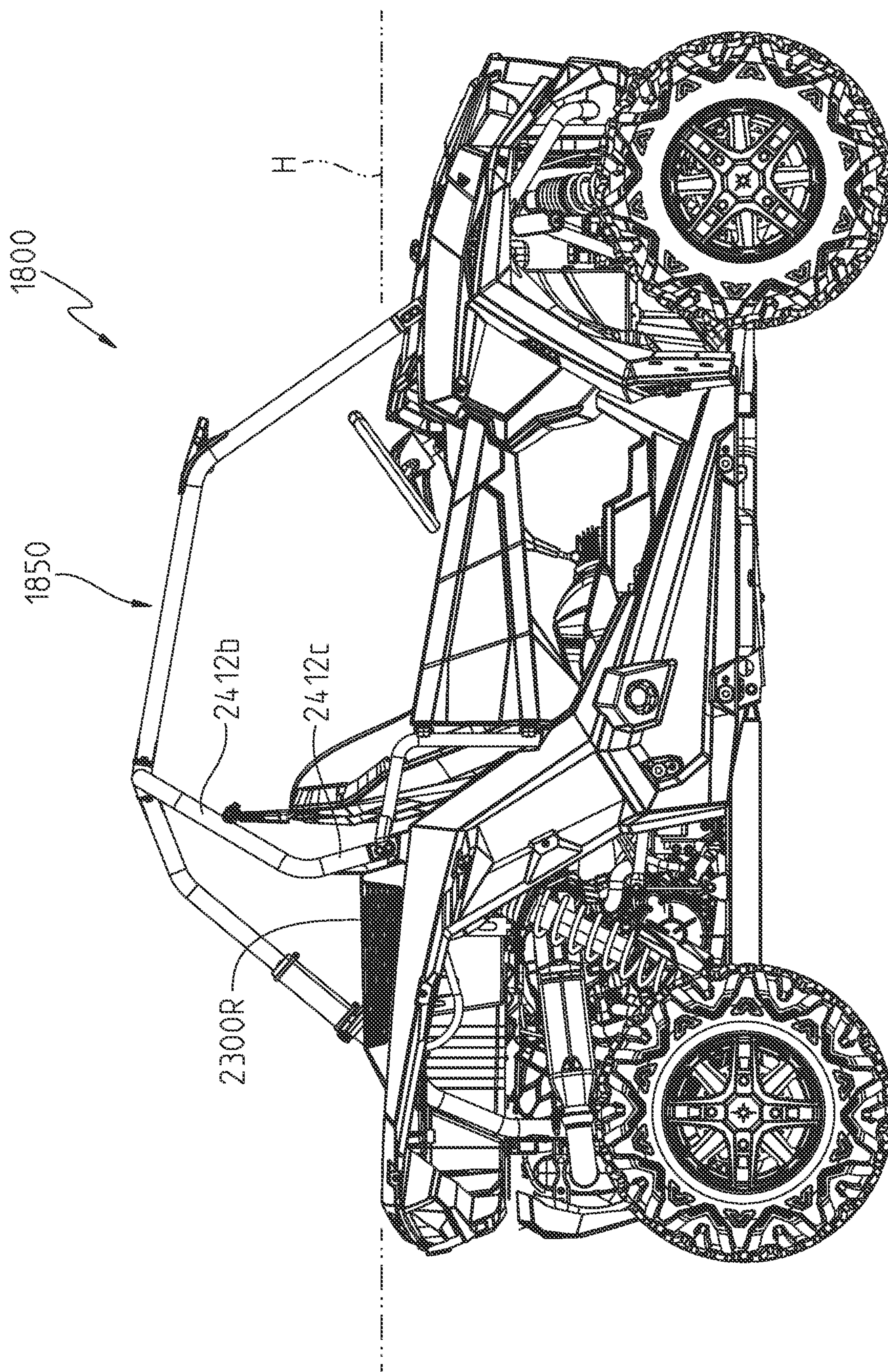


Fig. 95

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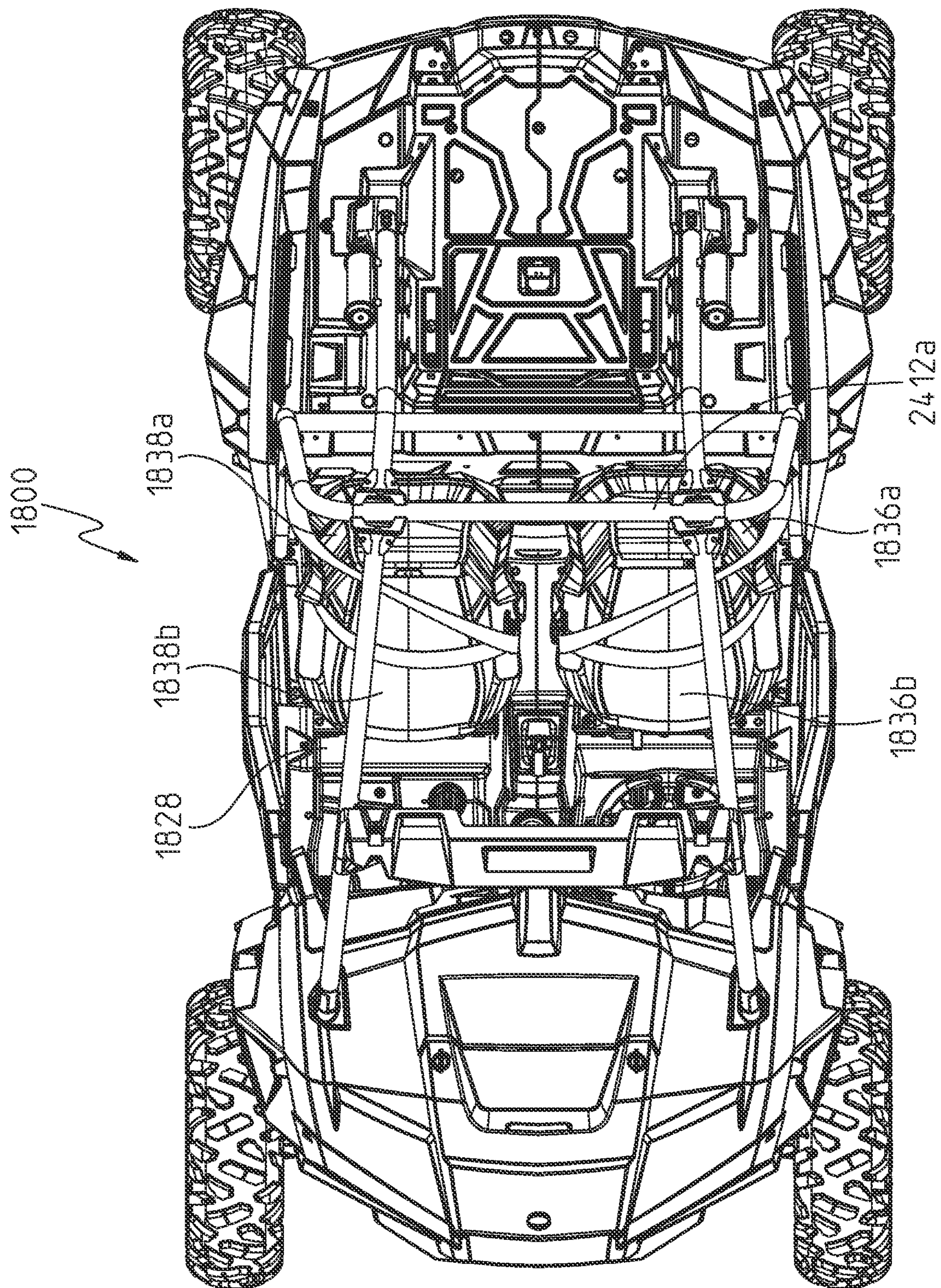


Fig. 96

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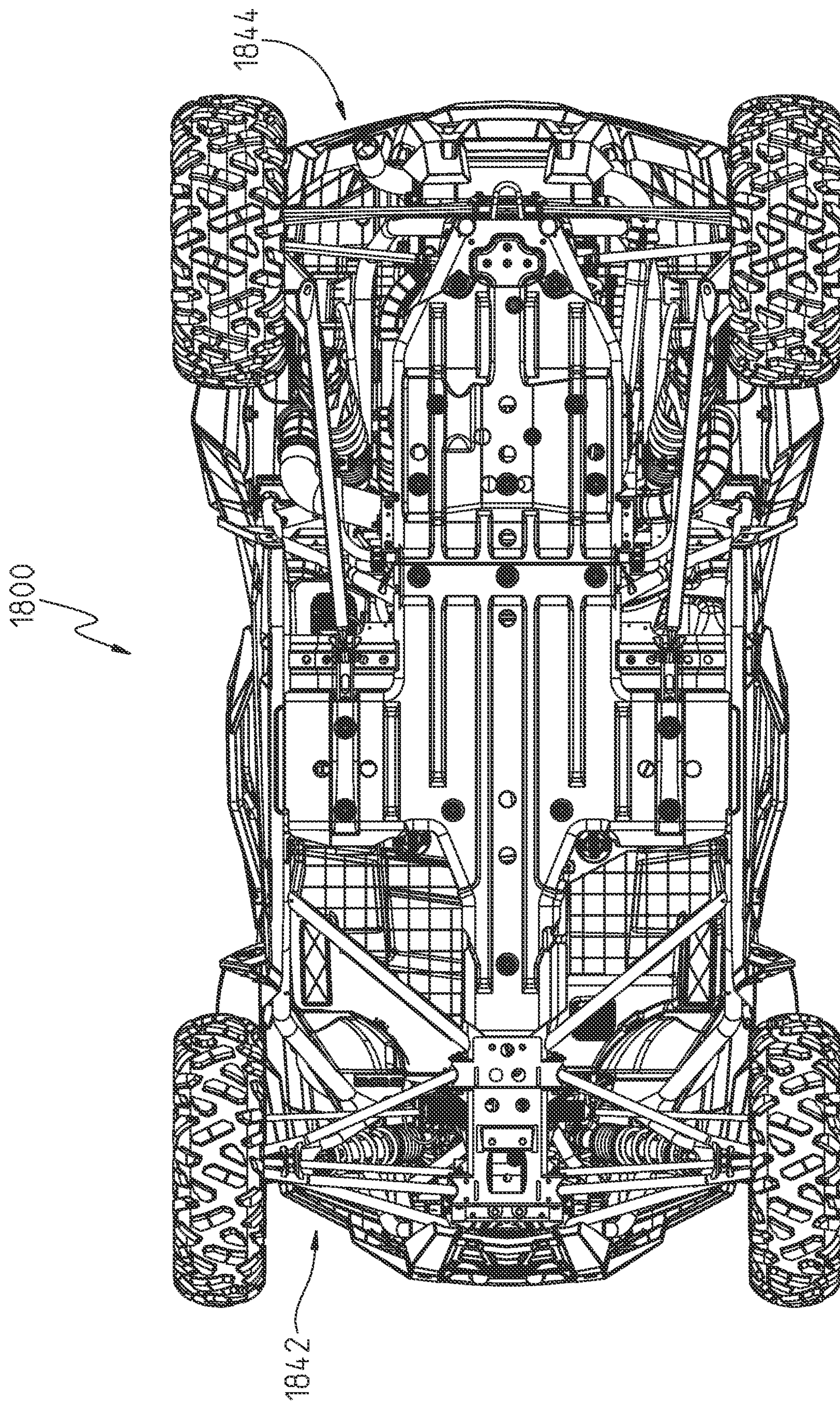


Fig. 97

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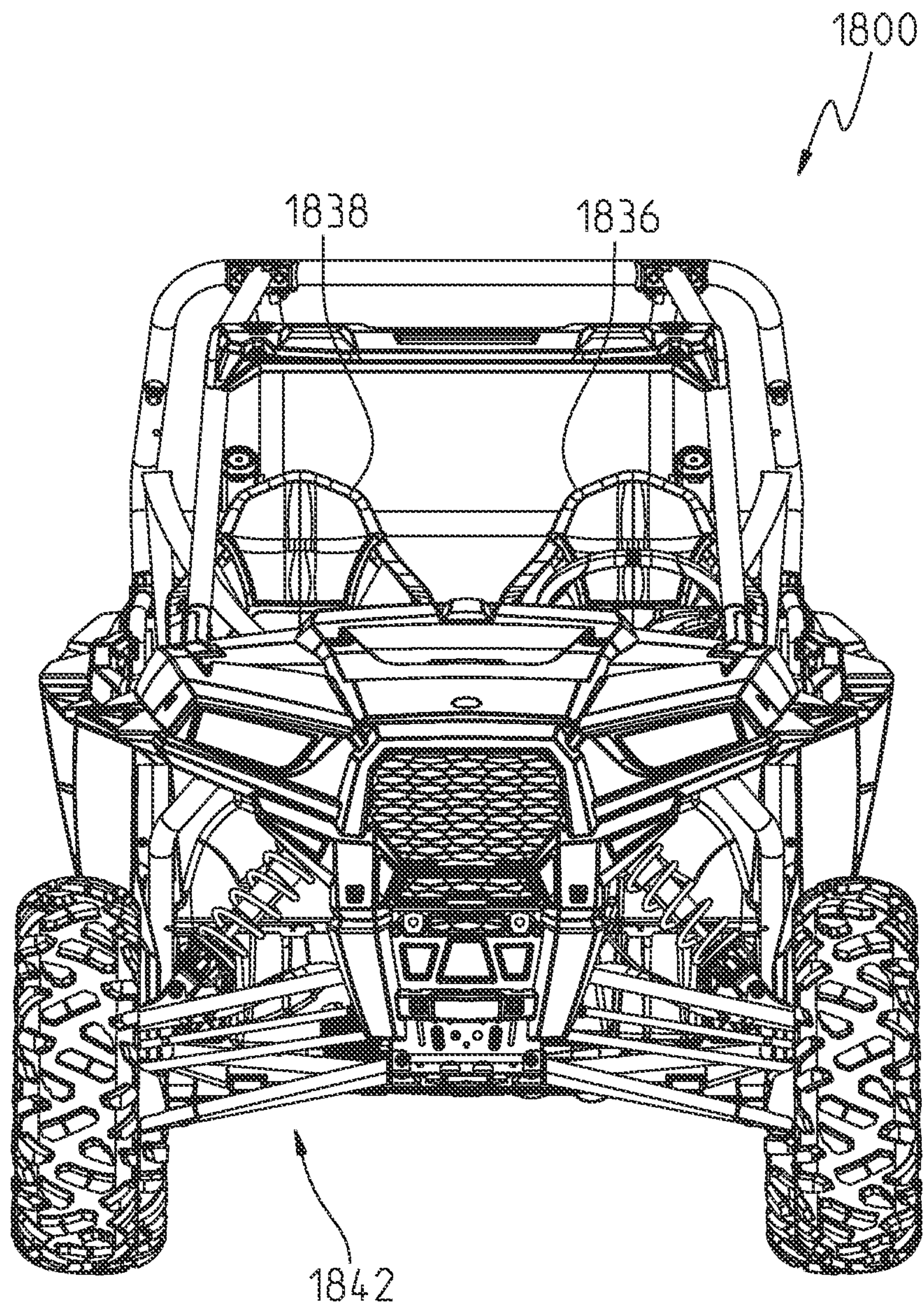


Fig. 98

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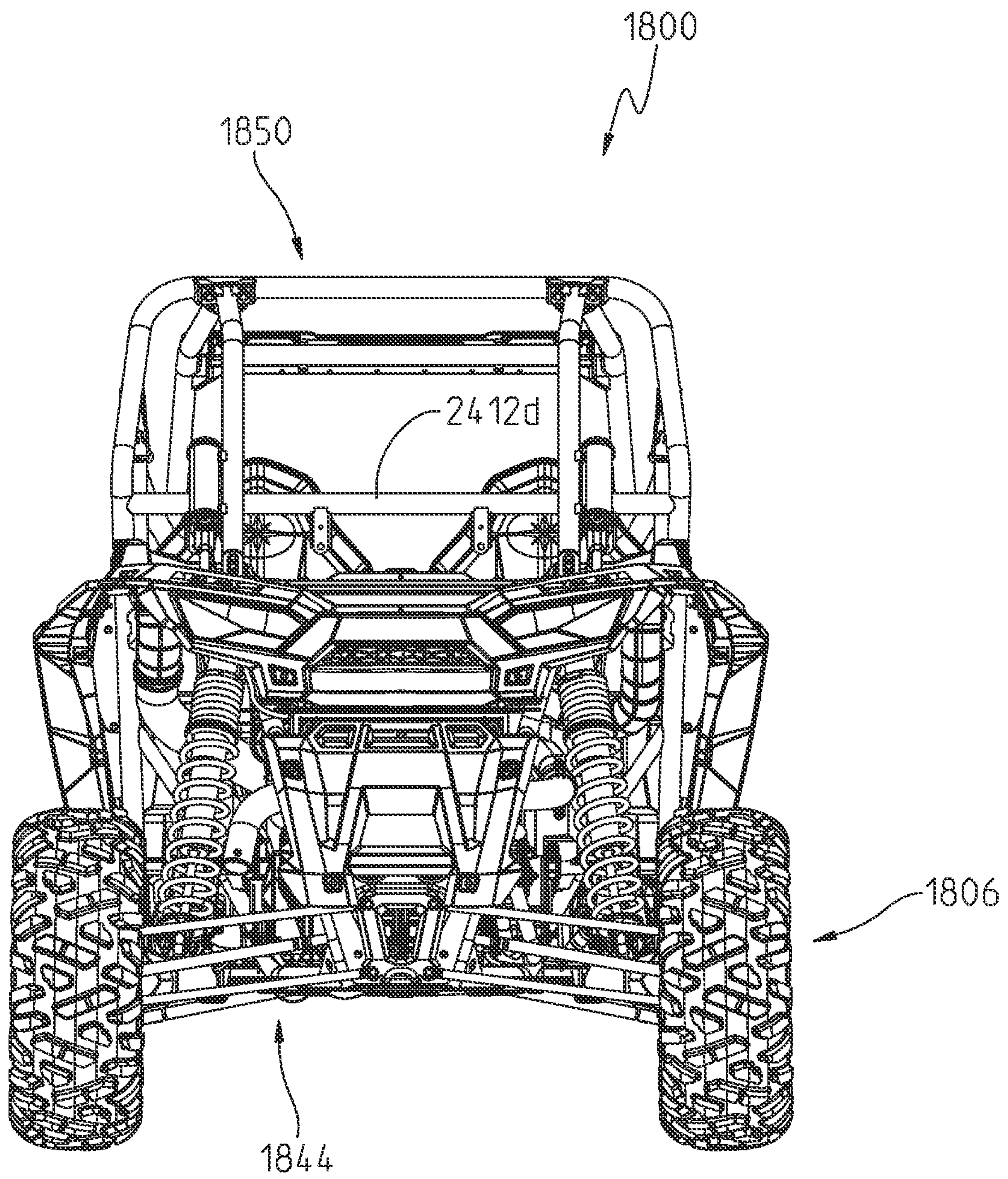


Fig. 99

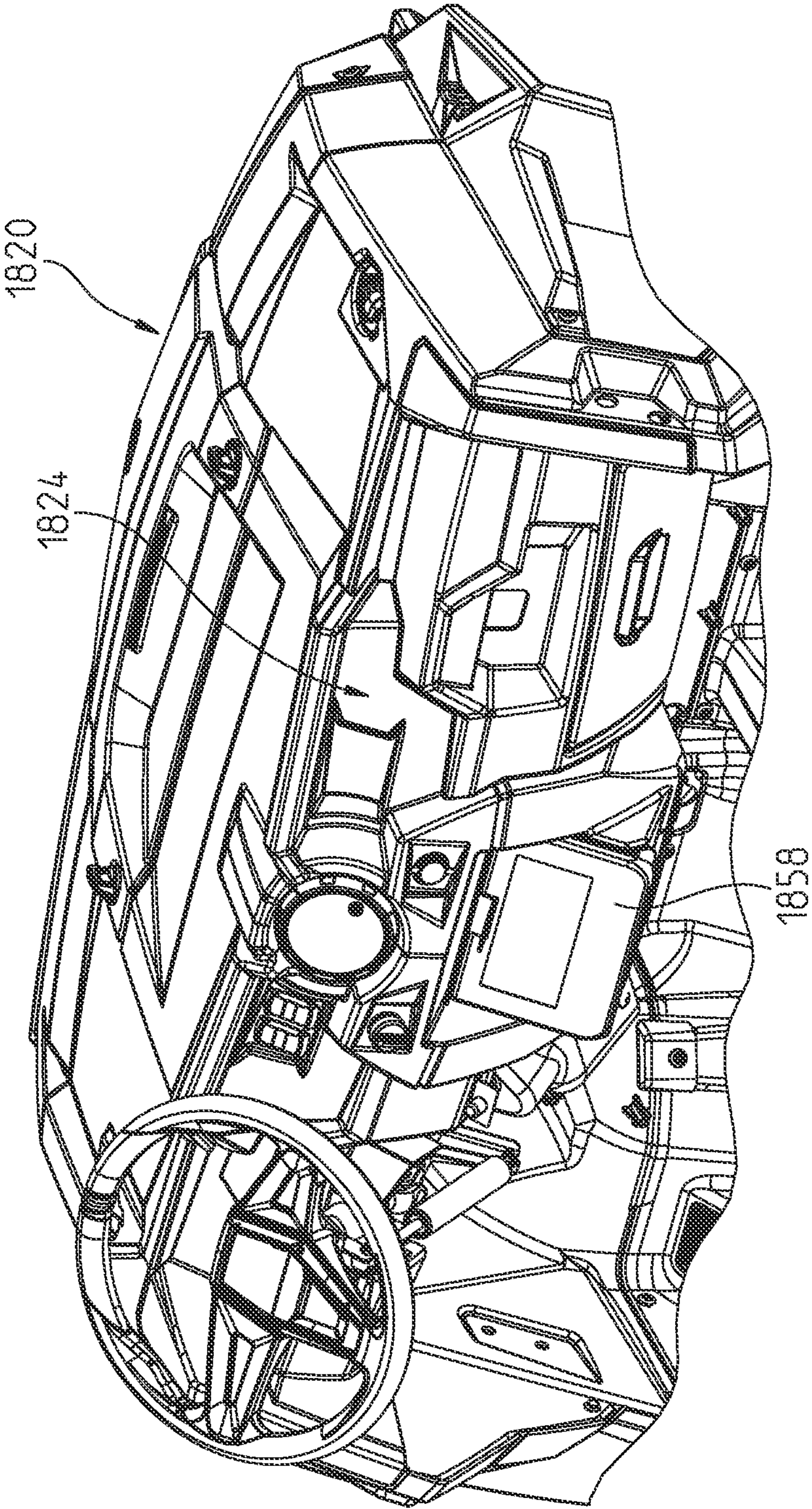
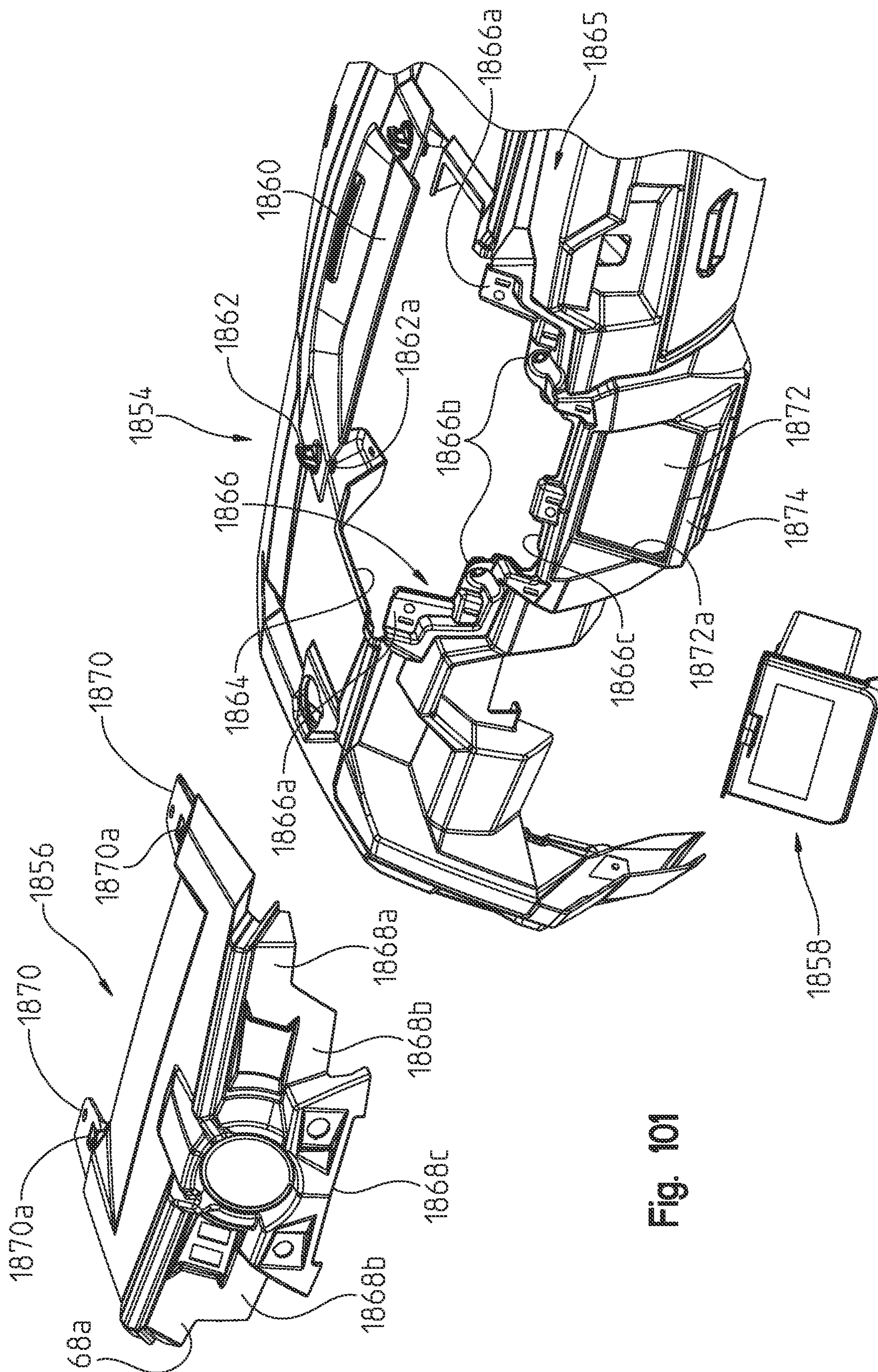


Fig. 100



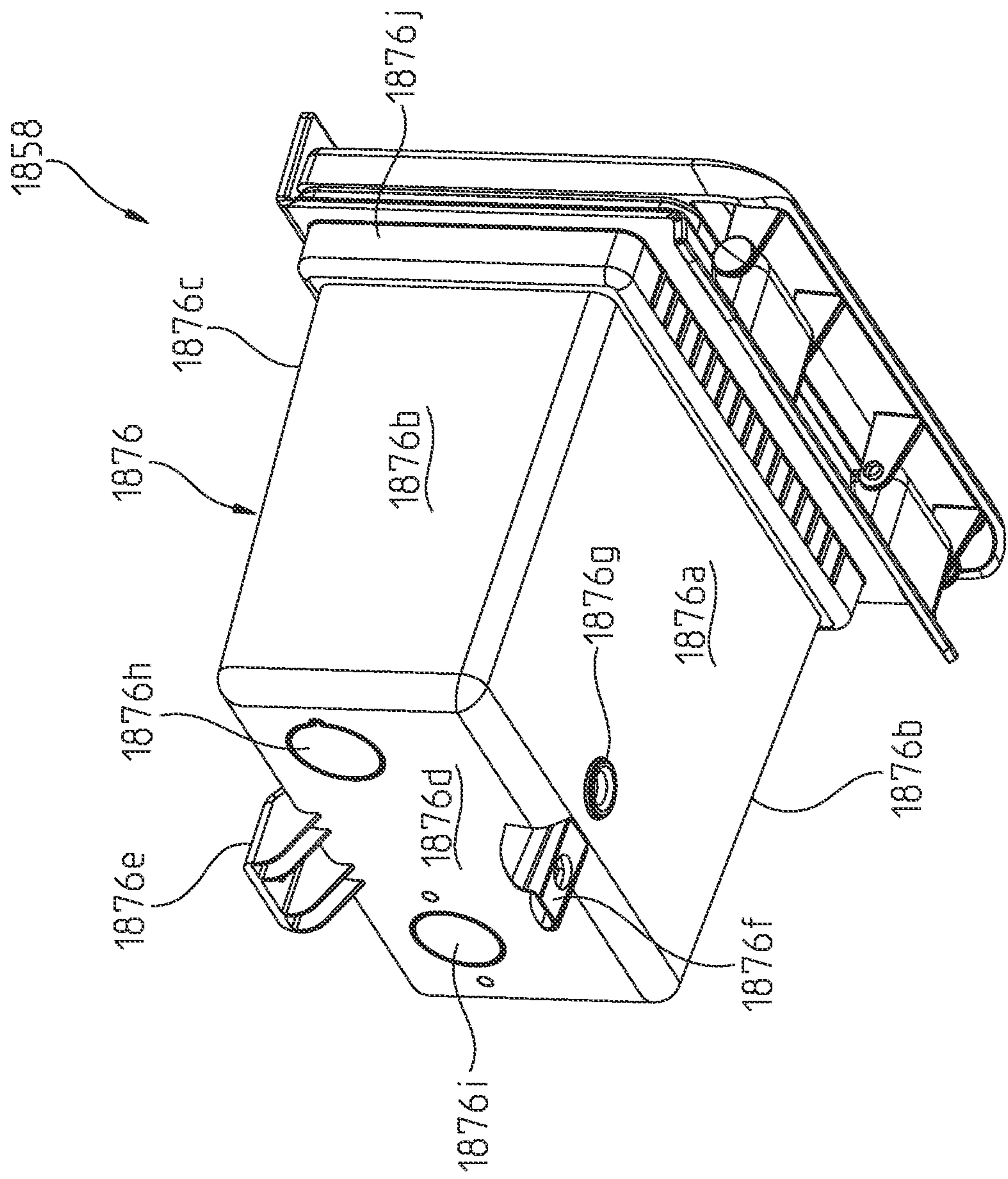


Fig. 102

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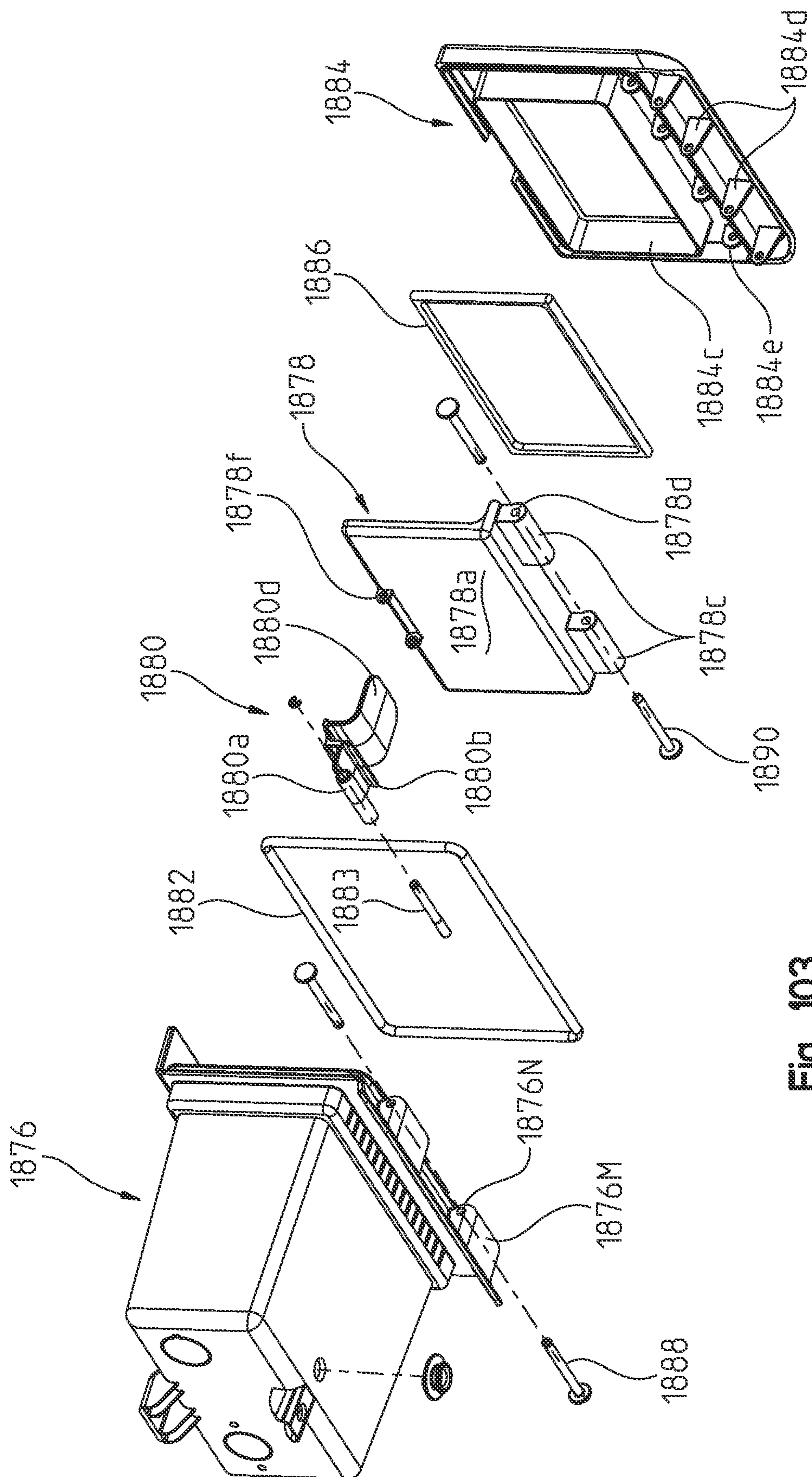


Fig. 103

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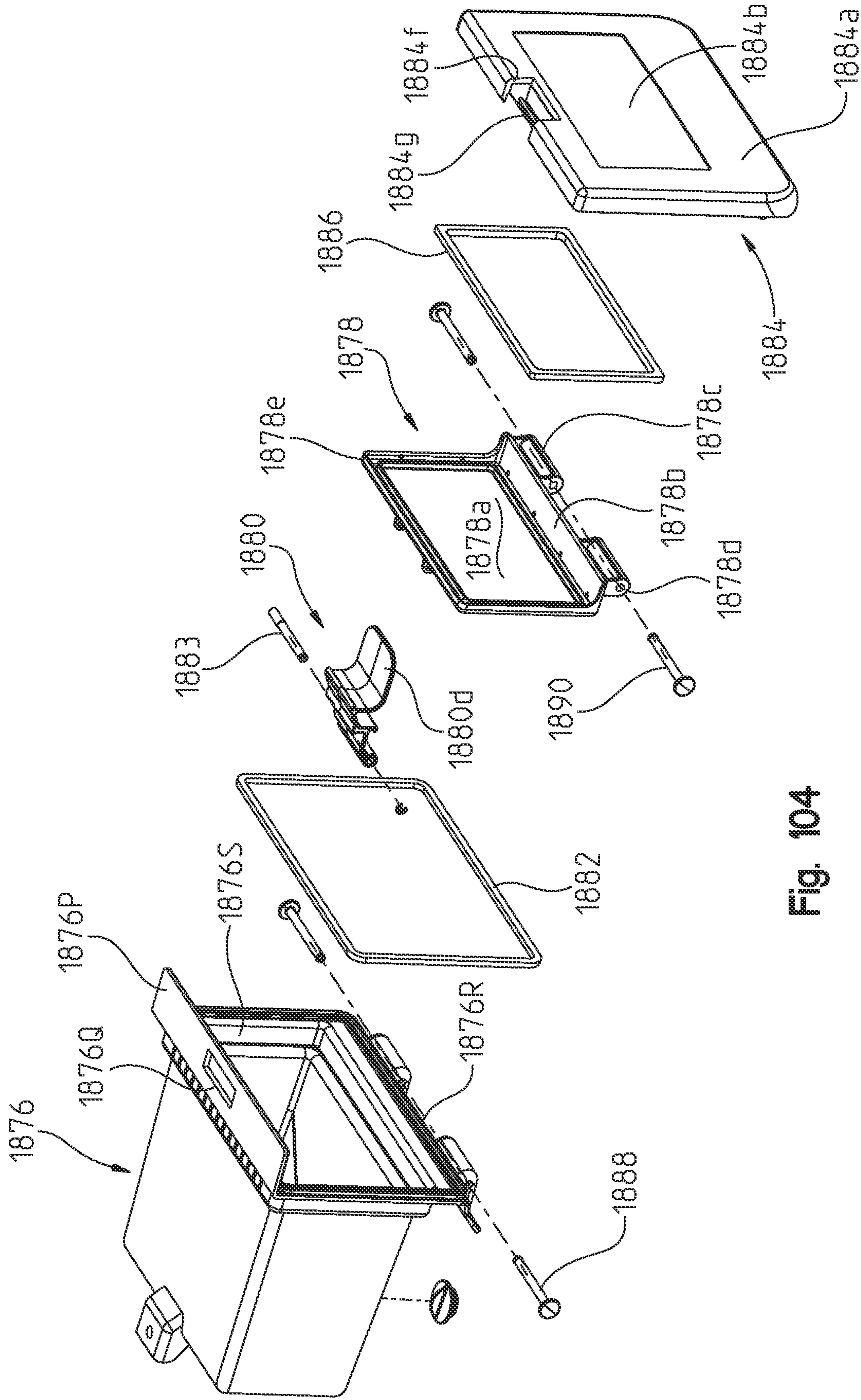


Fig. 104

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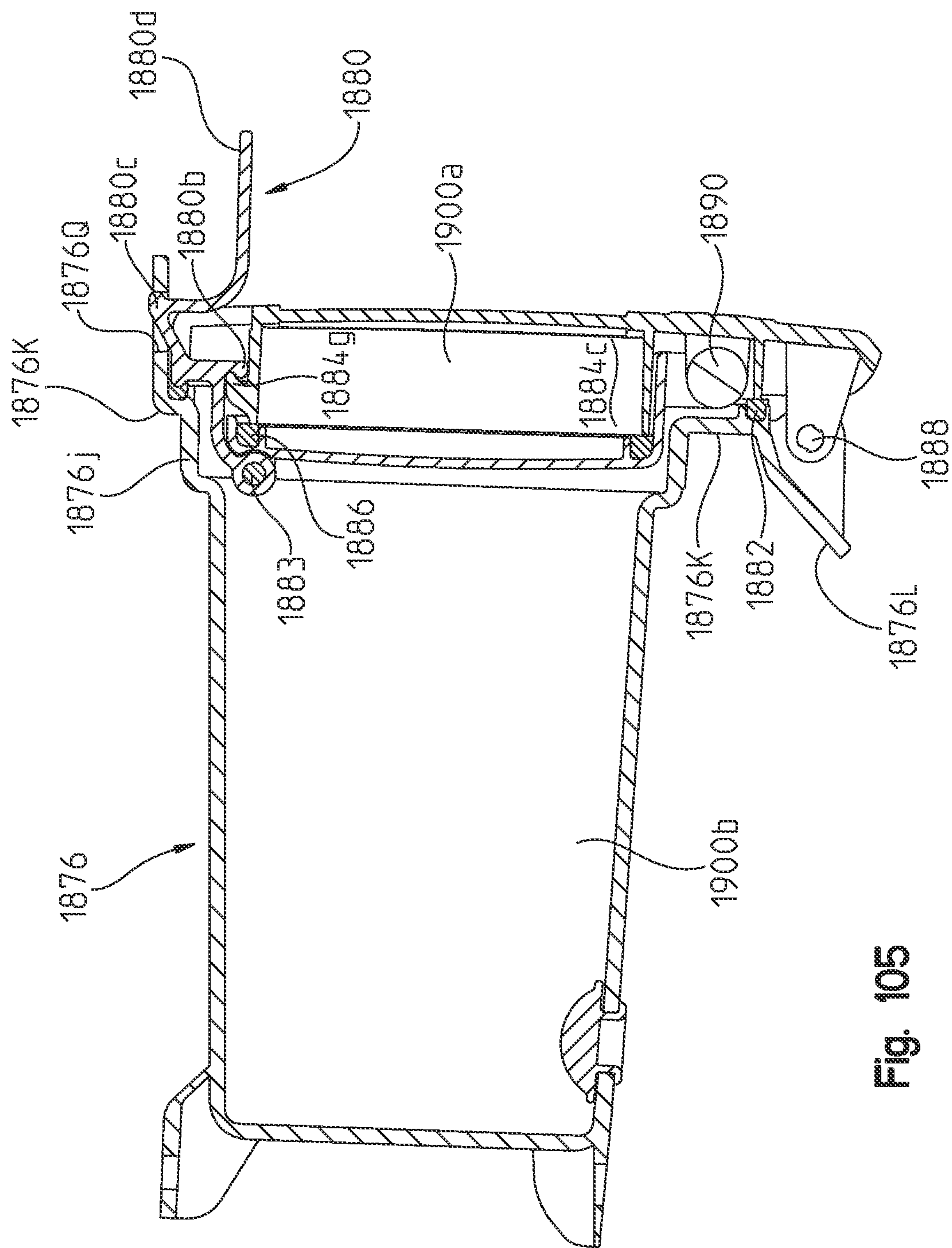


Fig. 105

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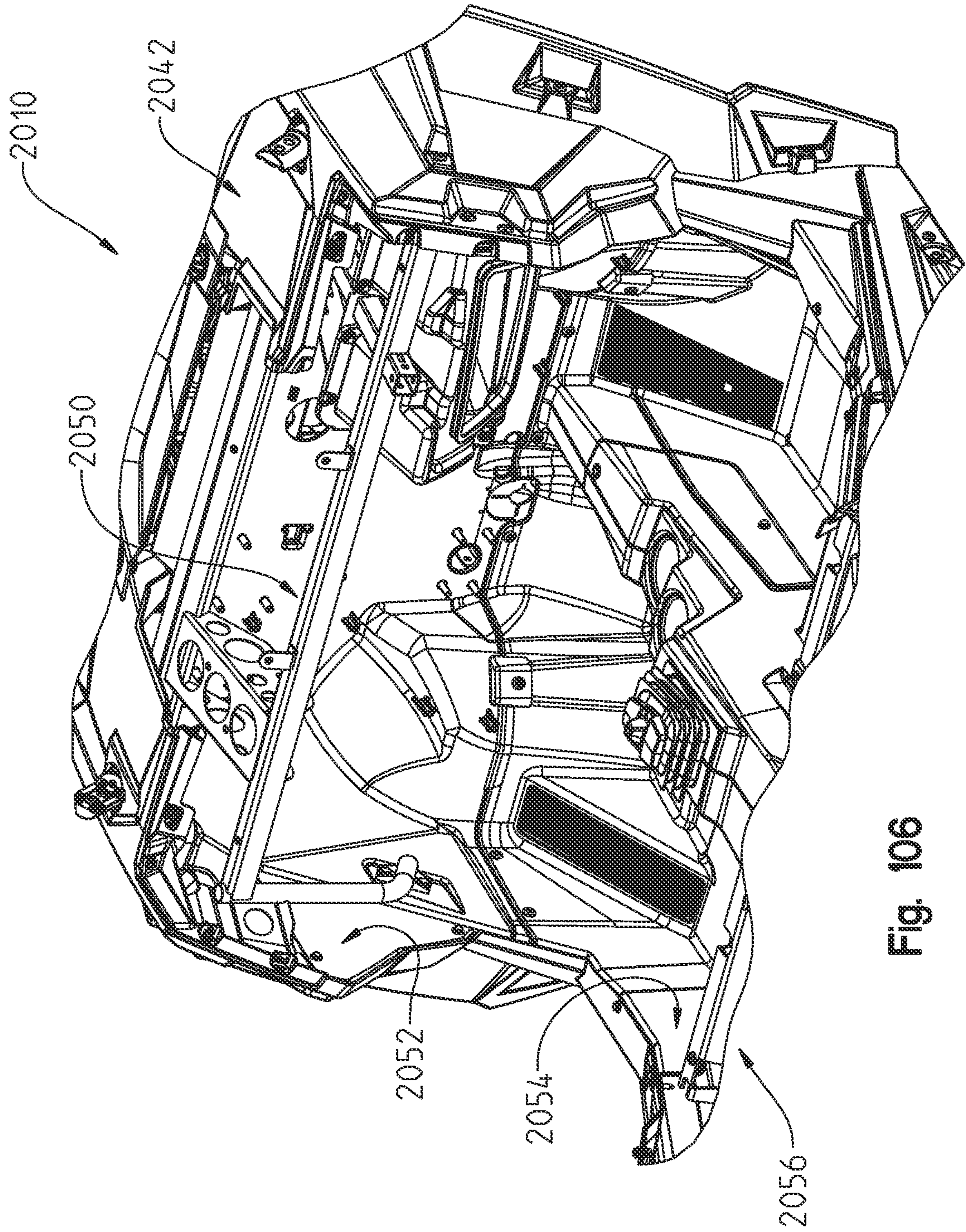
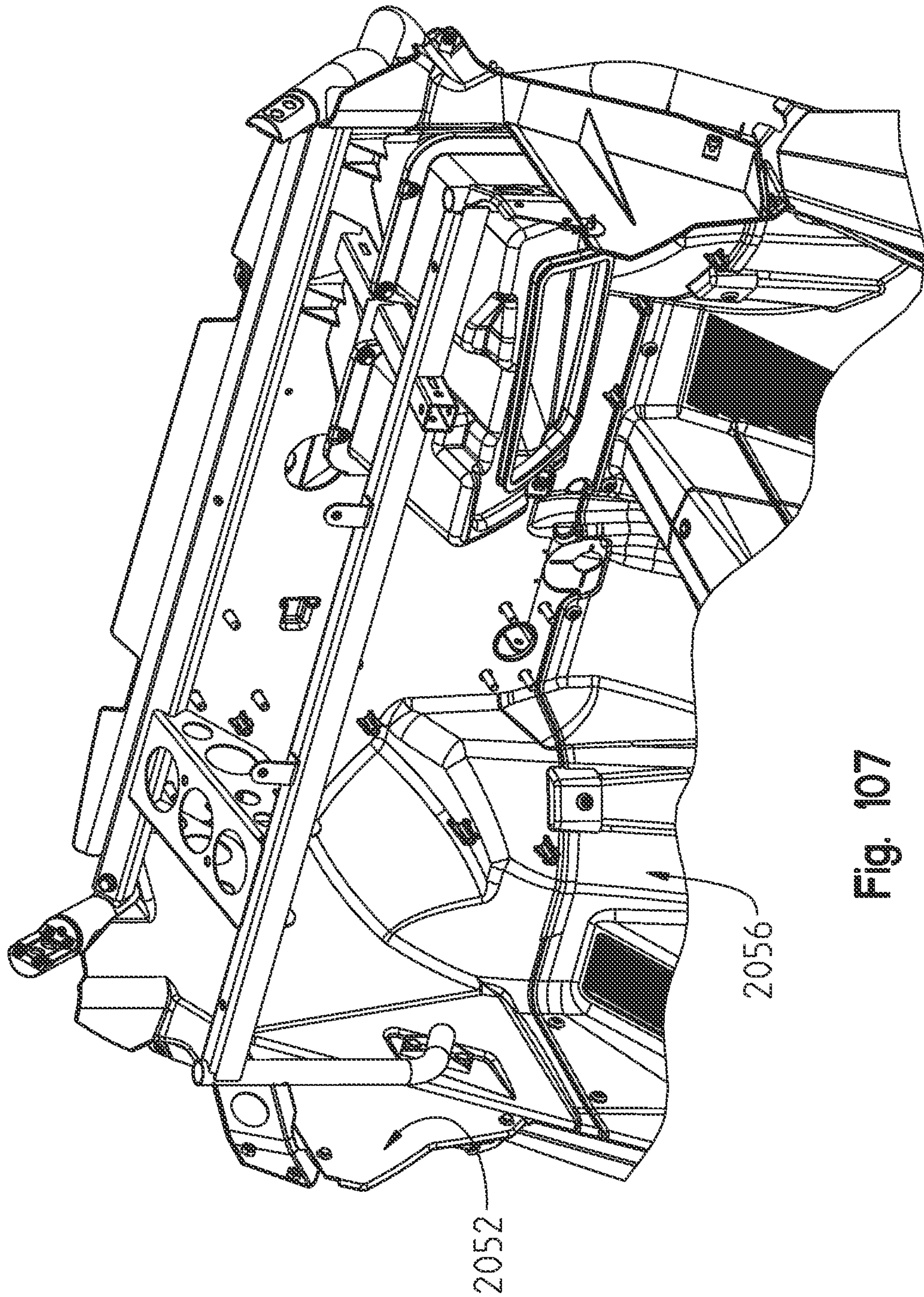


Fig. 106

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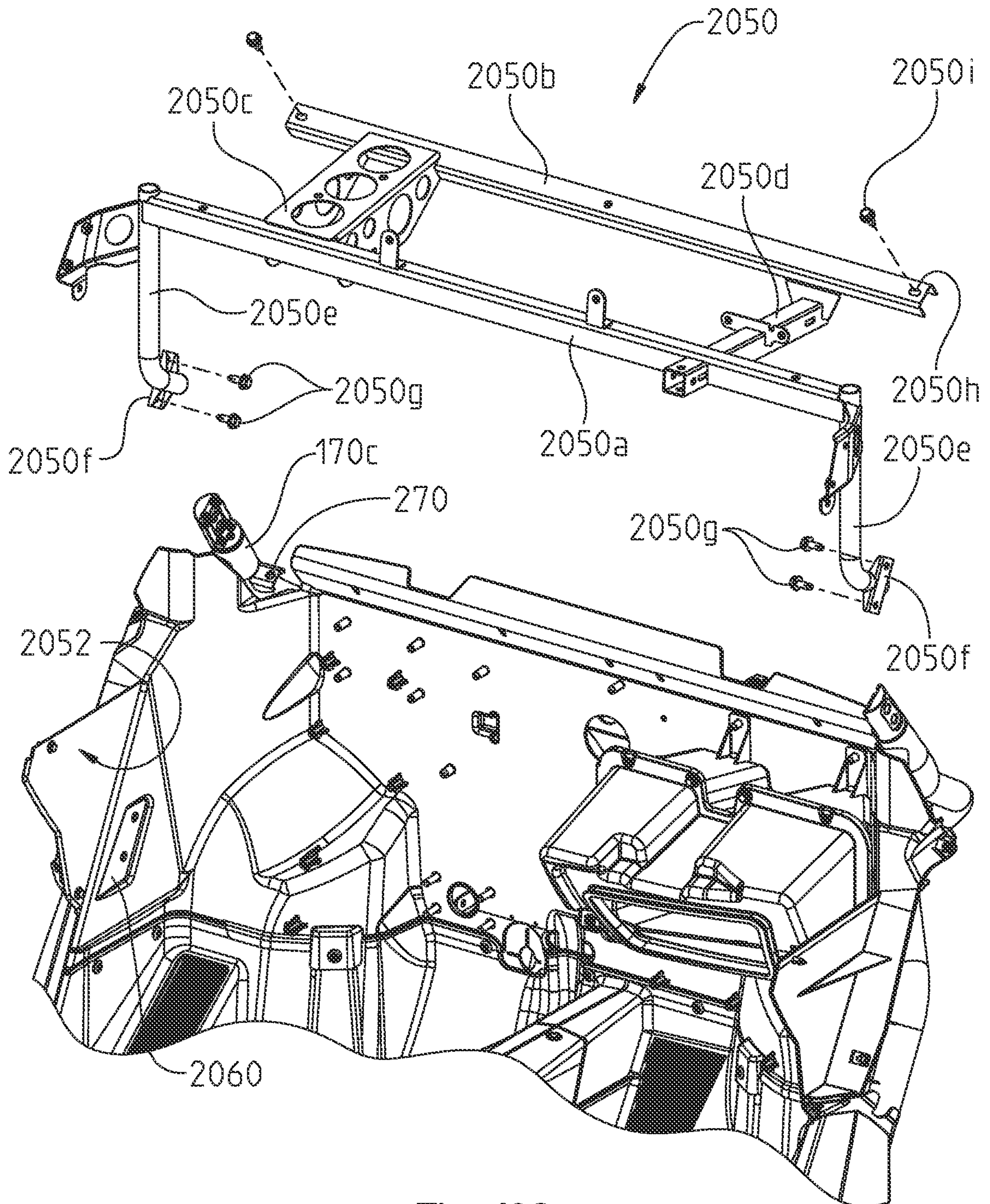


Fig. 108

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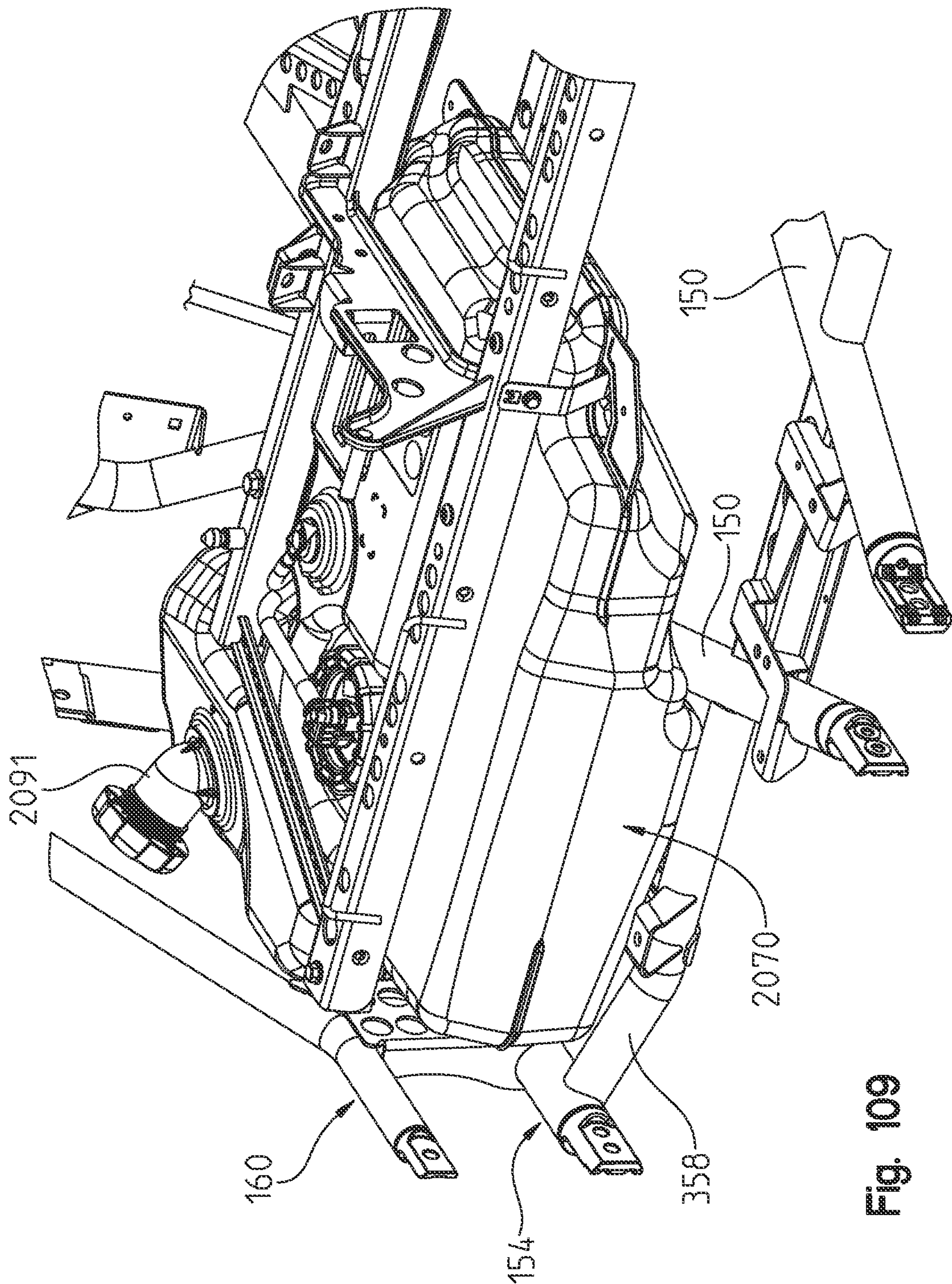
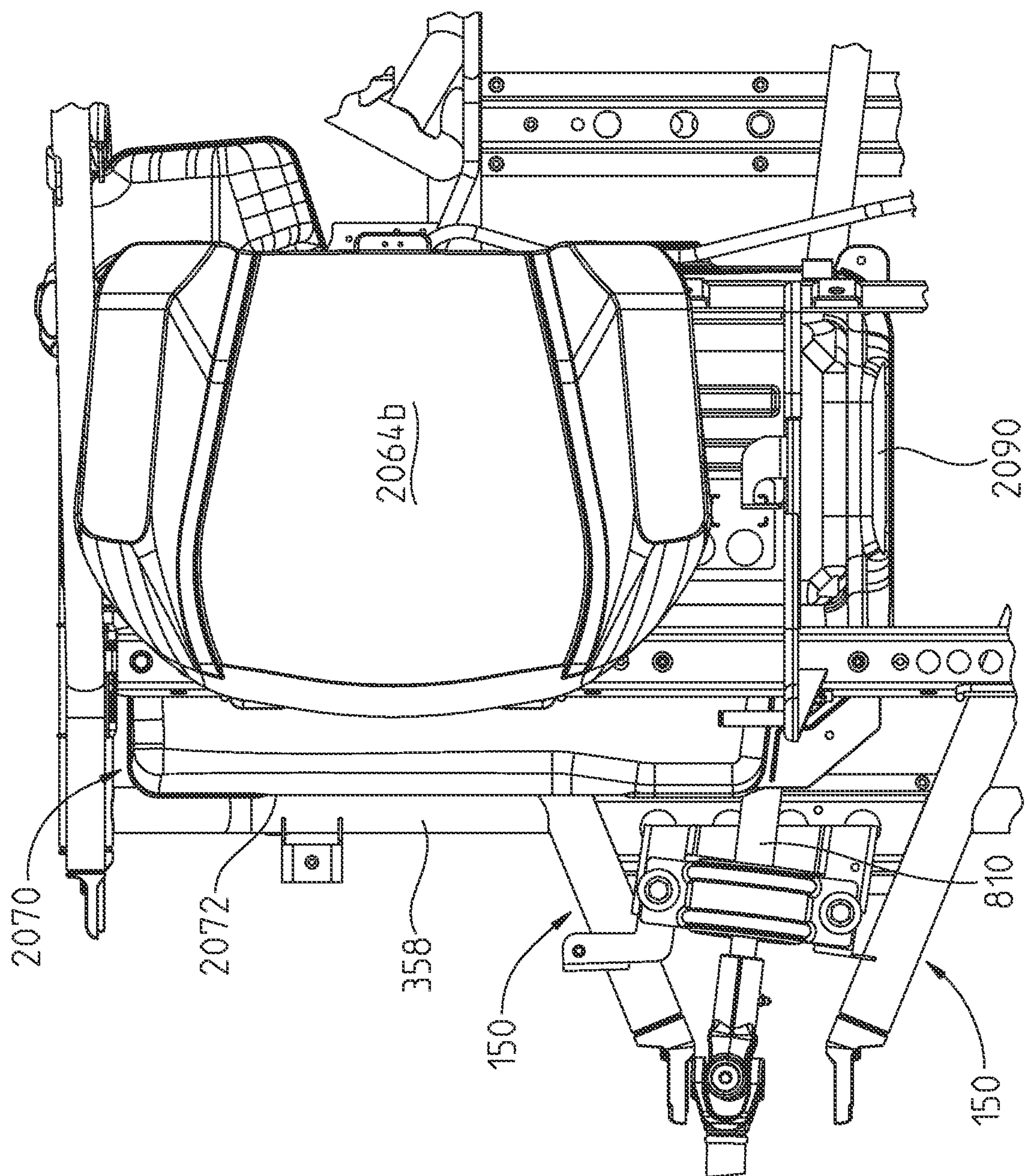


Fig. 109

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Fig. 110



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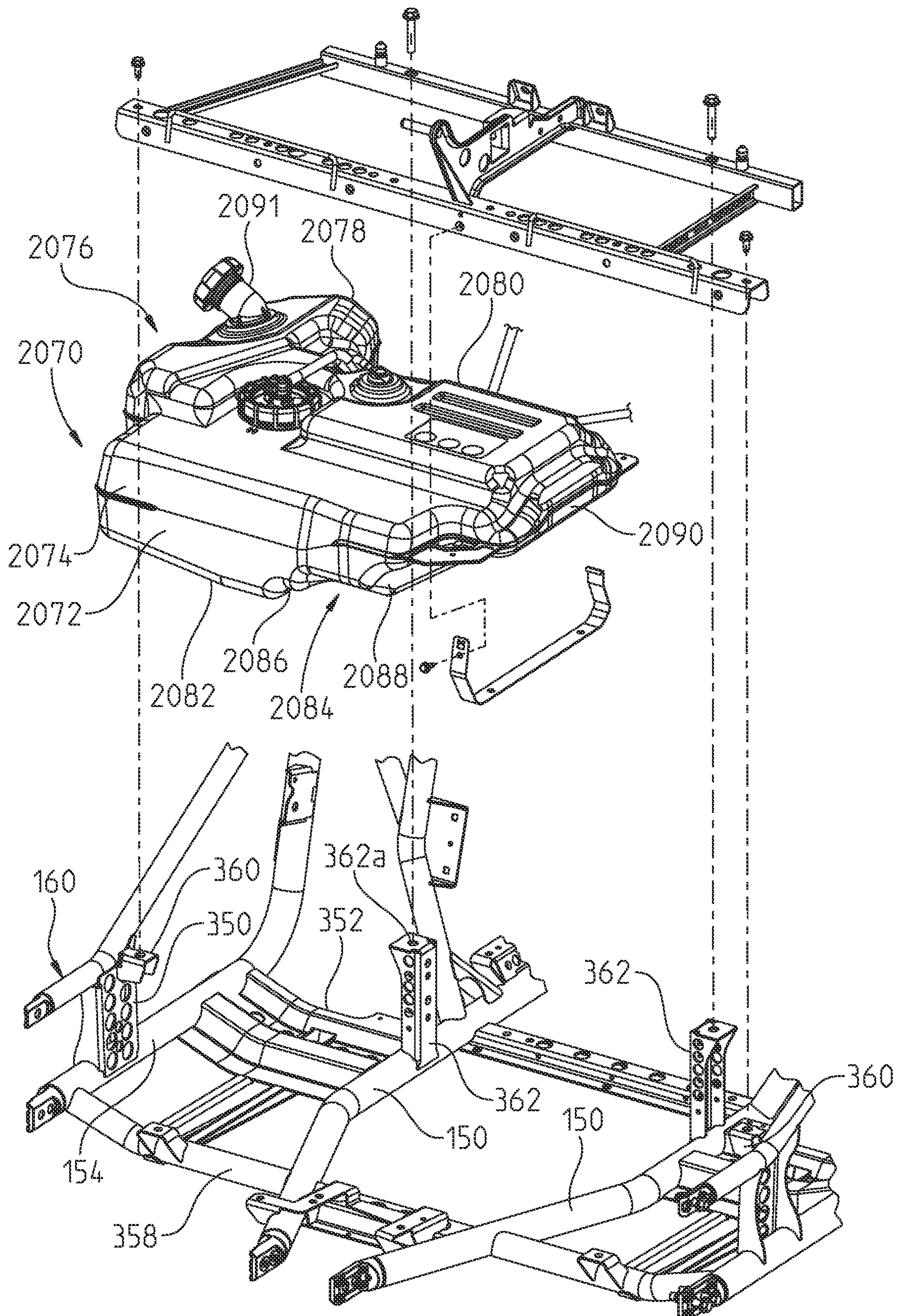


Fig. 111

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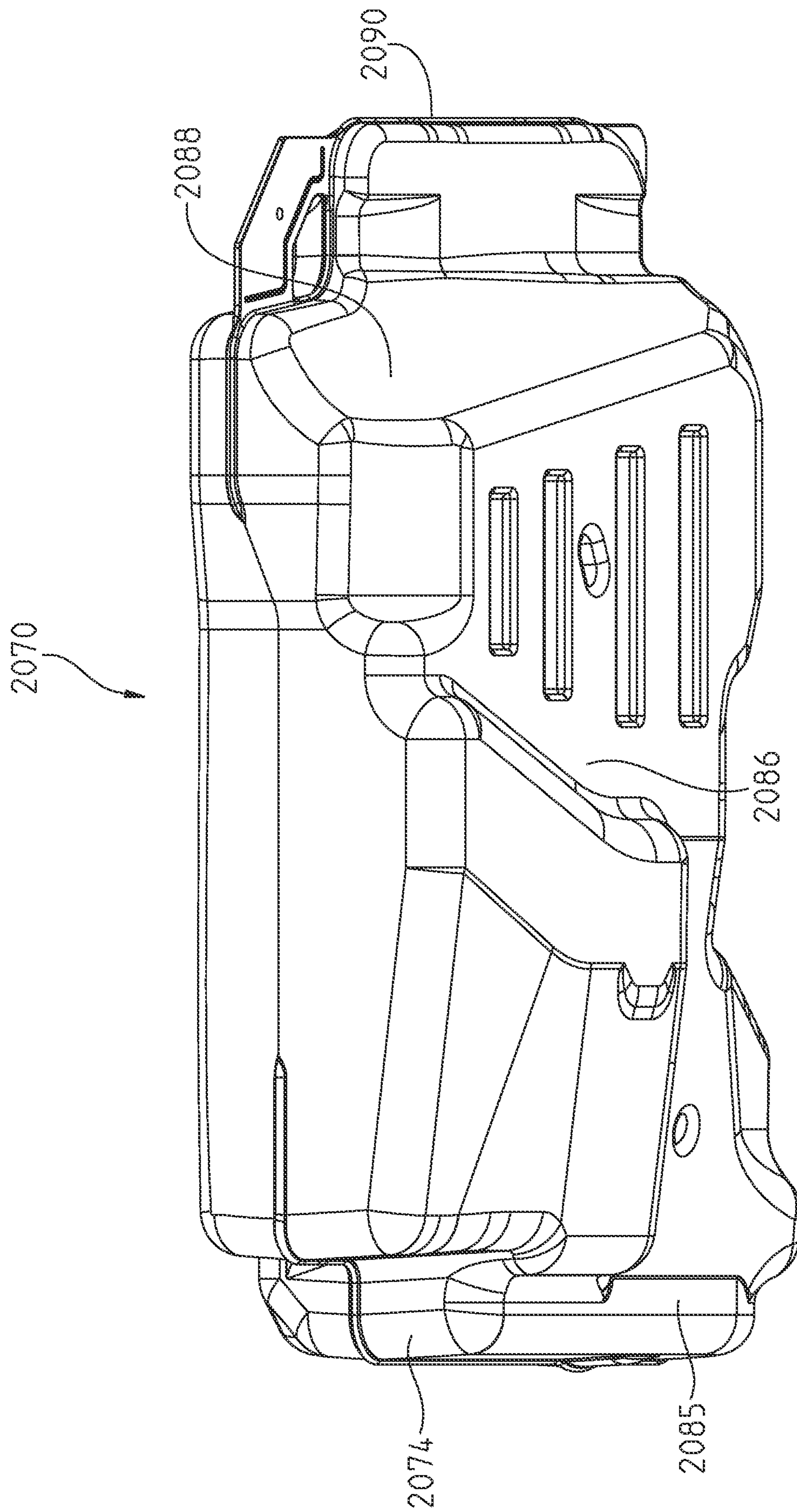


Fig. 11A

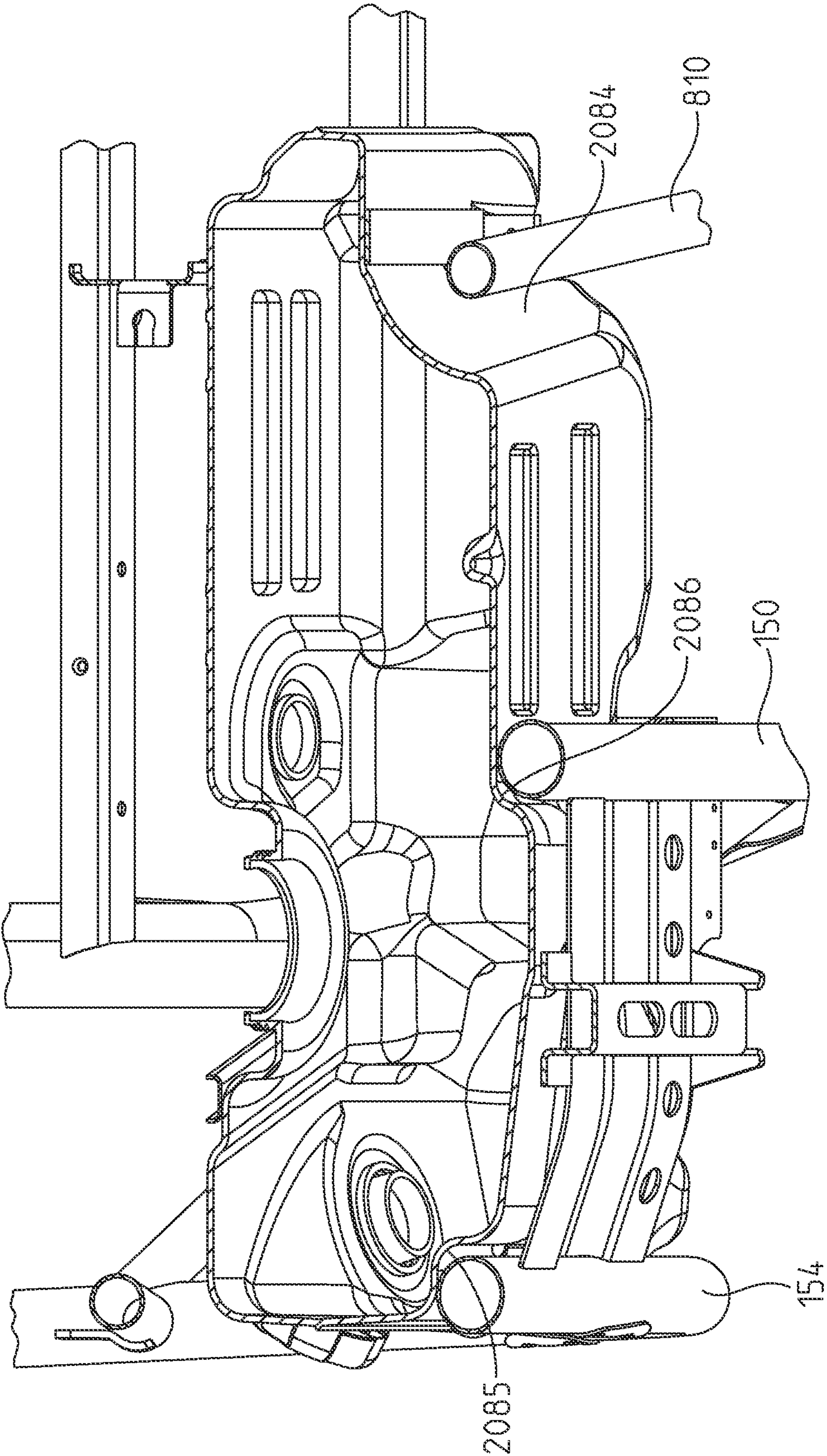


Fig. 11B

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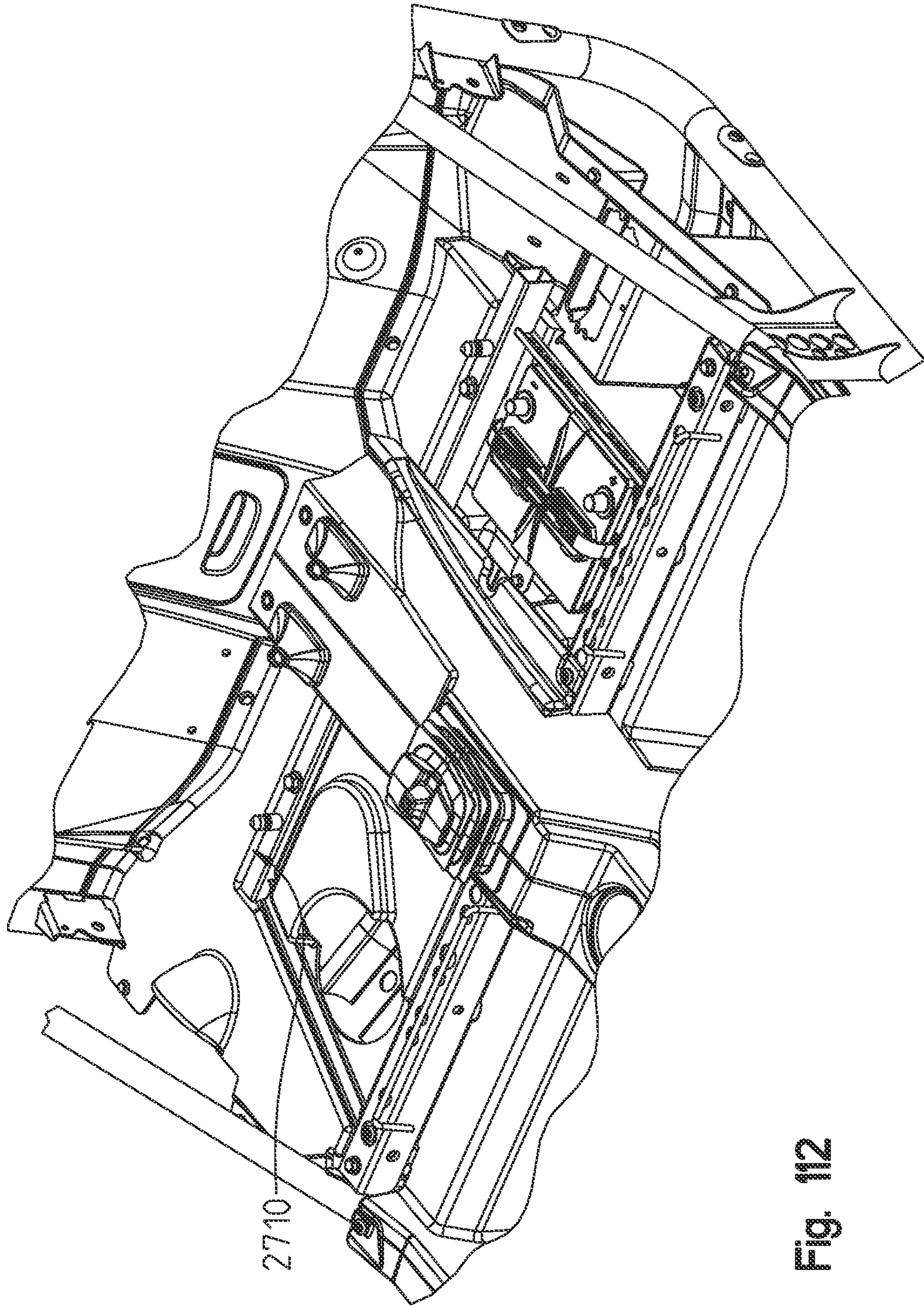


Fig. 112

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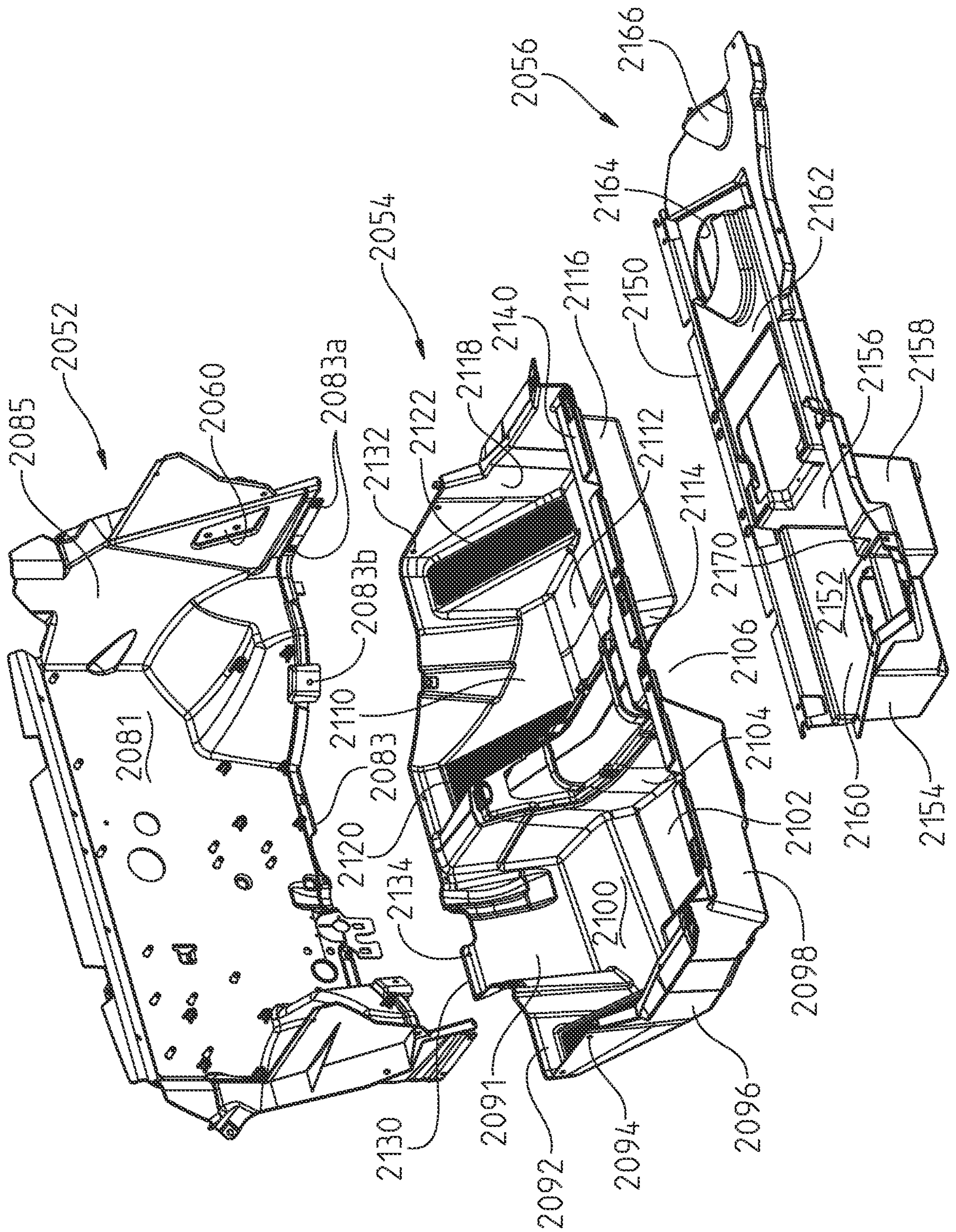


Fig. 113

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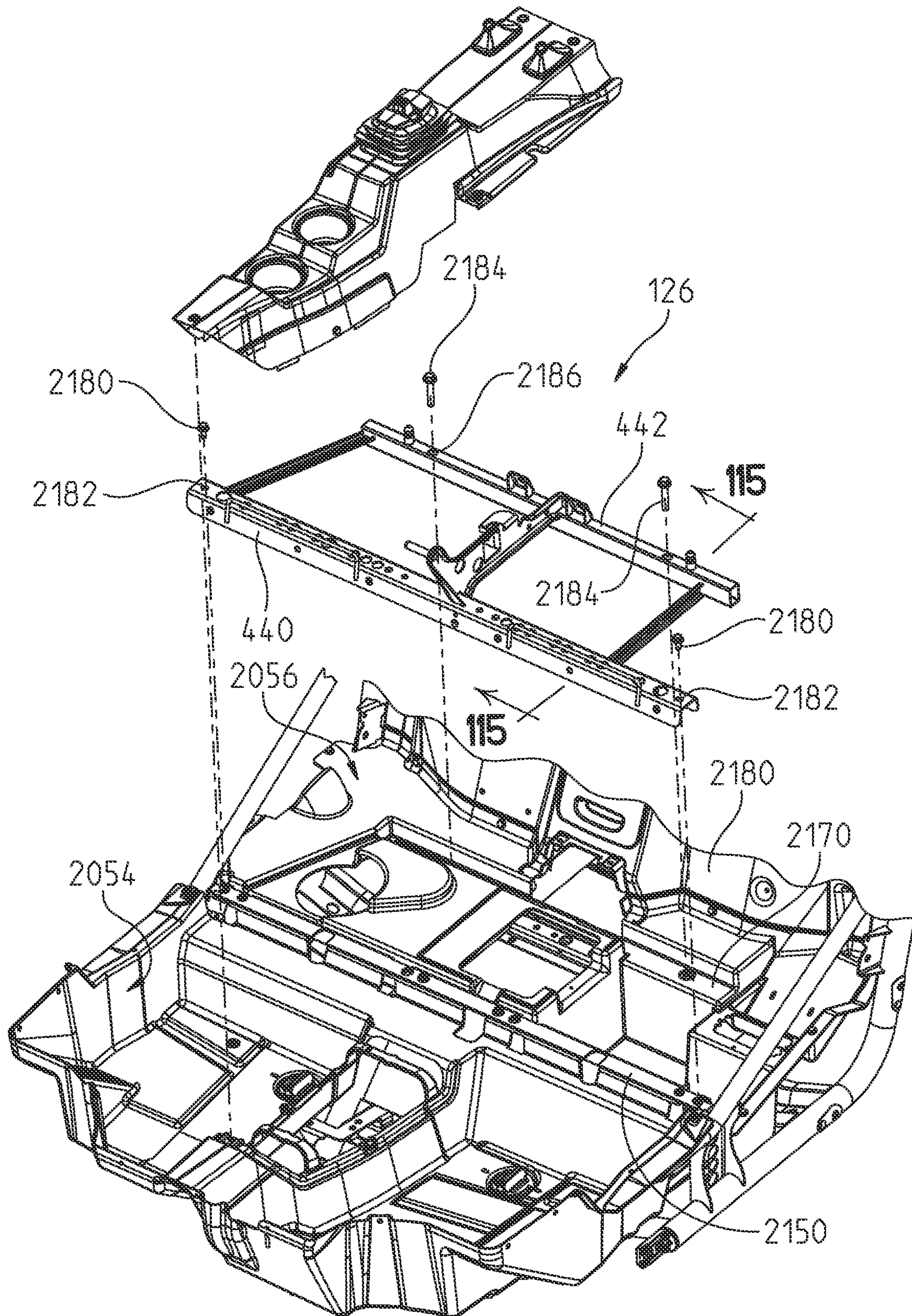
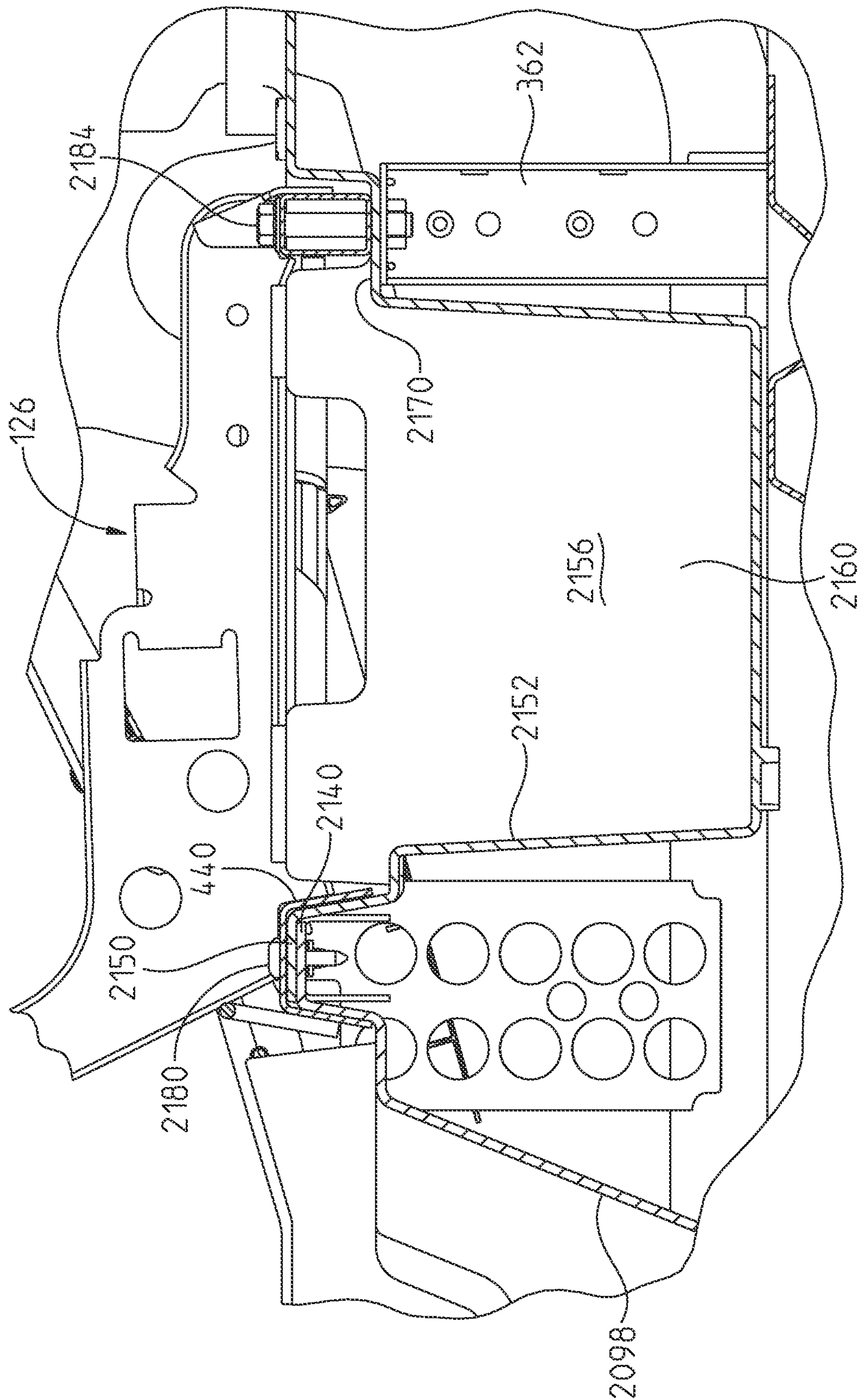


Fig. 114

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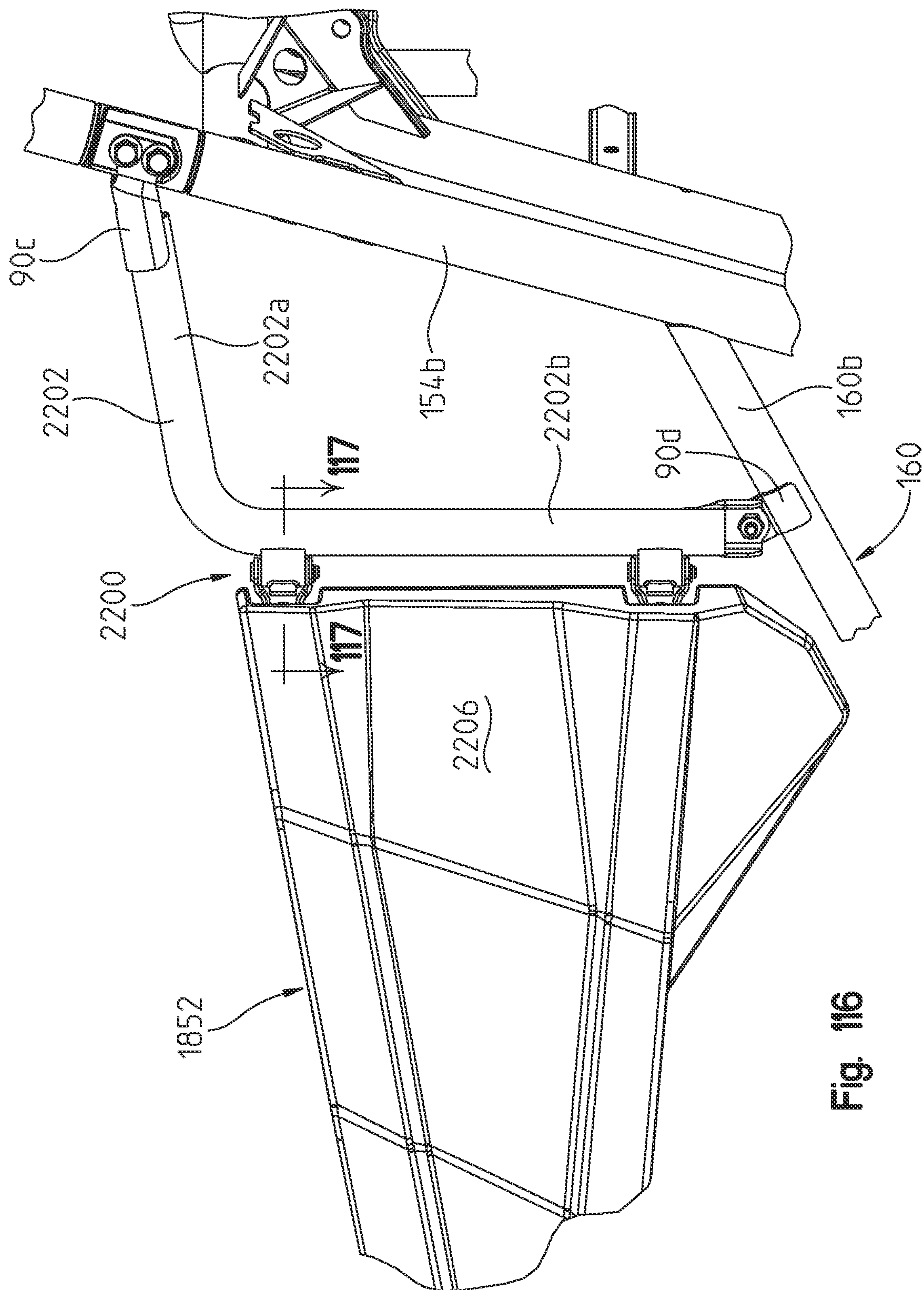
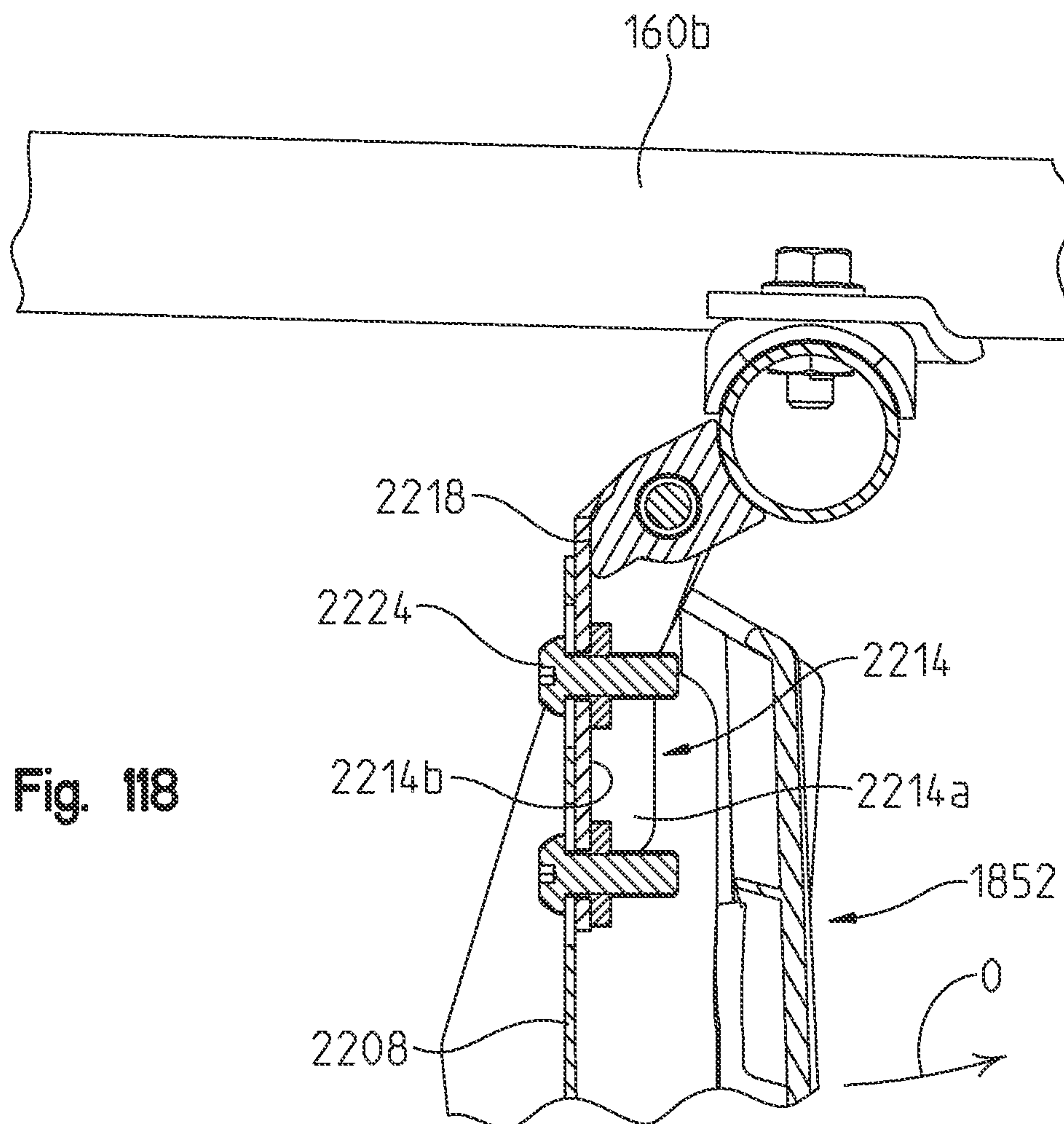
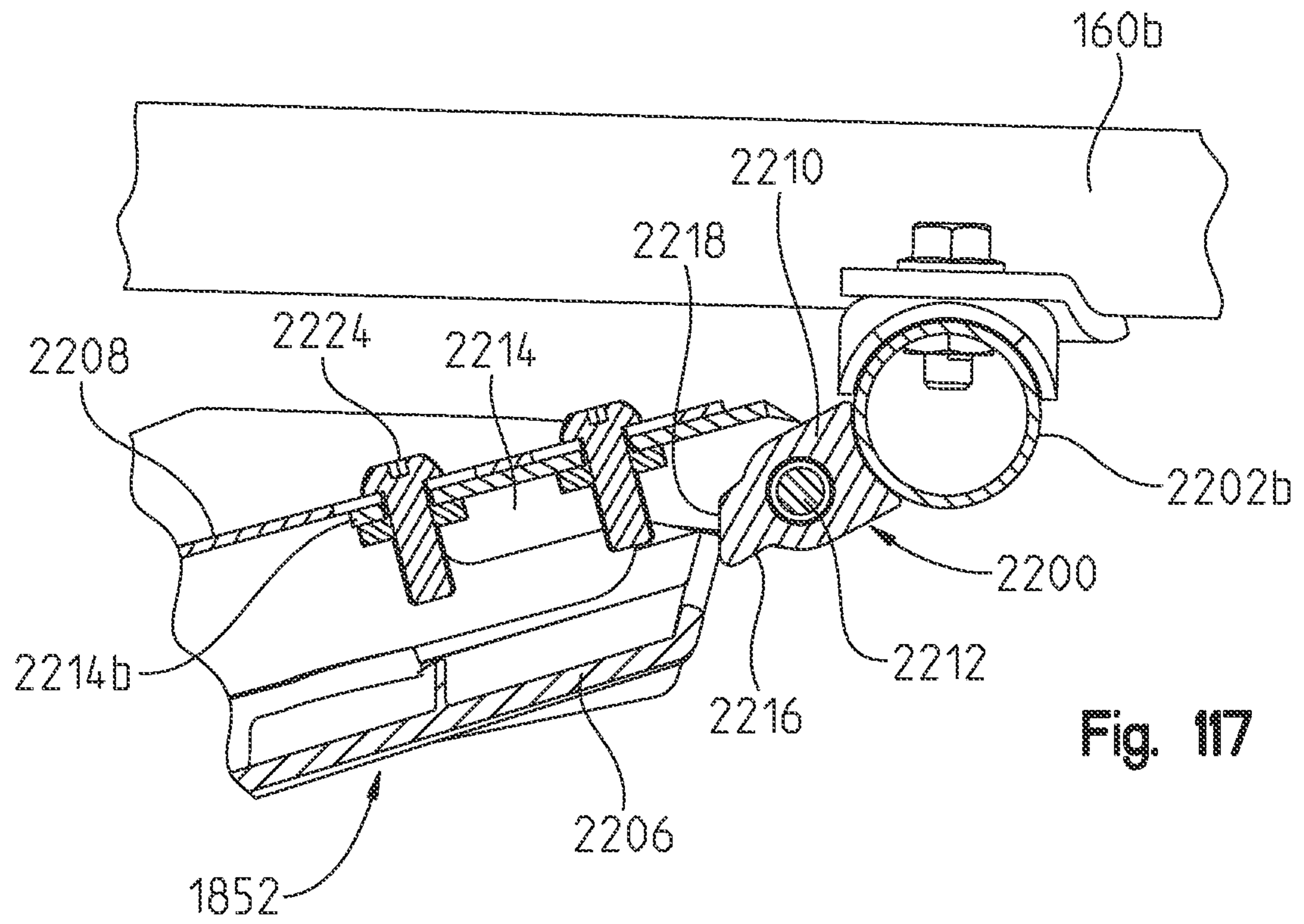


Fig. 116

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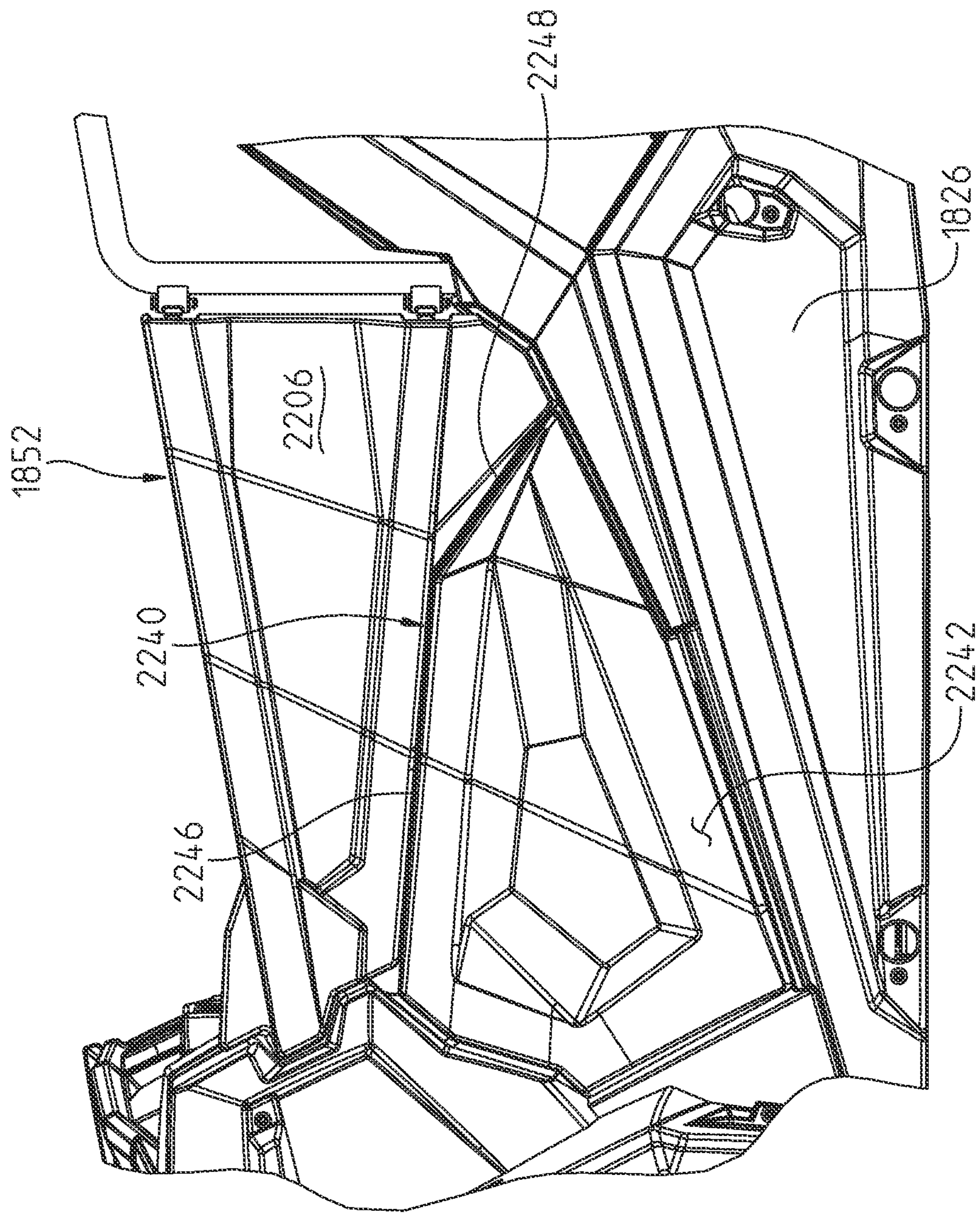


Fig. 119A

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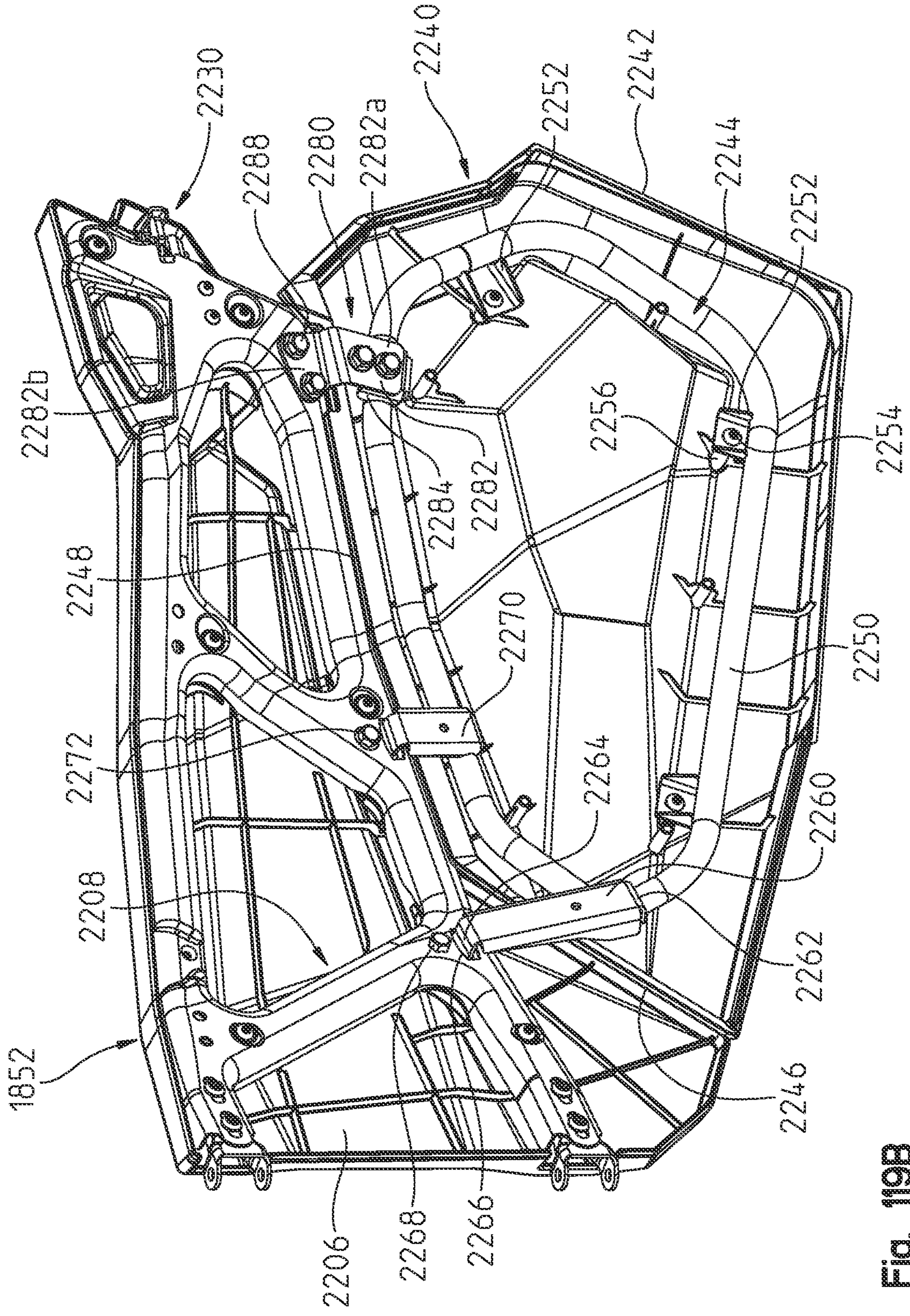


Fig. 119B

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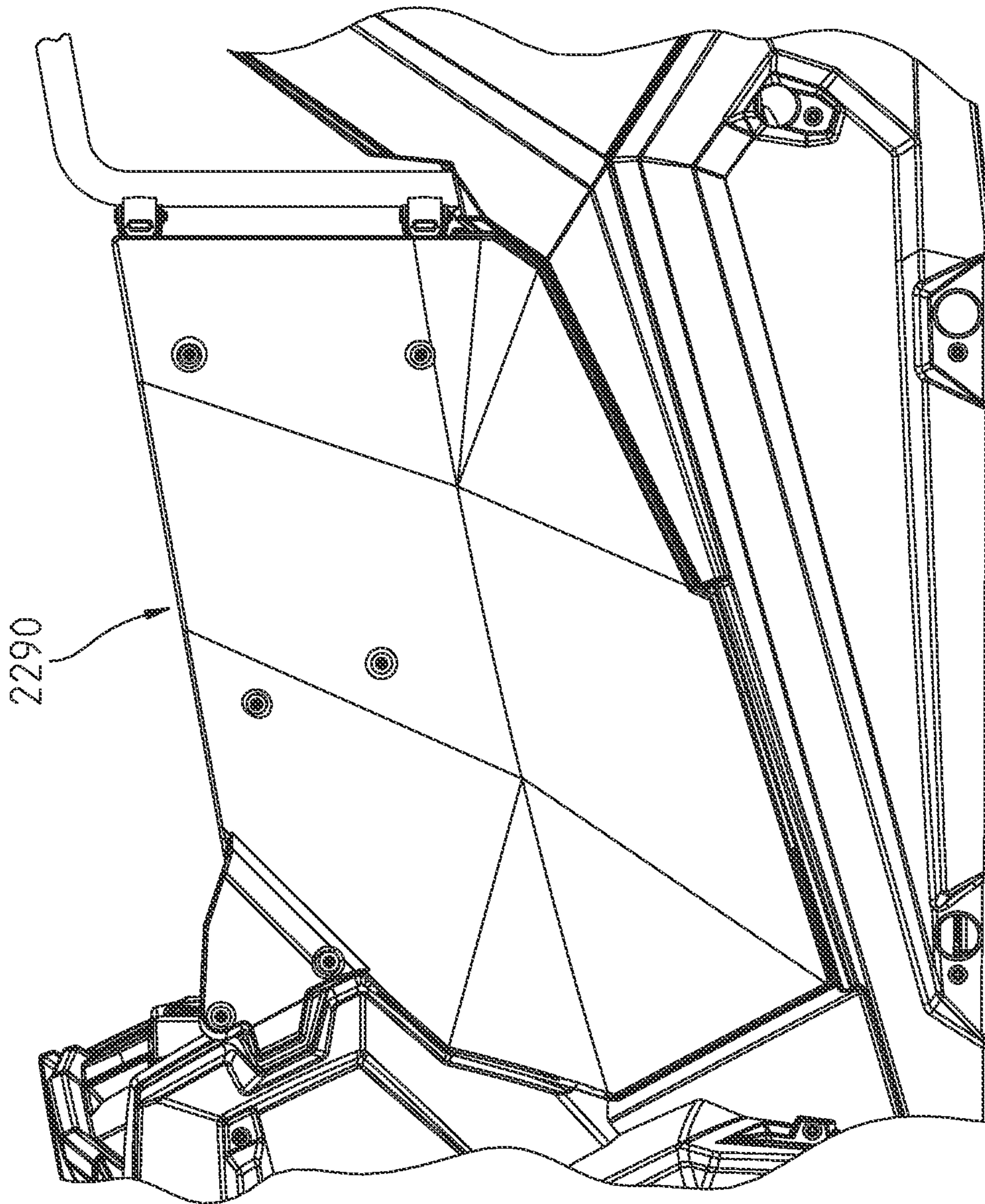


Fig. 120A

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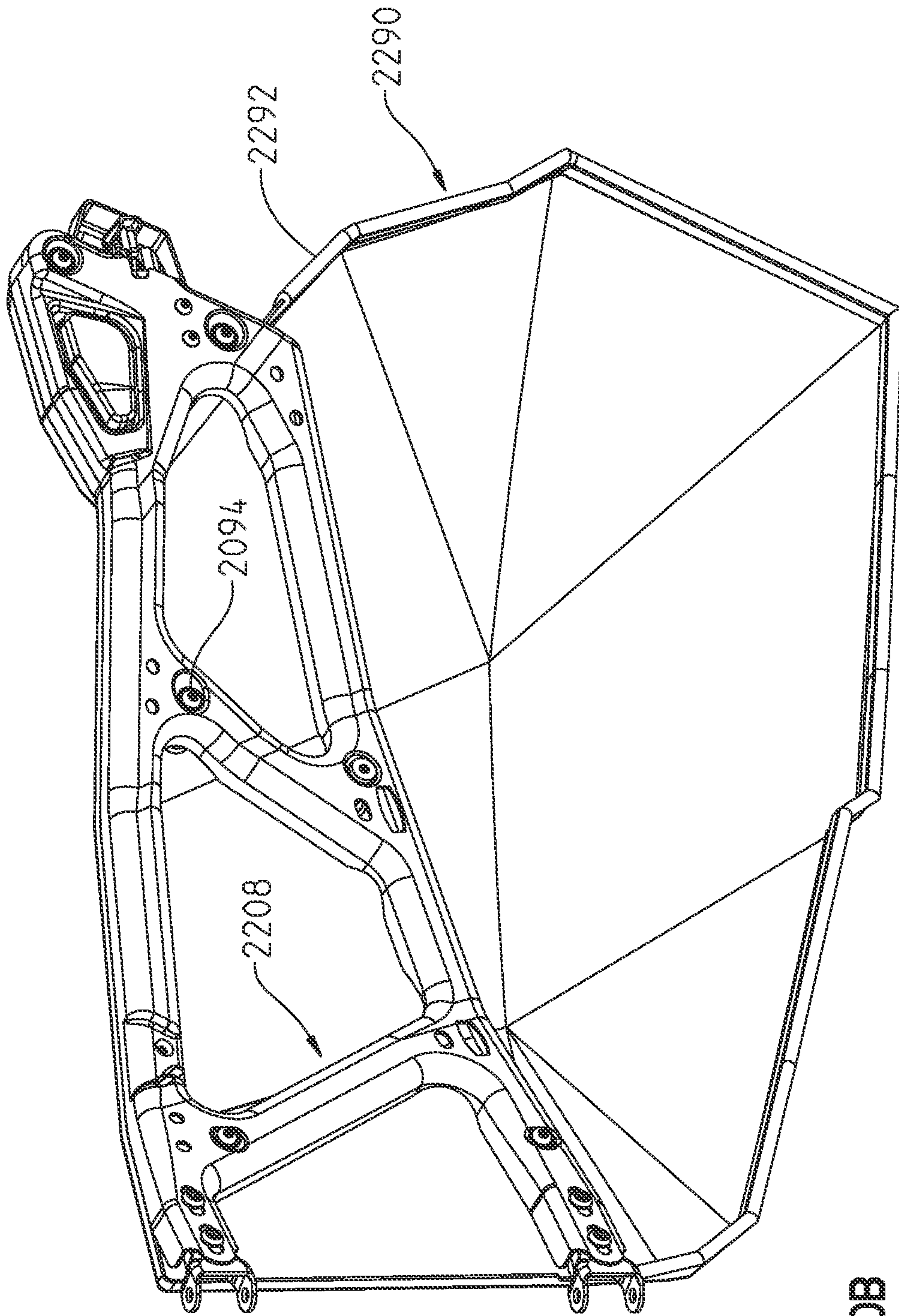


Fig. 120B

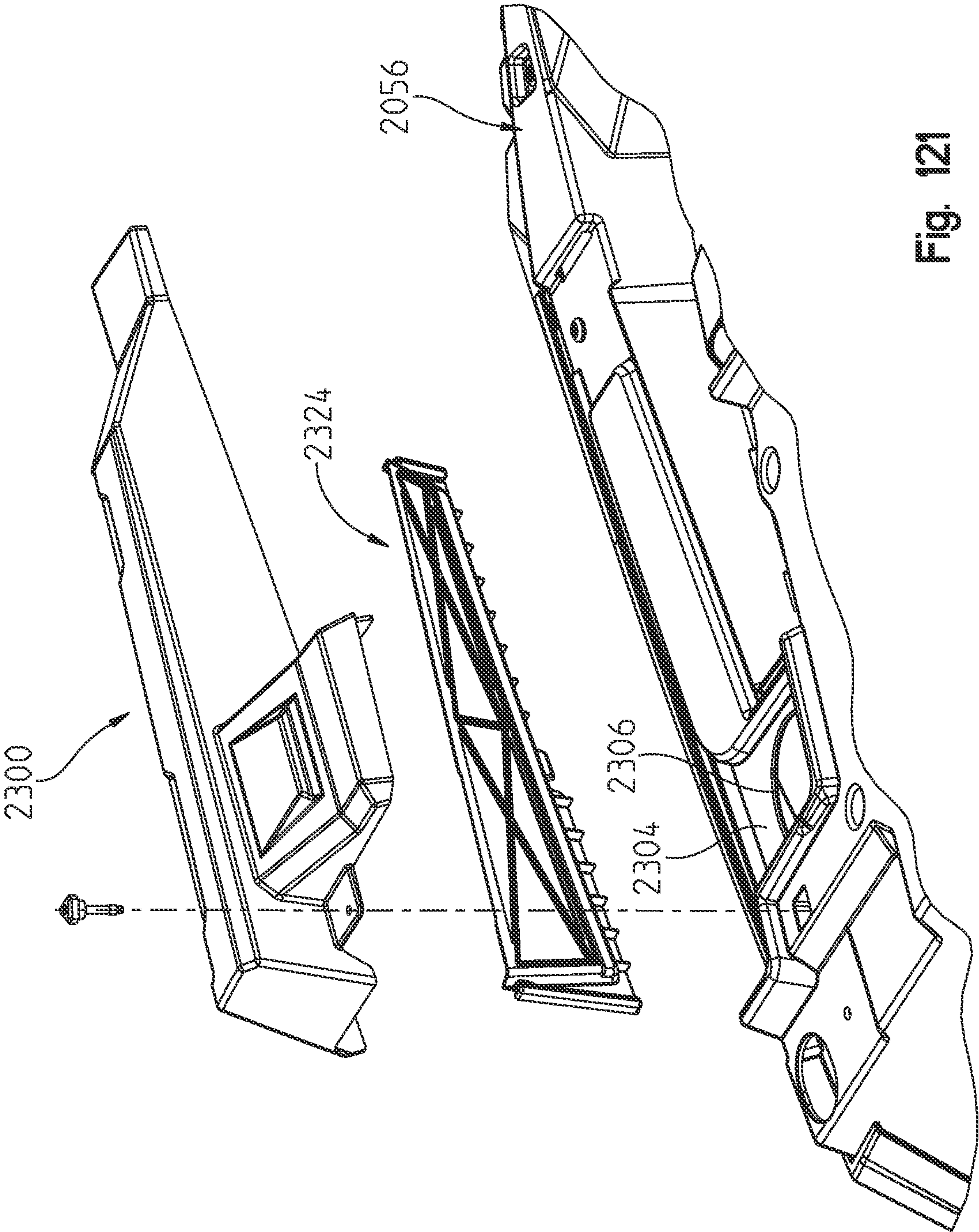
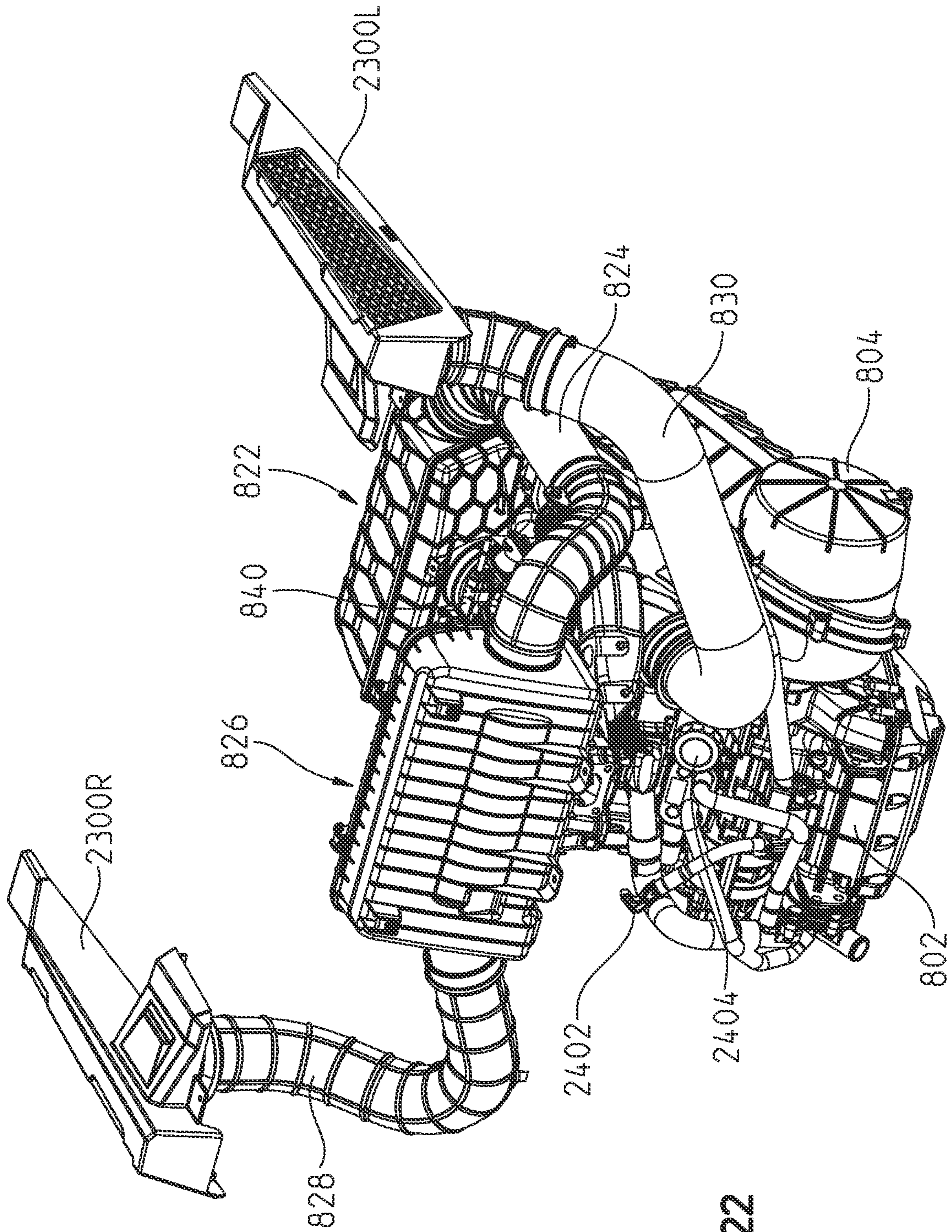


Fig. 121

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L'

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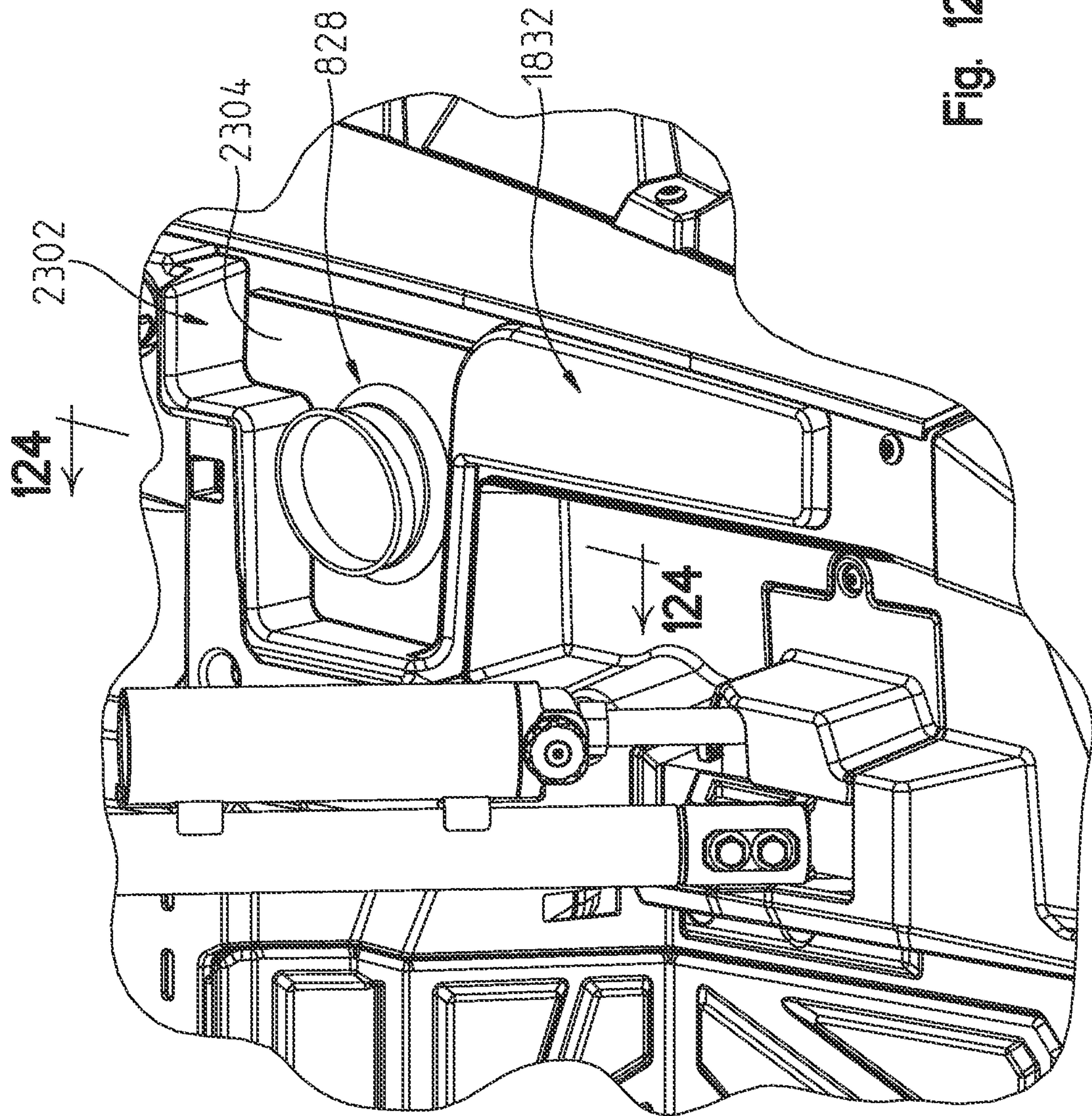


Fig. 123

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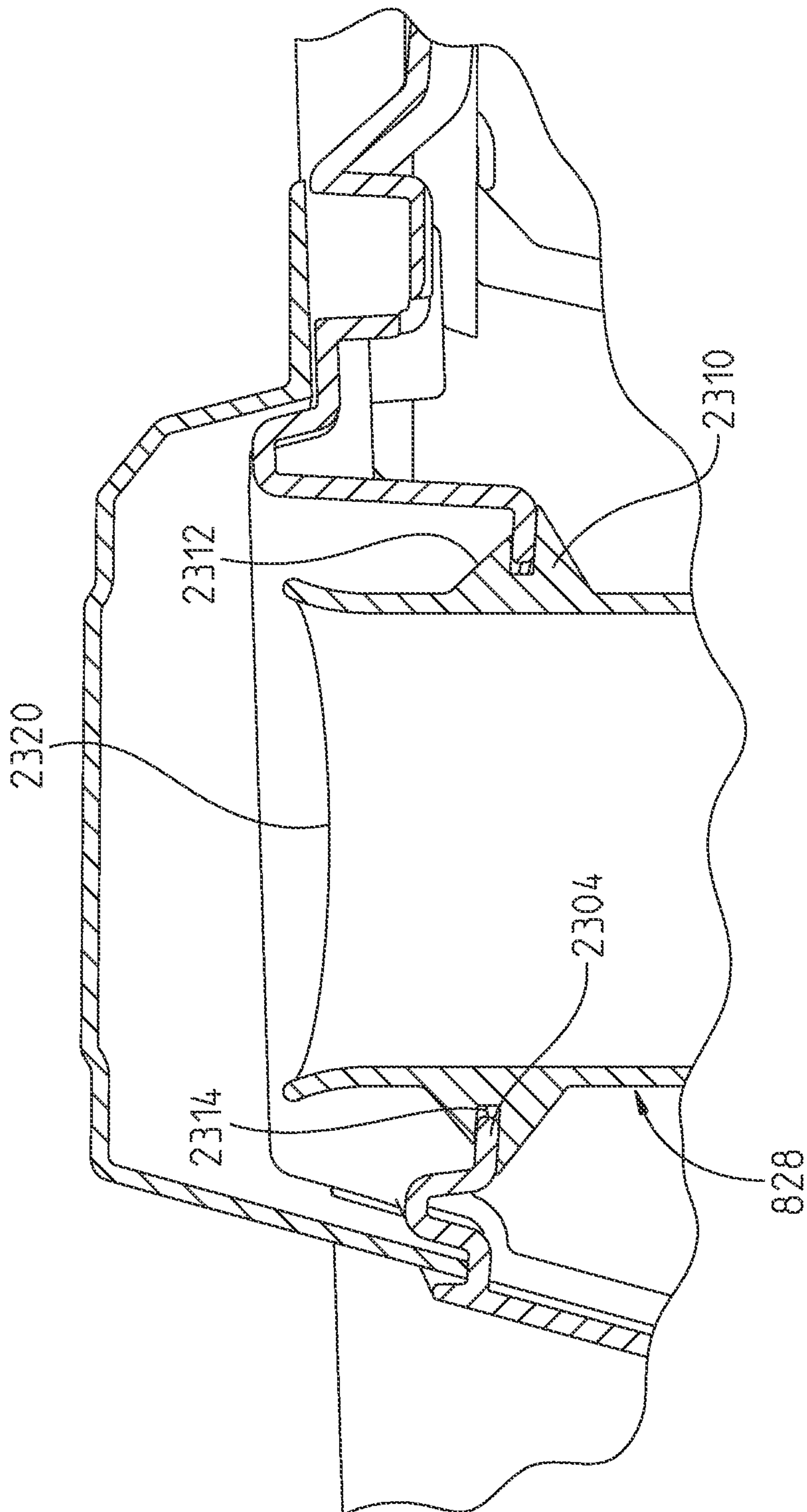


Fig. 124

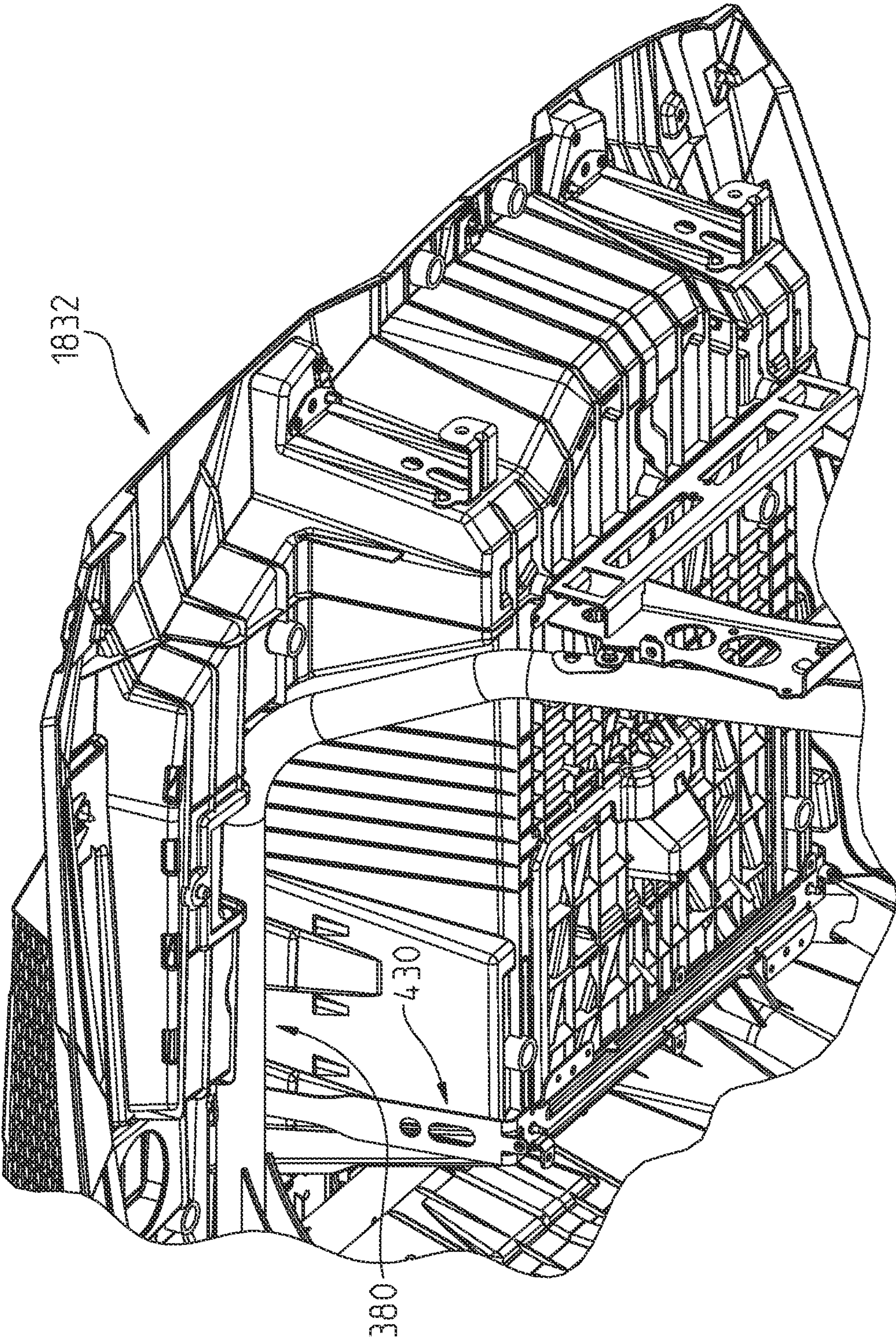


Fig. 125

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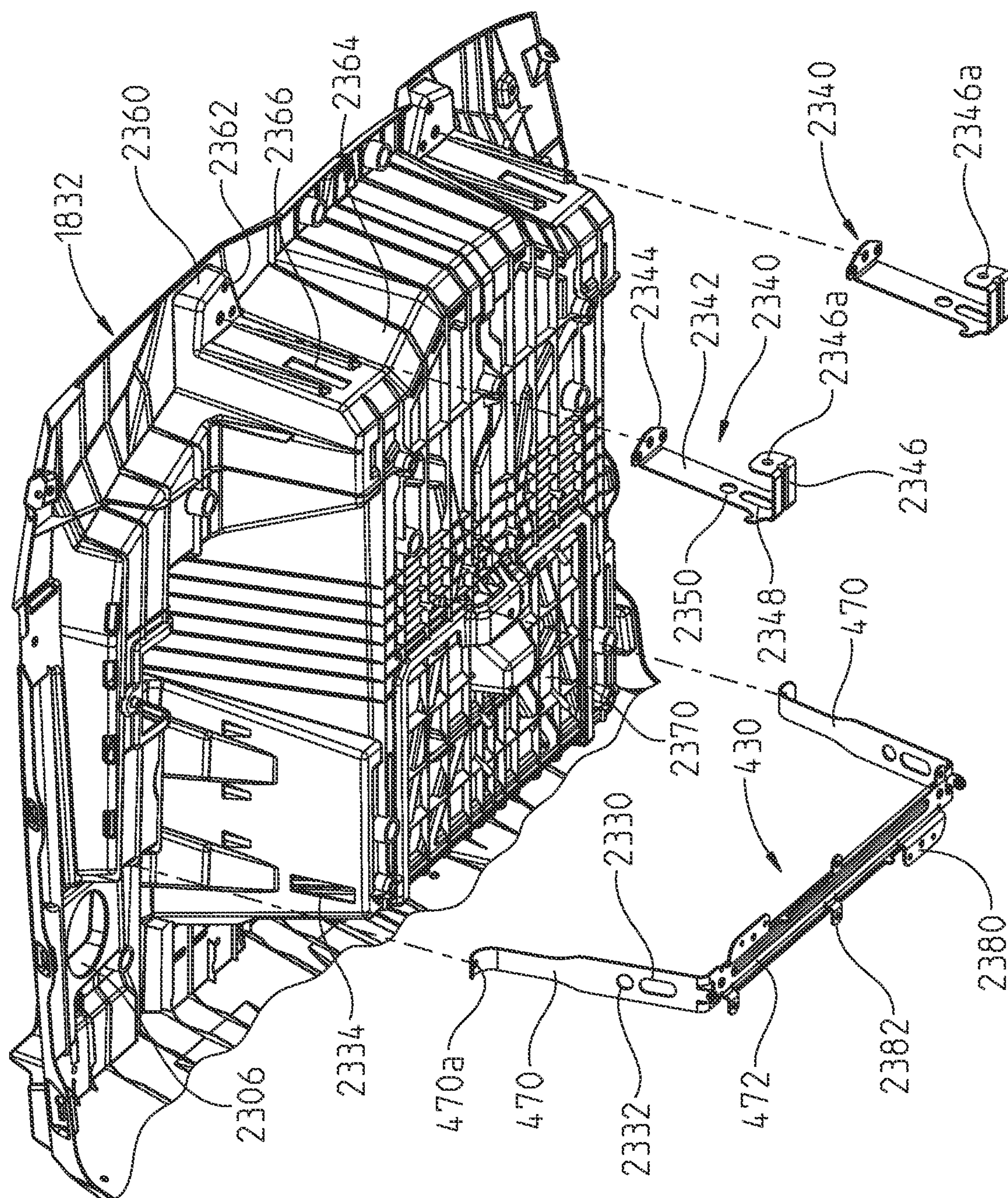


Fig. 126

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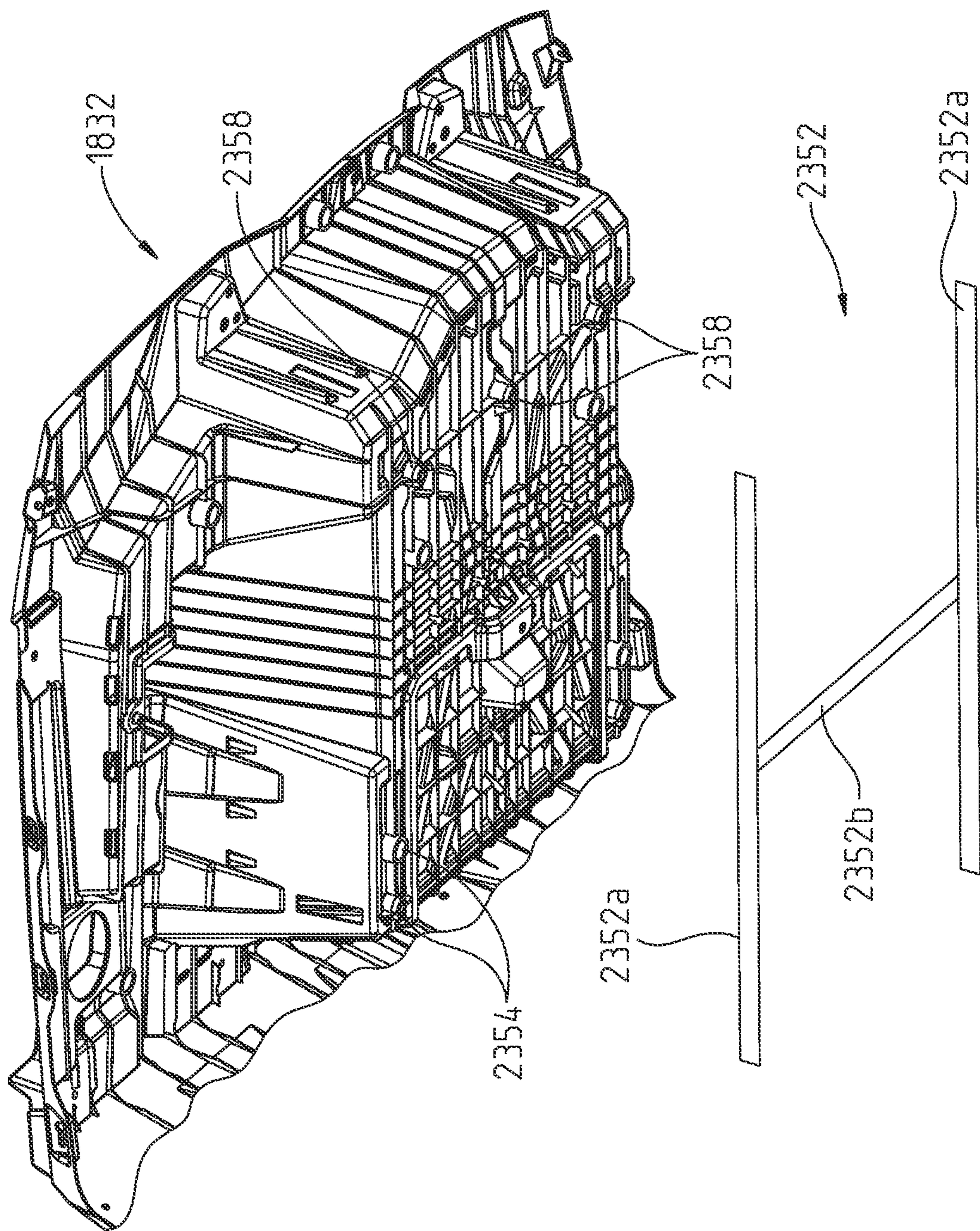


Fig. 126A

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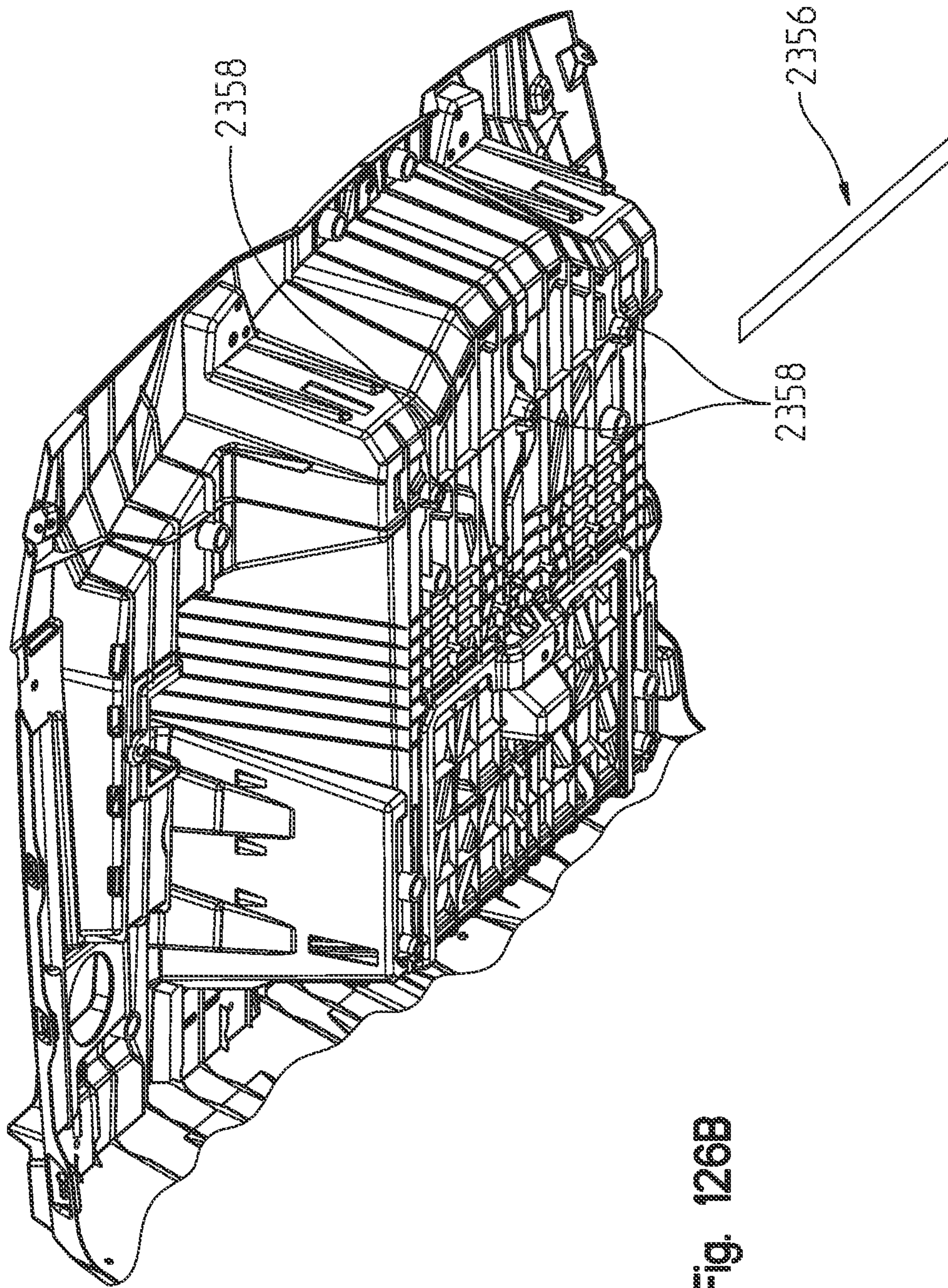


Fig. 126B

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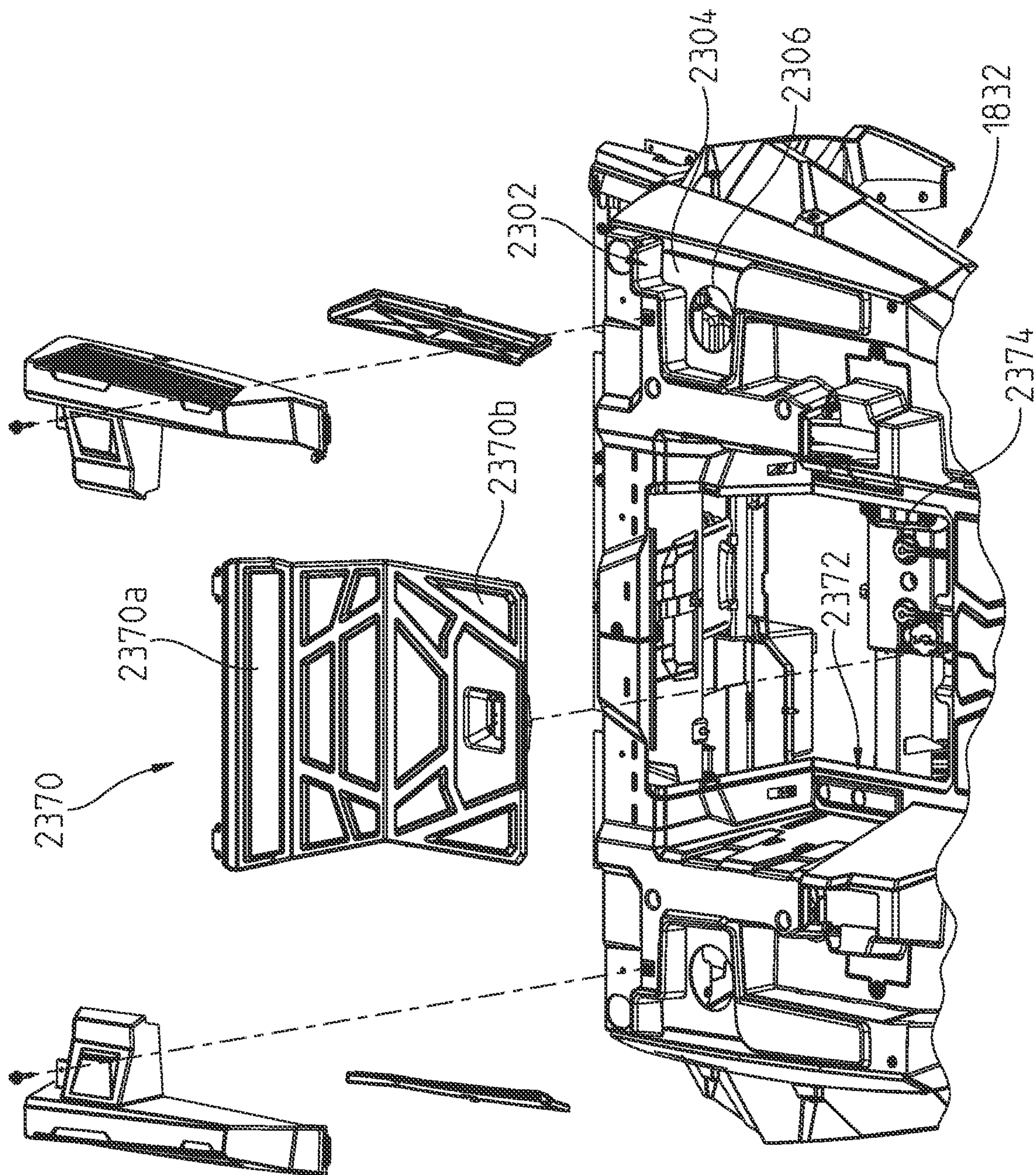


Fig. 127

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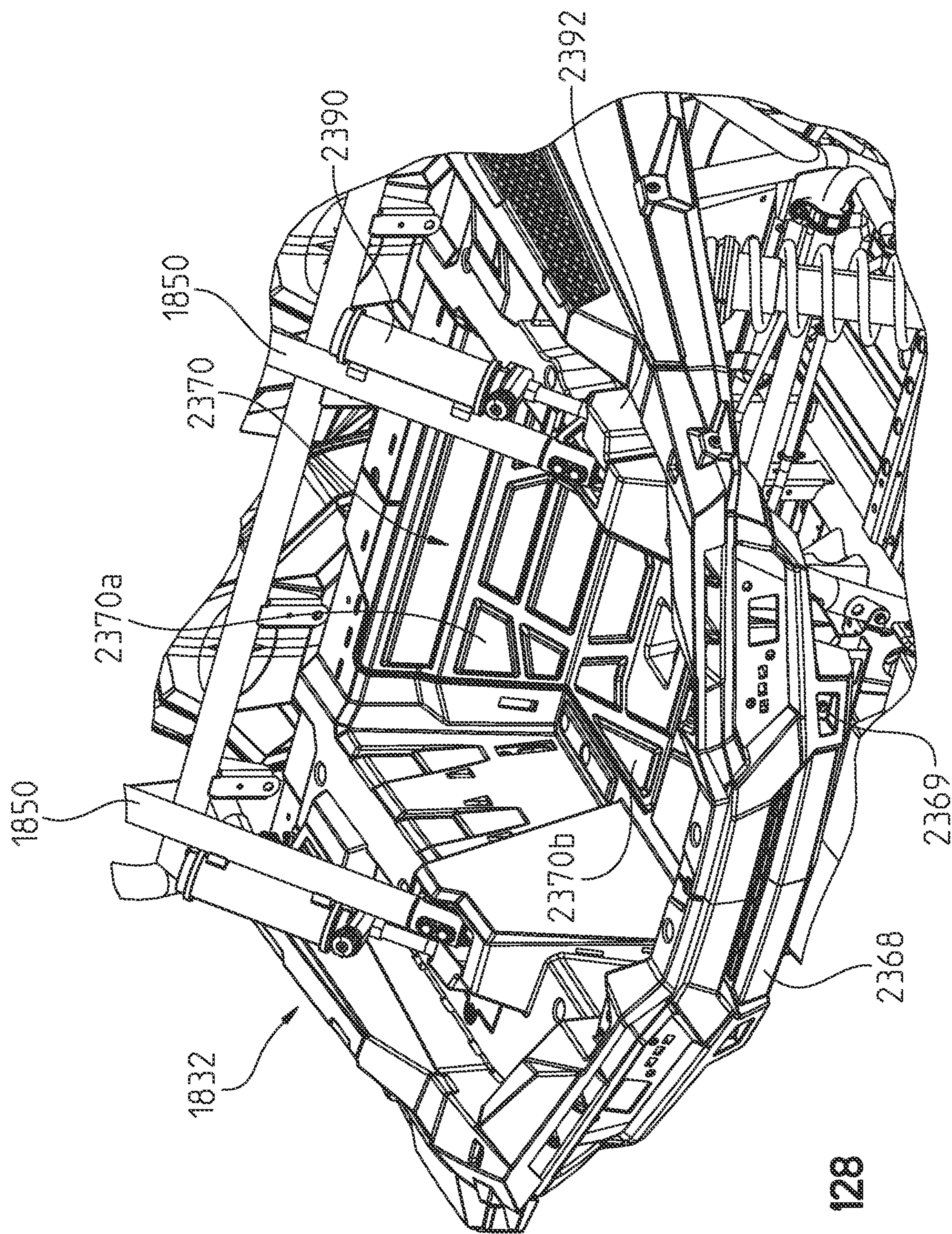
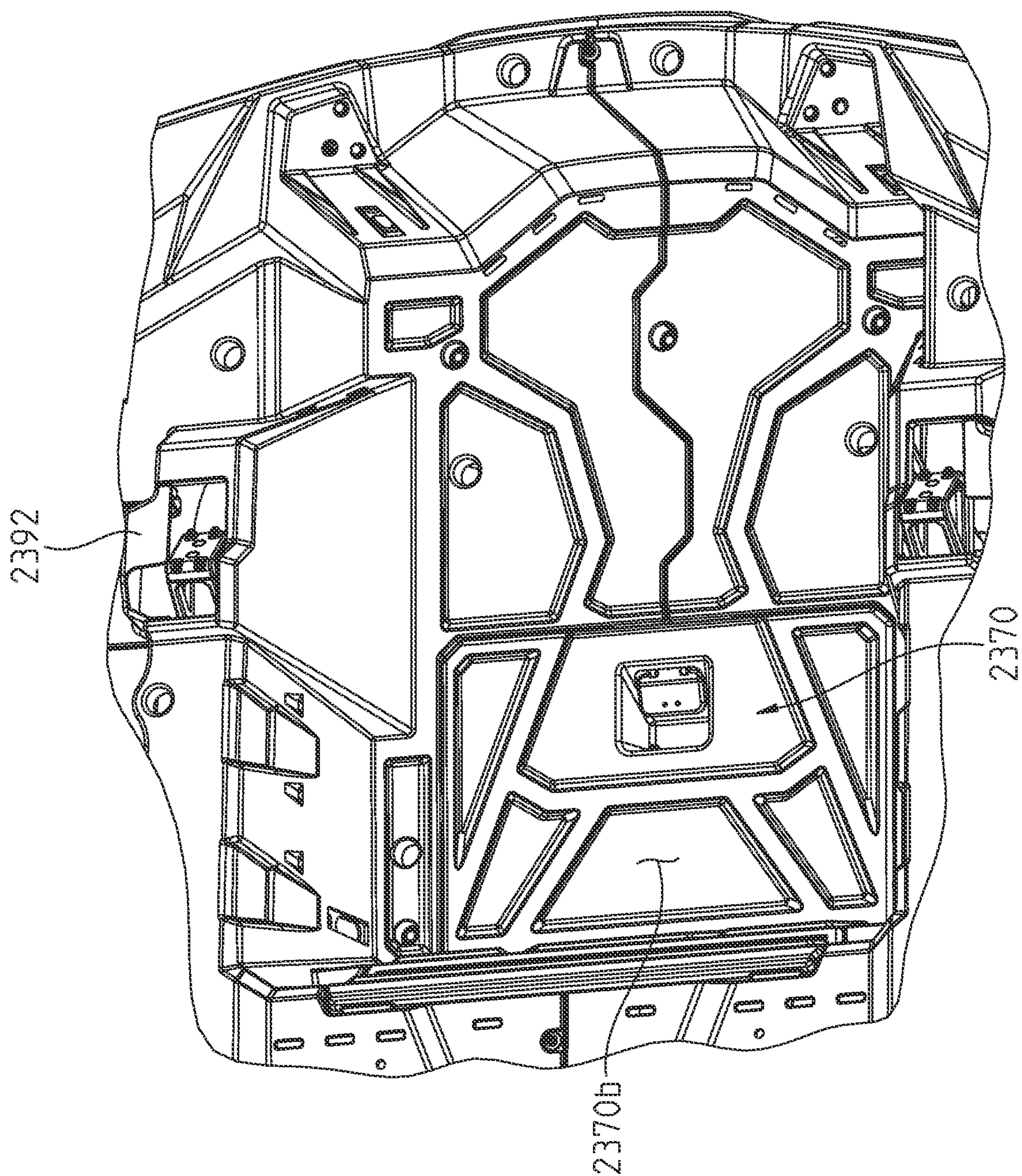


Fig. 128

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Fig. 129



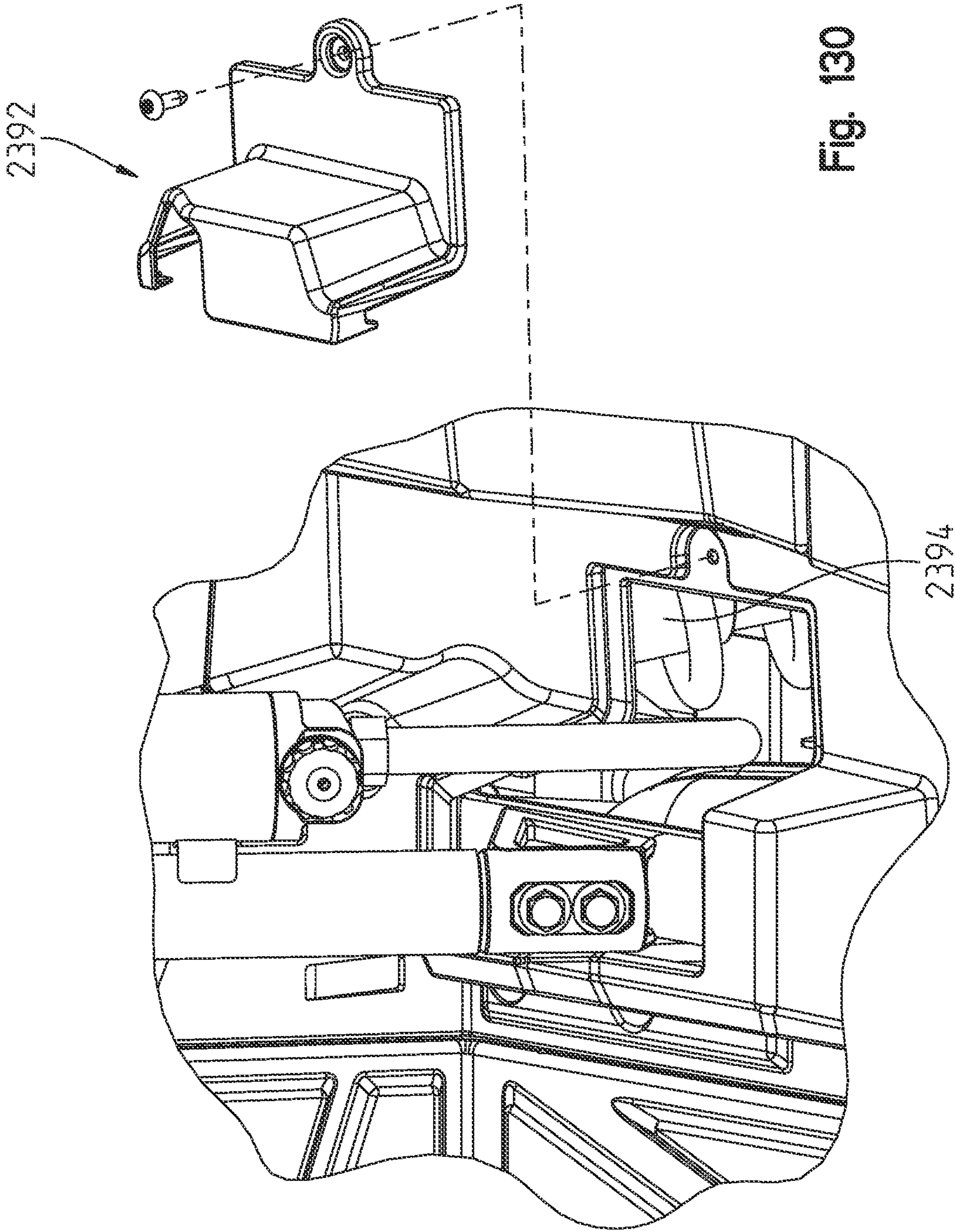


Fig. 130

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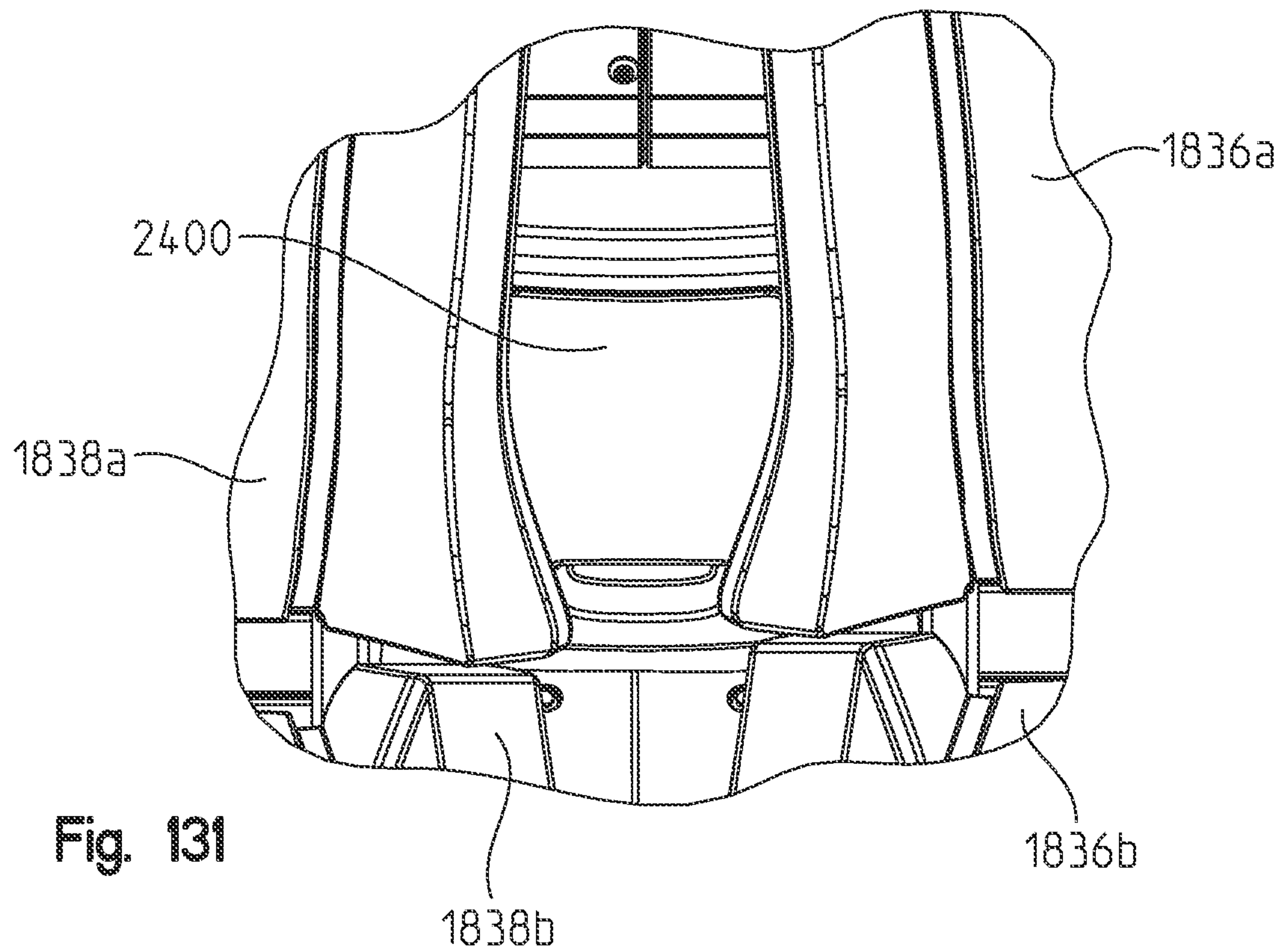


Fig. 131

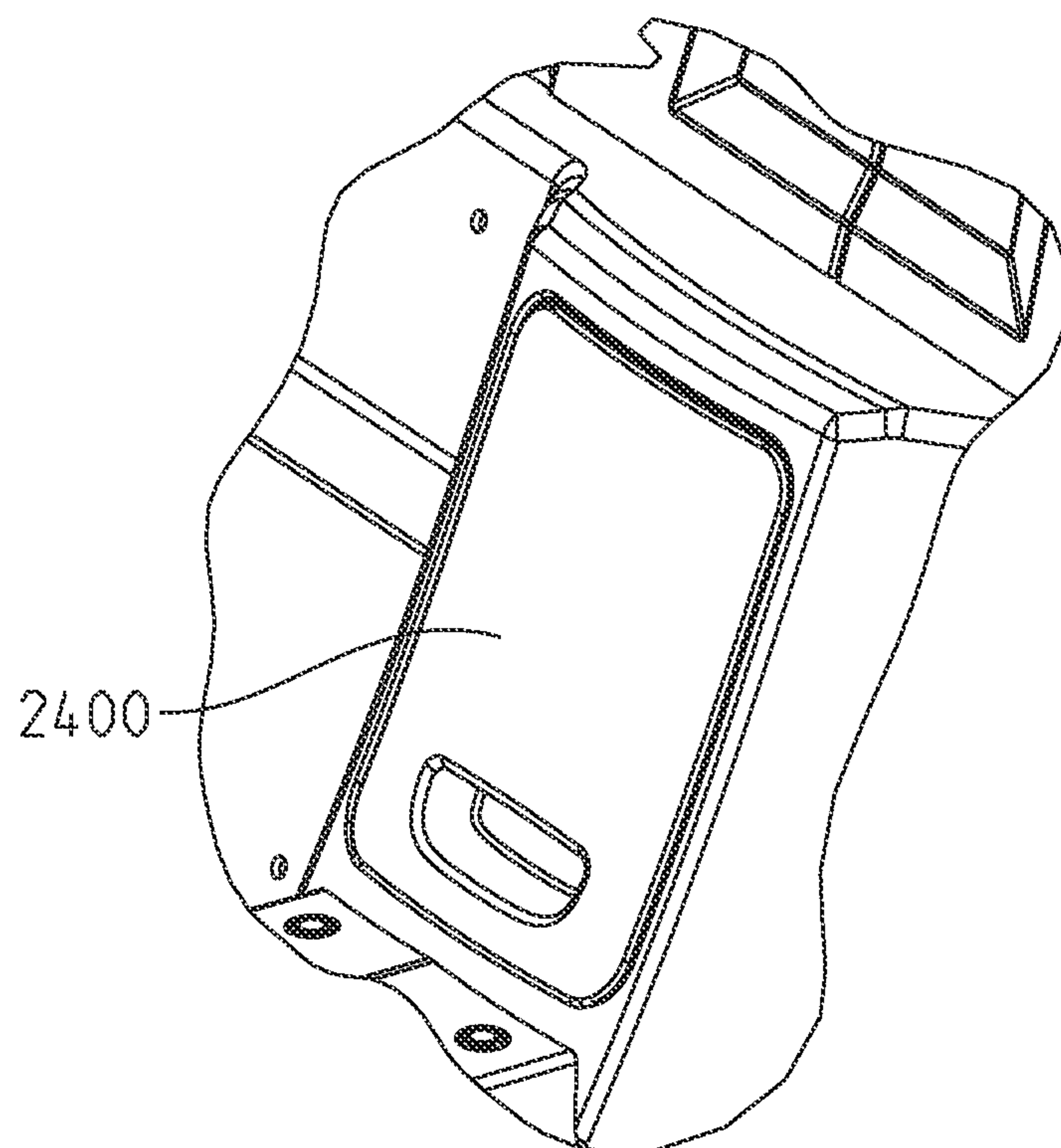


Fig. 132

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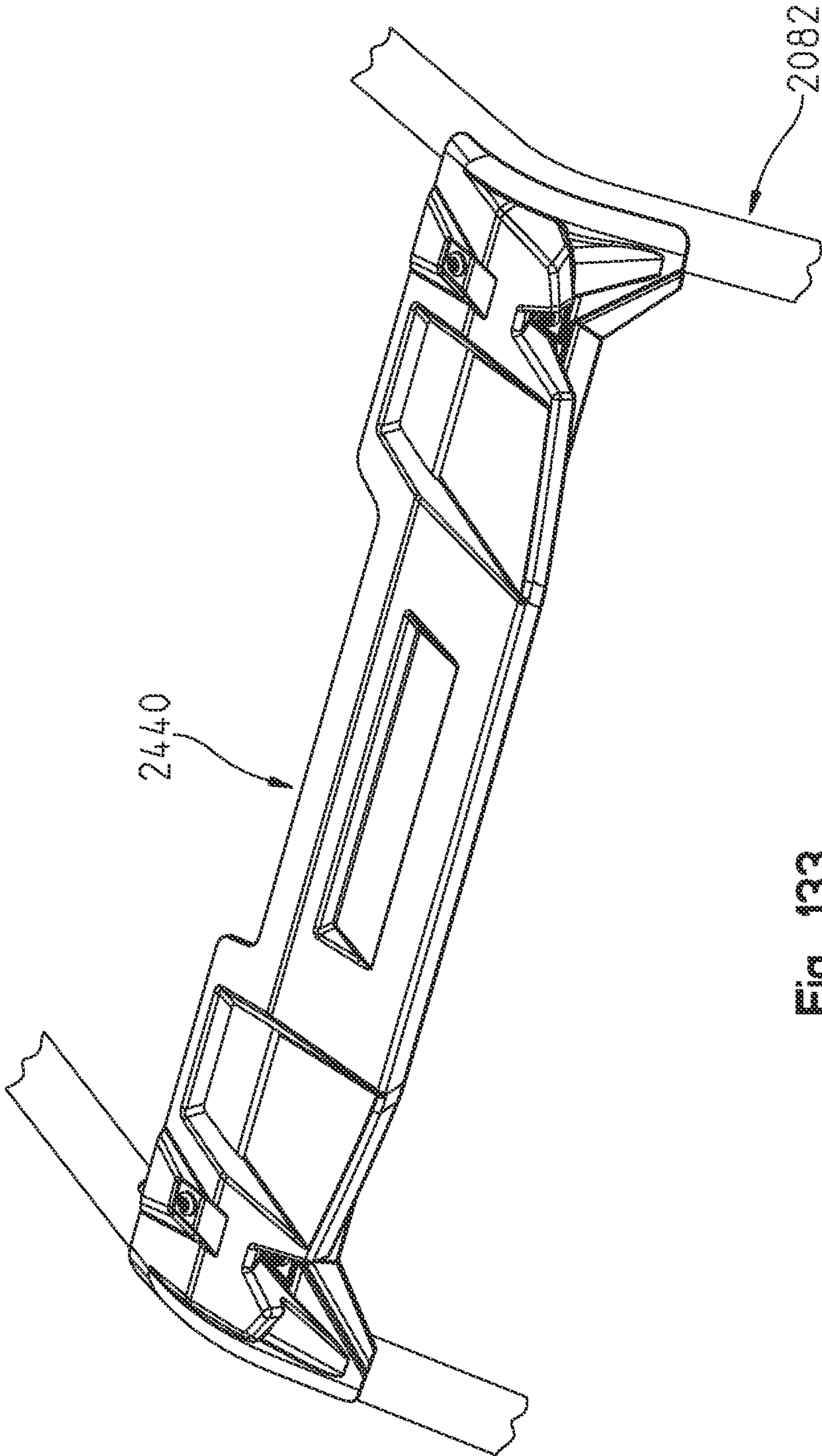


Fig. 133

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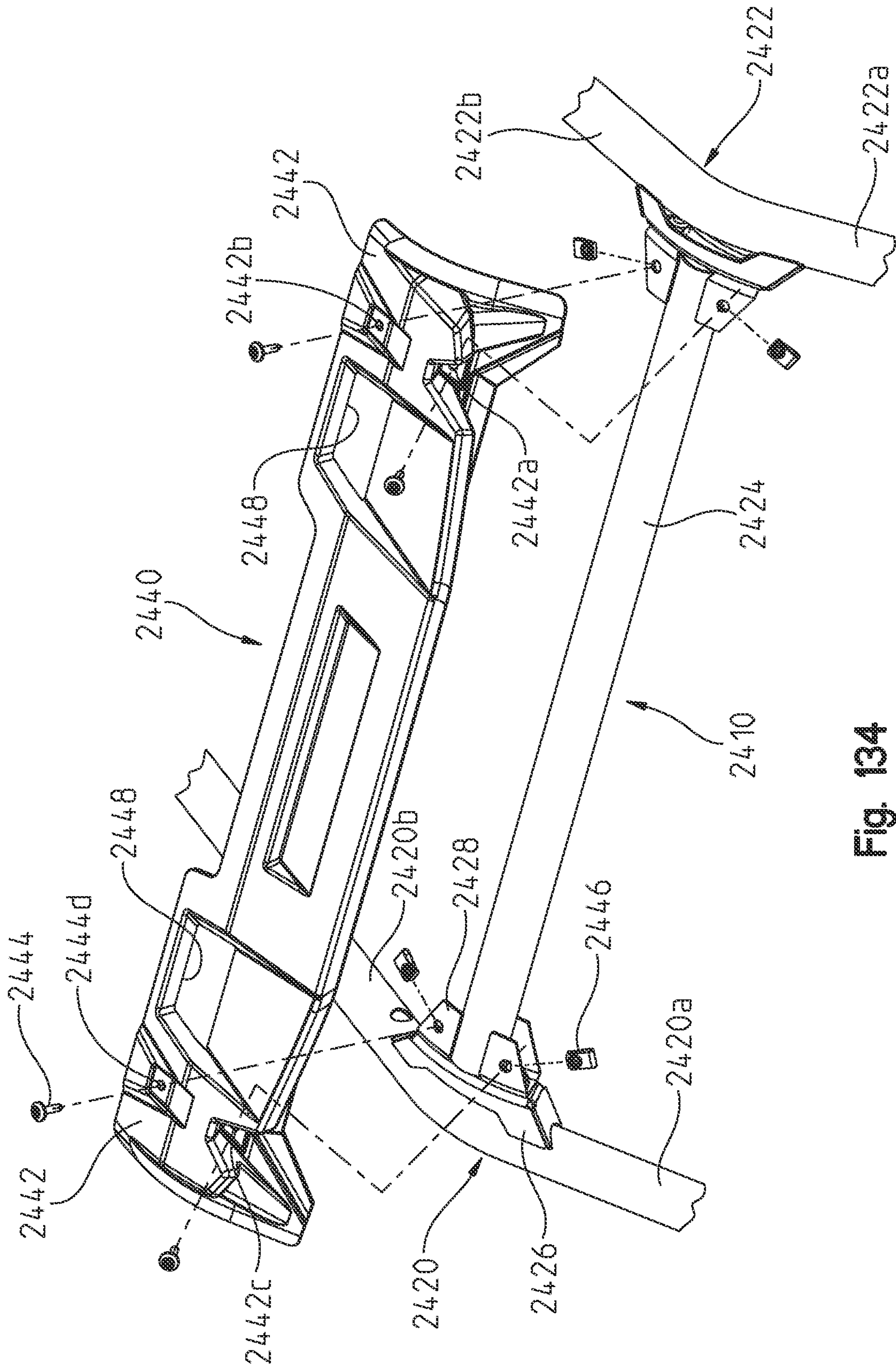


Fig. 134

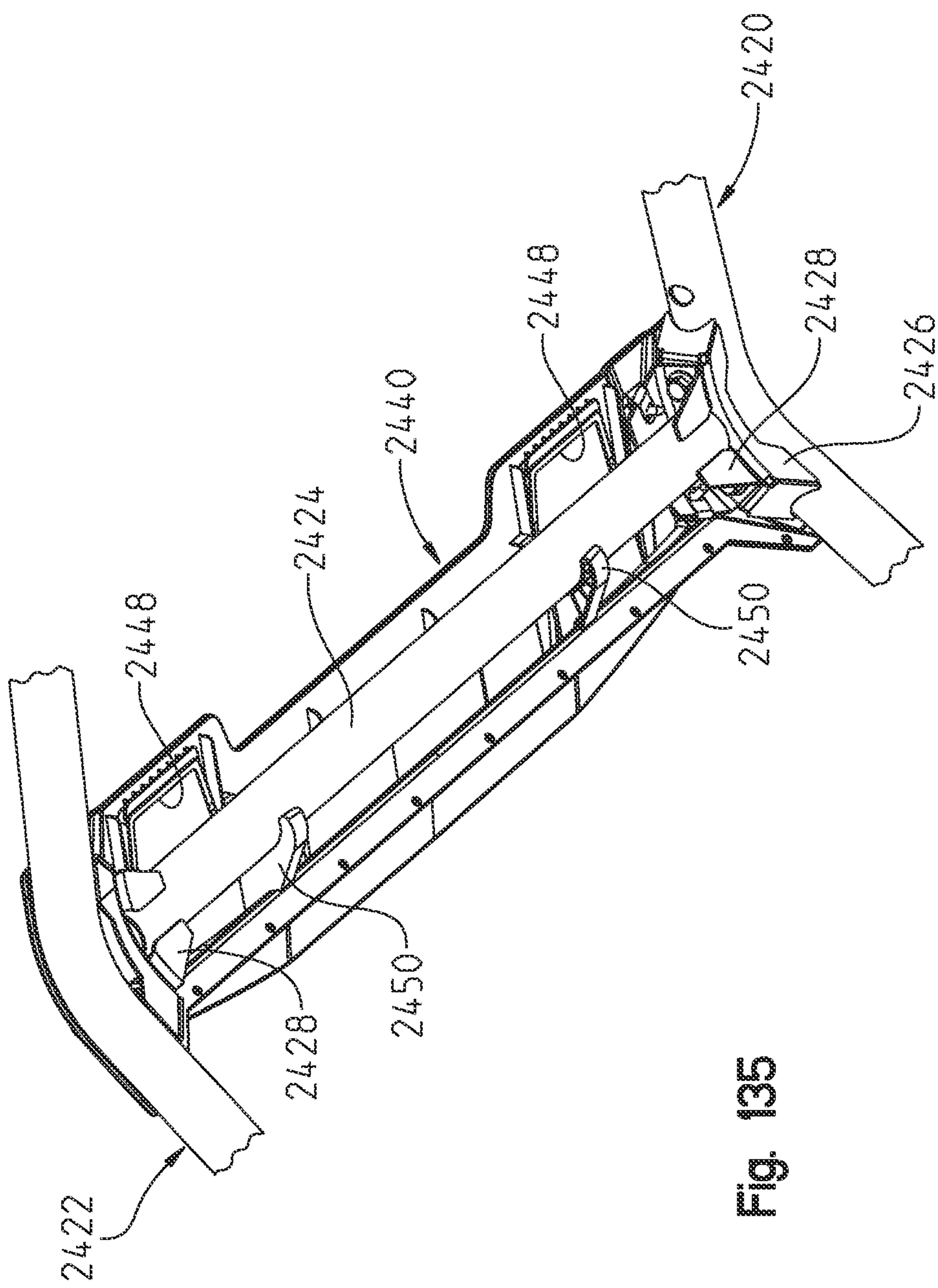


Fig. 135

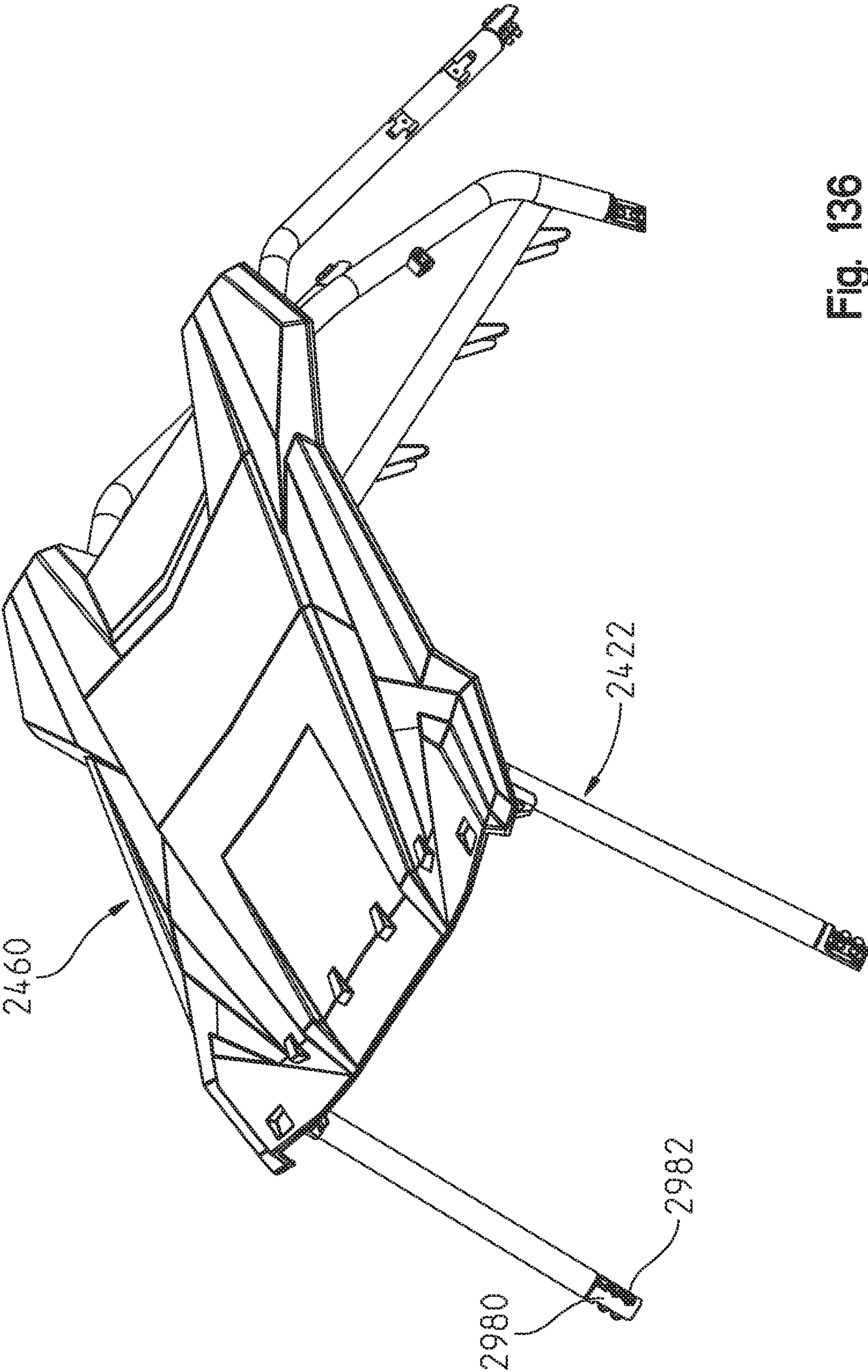


Fig. 136

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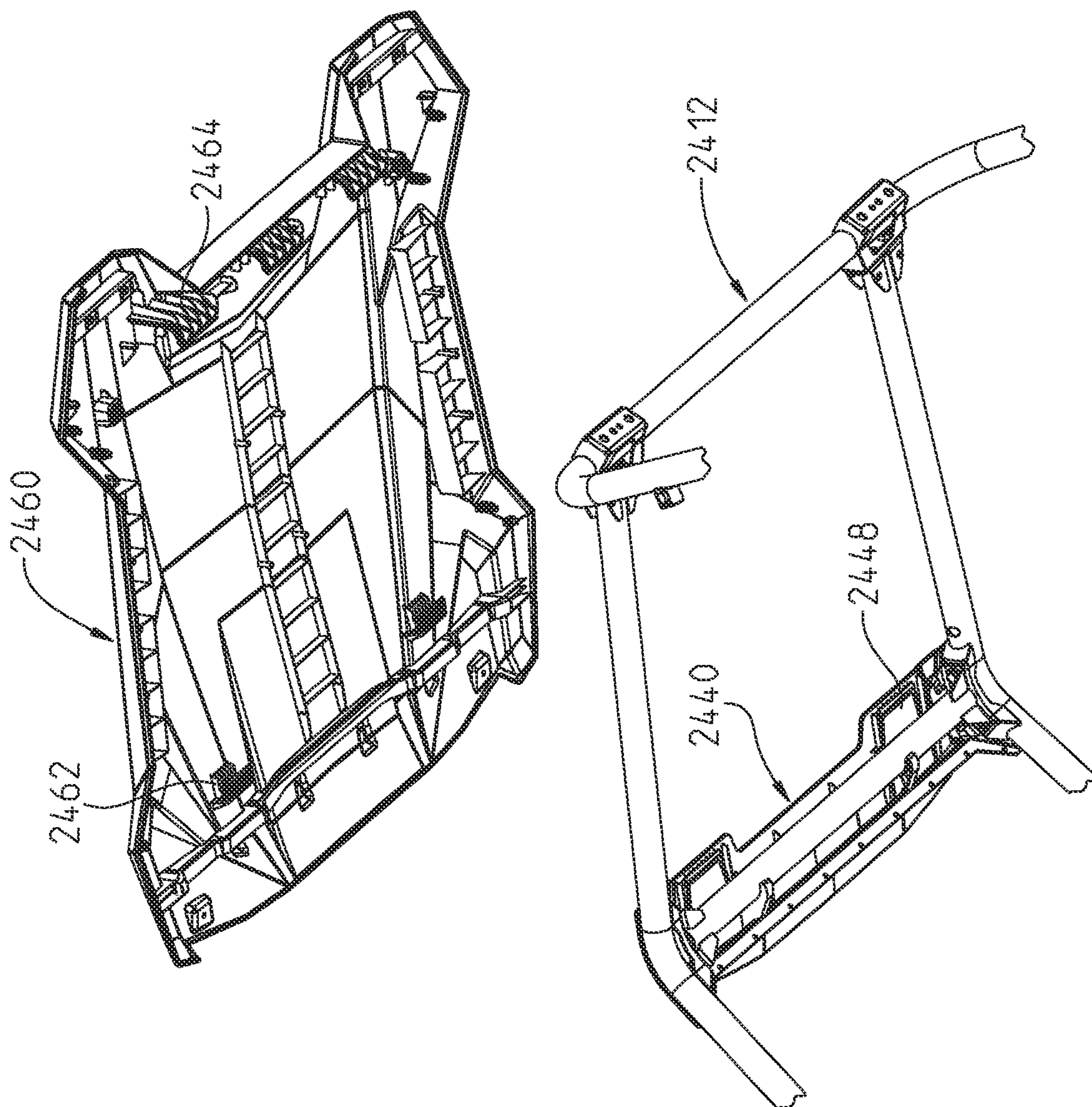
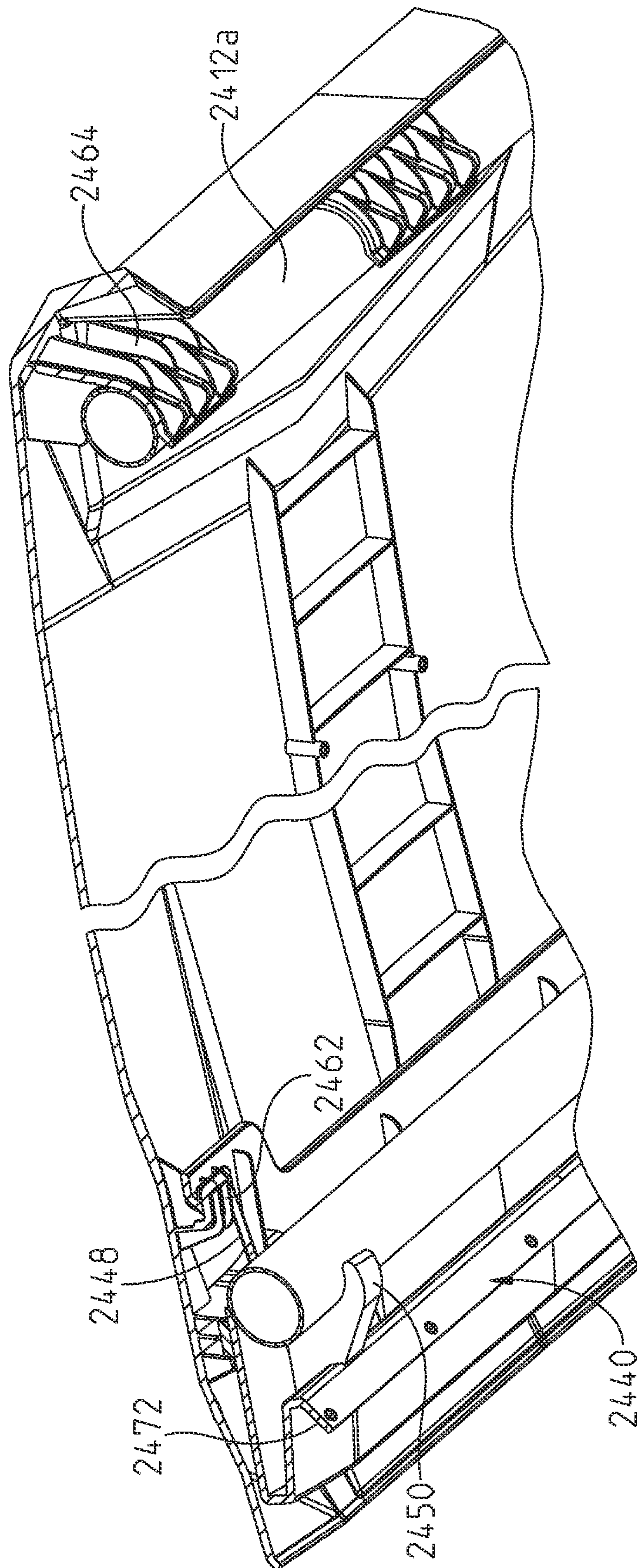


Fig. 137



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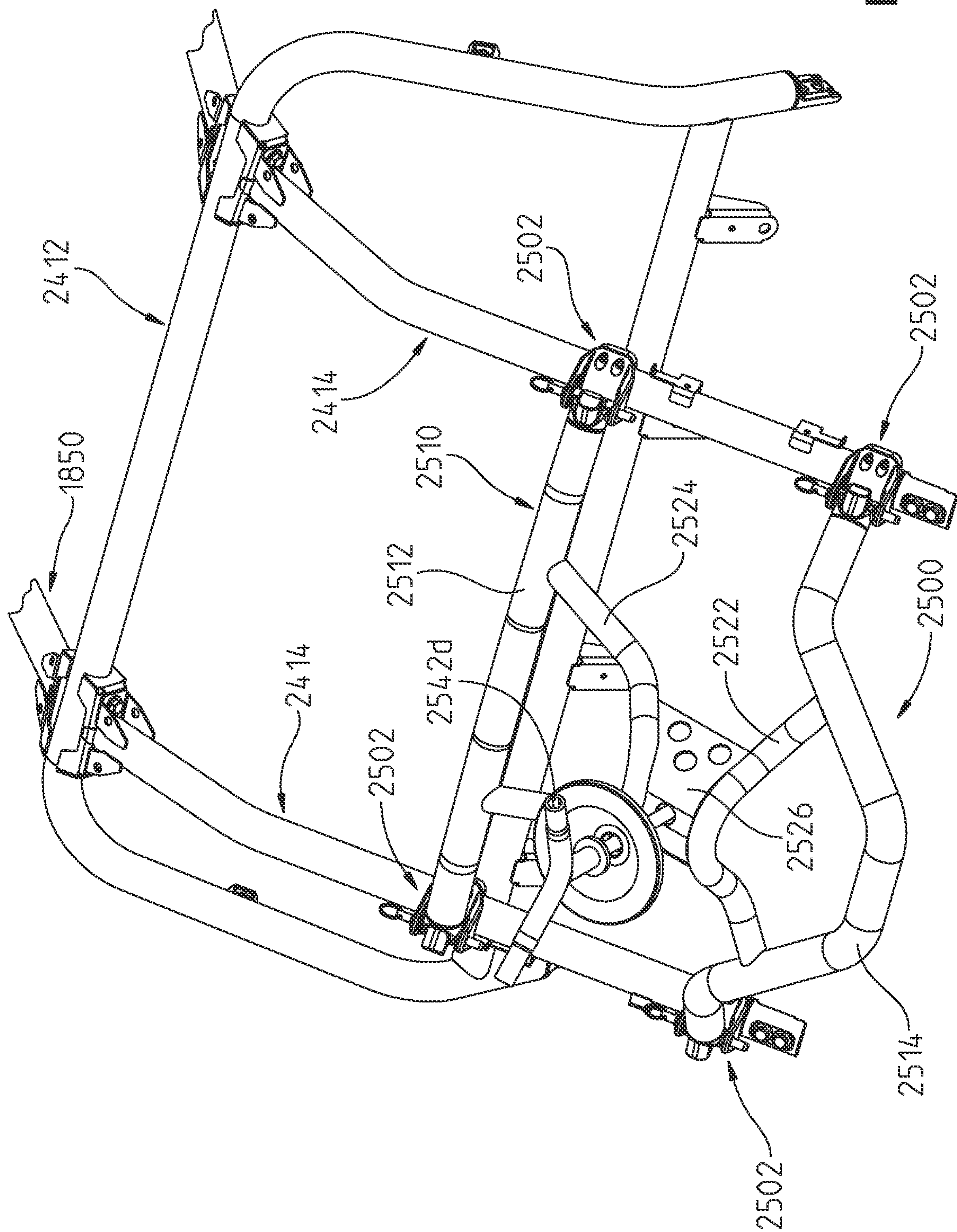
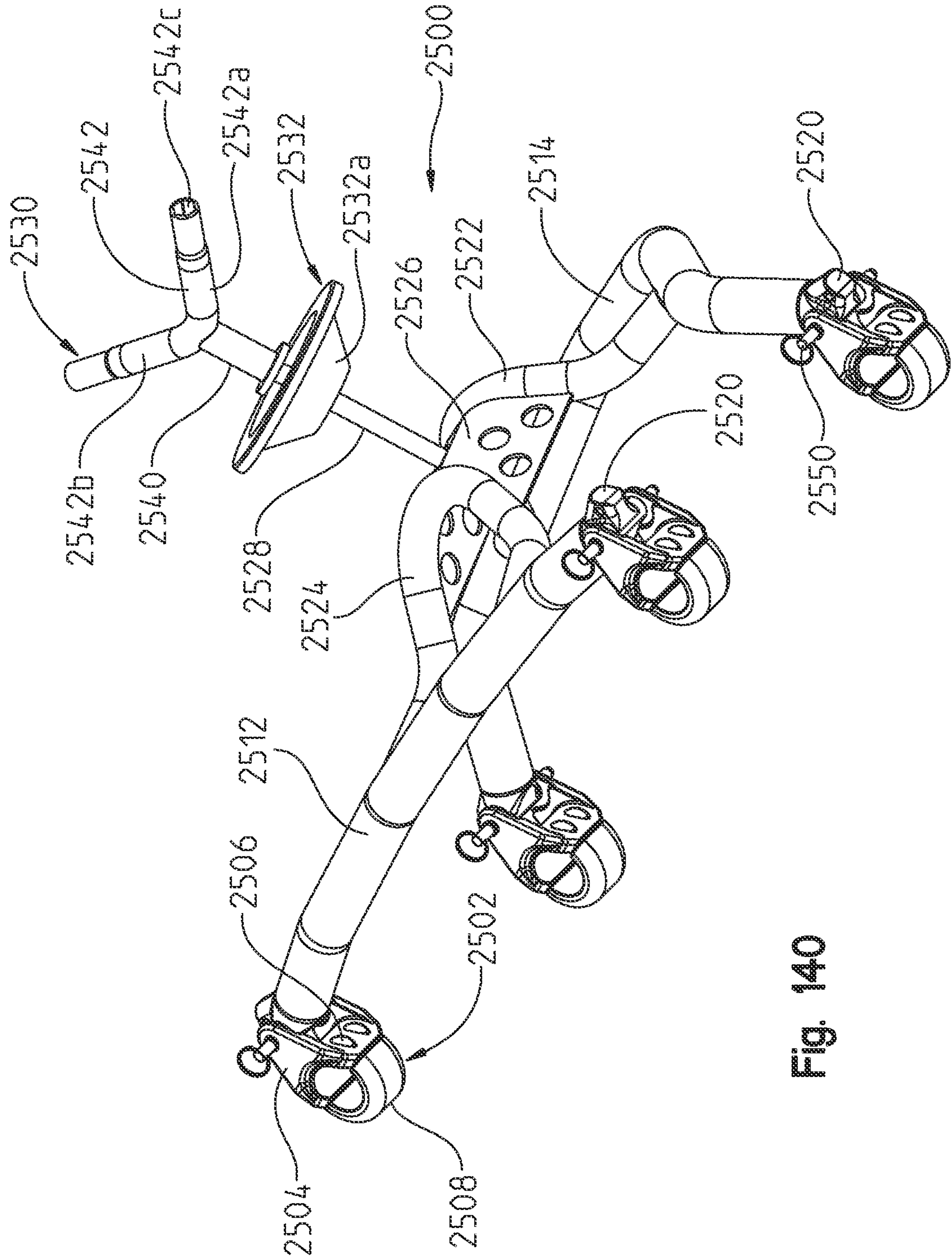


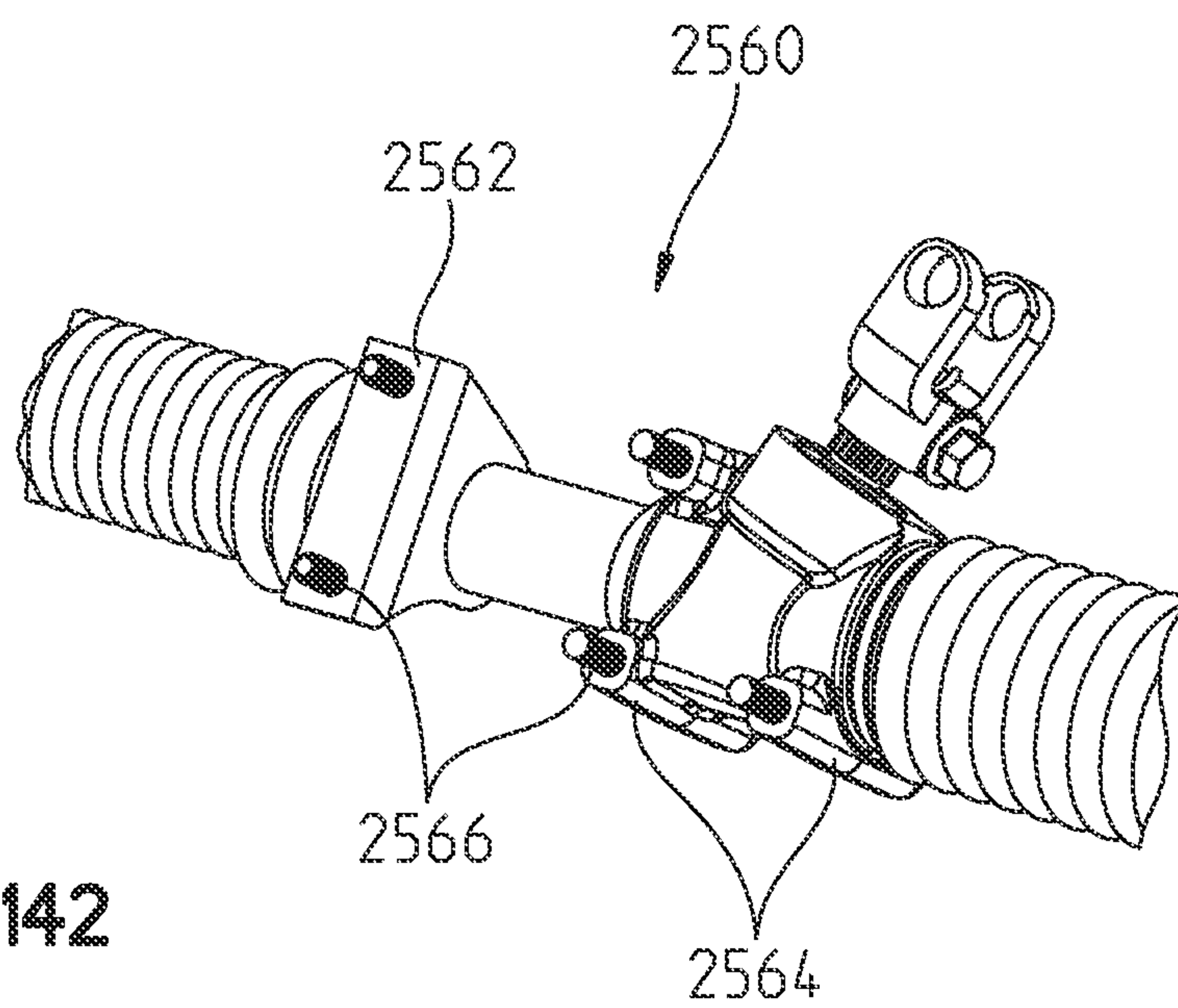
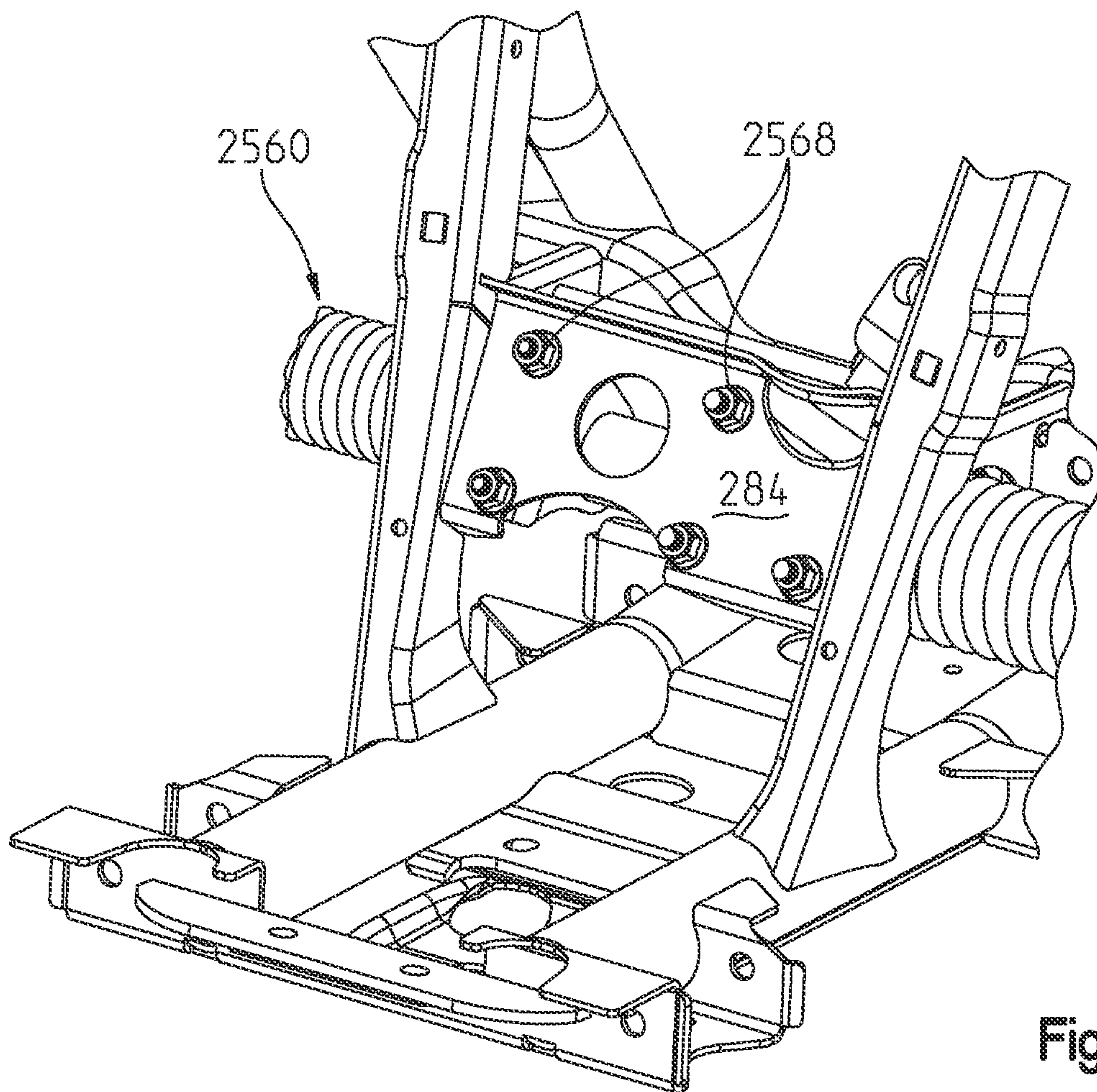
Fig. 139

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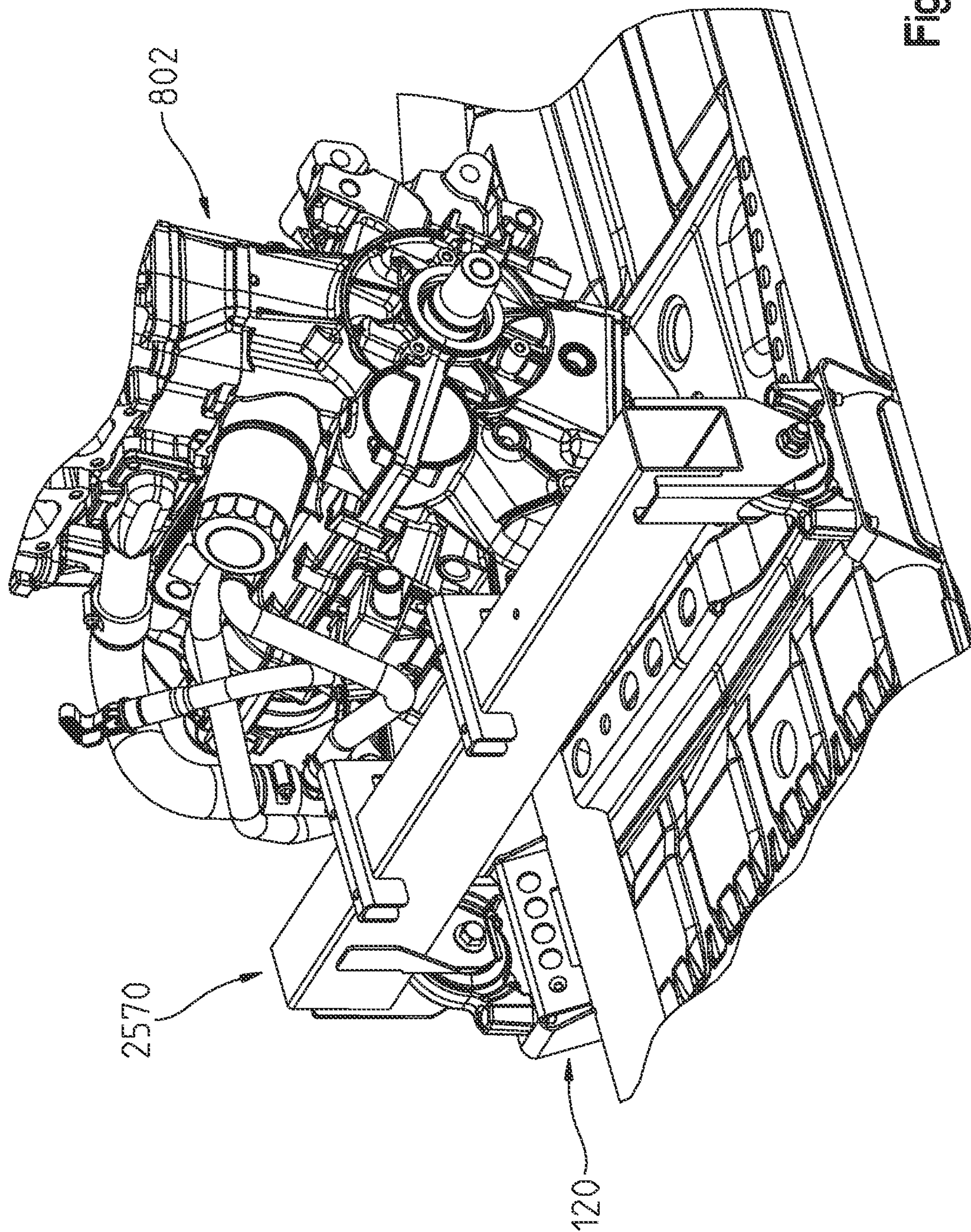


Fig. 143

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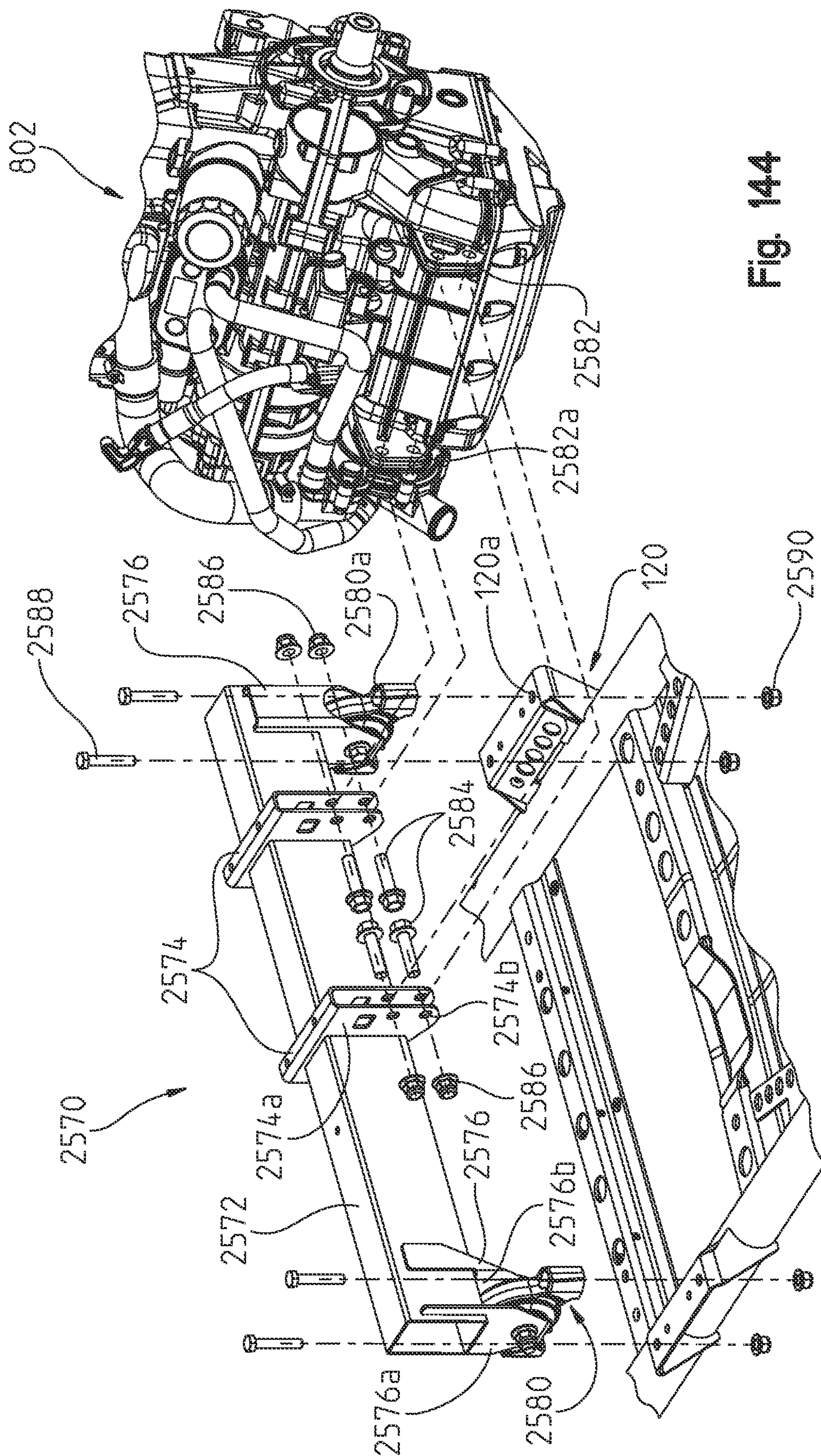


Fig. 144

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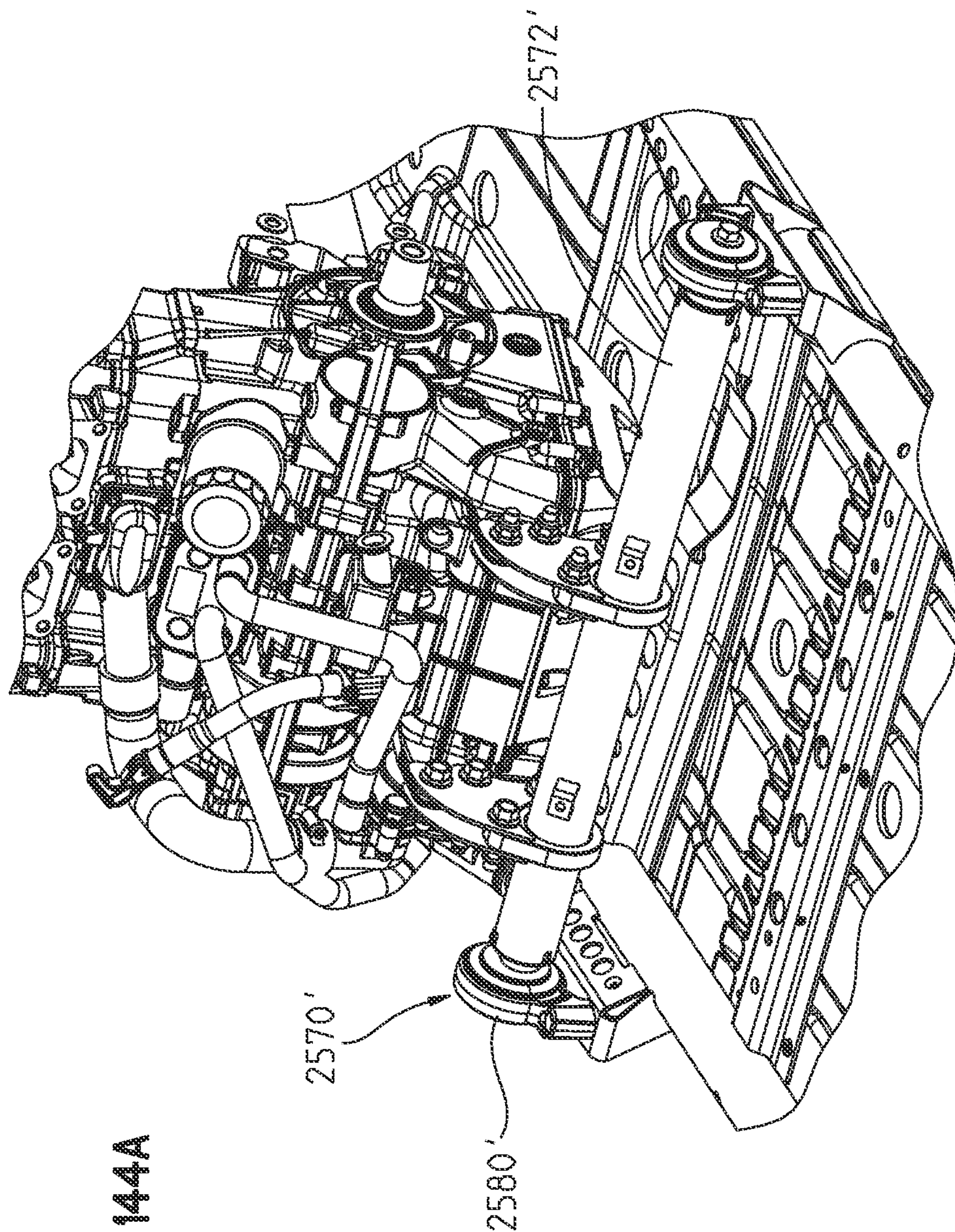


Fig. 144A

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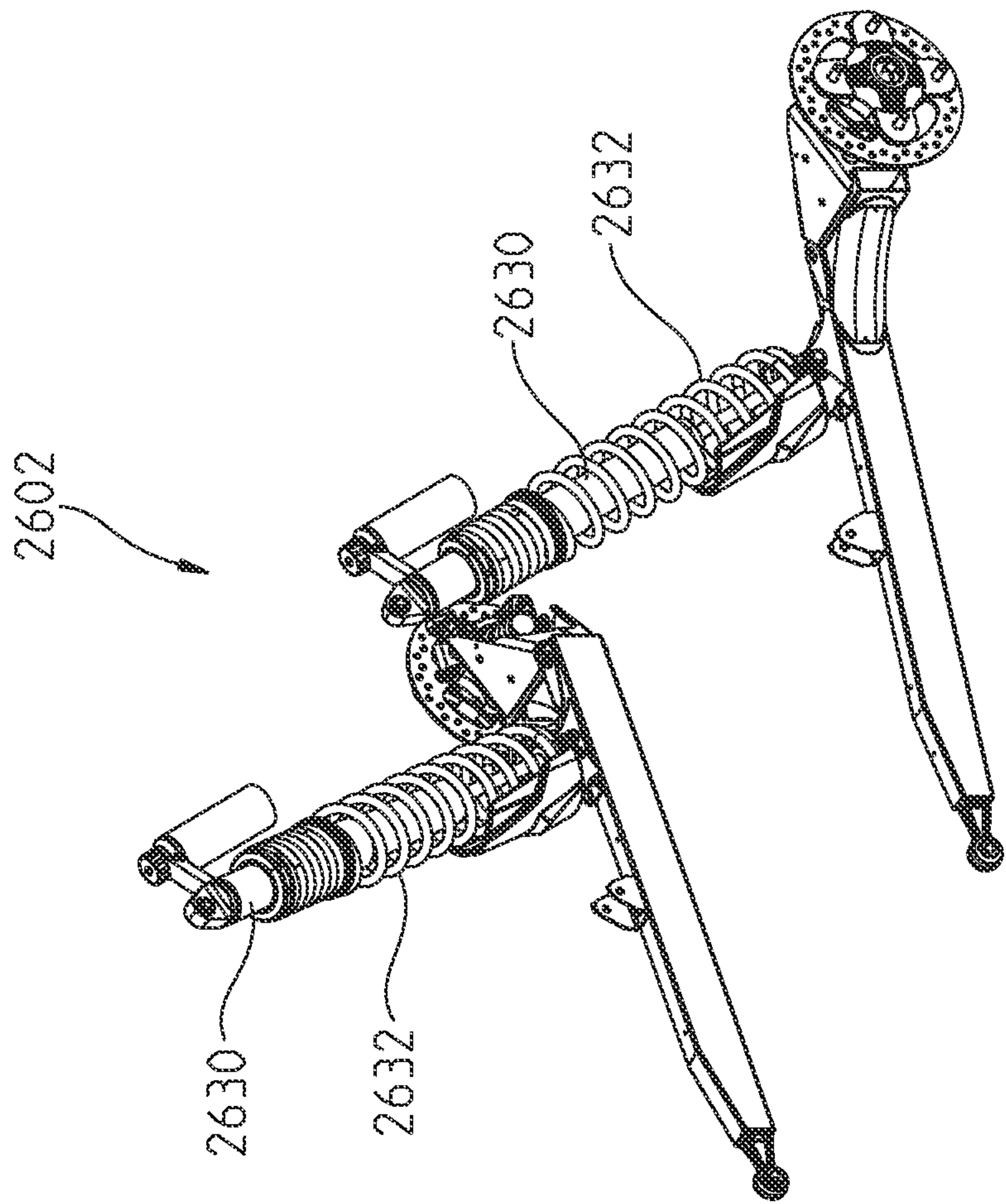
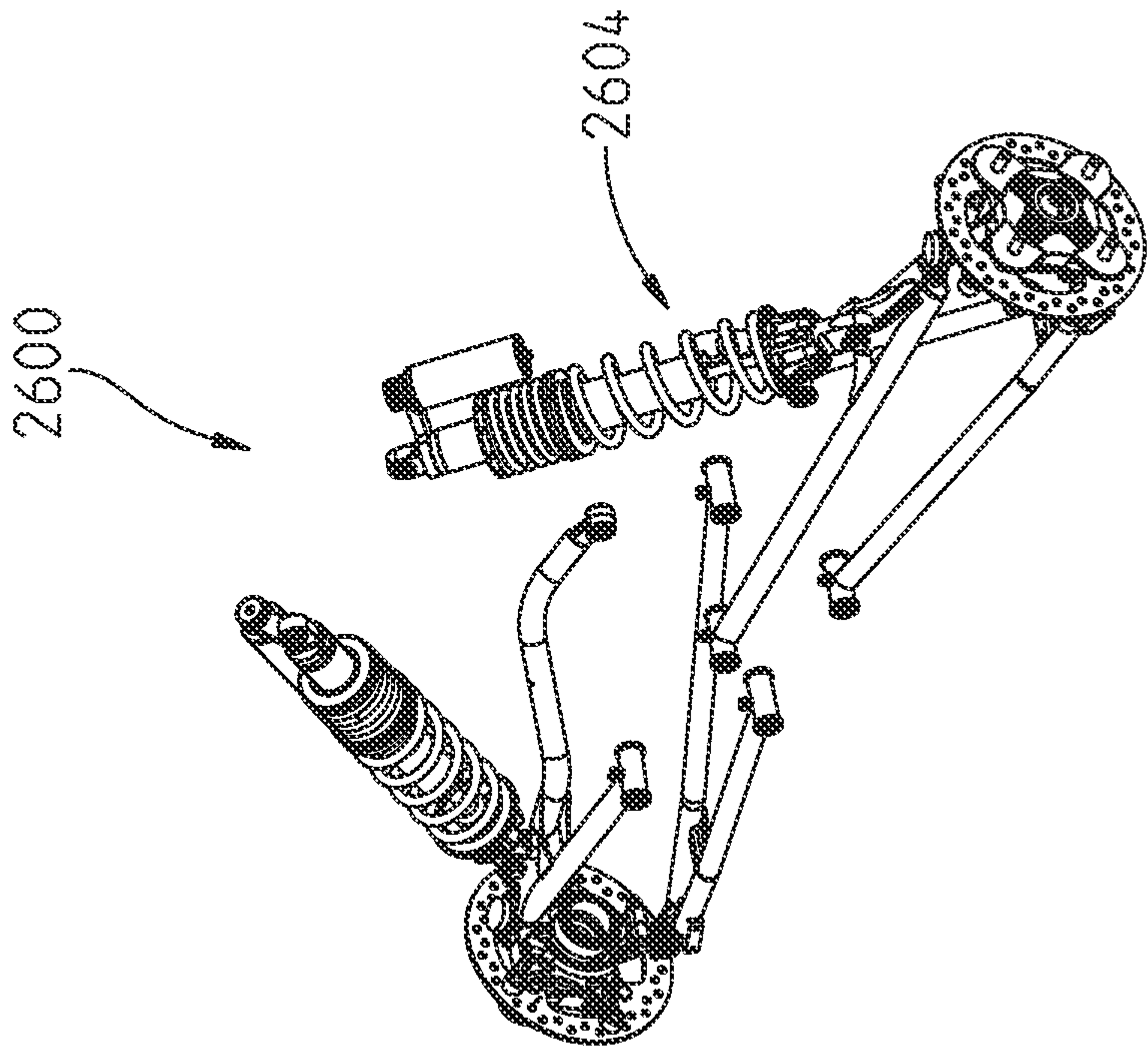


Fig. 145



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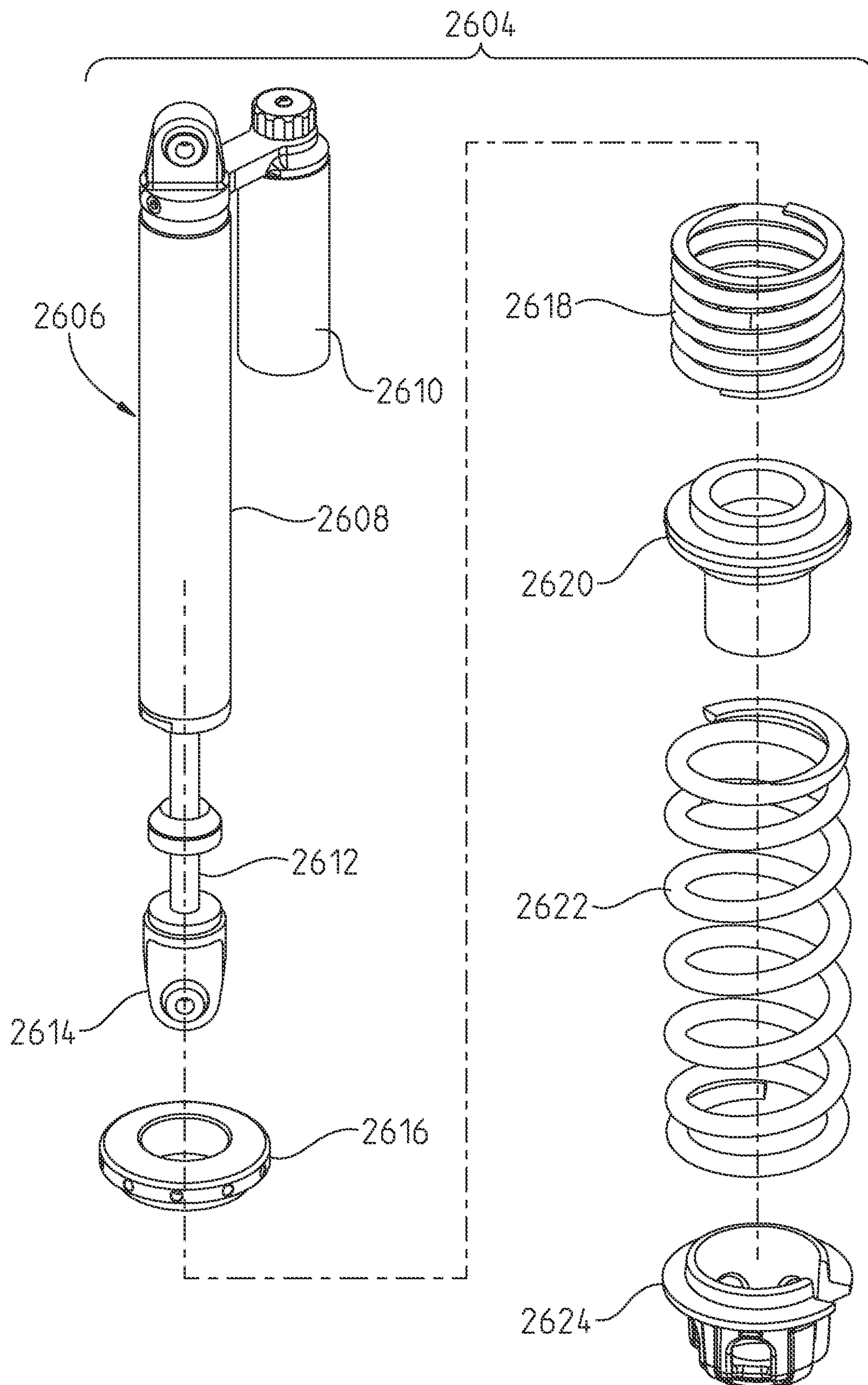
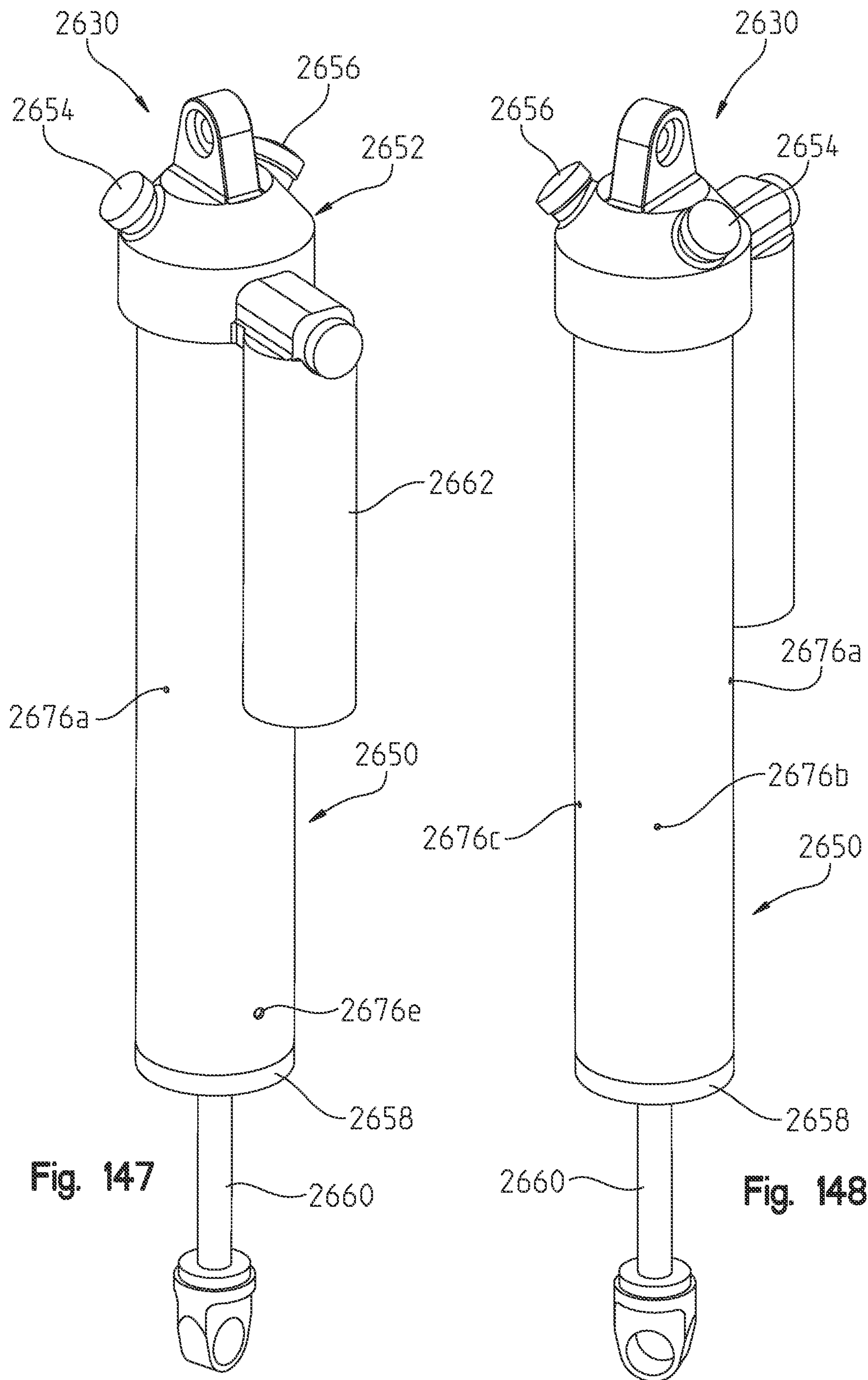


Fig. 146

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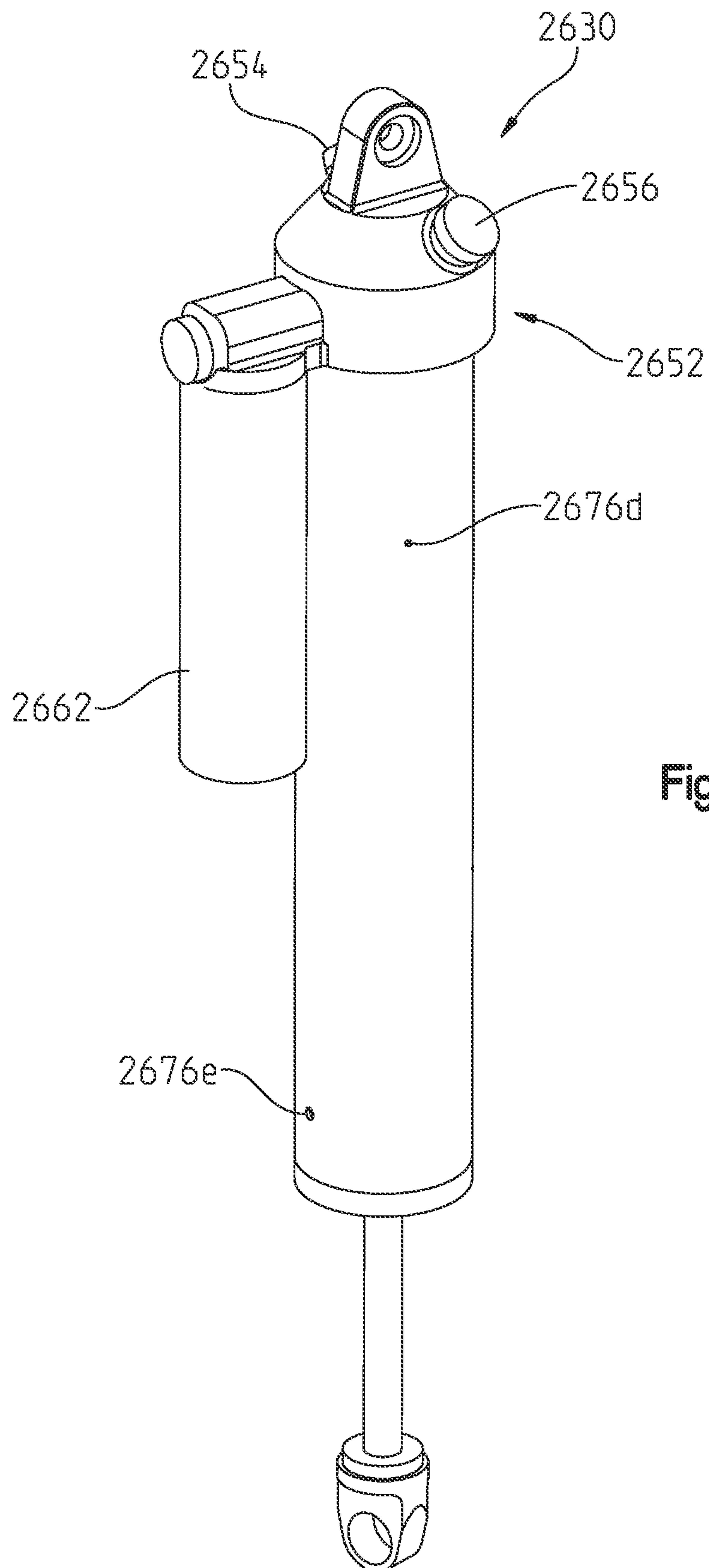


Fig. 149

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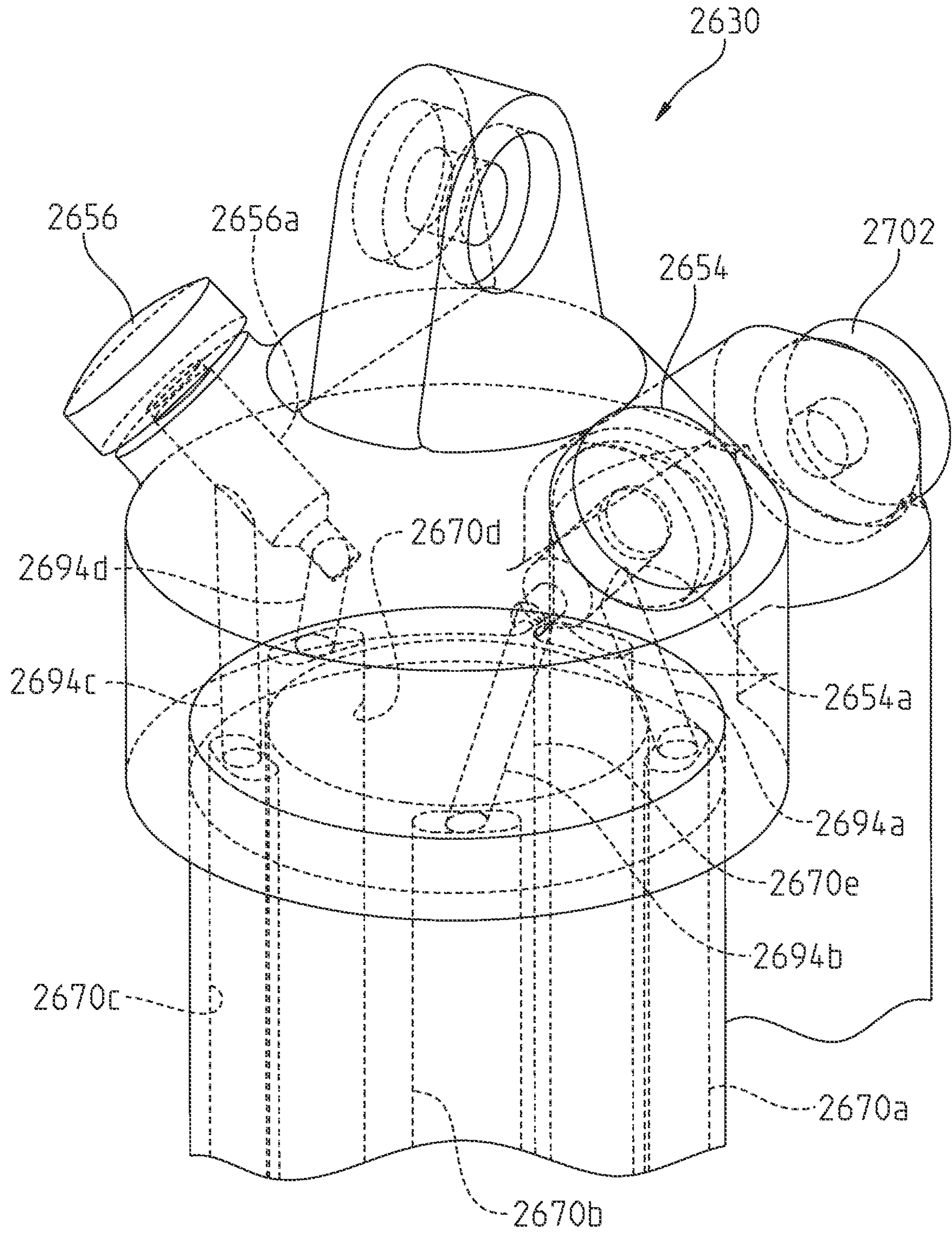


Fig. 150

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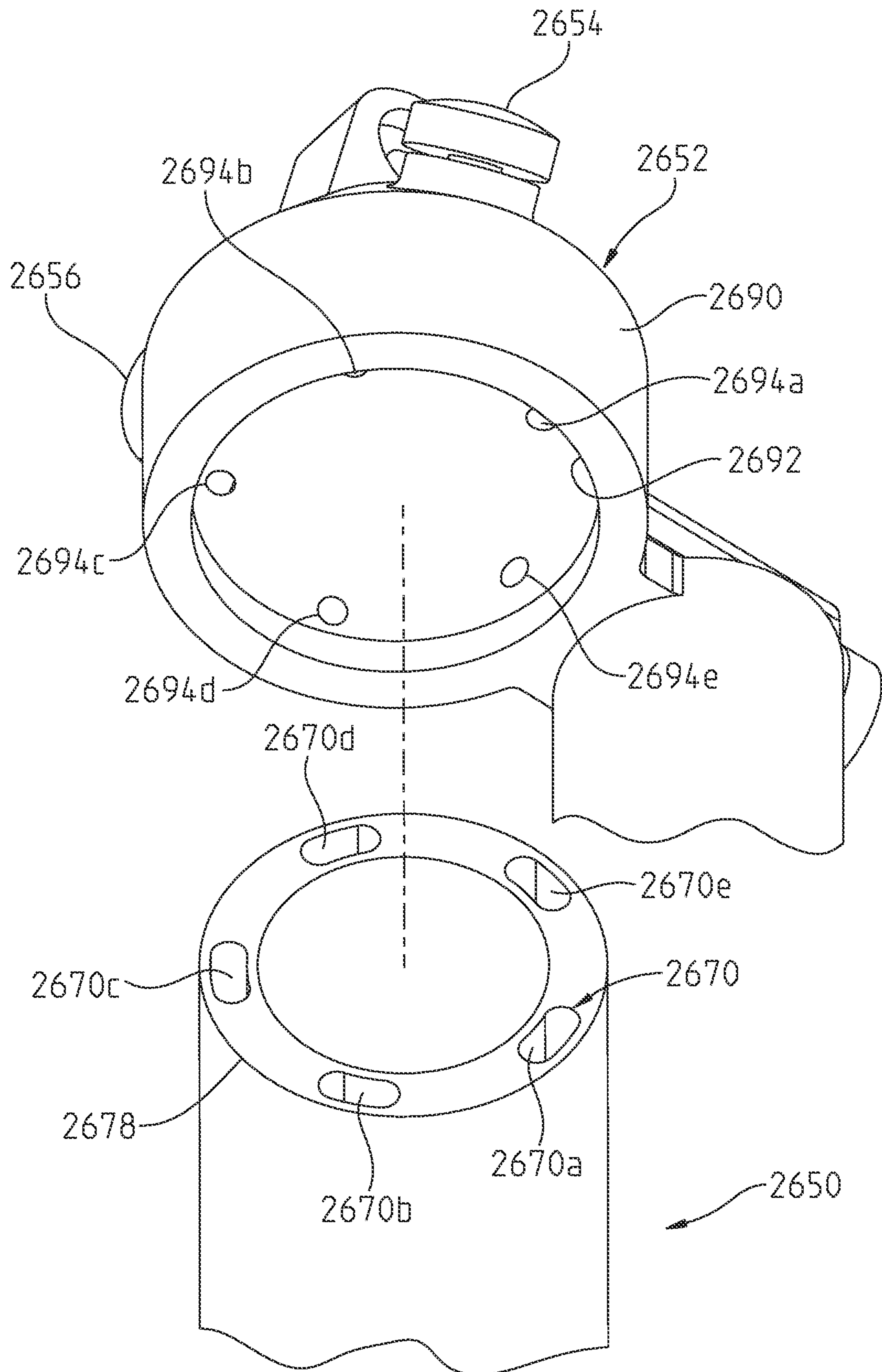


Fig. 151

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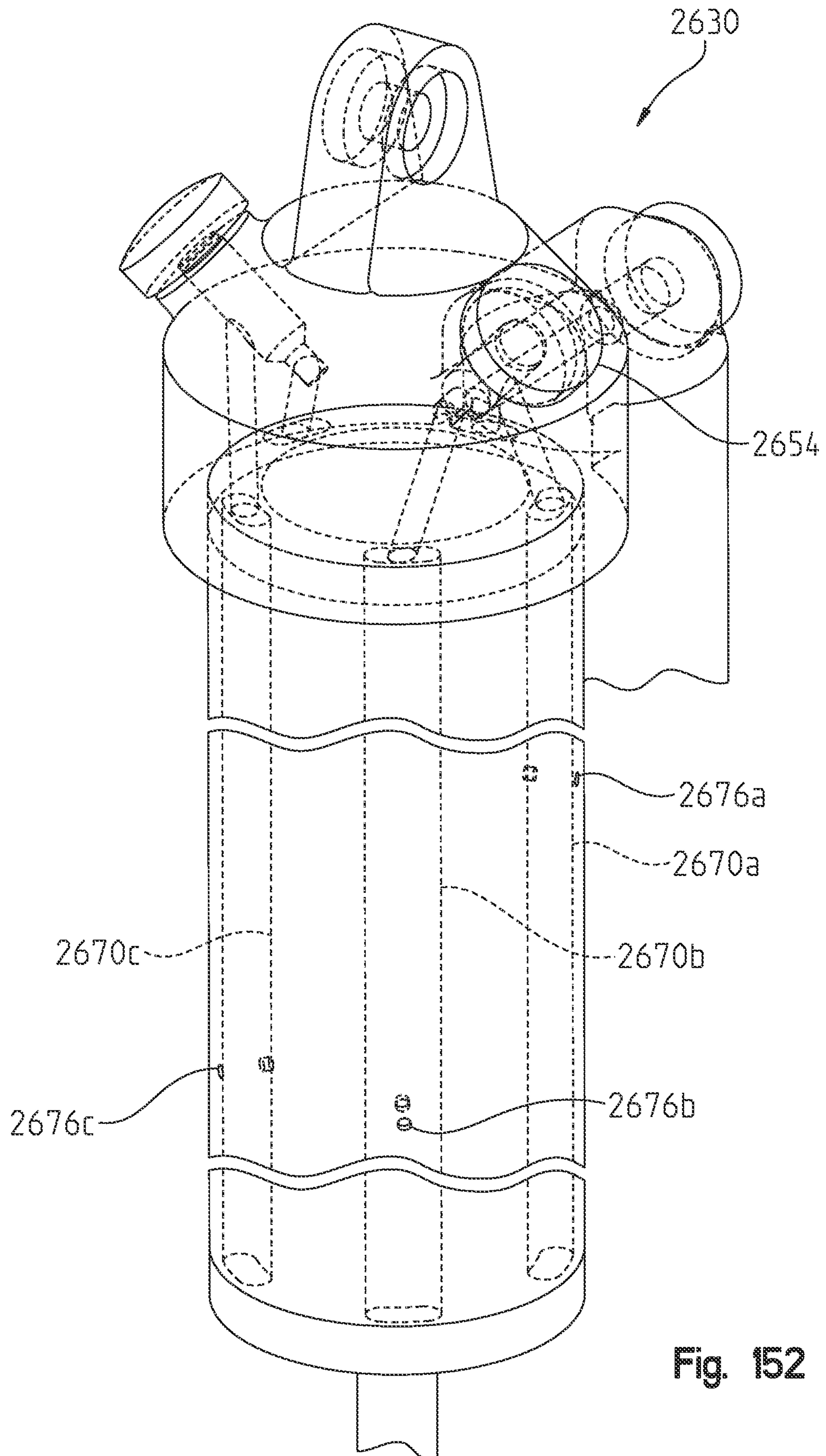
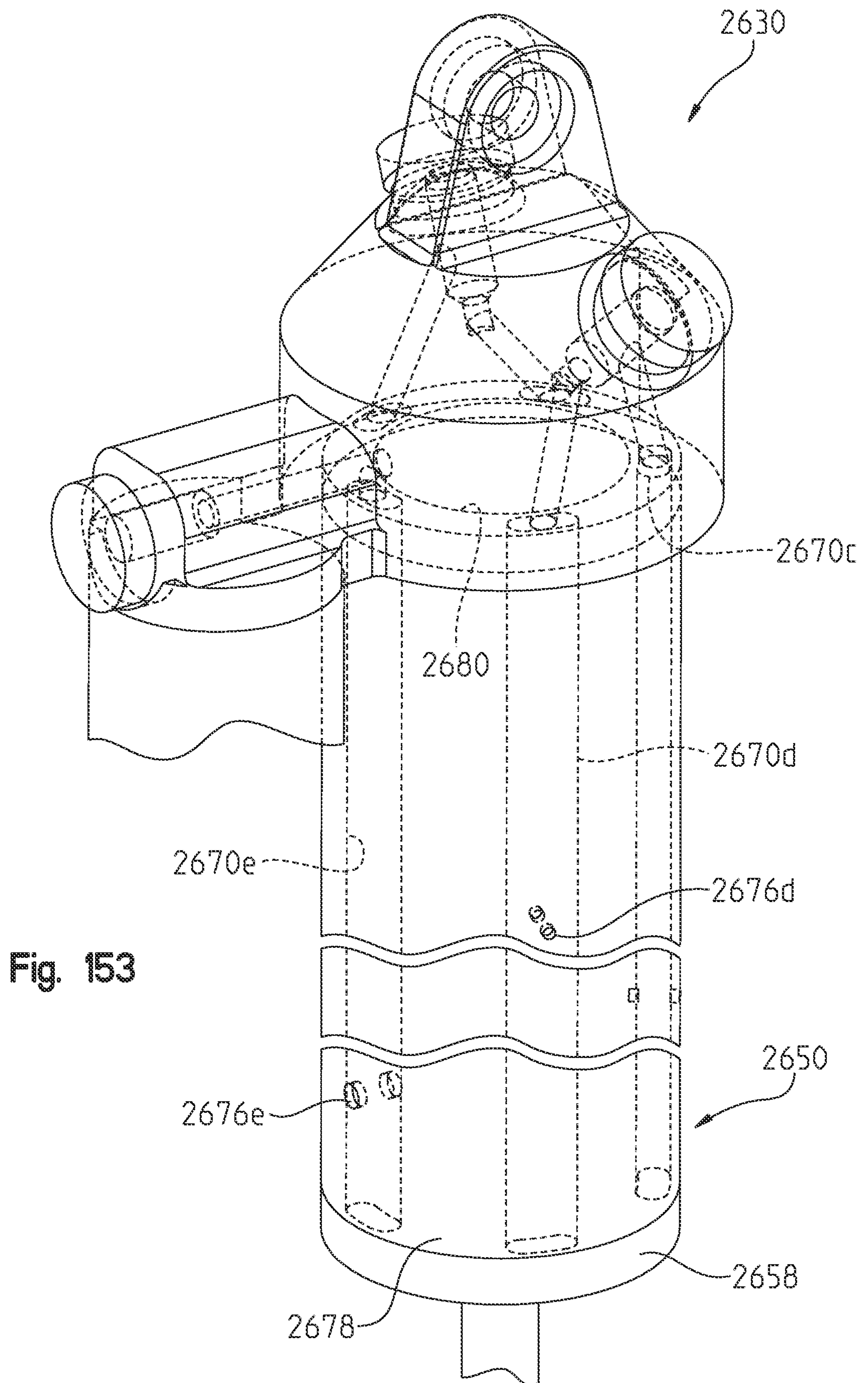


Fig. 152

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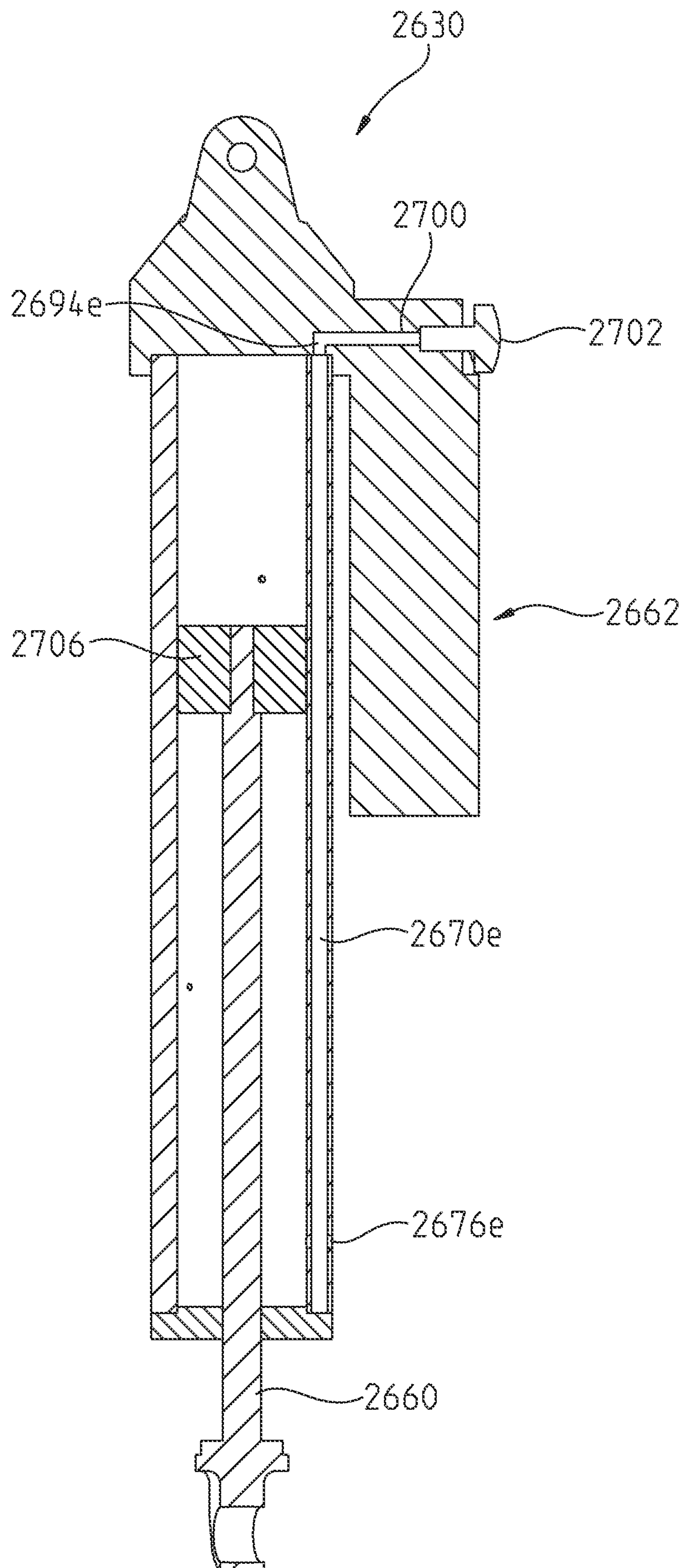


Fig. 154

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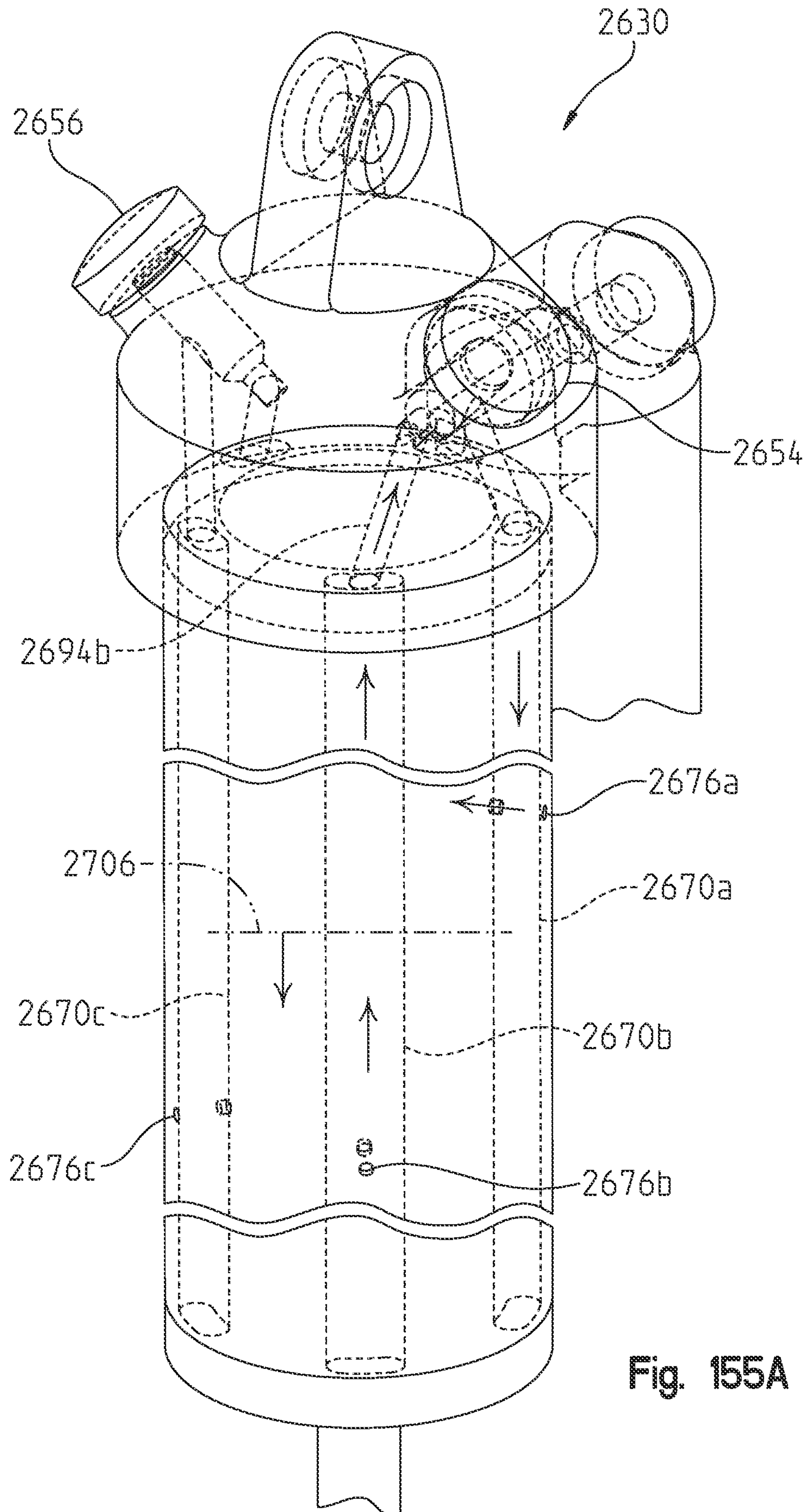
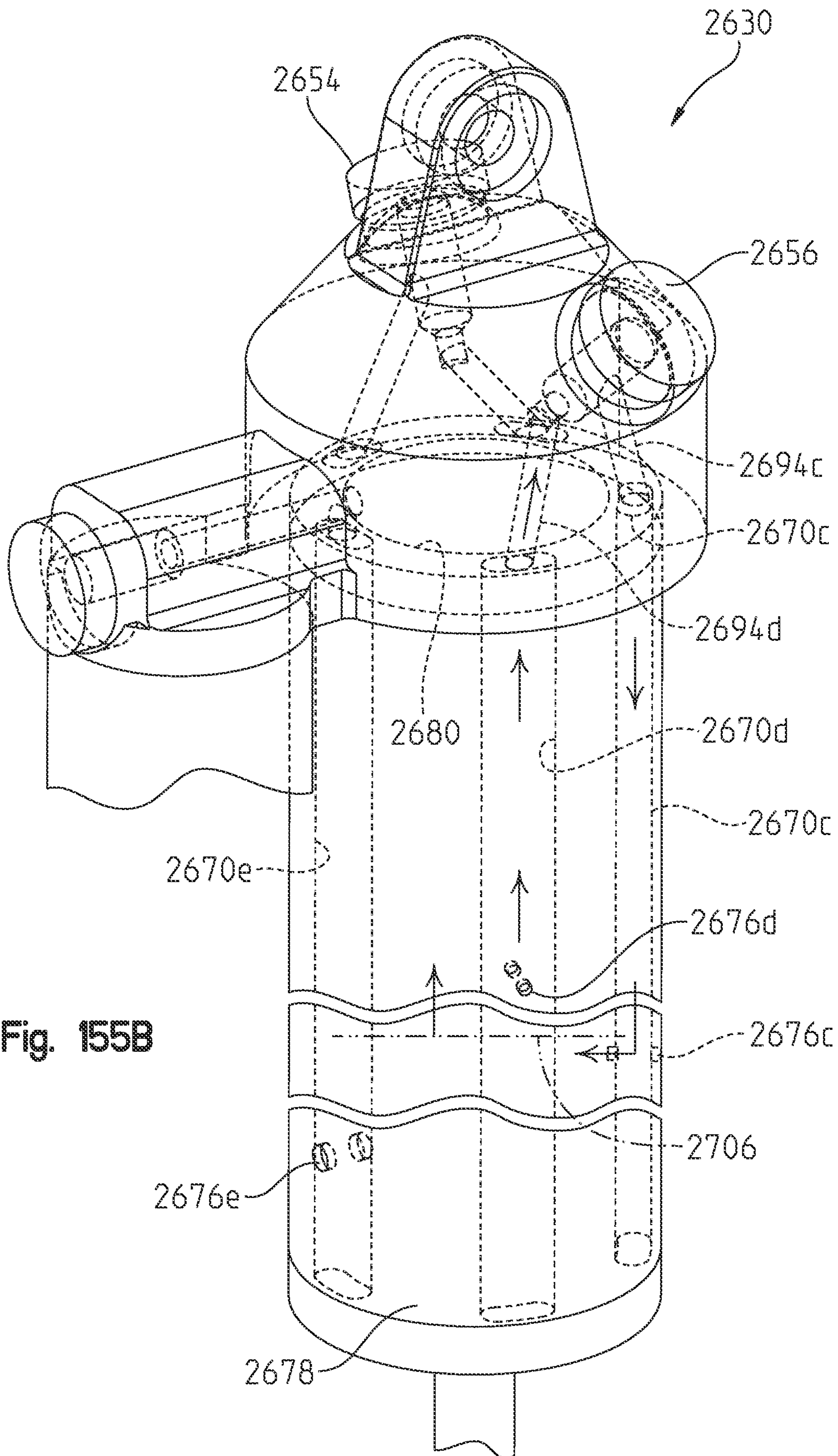


Fig. 155A

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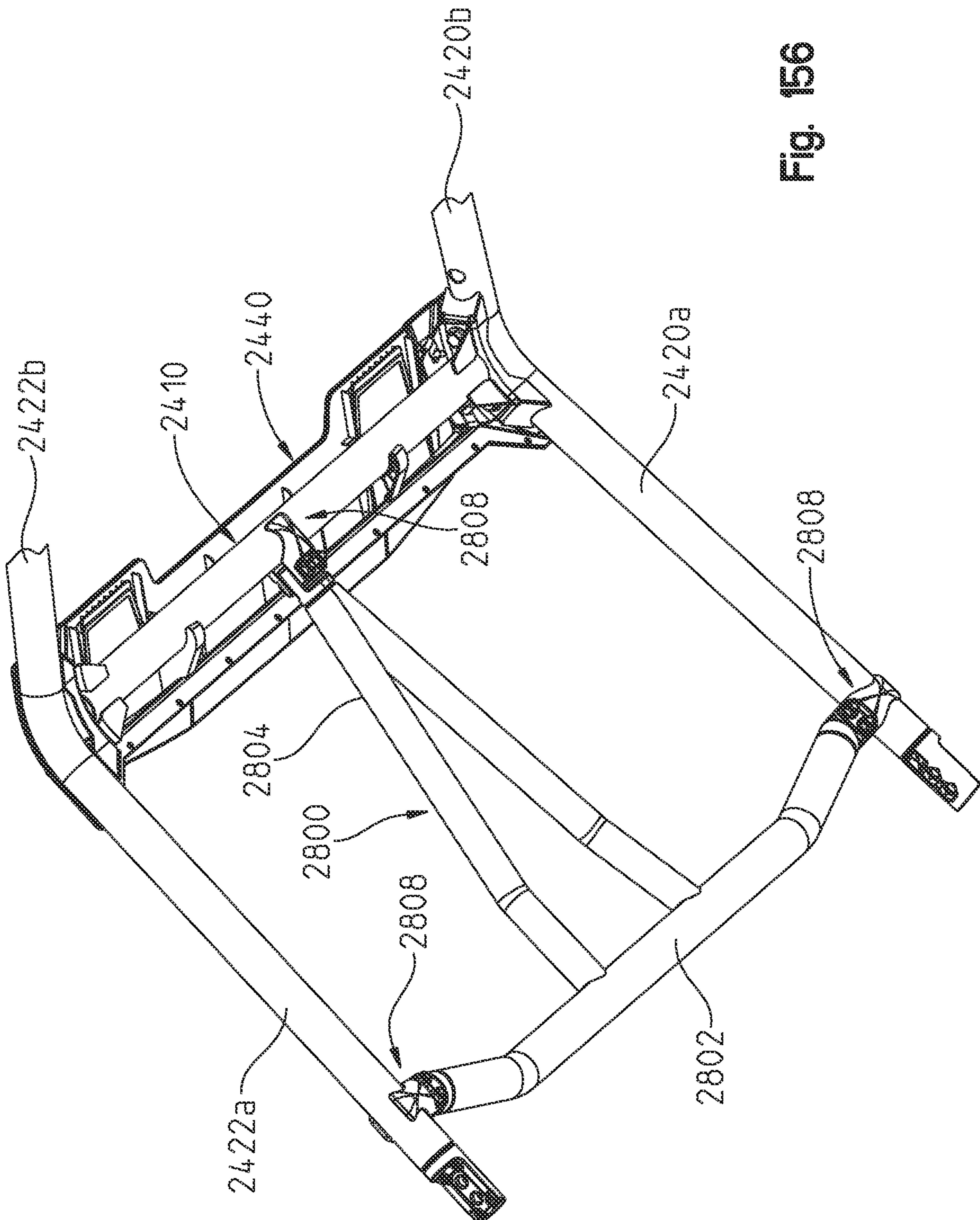
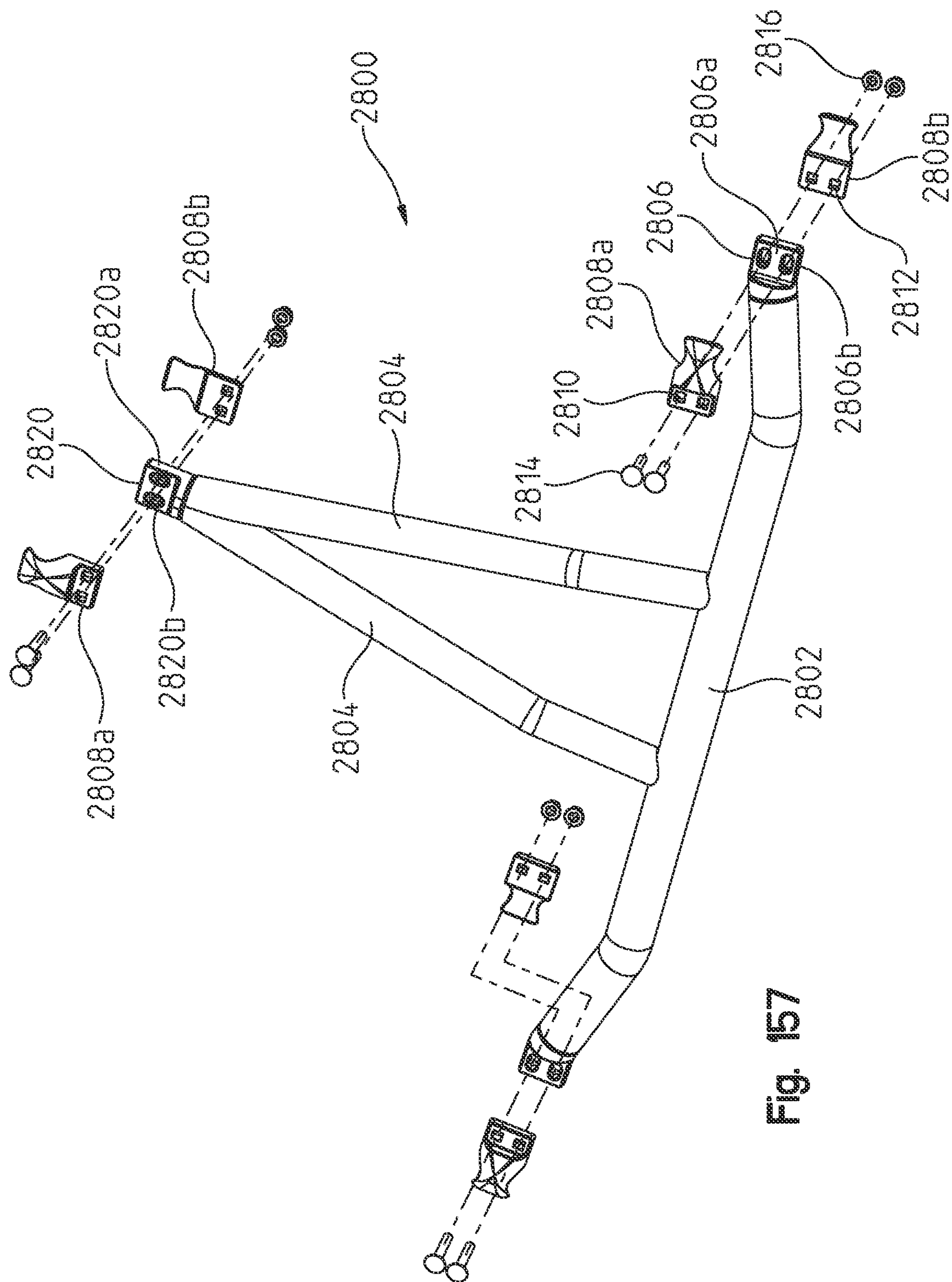


Fig. 156



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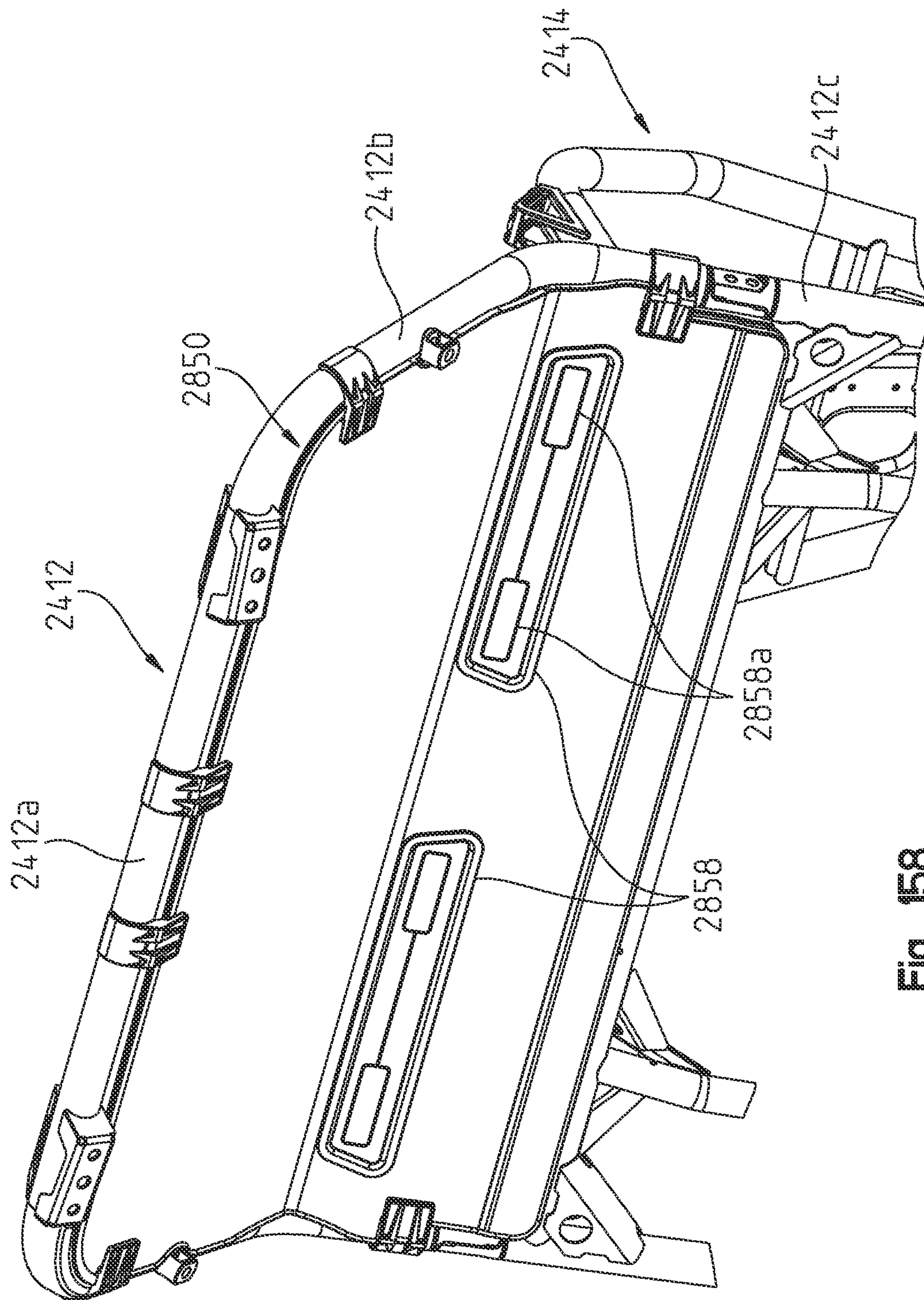


Fig. 158

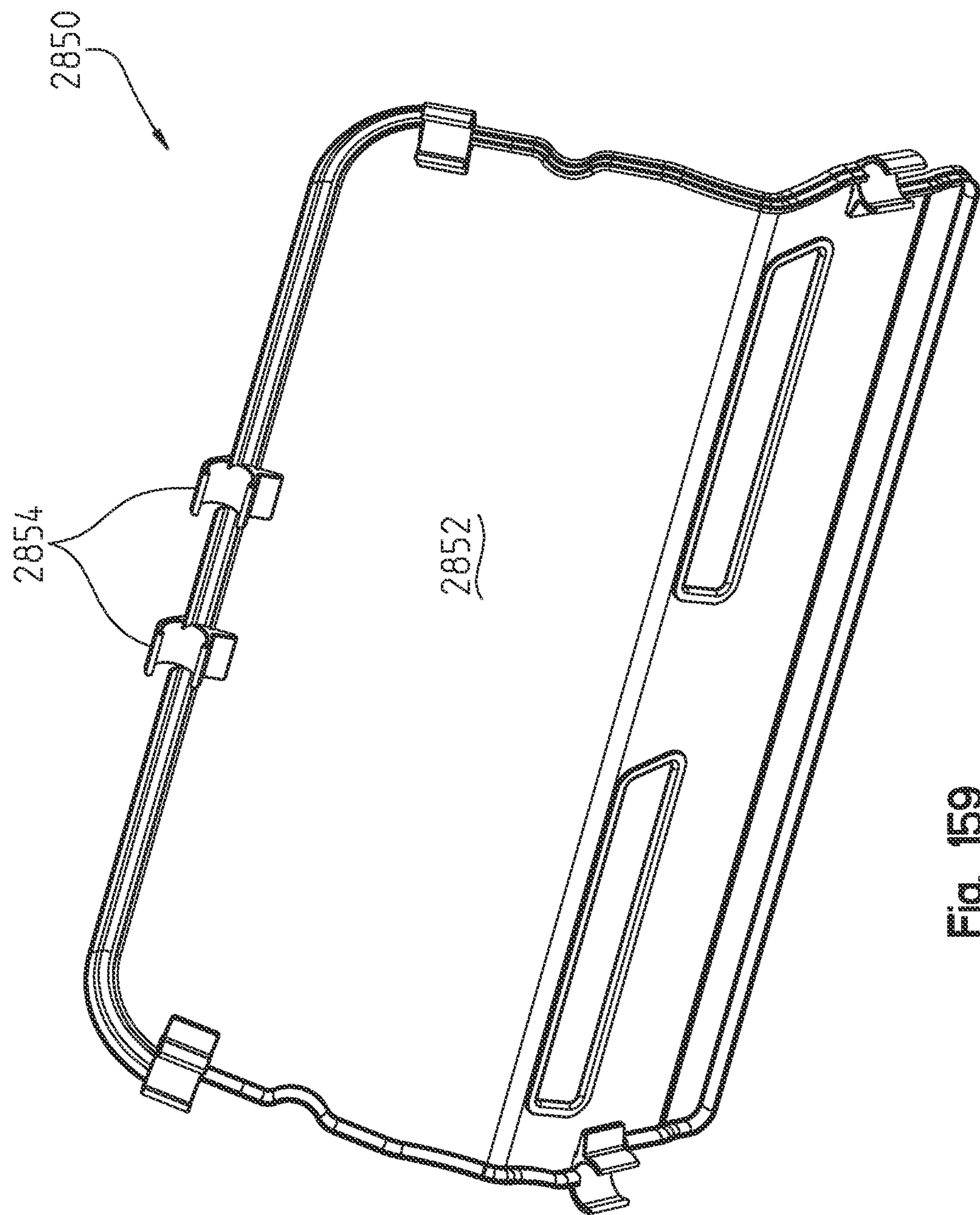
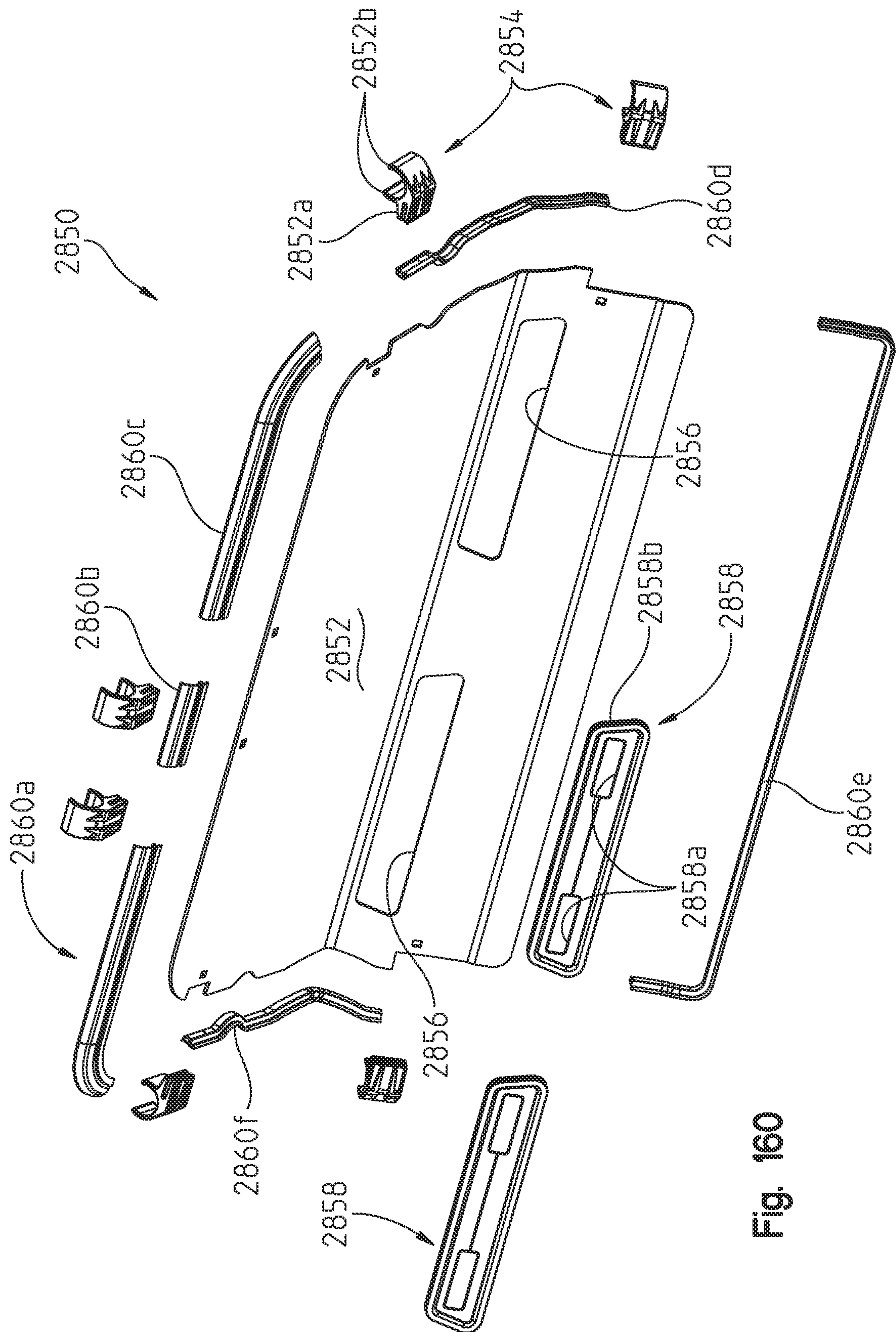


Fig. 159



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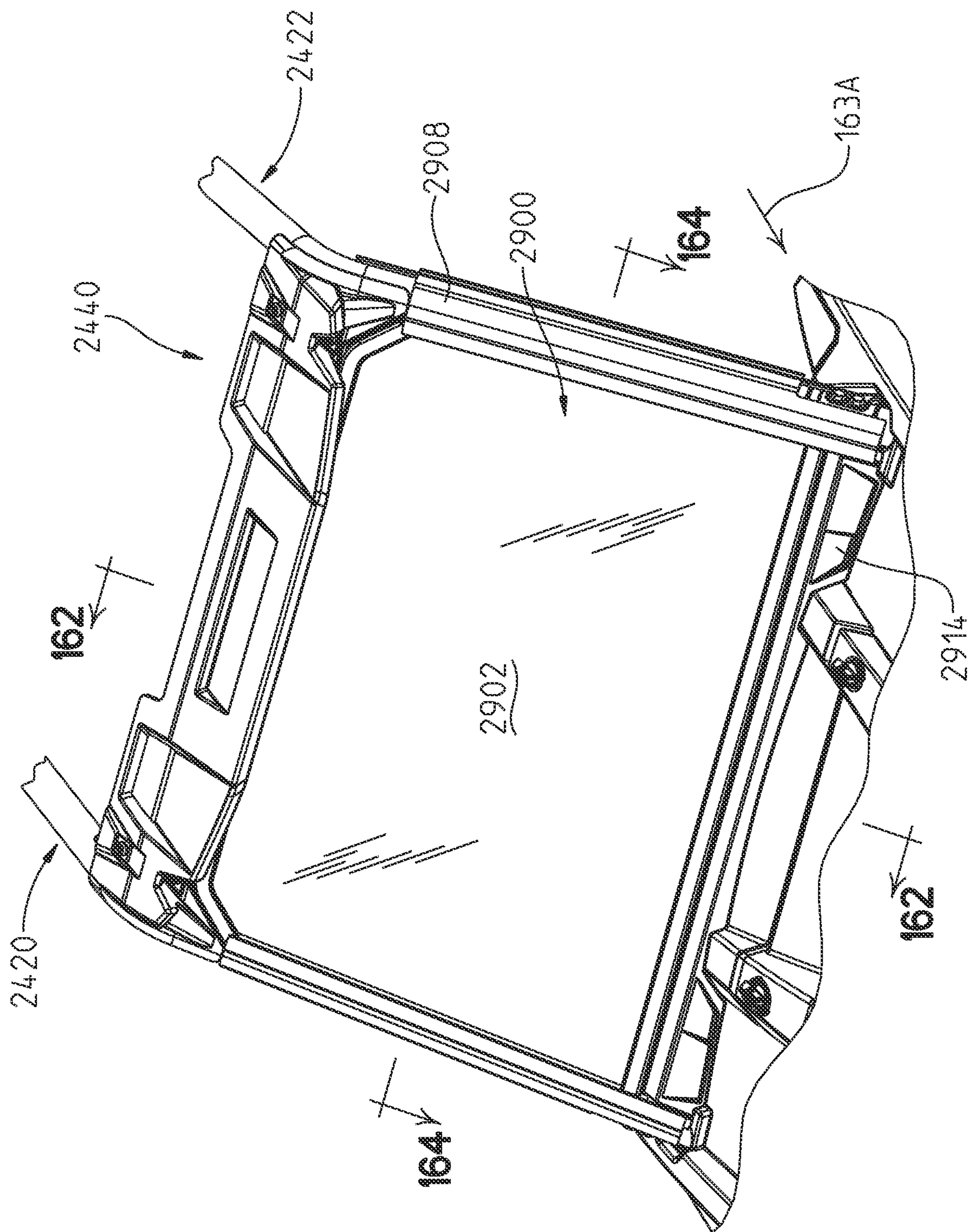
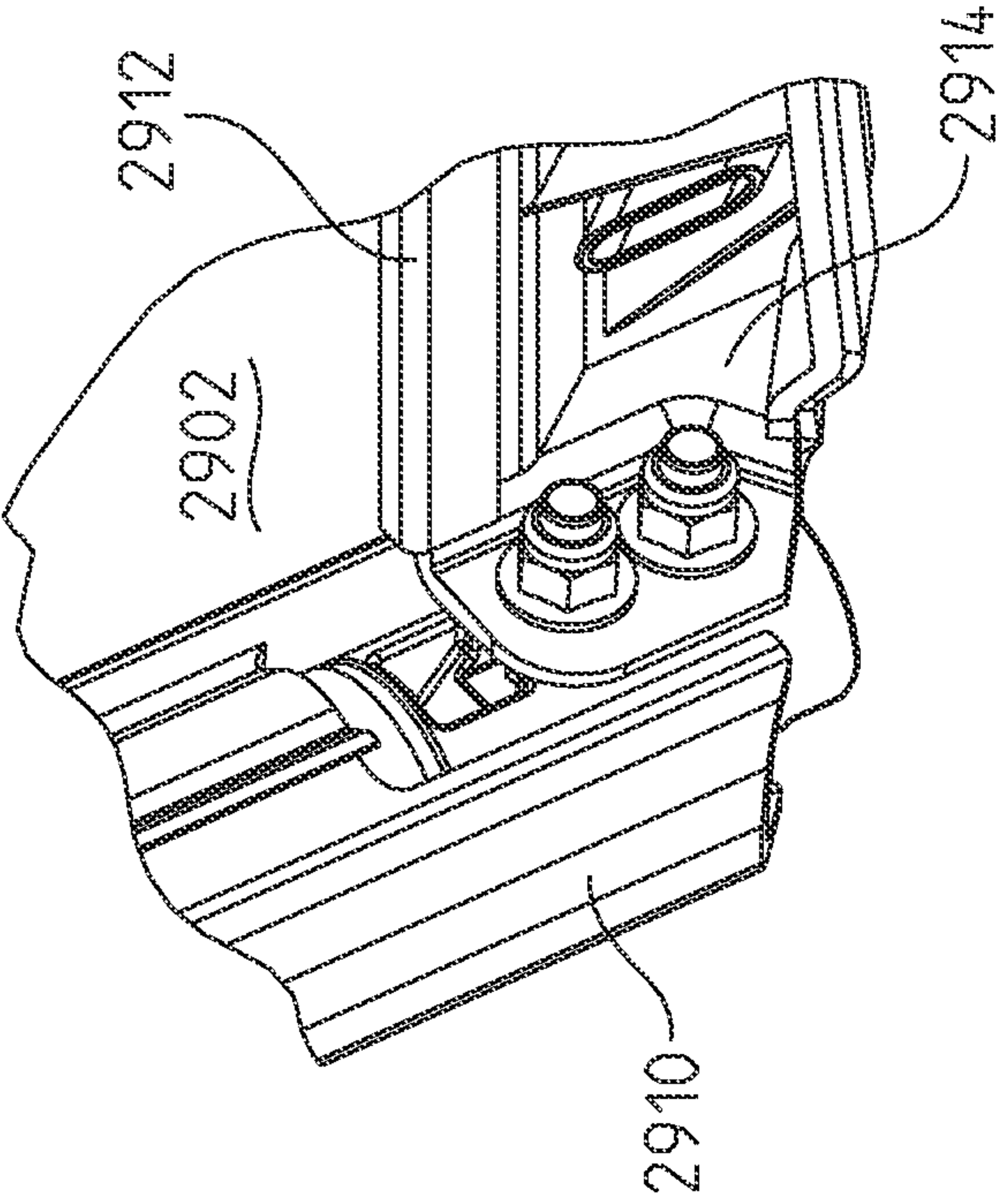
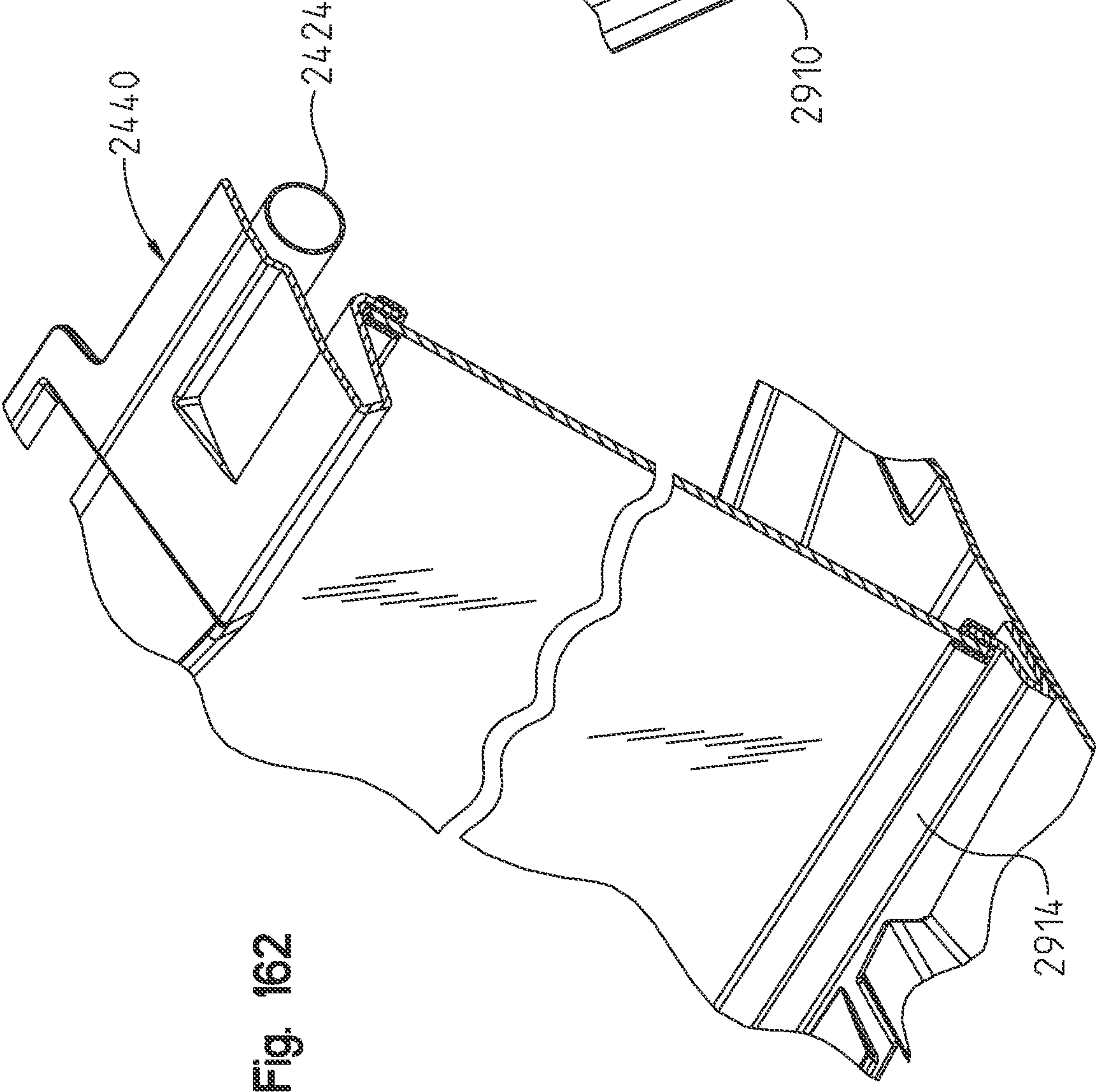


Fig. 161



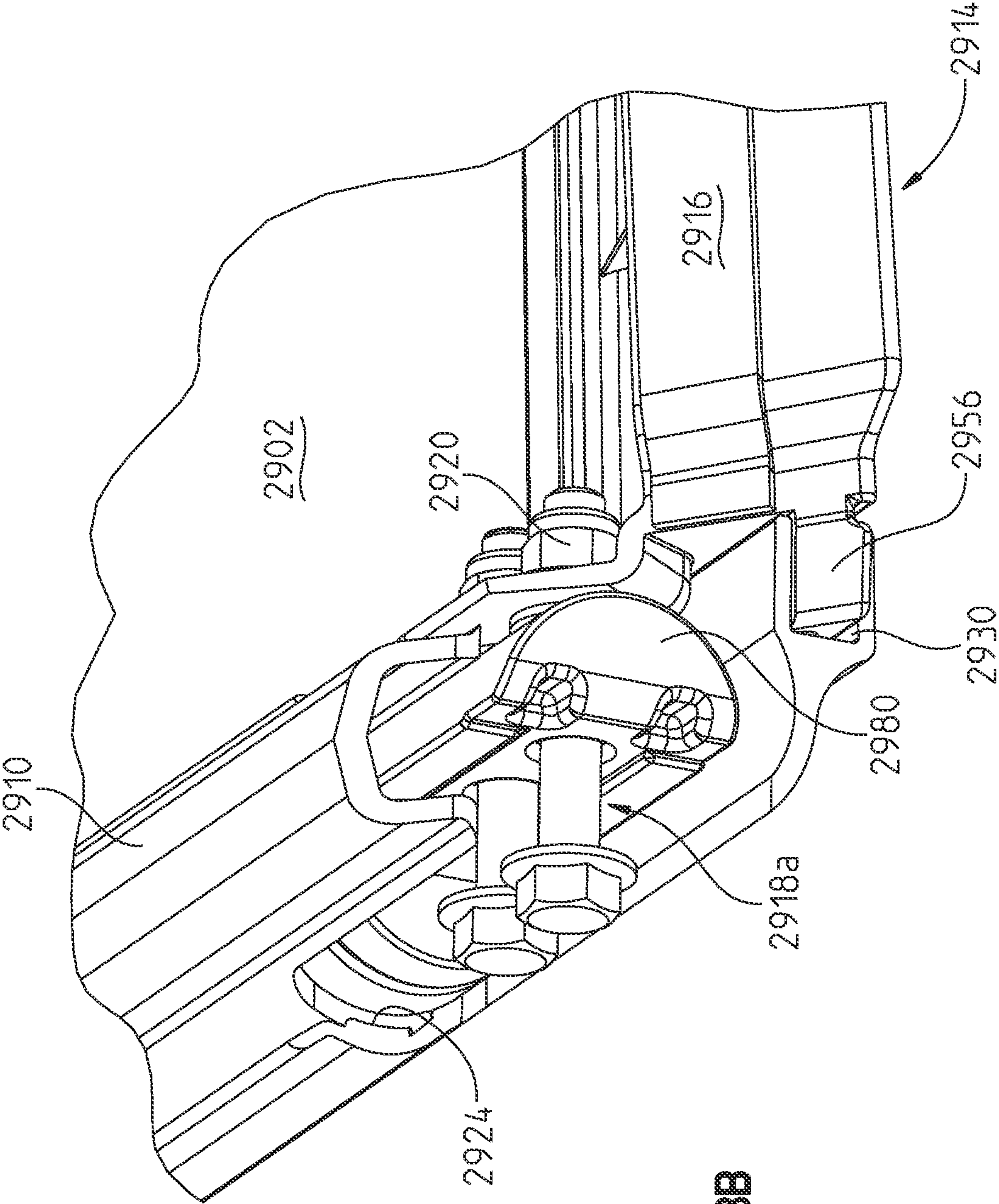


Fig. 163B

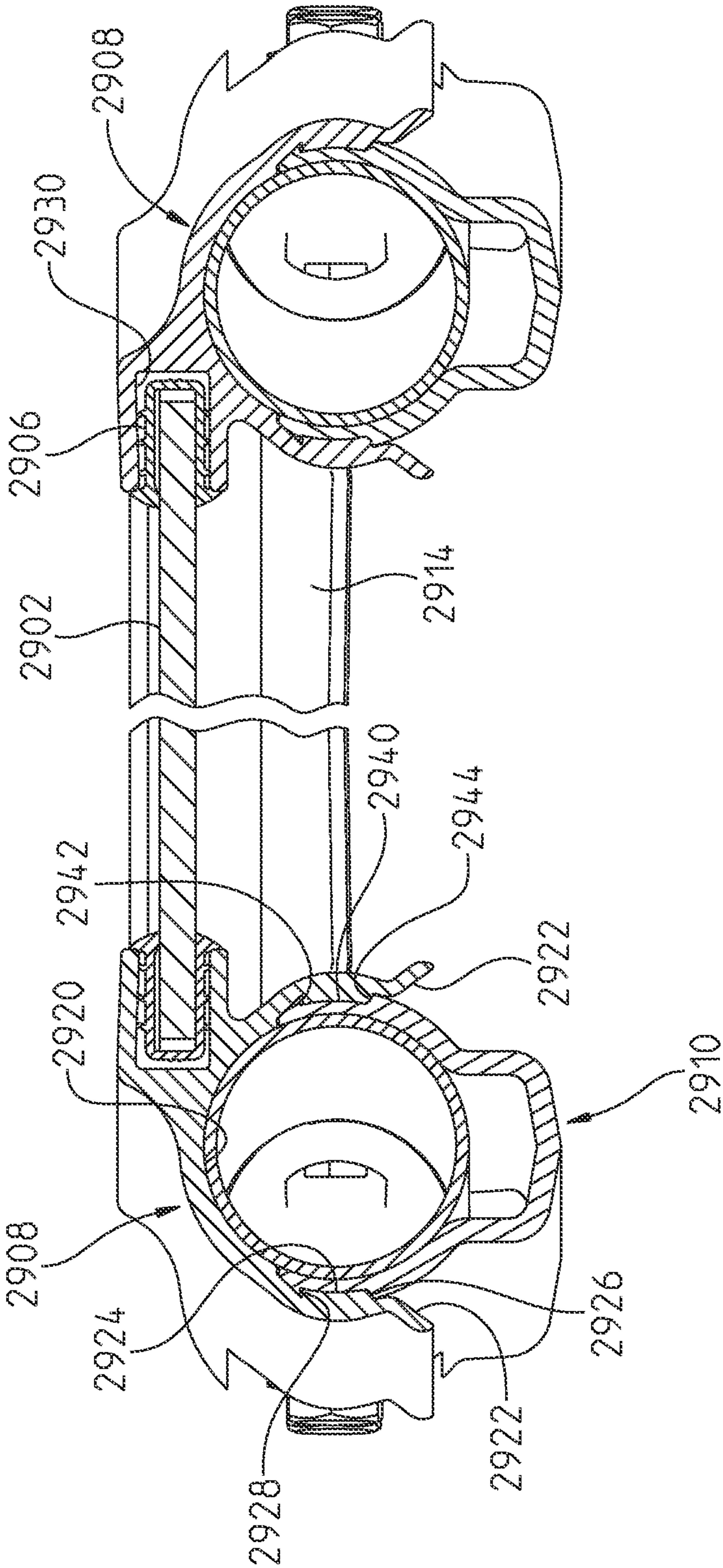
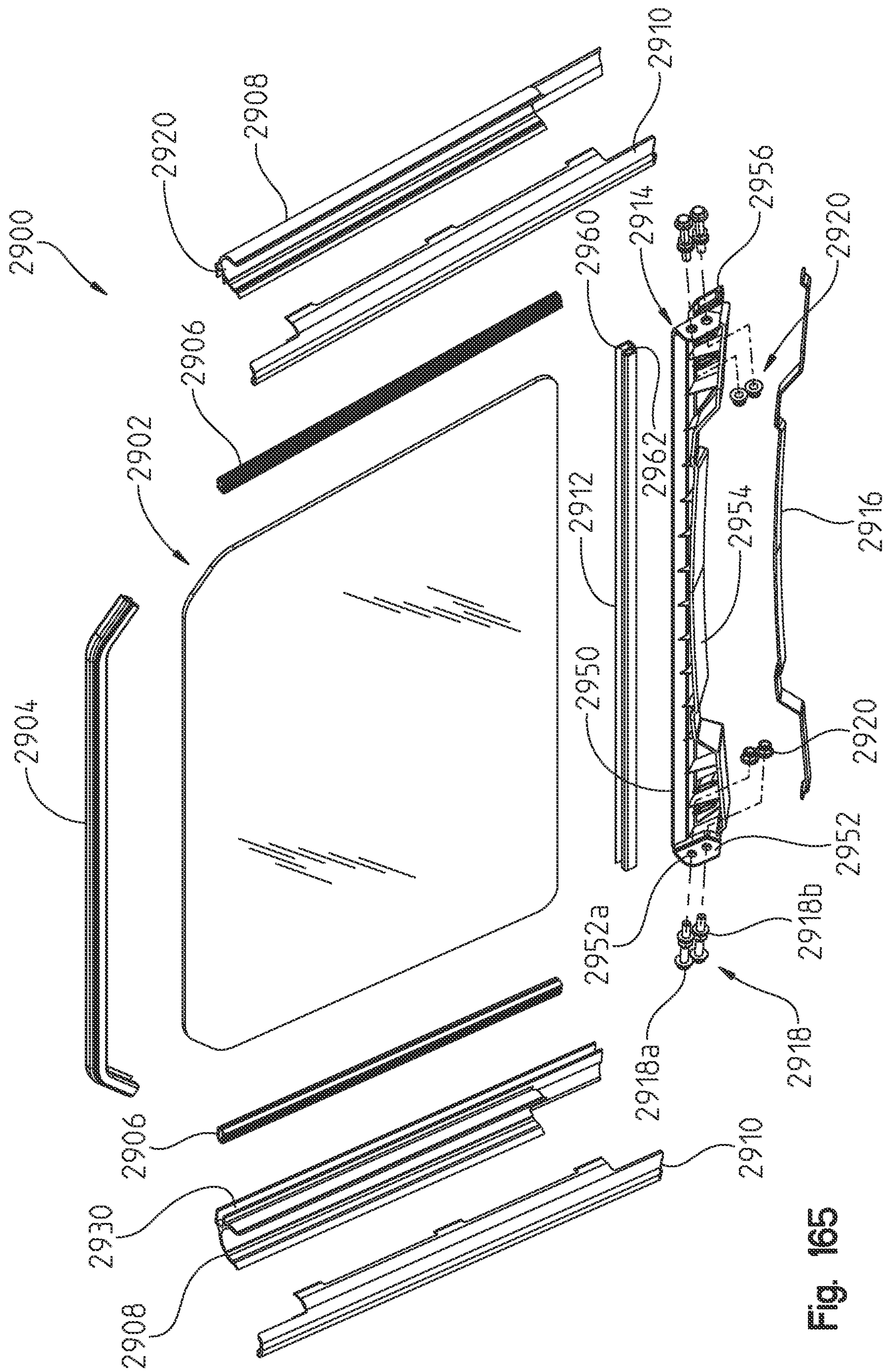


Fig. 164



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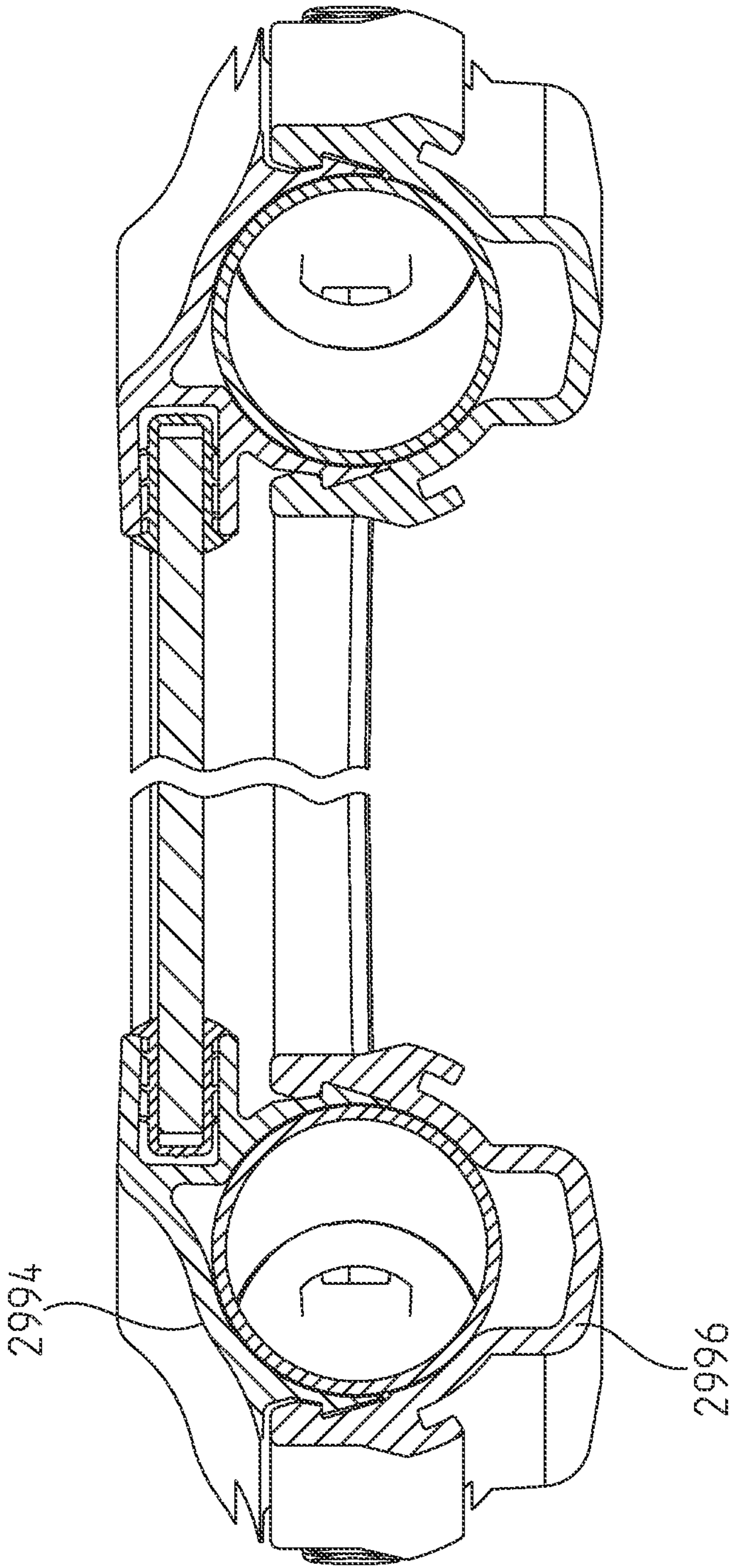


Fig. 166

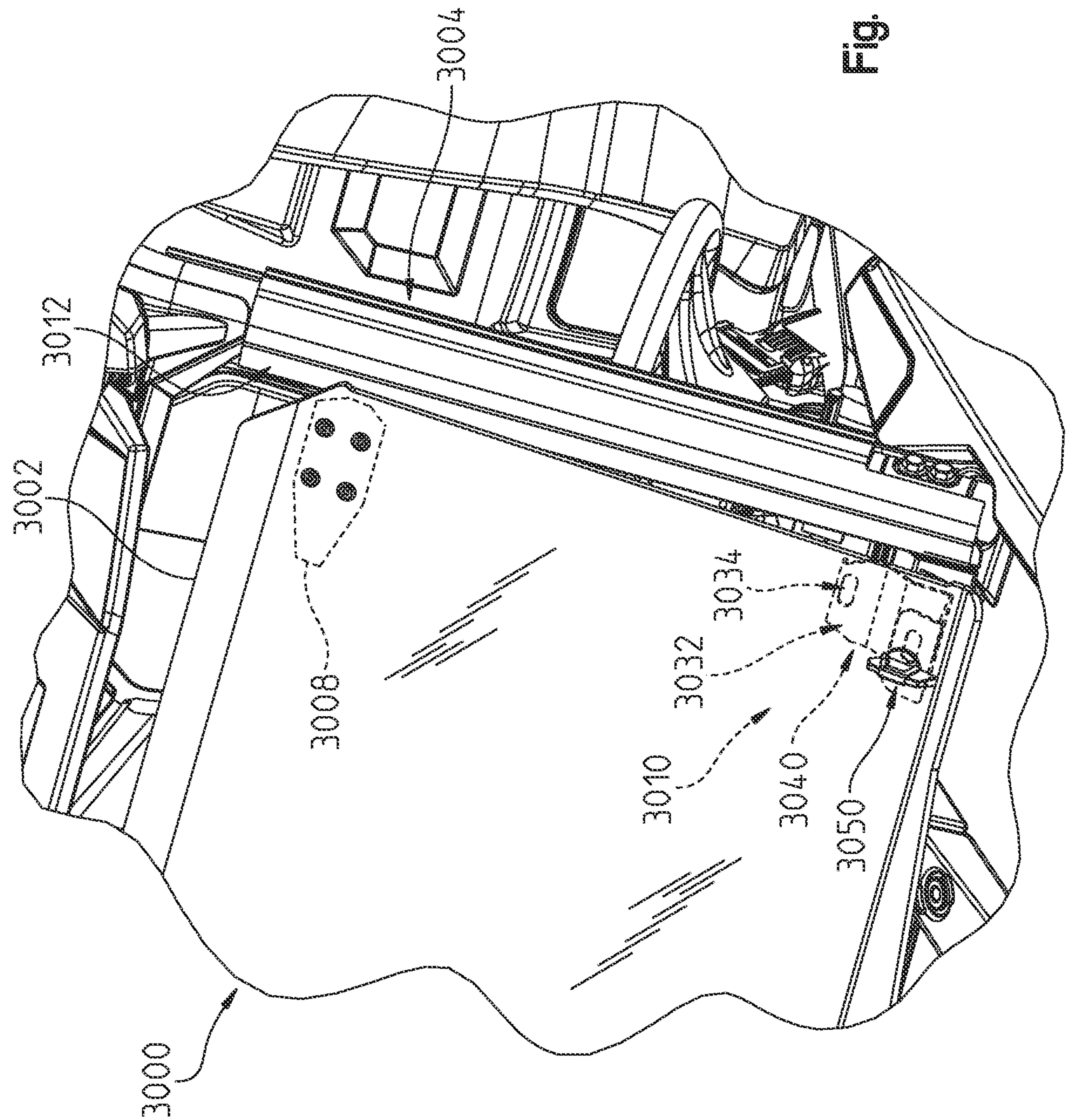


Fig. 167

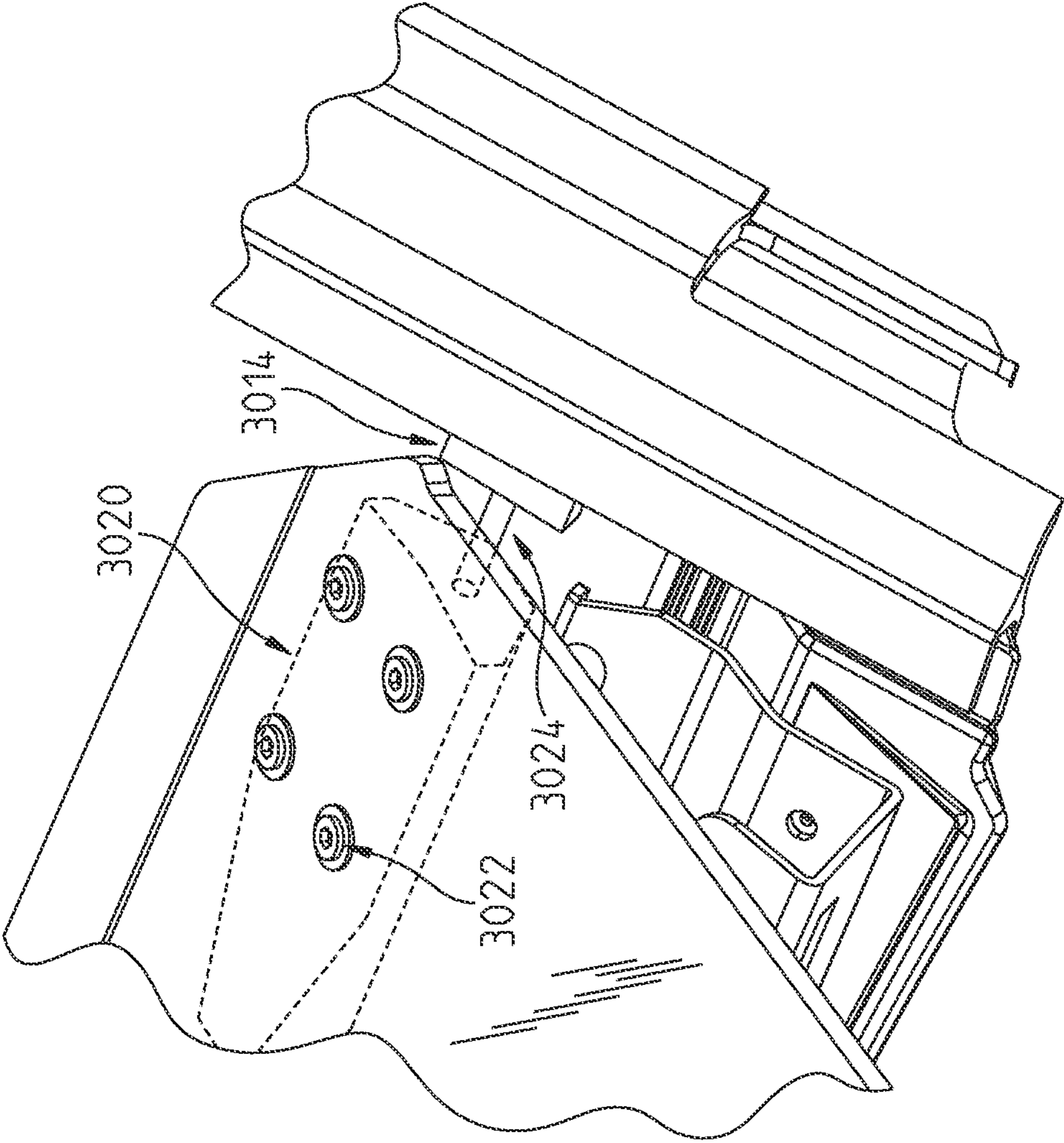


Fig. 168

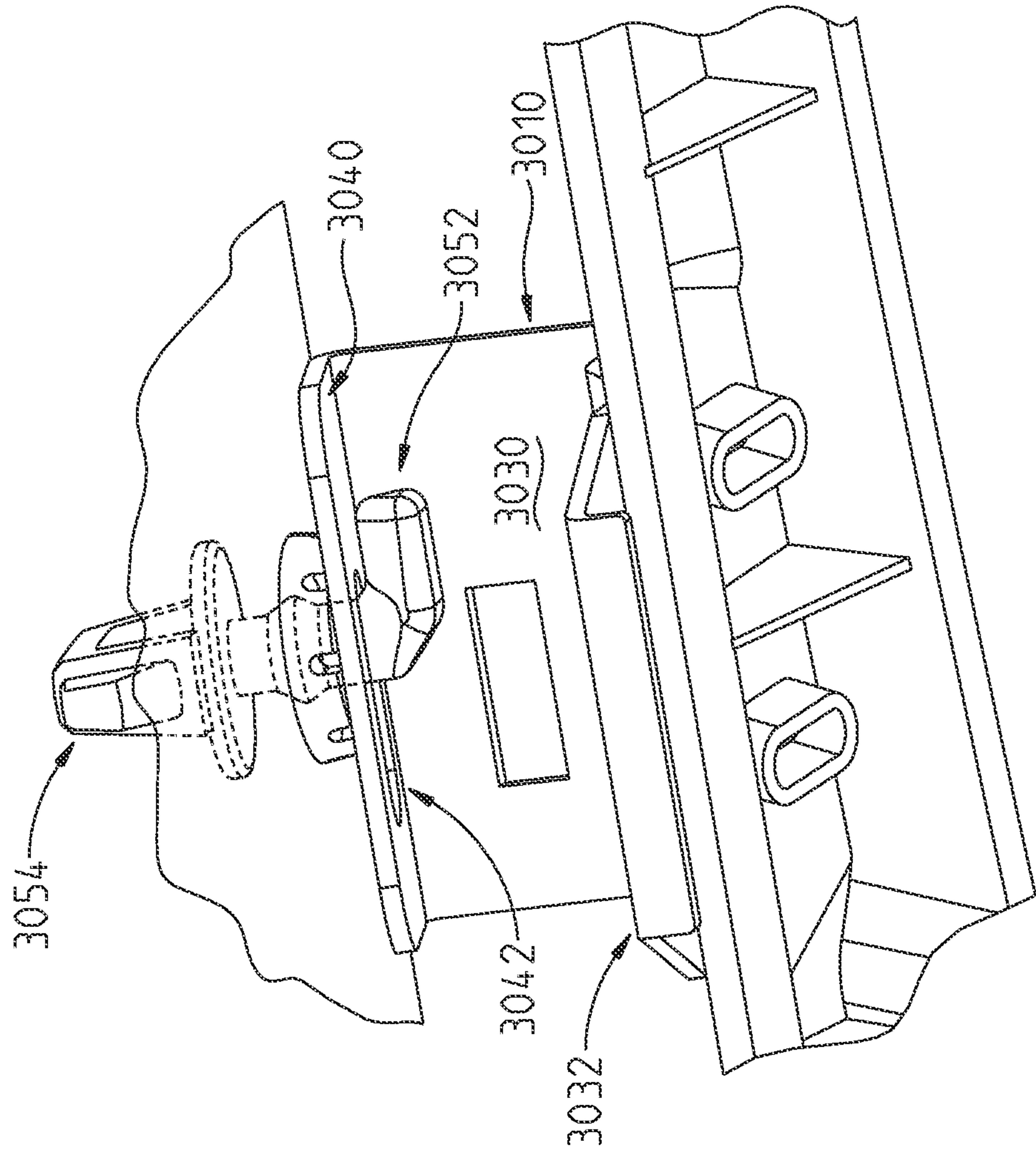


Fig. 169

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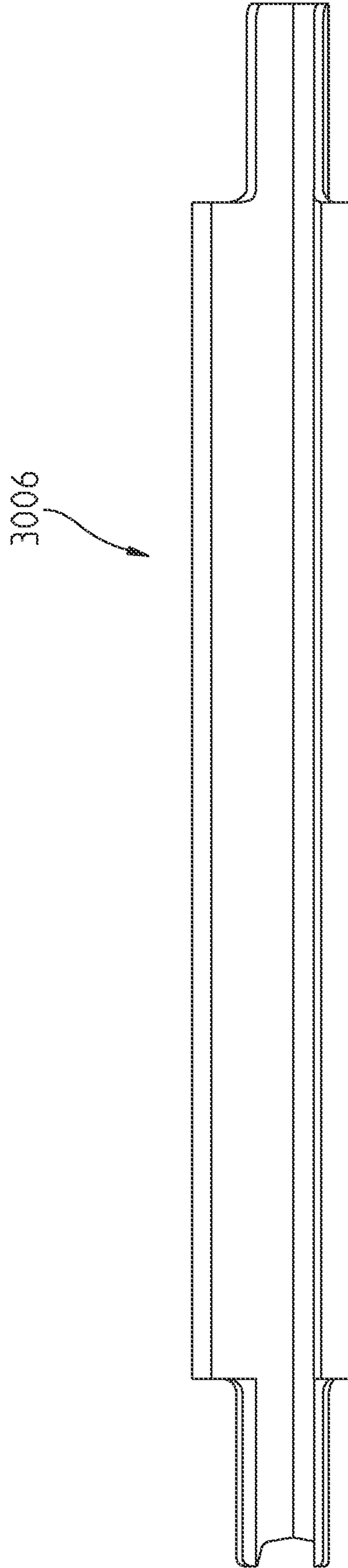


Fig. 170

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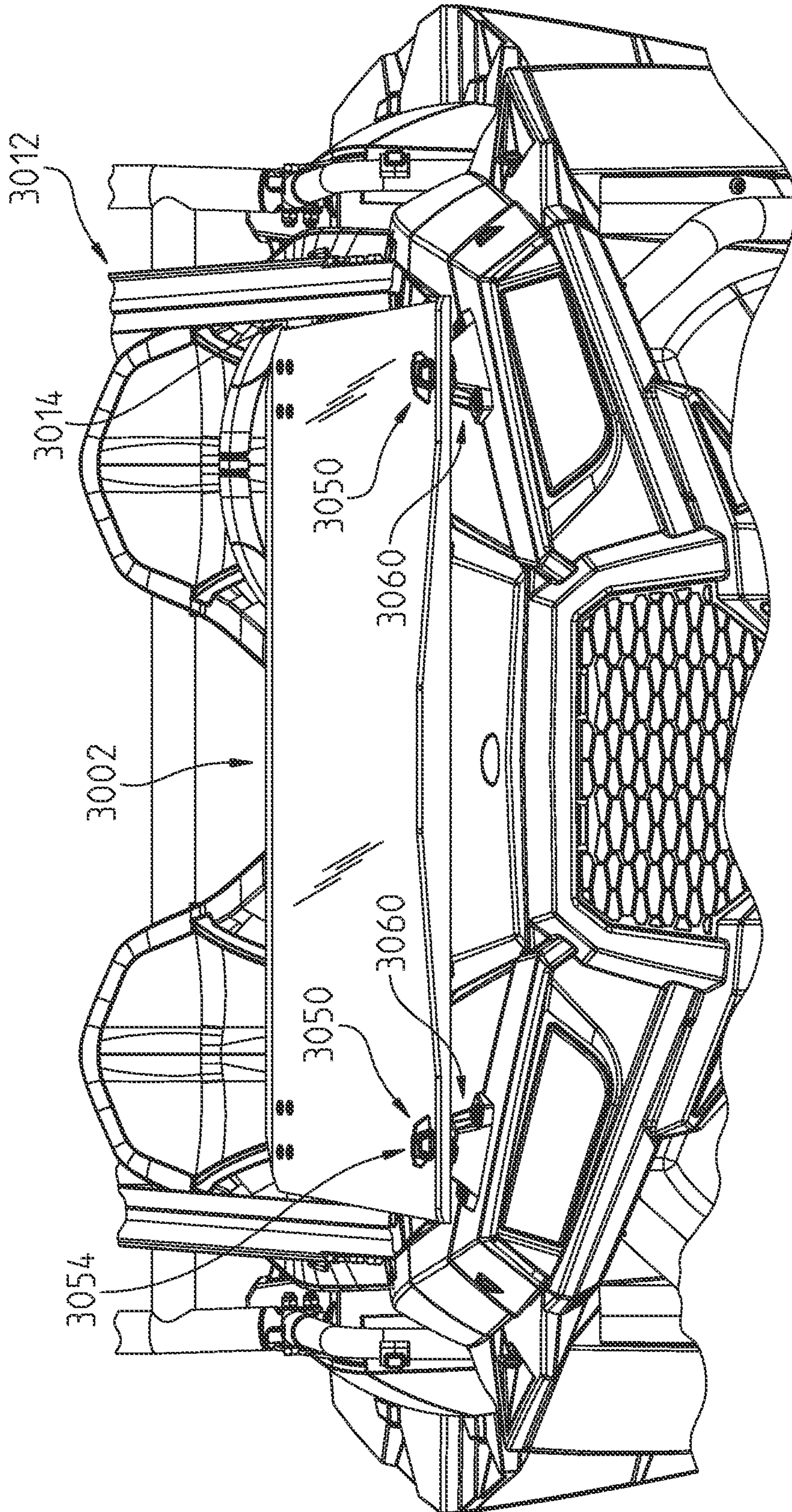


Fig. 171

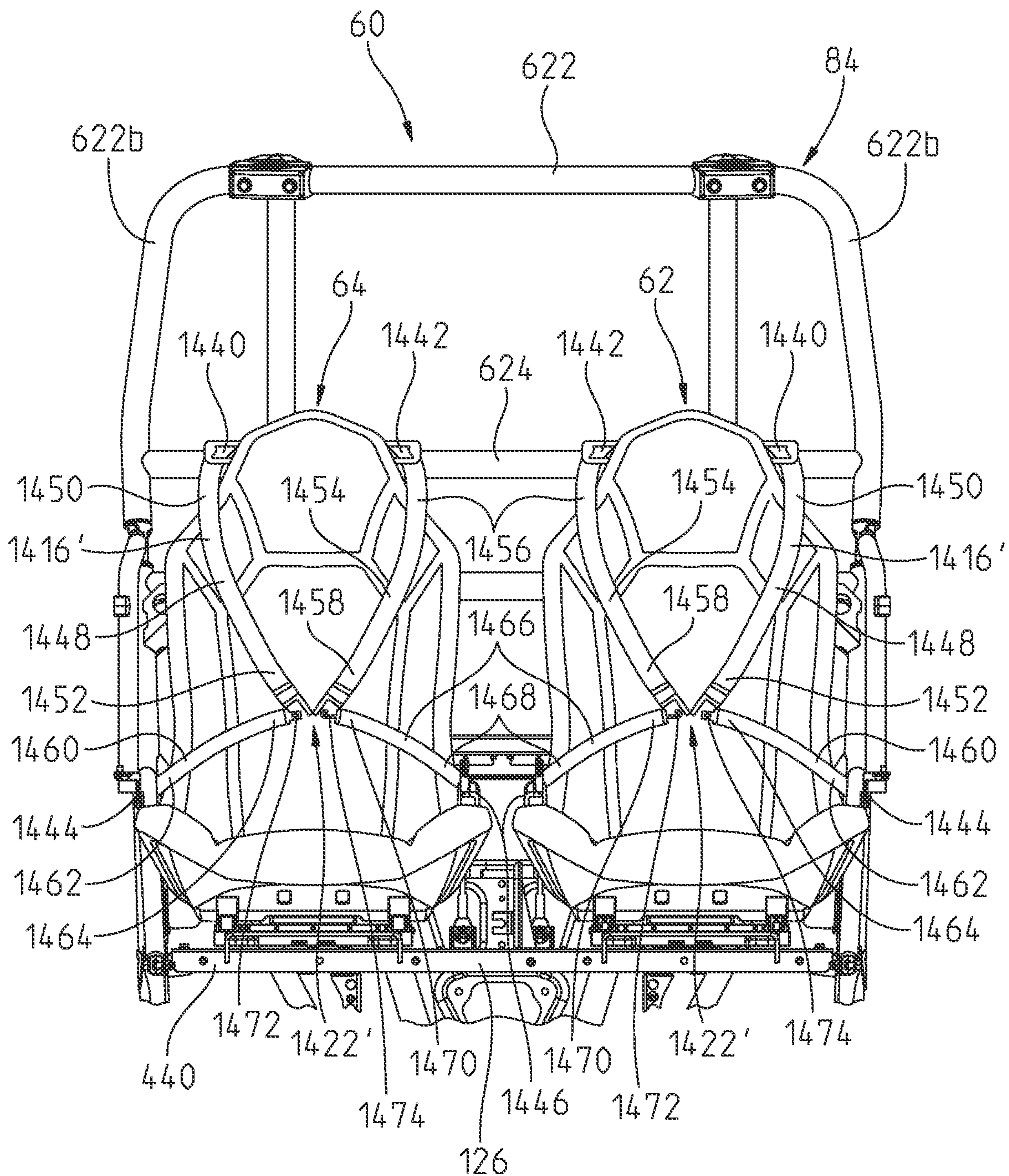


Fig. 64