

(12) **United States Patent**
Vezina

(10) **Patent No.:** **US 10,300,989 B2**
(45) **Date of Patent:** **May 28, 2019**

- (54) **FRAME FOR A SNOWMOBILE**
- (71) Applicant: **BOMBARDIER RECREATIONAL PRODUCTS INC.**, Valcourt (CA)
- (72) Inventor: **Sebastien Vezina**, Sherbrooke (CA)
- (73) Assignee: **BOMBARDIER RECREATIONAL PRODUCTS INC.**, Valcourt (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 31 days.

- (21) Appl. No.: **15/470,131**
- (22) Filed: **Mar. 27, 2017**

(65) **Prior Publication Data**
US 2017/0341710 A1 Nov. 30, 2017

Related U.S. Application Data
(60) Provisional application No. 62/343,075, filed on May 30, 2016.

(51) **Int. Cl.**
B60G 3/20 (2006.01)
B62M 27/02 (2006.01)

(52) **U.S. Cl.**
CPC **B62M 27/02** (2013.01); **B60G 3/20** (2013.01); **B60G 2200/144** (2013.01); **B60G 2300/322** (2013.01); **B62M 2027/023** (2013.01); **B62M 2027/026** (2013.01); **B62M 2027/028** (2013.01)

(58) **Field of Classification Search**
CPC B60G 3/18; B60G 7/00; B62M 27/02; B62M 2027/025; B62M 2027/026; B62M 2027/028

See application file for complete search history.

- (56) **References Cited**
- U.S. PATENT DOCUMENTS
- 6,446,744 B2 * 9/2002 Wubbolts B62J 35/00 180/190
- 6,651,768 B2 11/2003 Fournier et al.
- 6,866,110 B2 * 3/2005 Mallette B62J 35/00 180/183
- 7,451,846 B2 11/2008 Wubbolts et al.
- 7,469,764 B2 * 12/2008 Girouard B62J 35/00 180/186

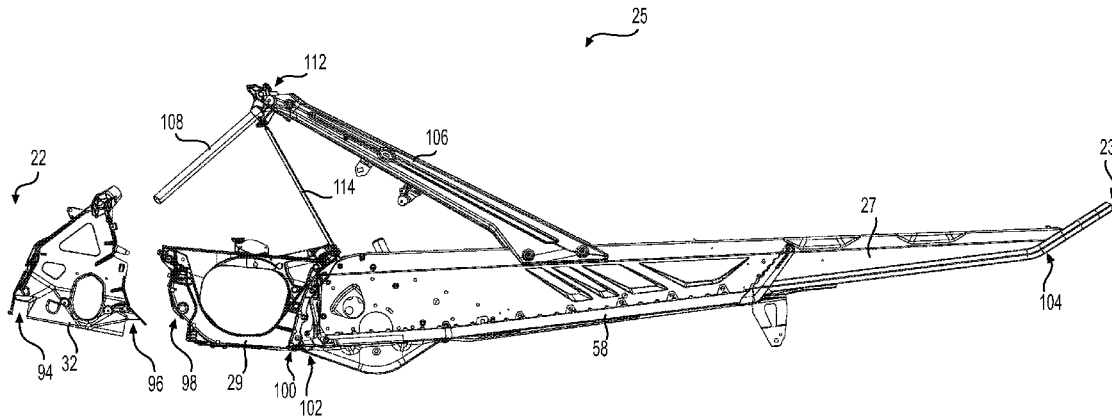
(Continued)

OTHER PUBLICATIONS
Bombardier Recreational Products Inc.; SKI-DOO-2007 Shop Manual REV Series; 2006; Cover pages, pp. 575-592 and last page; Valcourt; Canada.

Primary Examiner — Kevin Hurley
Assistant Examiner — Michael R Stabley
(74) *Attorney, Agent, or Firm* — BCF LLP

(57) **ABSTRACT**
A snowmobile has a frame having a motor module. The motor module has a front portion defining a cross member and further defining an aperture below the cross member. The frame further has a tunnel, a suspension module, a motor, a handlebar, front left and right skis both operatively connected to the handlebar and front left and right suspension assemblies operatively connecting the front left and right skis respectively to the suspension module and to the motor module. Each one of the front left and right suspension assemblies have a respective support arm having a proximal end positioned longitudinally forward of the motor module and a proximal fastener pivotally connecting the proximal end to the front portion of the motor module about a pivot axis. A line extending from a left pivot axis to a right pivot axis is contained in the cross member.

17 Claims, 34 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

7,469,794	B2	12/2008	Krueger	
7,753,154	B2 *	7/2010	Maltais	B62M 27/02 180/190
7,997,372	B2	8/2011	Maltais	
8,074,759	B2	12/2011	Rasidescu et al.	
8,490,731	B2 *	7/2013	Eaton	B60K 28/00 180/190
8,733,773	B2 *	5/2014	Sampson	B62M 27/02 280/190
8,944,204	B2	2/2015	Ripley et al.	

* cited by examiner

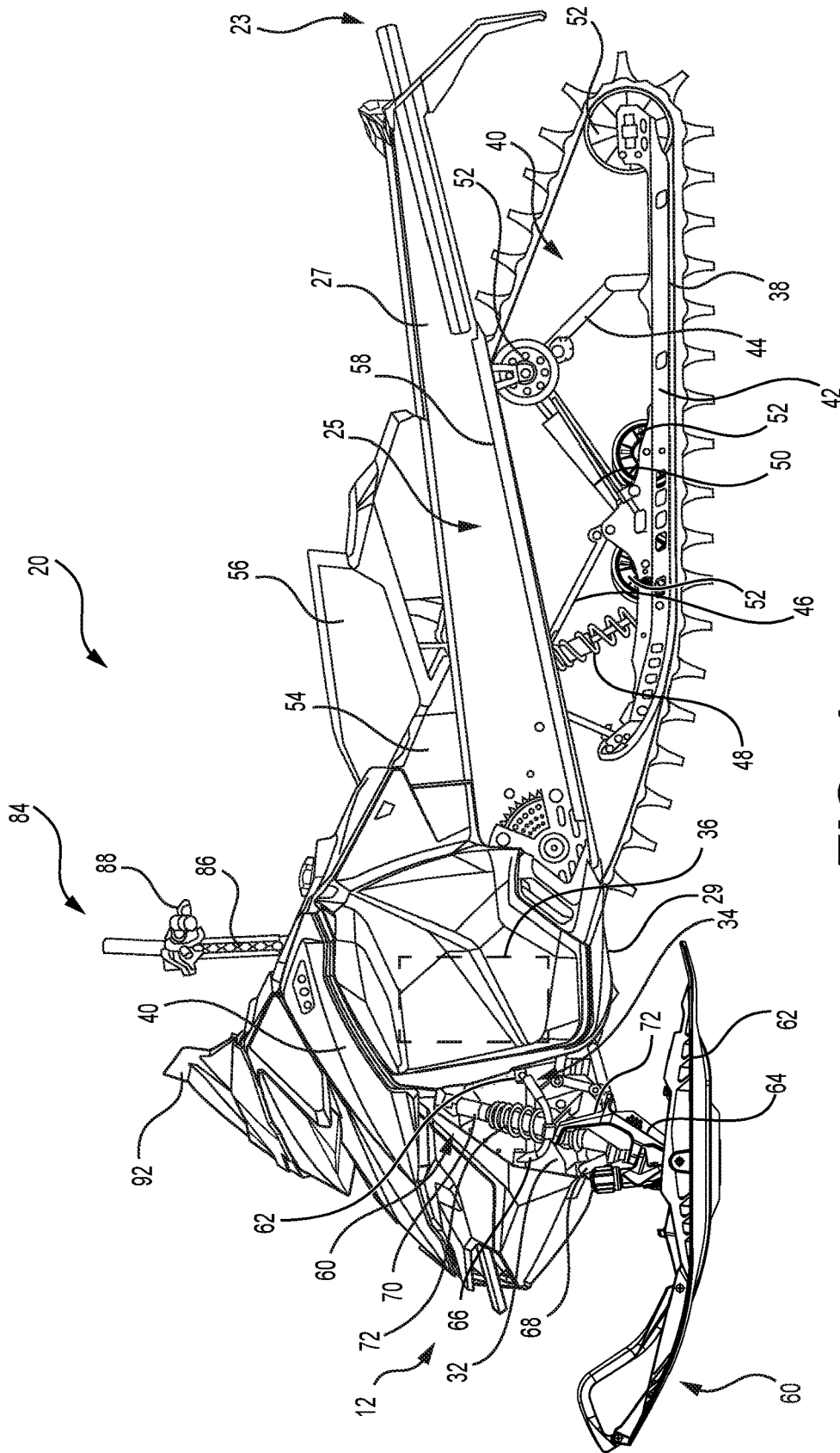


FIG. 1

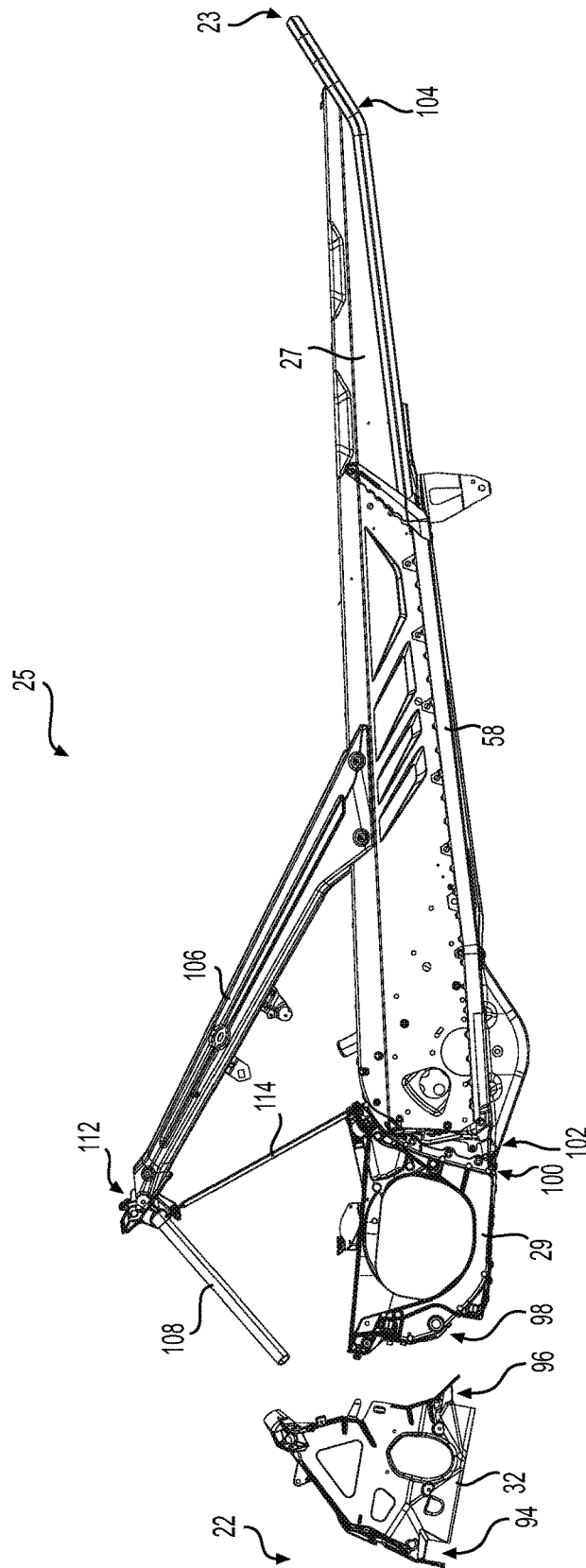


FIG. 2

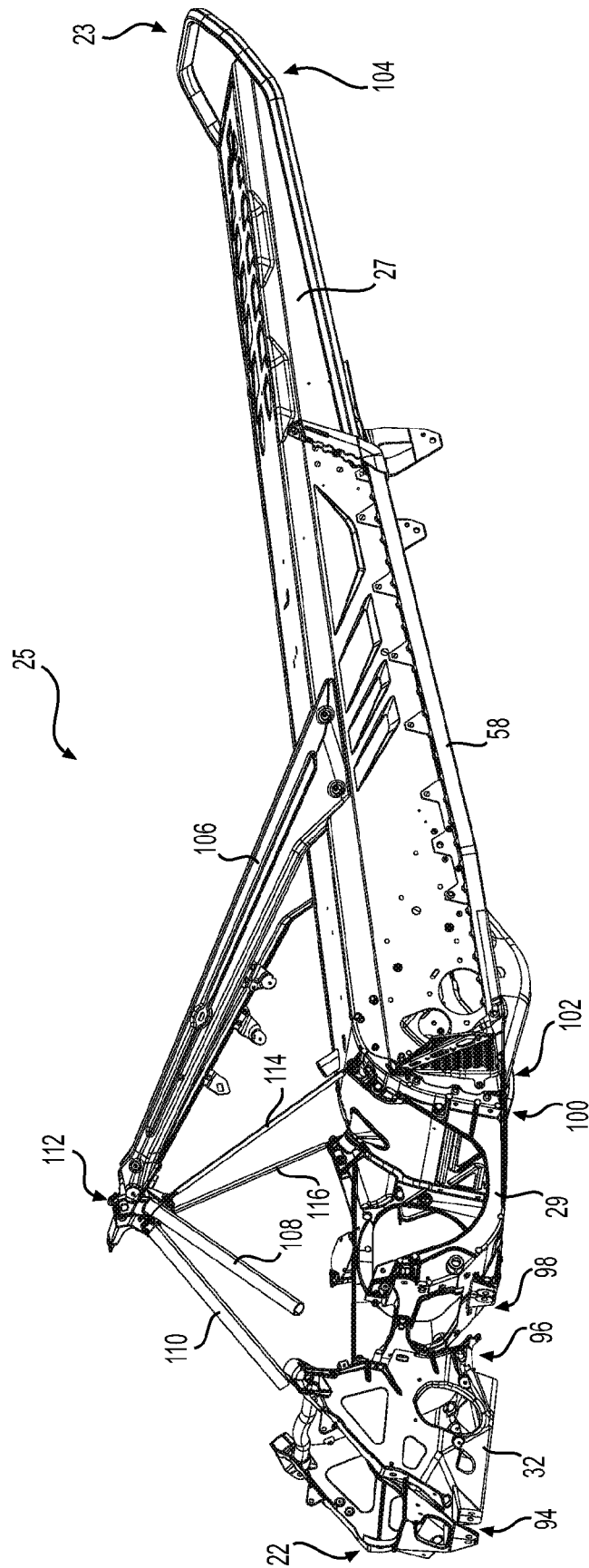


FIG. 3

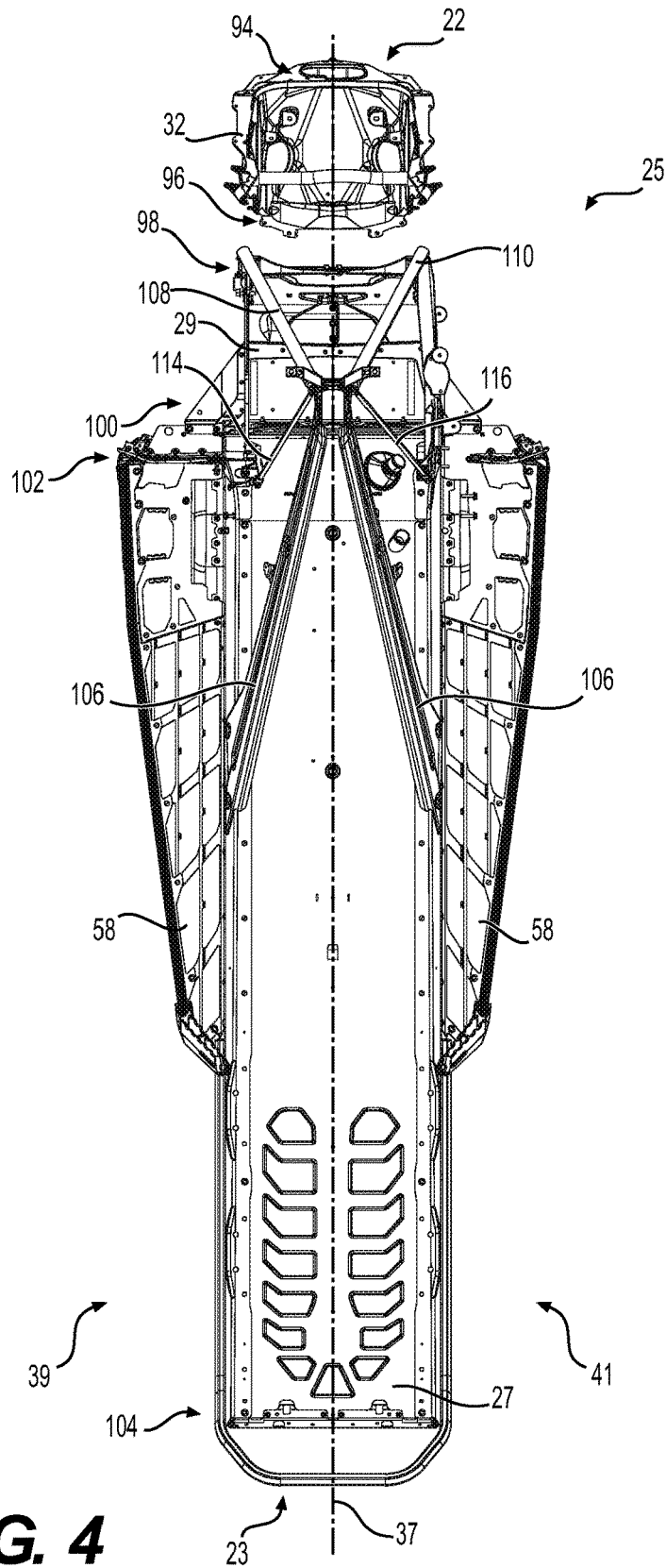


FIG. 4

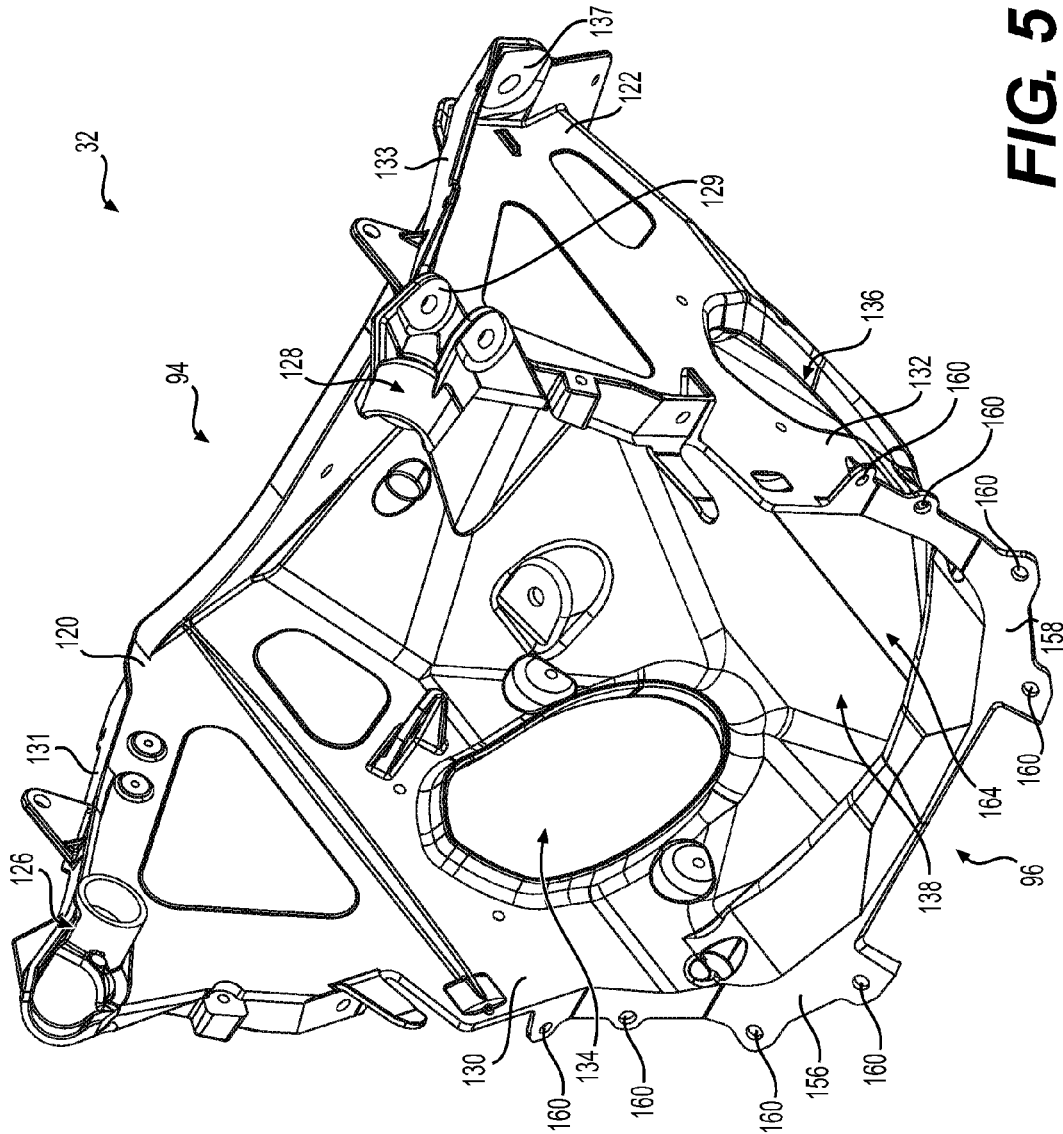


FIG. 5

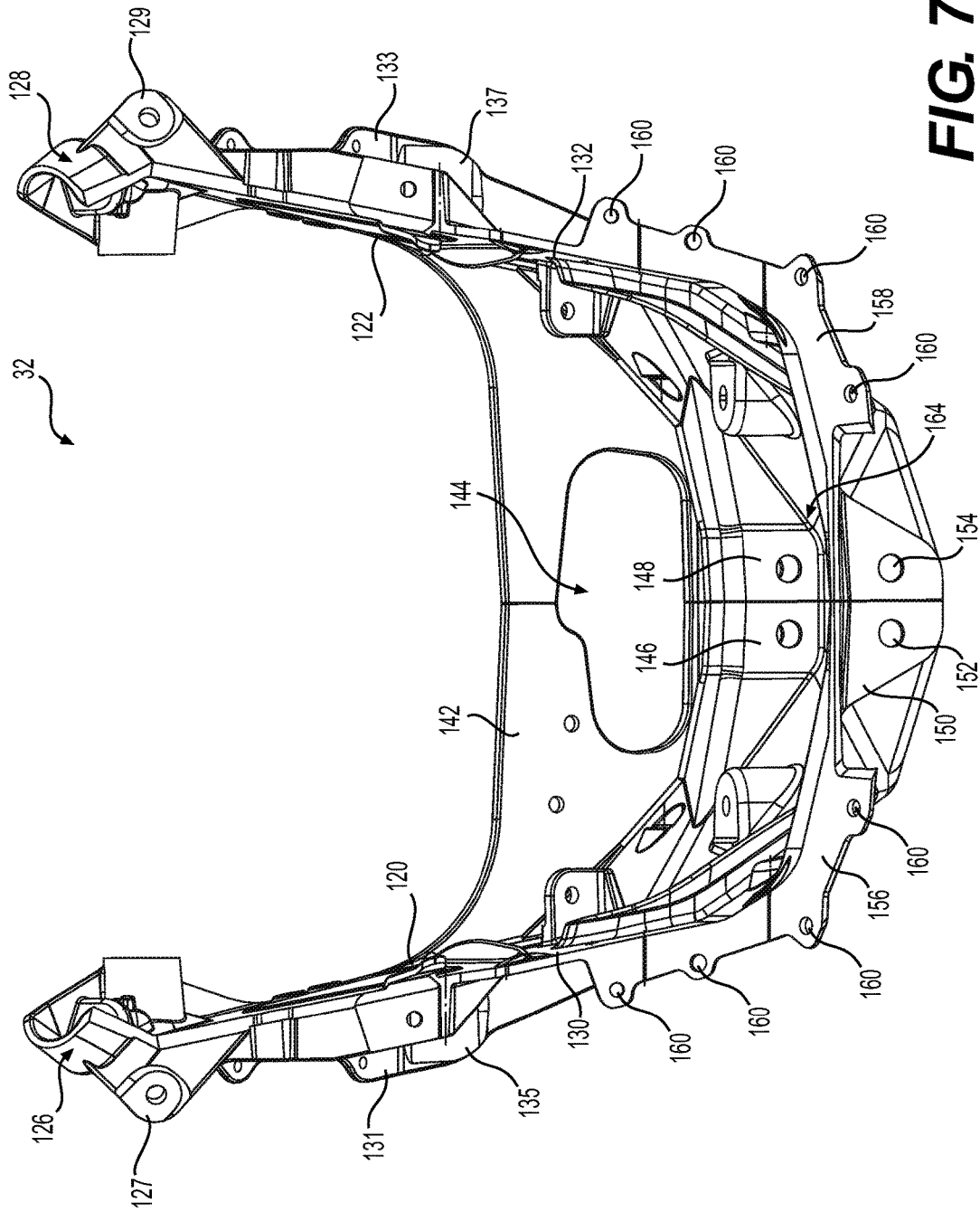


FIG. 7

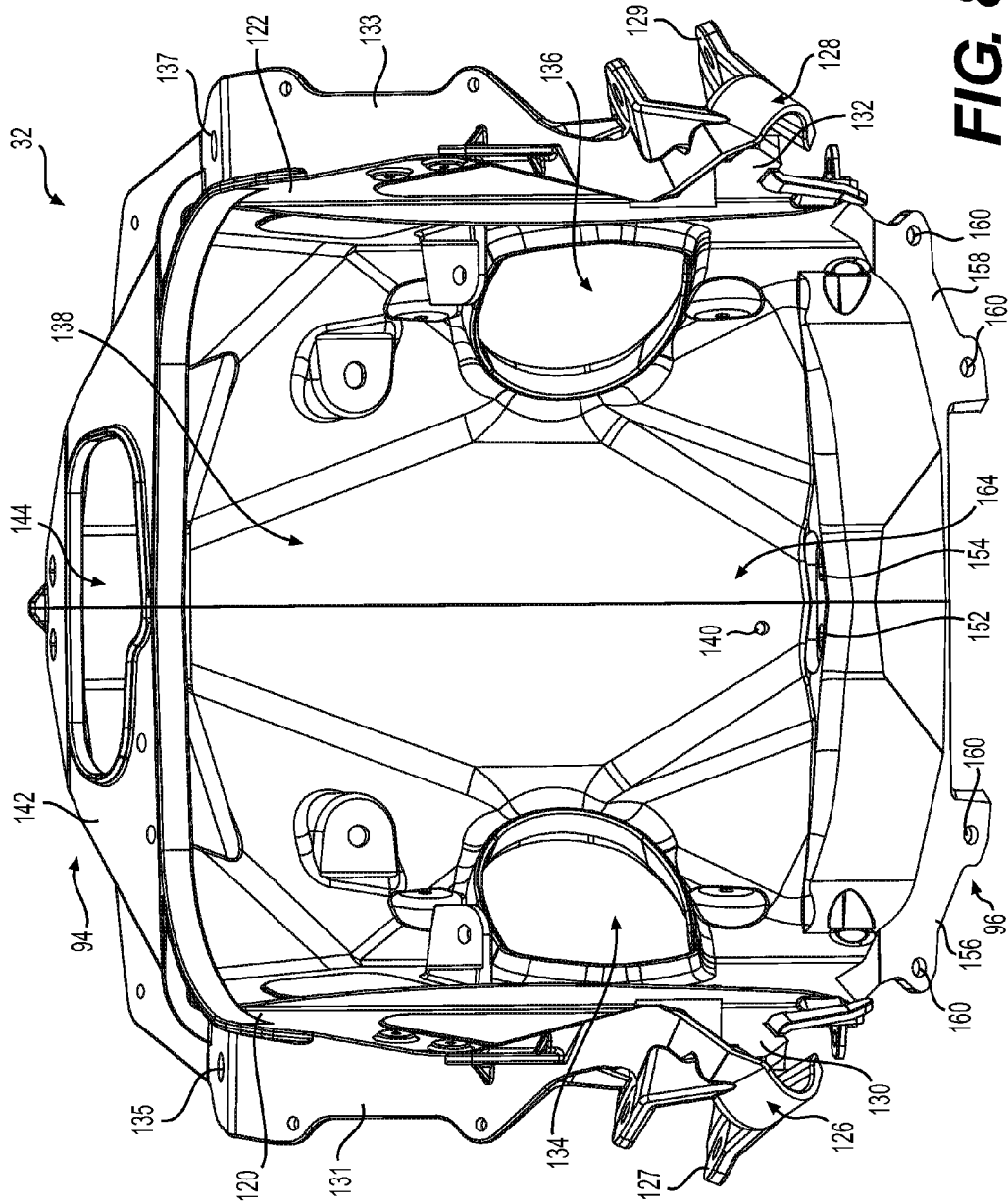


FIG. 8

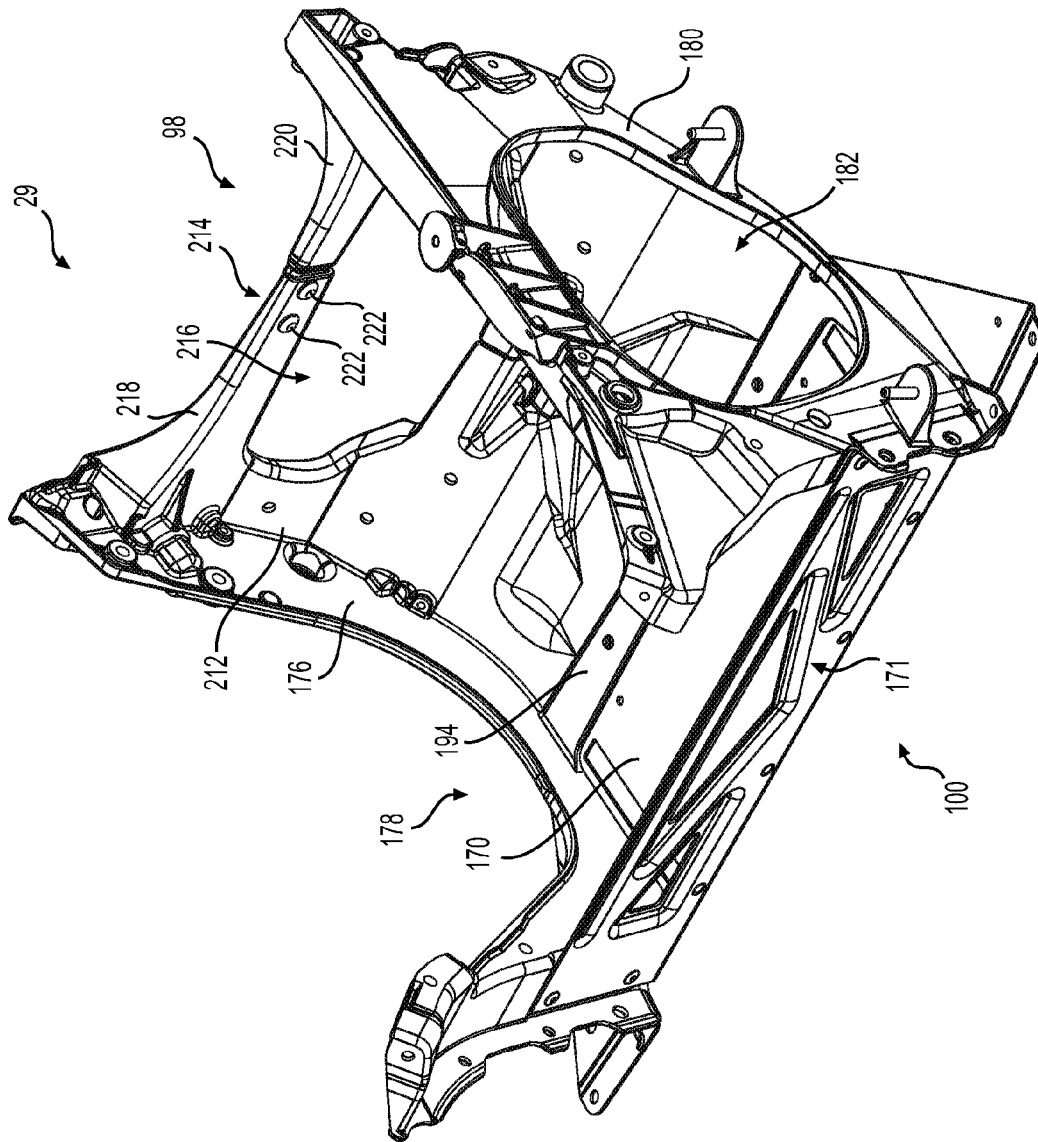


FIG. 9

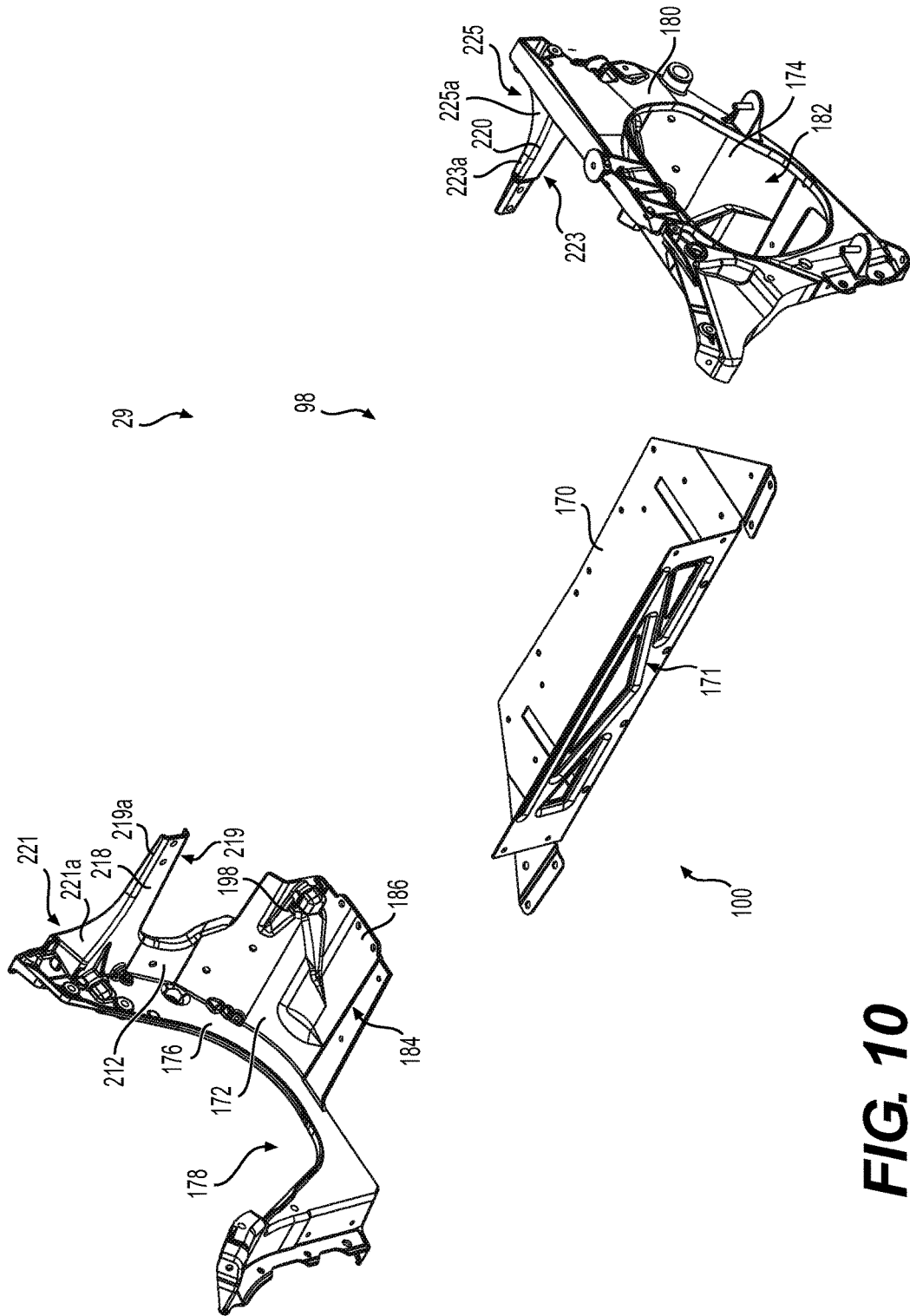


FIG. 10

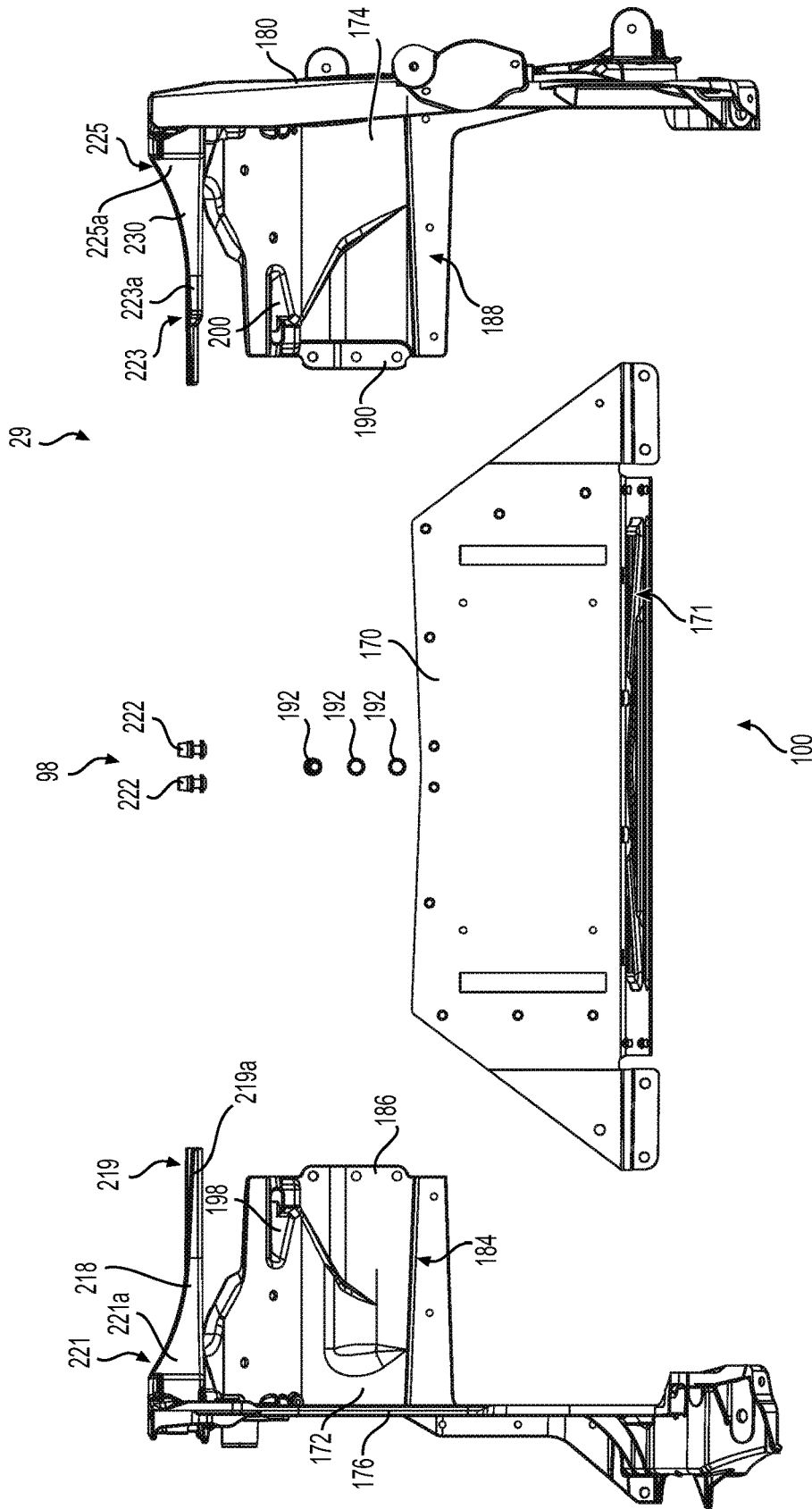


FIG. 11

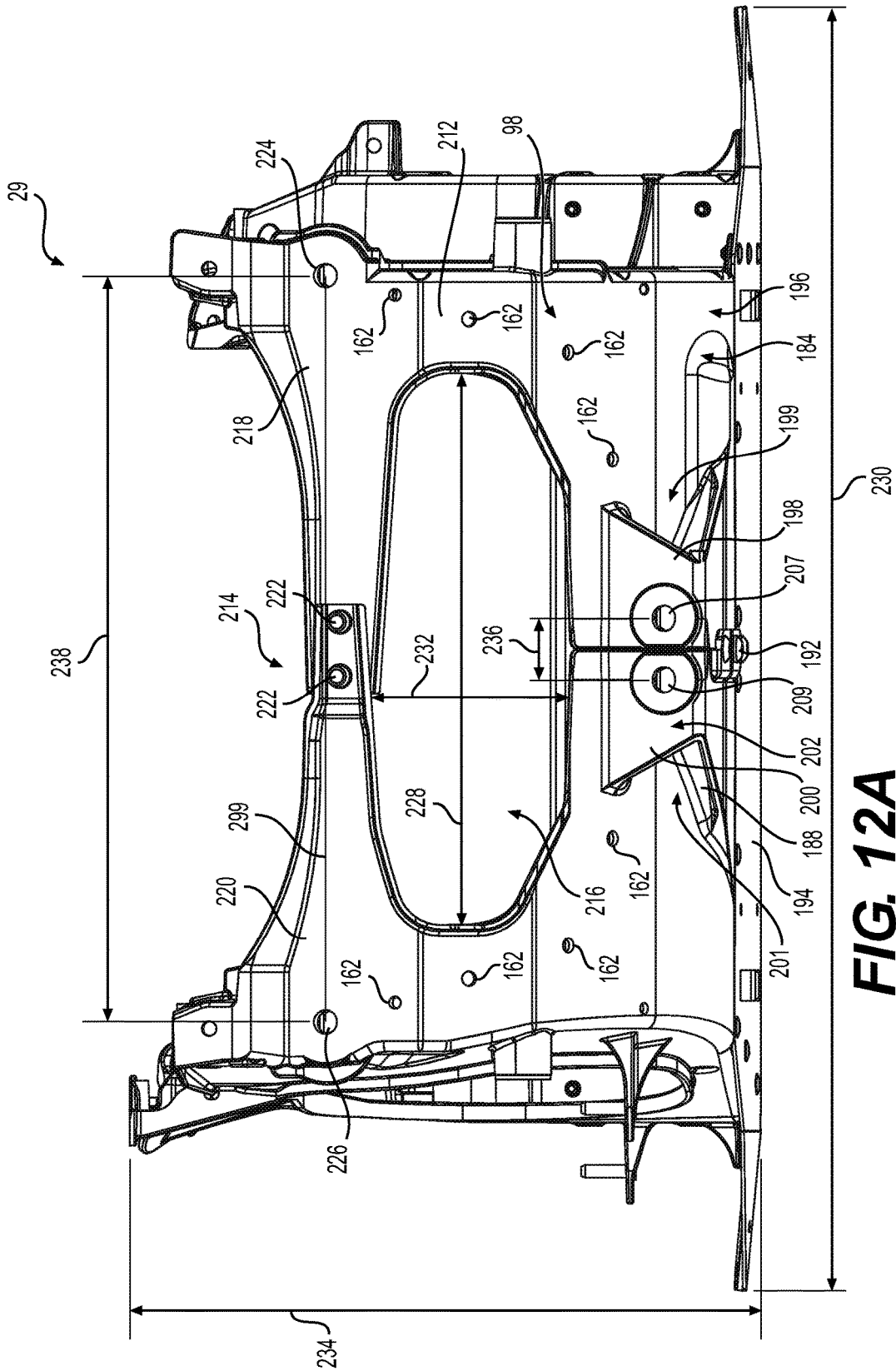


FIG. 12A

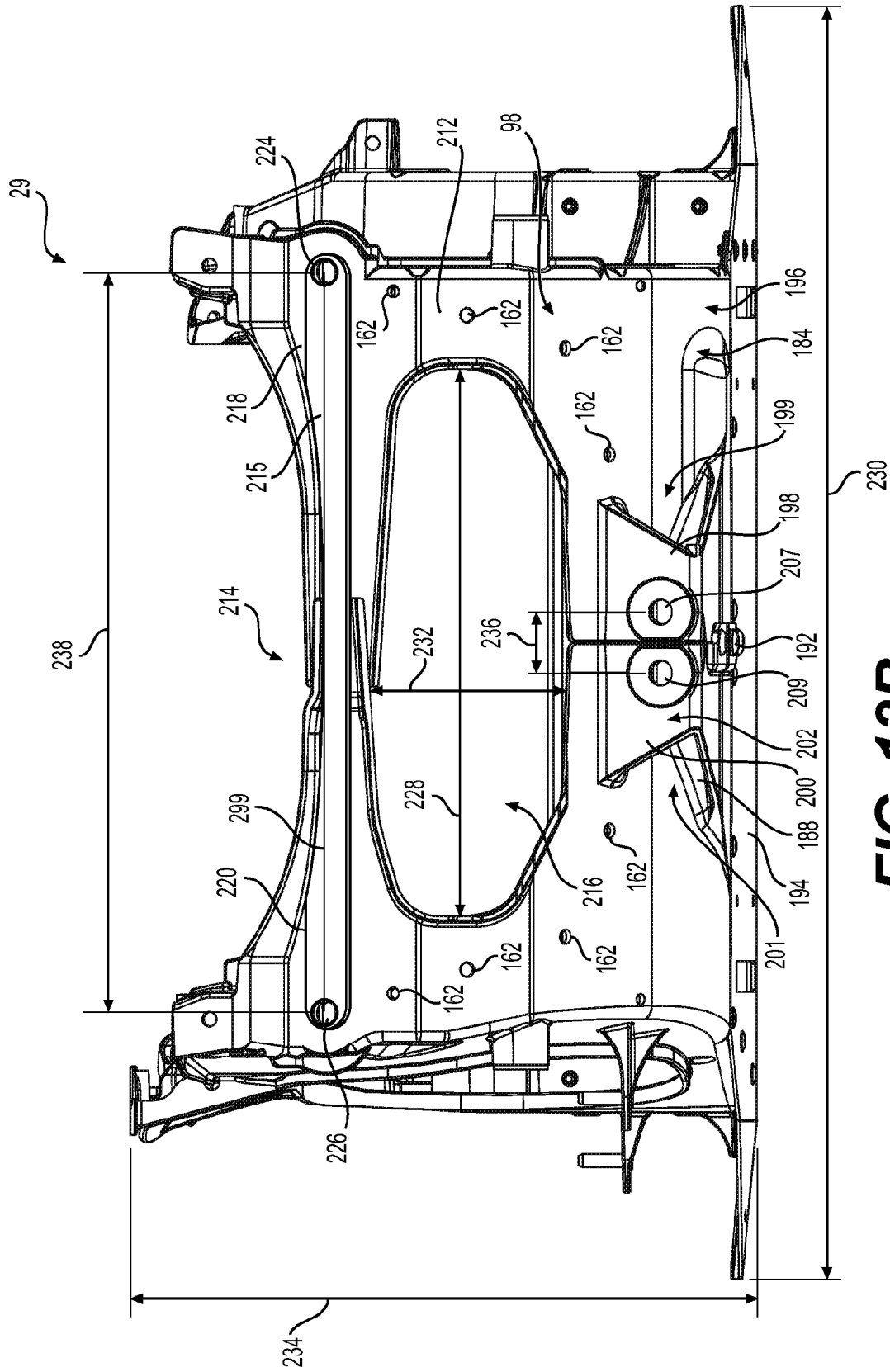


FIG. 12B

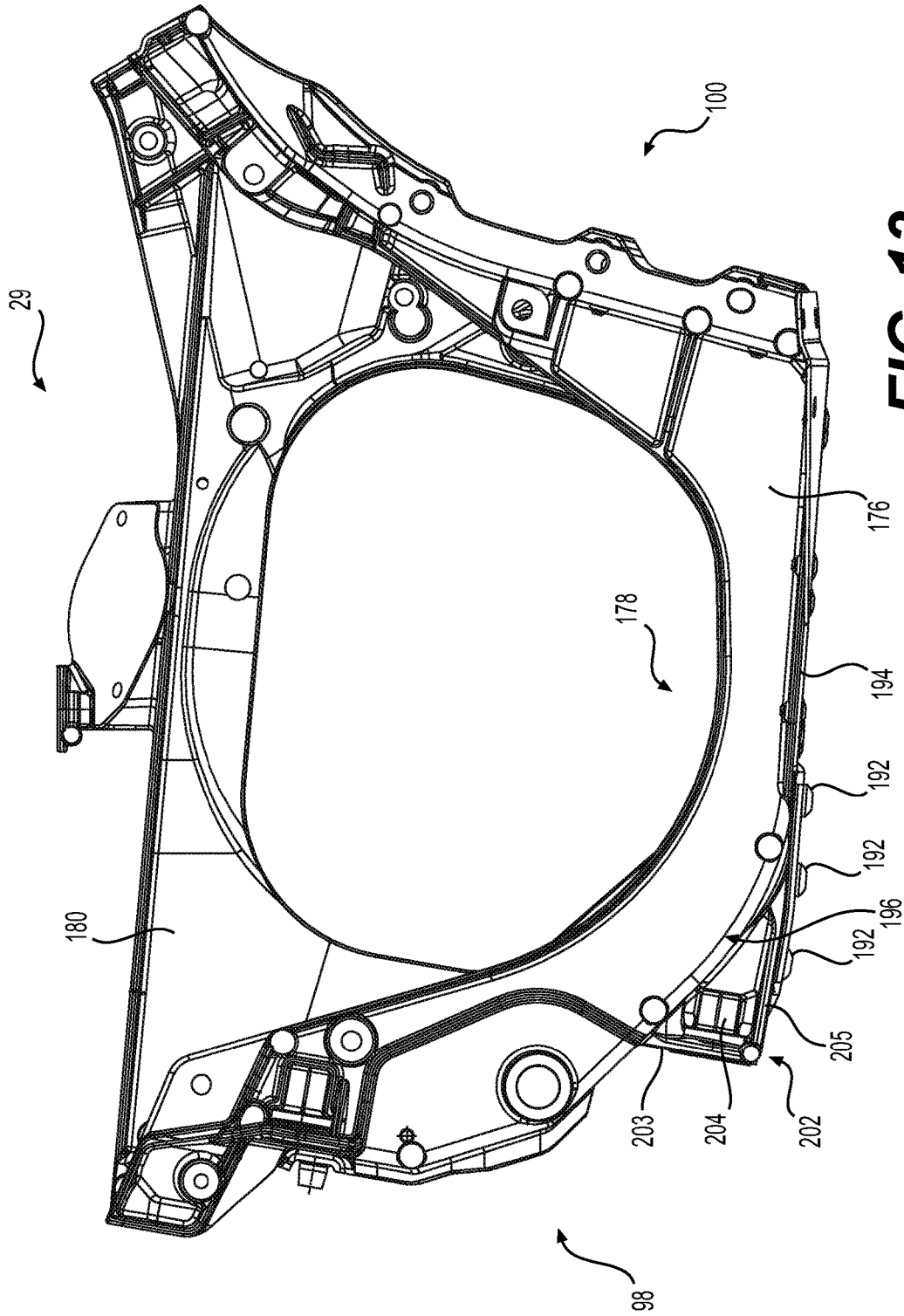


FIG. 13

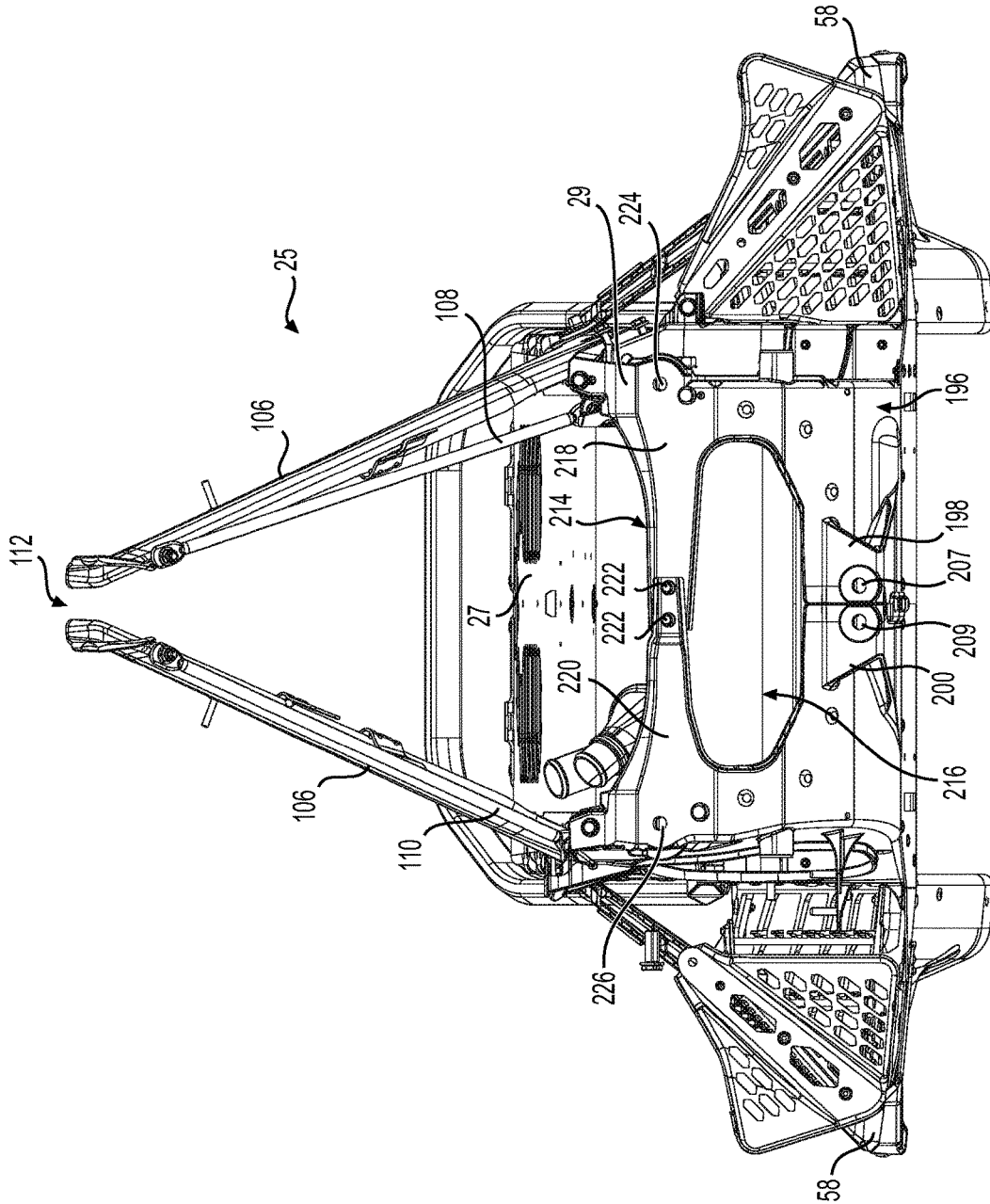


FIG. 14

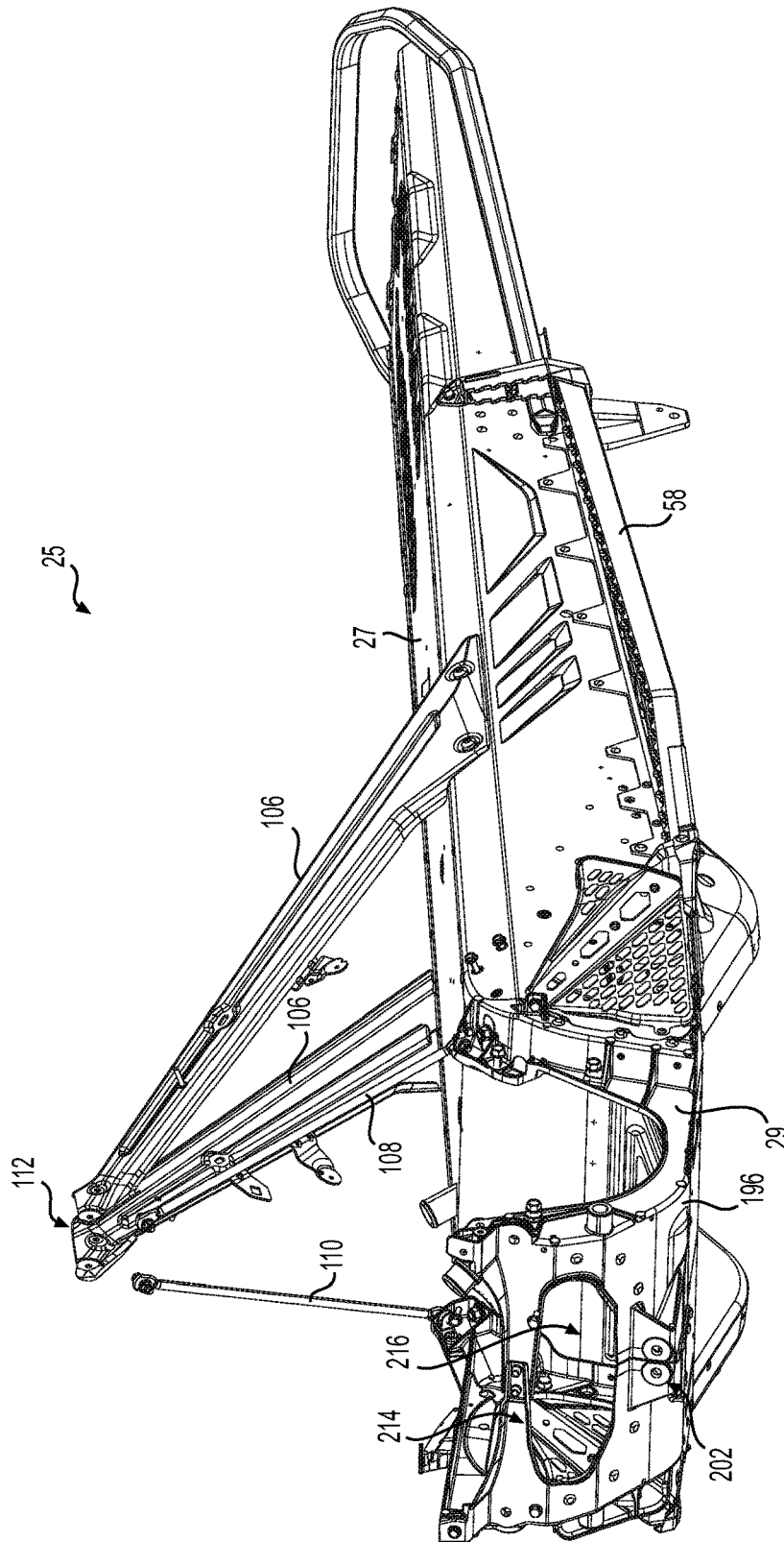


FIG. 15

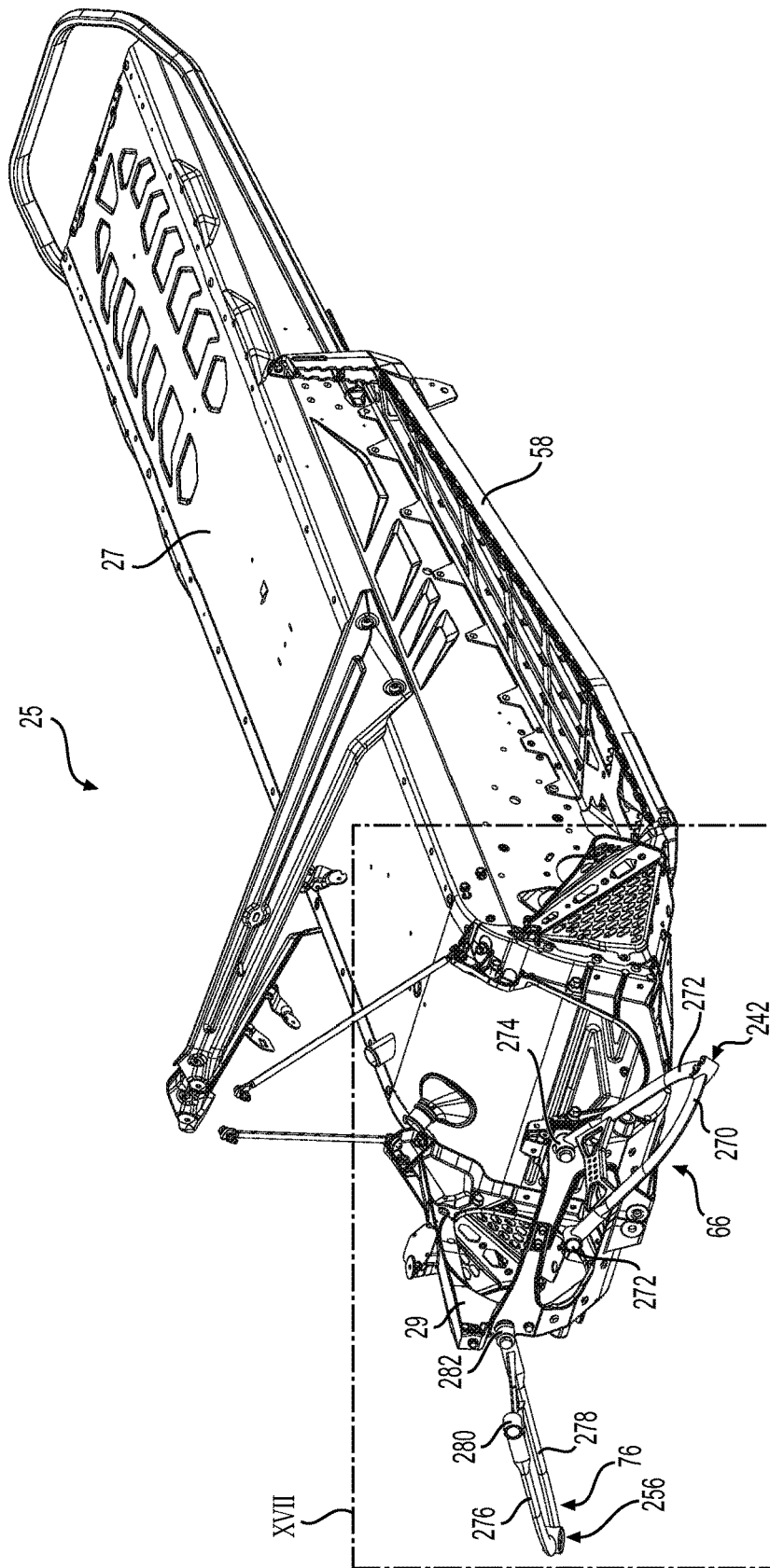


FIG. 16

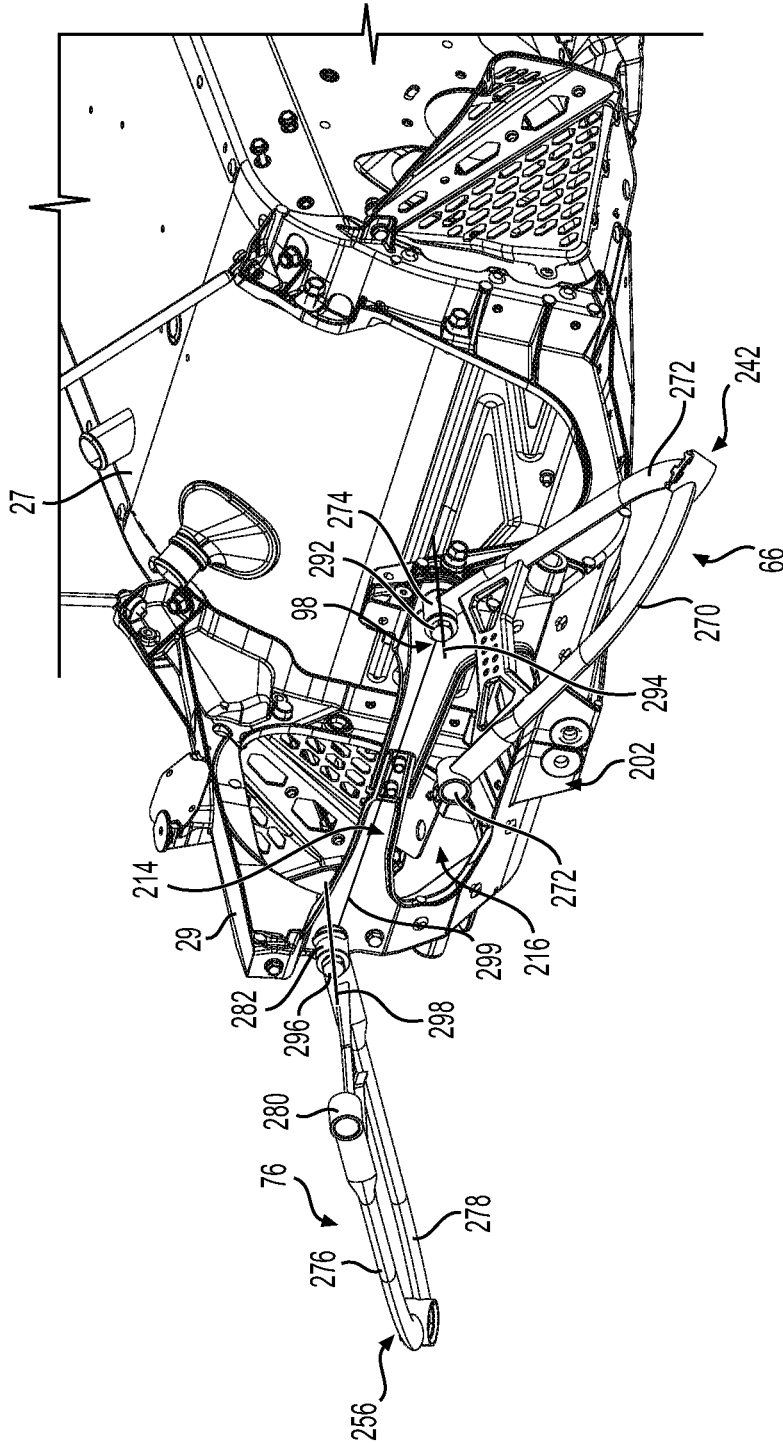


FIG. 17A

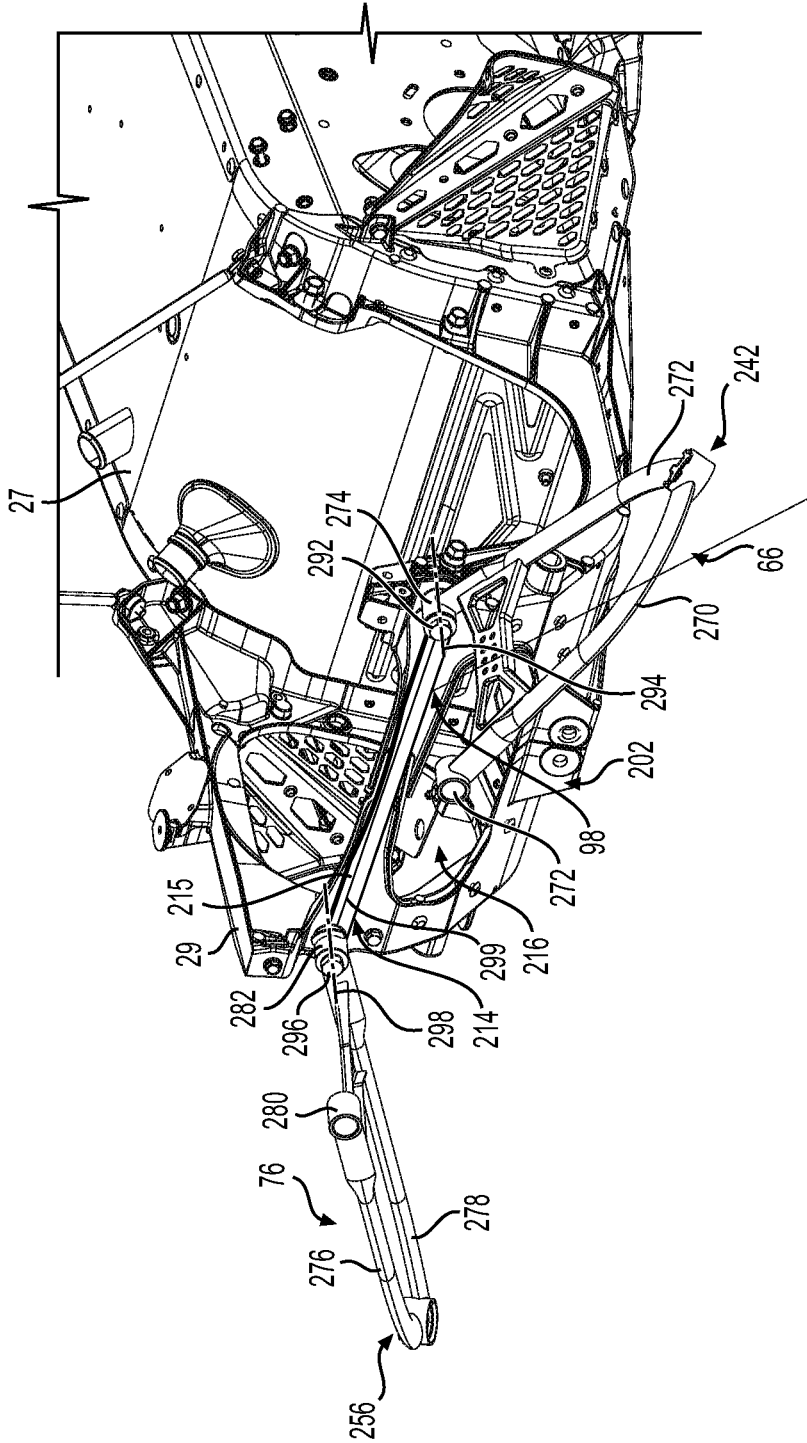


FIG. 17B

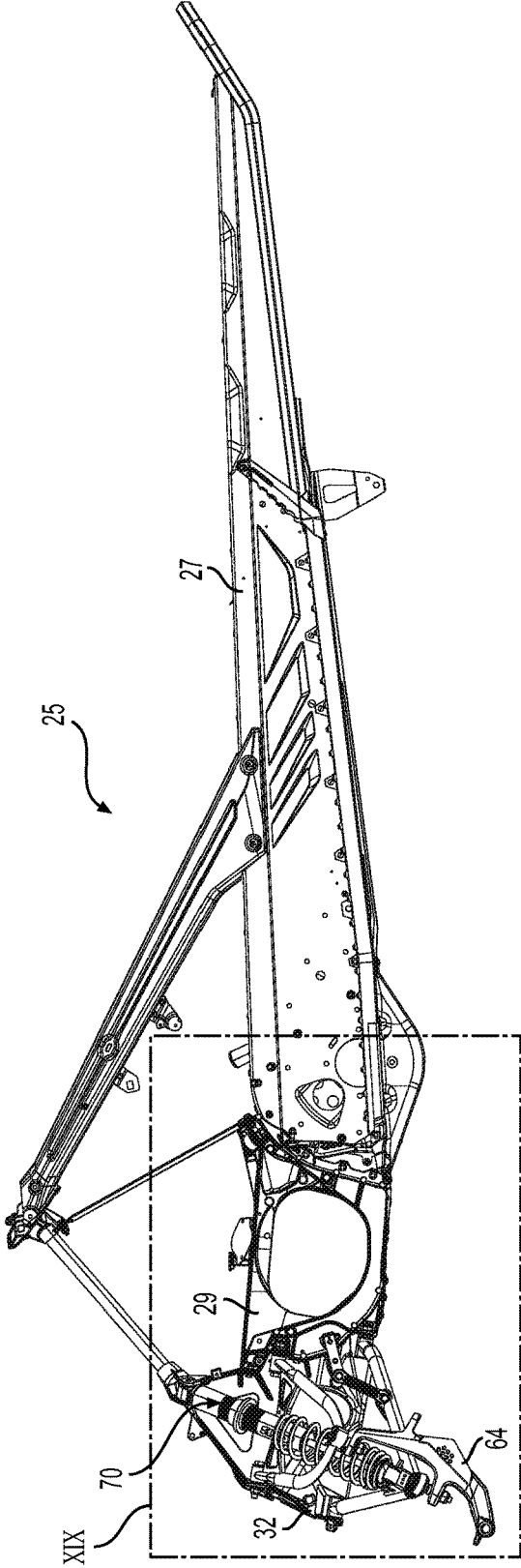


FIG. 18

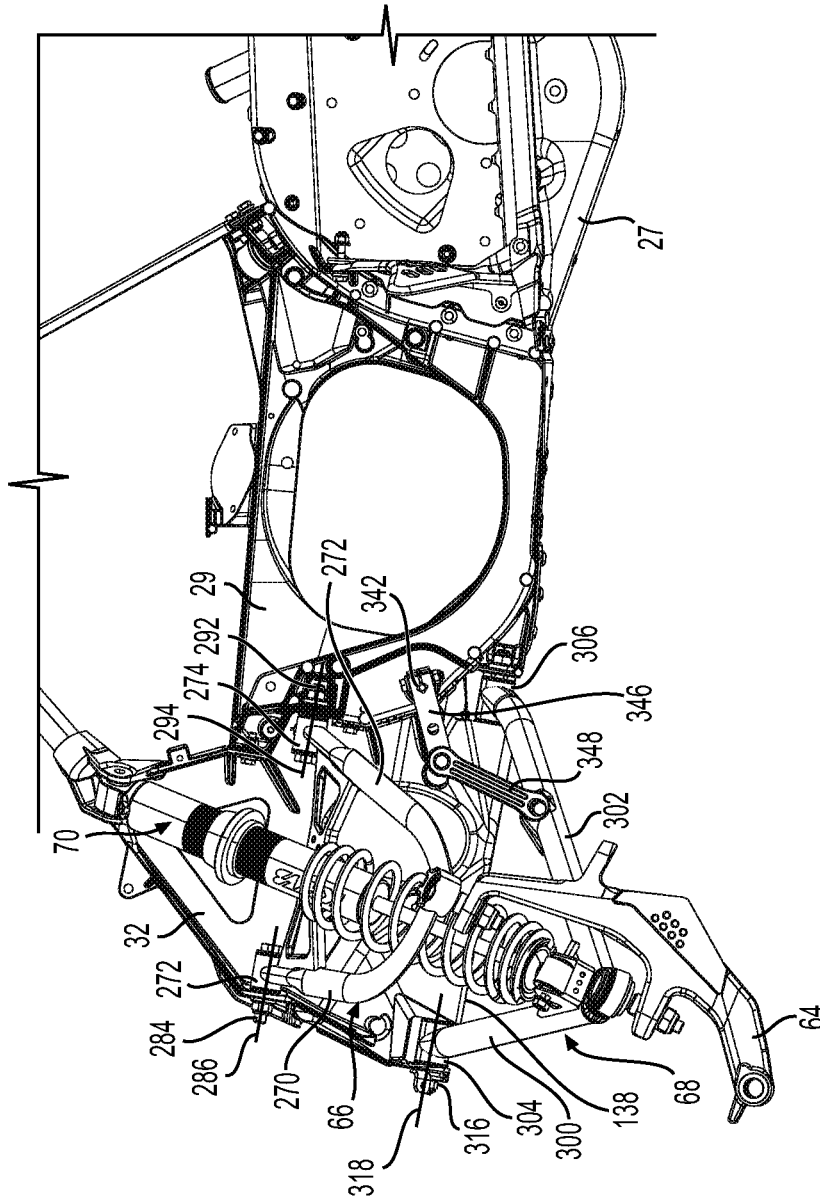


FIG. 19

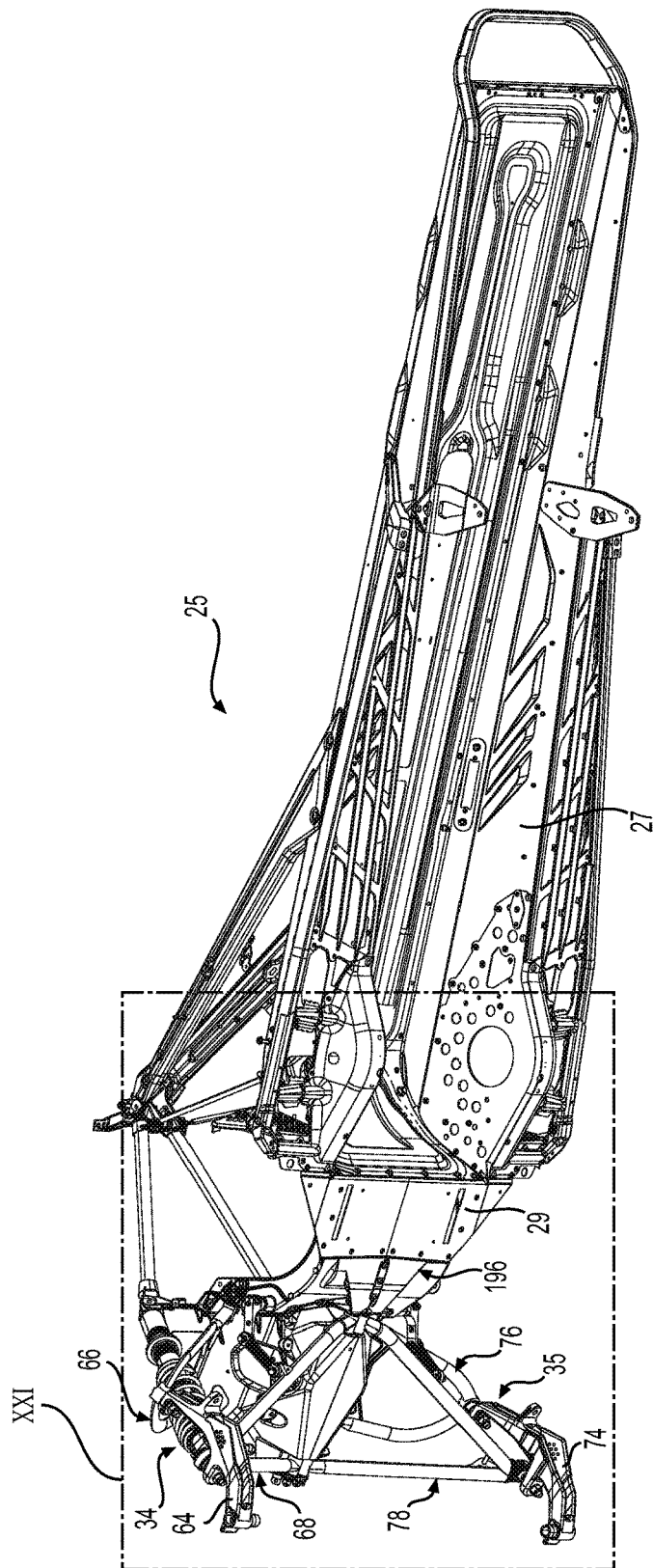


FIG. 20

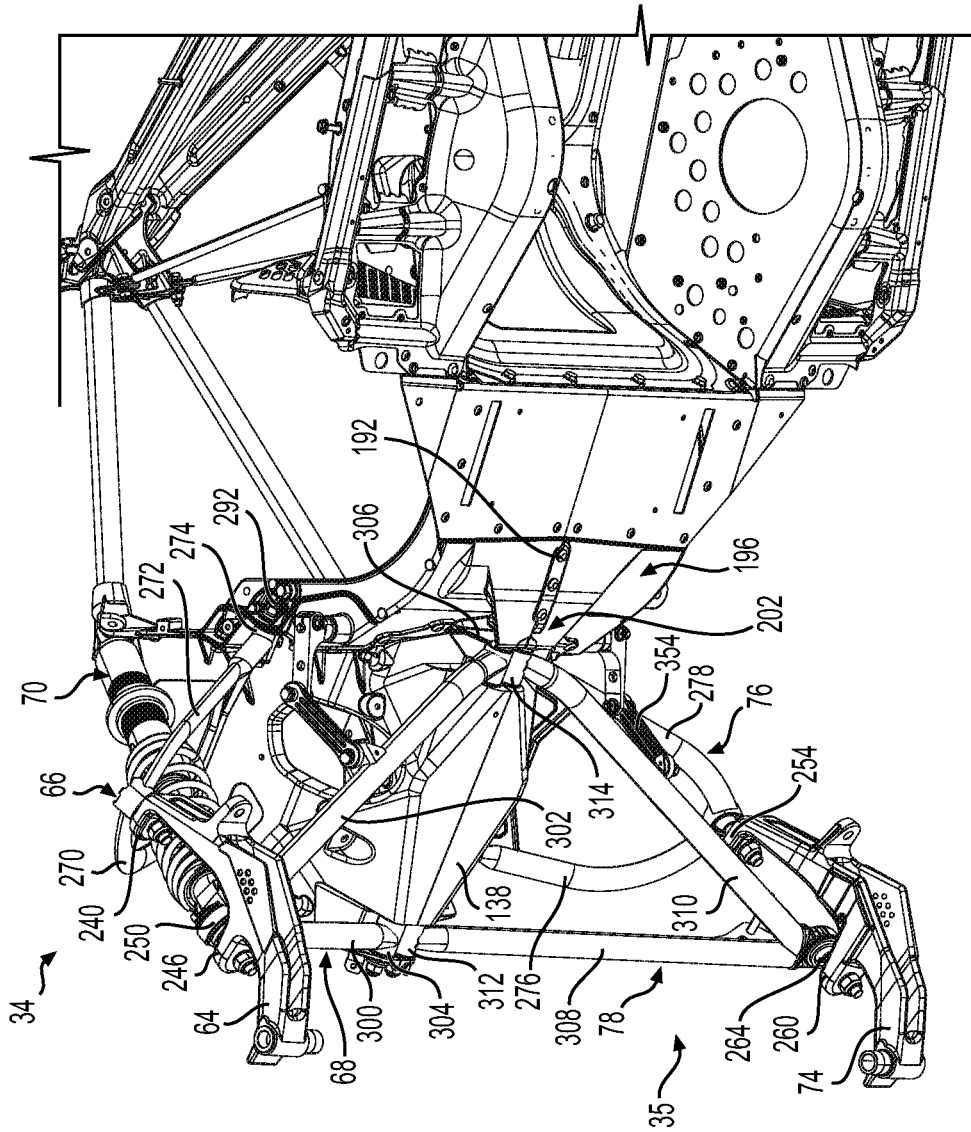


FIG. 21

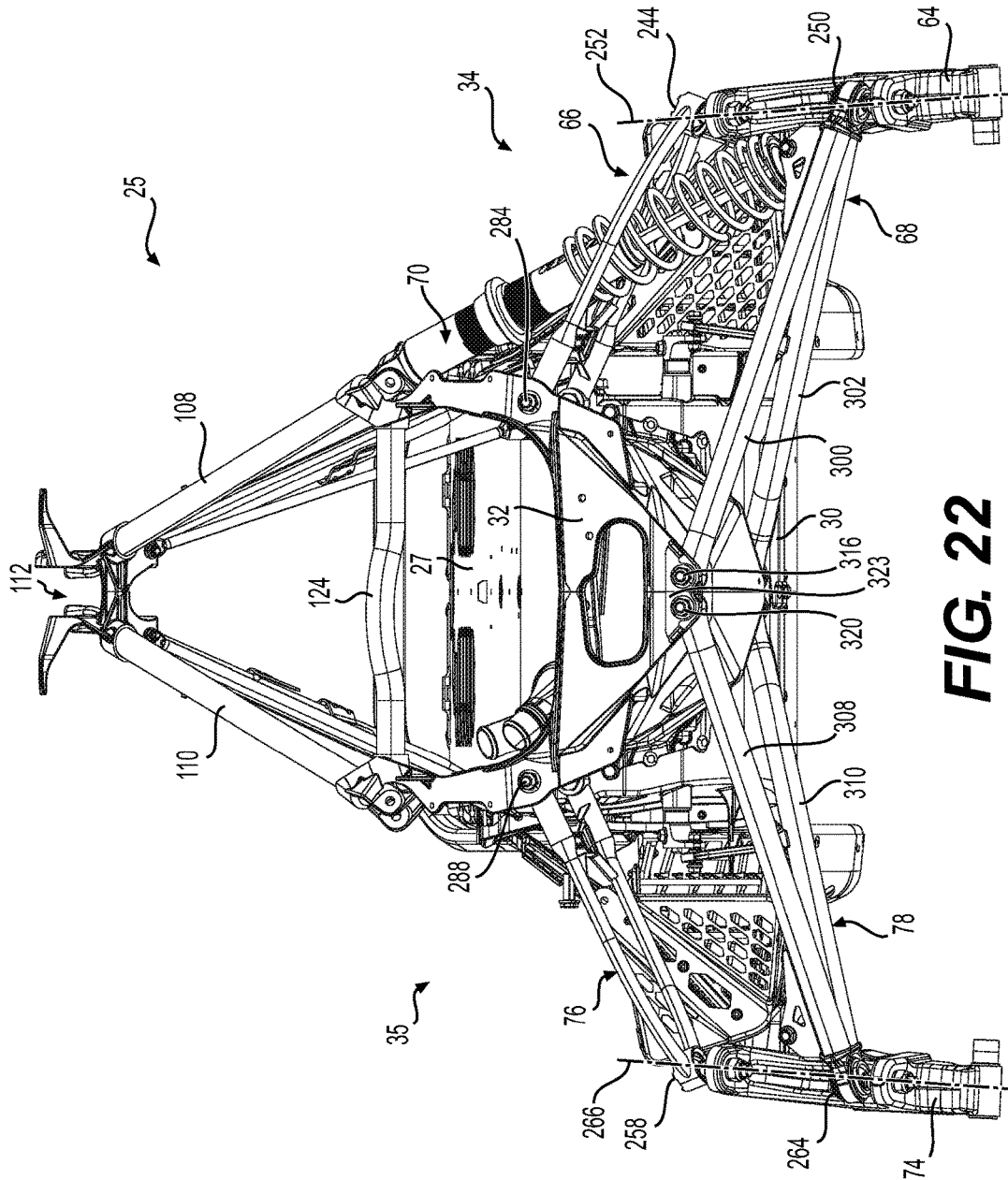


FIG. 22

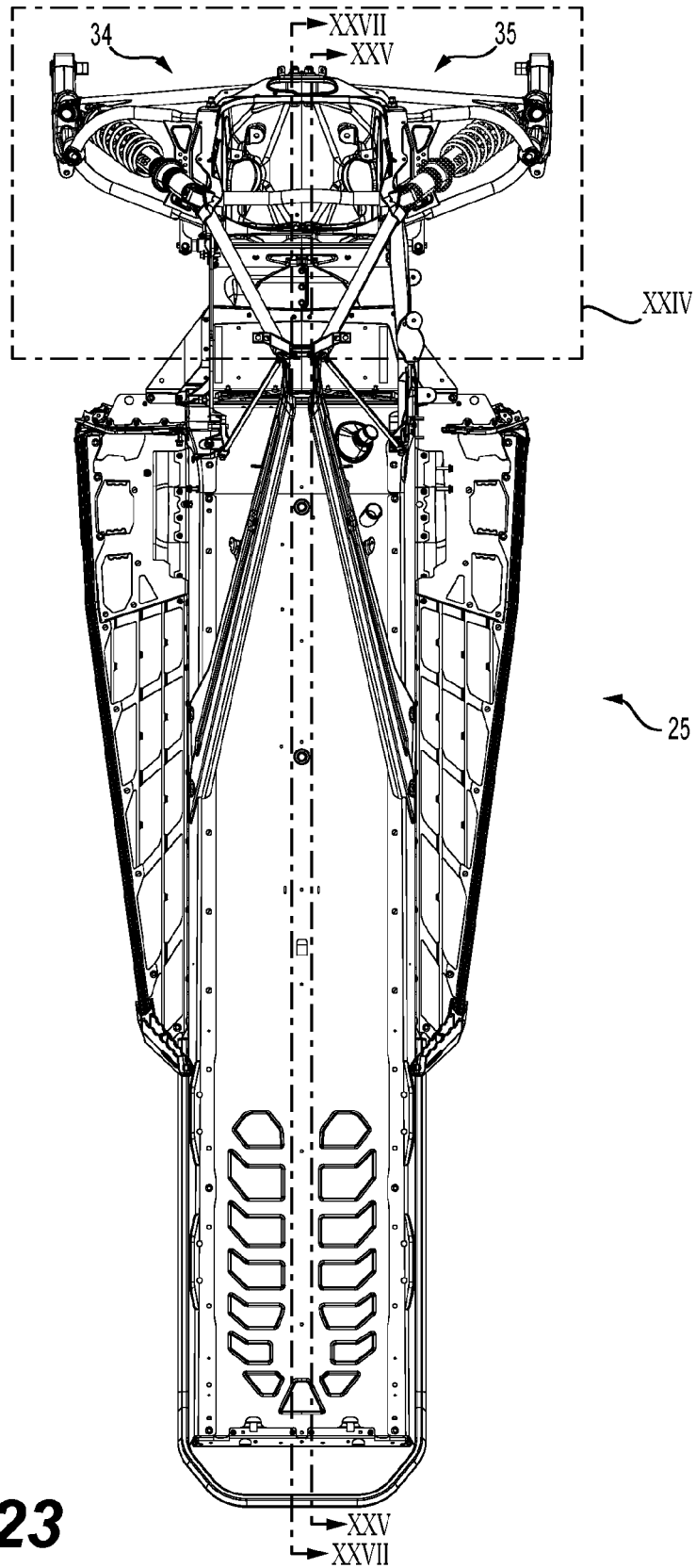


FIG. 23

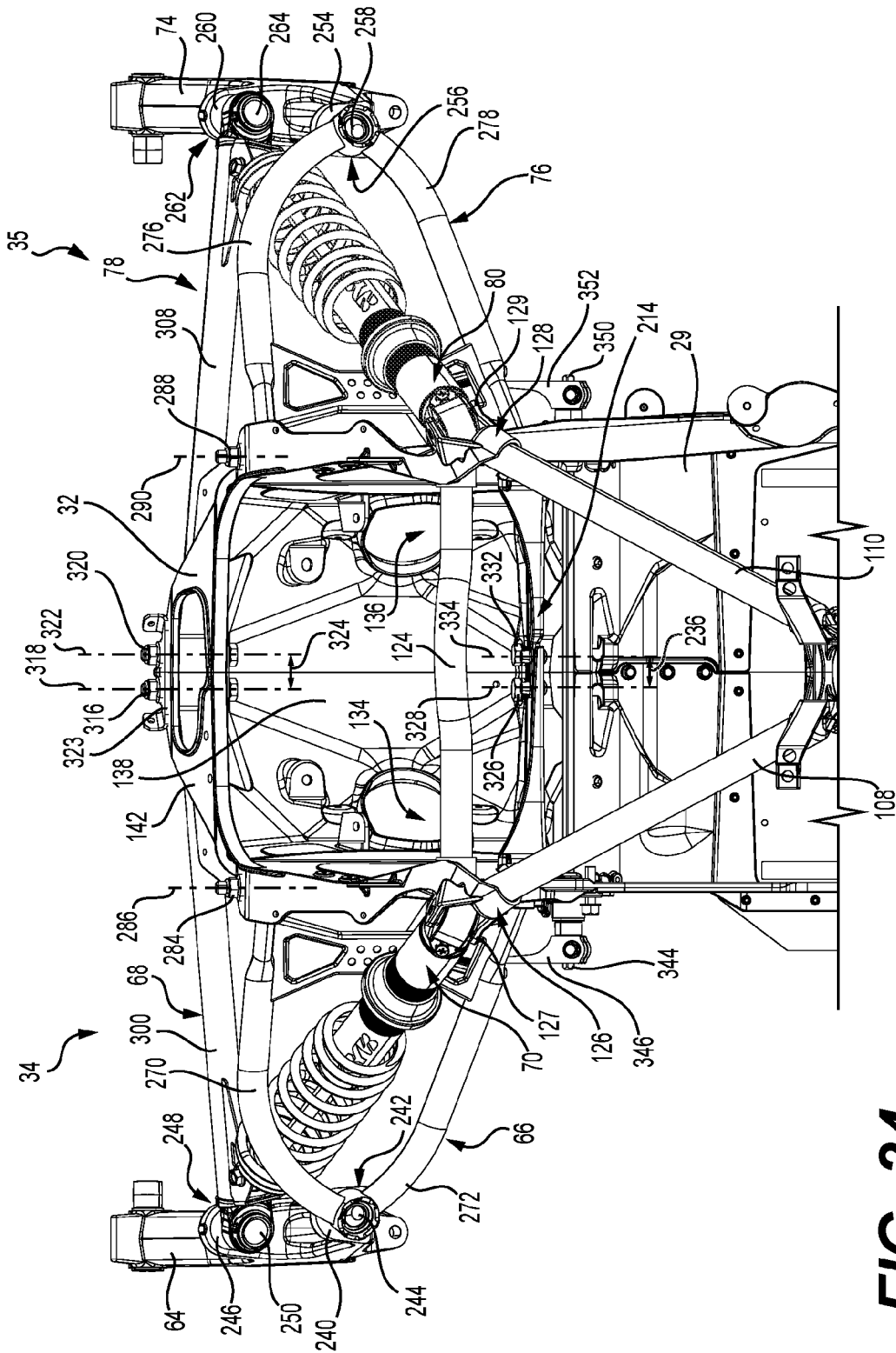


FIG. 24

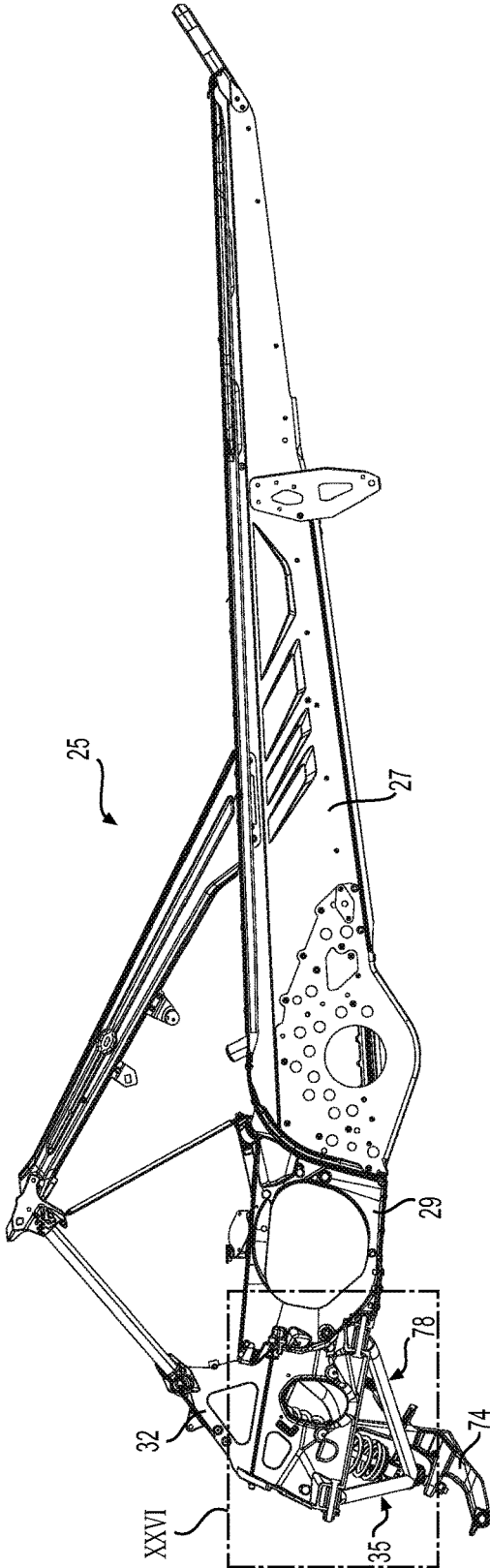


FIG. 25

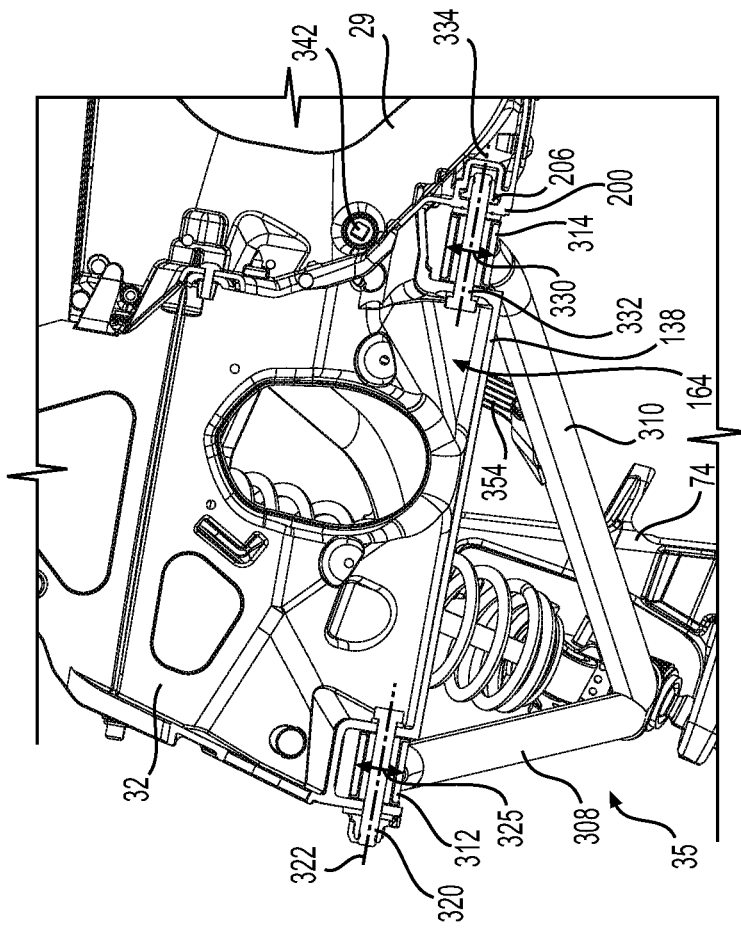


FIG. 26

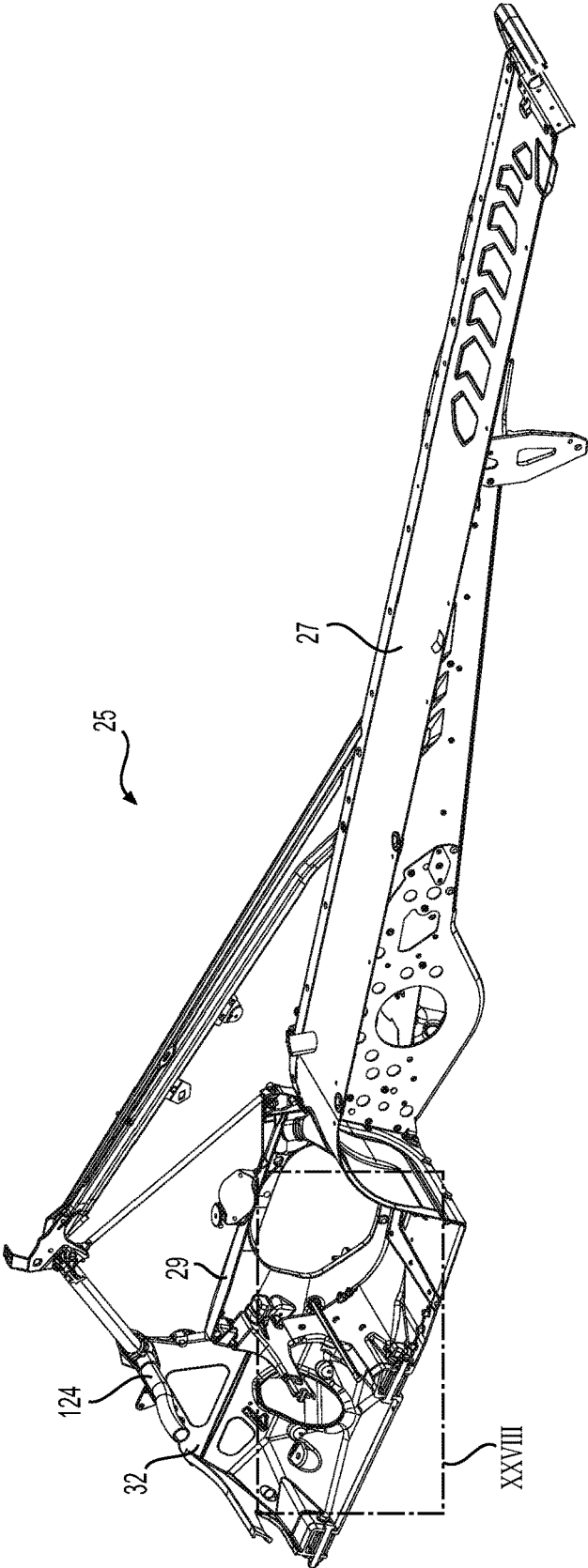


FIG. 27

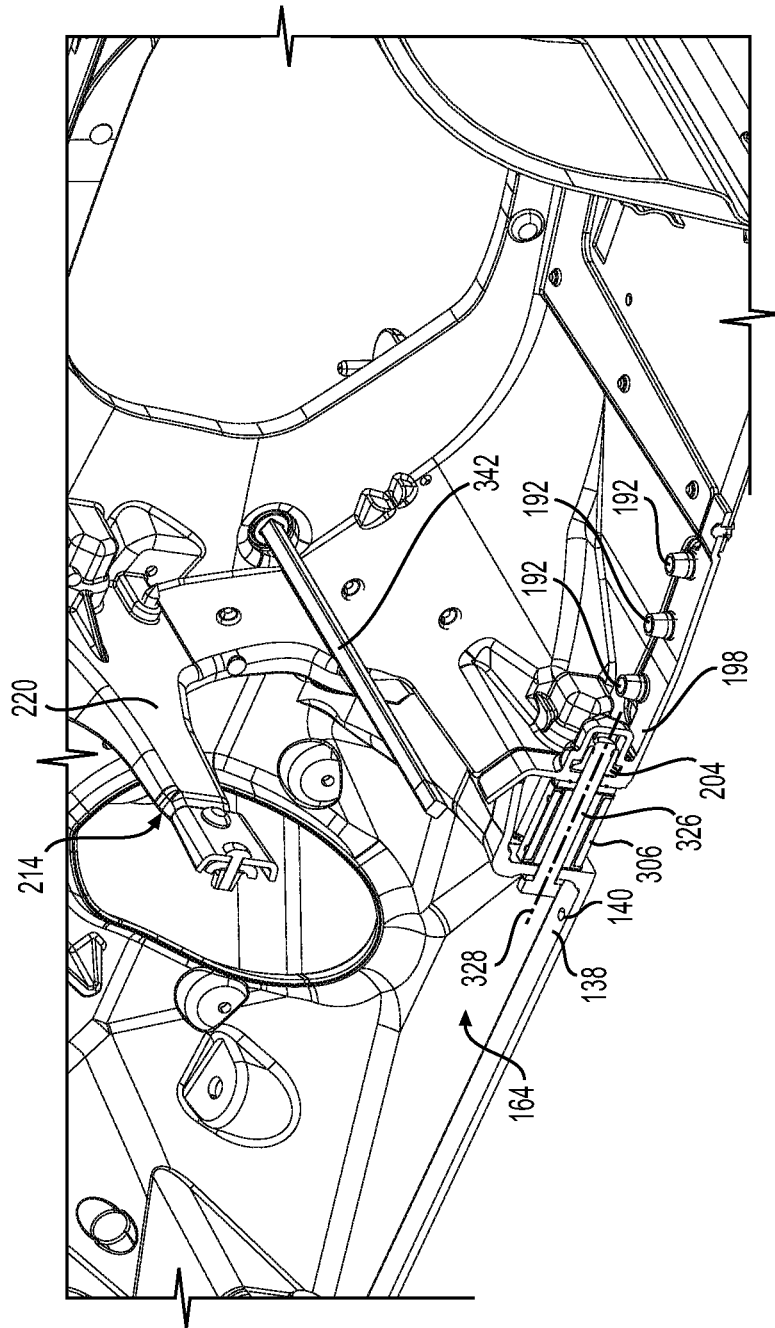


FIG. 28

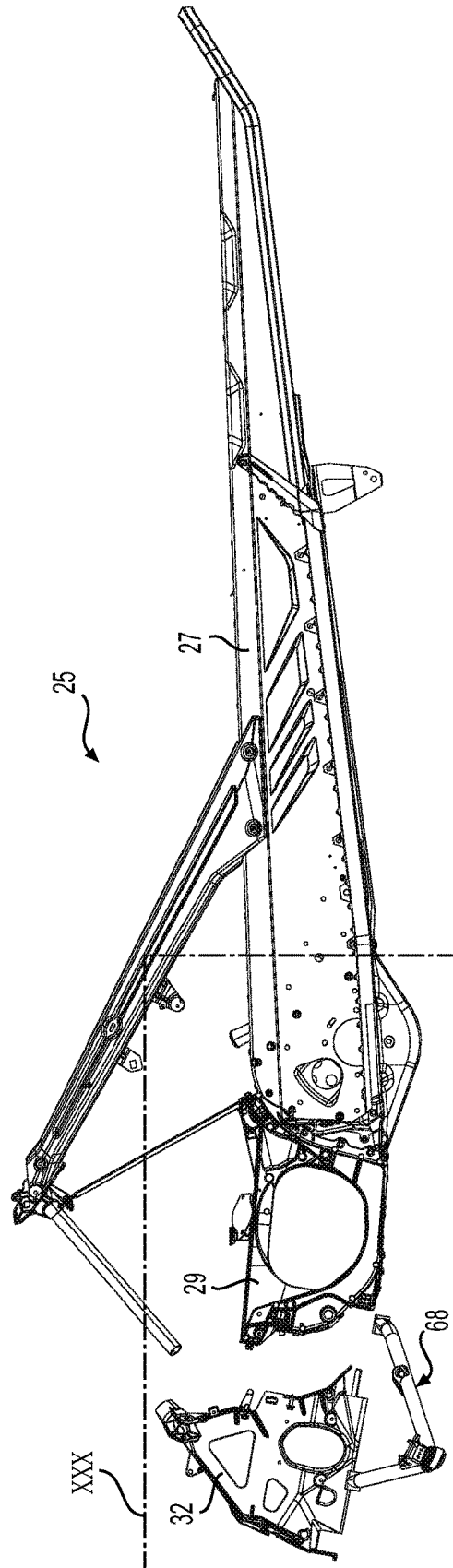


FIG. 29

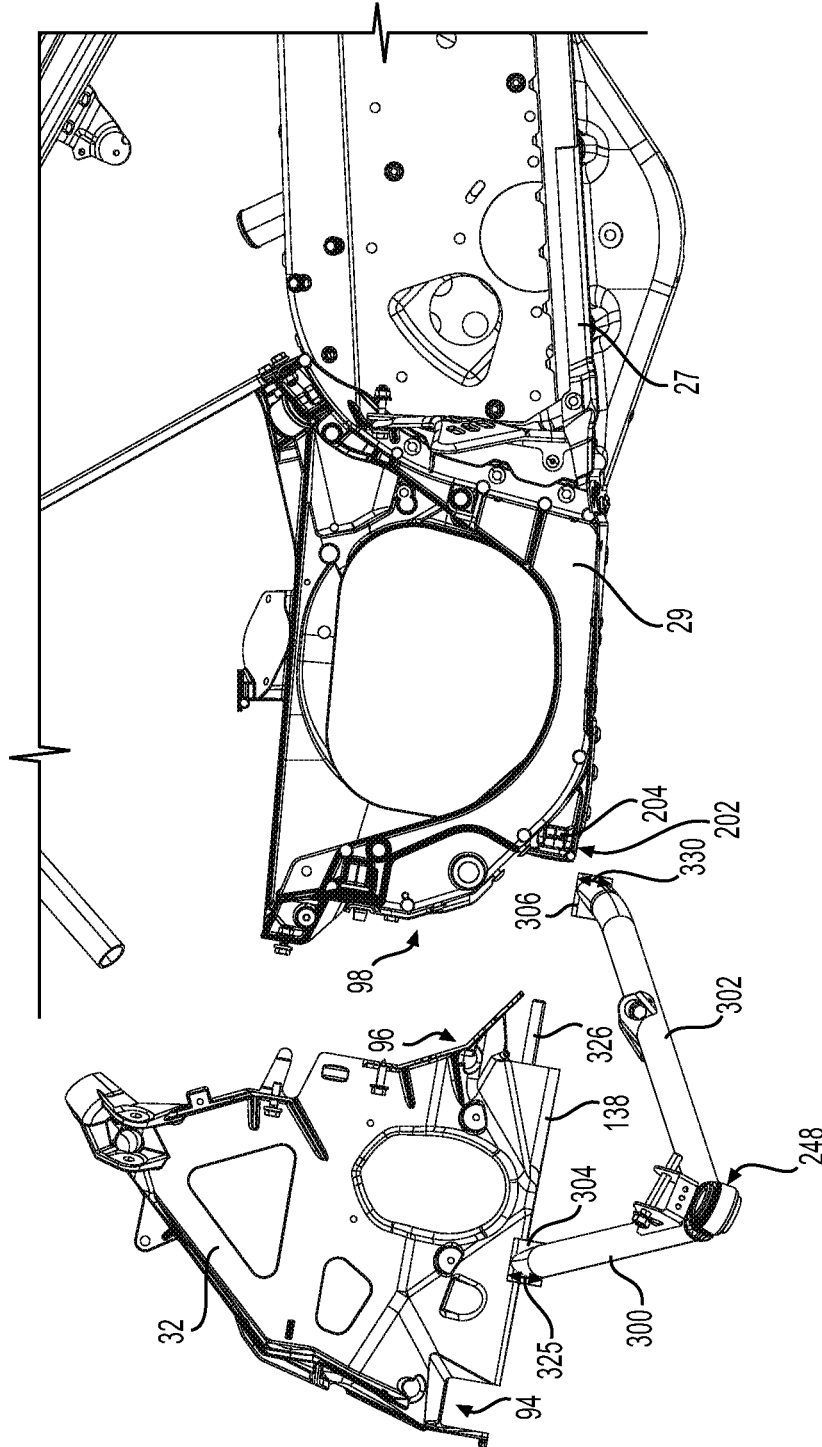


FIG. 30

FRAME FOR A SNOWMOBILE

CROSS-REFERENCE

The present application claims priority to U.S. Provisional Patent Application No. 62/343,075, filed May 30, 2016, the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

The present technology relates to the construction of snowmobiles. More specifically, the present technology relates to the construction of frames and front suspension assemblies for snowmobiles.

BACKGROUND

The frame of a snowmobile typically includes a suspension module in a front portion of the frame for connecting a front suspension assembly between the skis and the frame, a motor module connected at the rear of the suspension module for receiving the motor of the snowmobile, and a tunnel connected at the rear of the motor module for connecting an endless track to the frame.

In some snowmobiles, the front suspension assembly is only connected to the suspension module, which is common when the front suspension assembly includes upper and lower suspension arms on both left and right sides. Such a construction is disclosed in U.S. Pat. No. 7,451,846 B2 for instance.

To withstand the forces encountered under normal operating conditions, the suspension module, the motor module and the tunnel and their respective parts are connected together using a plurality of fasteners and/or welds that adds significantly to the overall weight of the snowmobile. The manufacturing costs and complexity of the frame also increase as the number of fasteners and/or welds goes up.

Other components, such as cross members extending across the suspension module and/or the motor module, are sometimes provided to allow the suspension module and/or the motor module to withstand the forces applied to the frame by the suspension assemblies when the snowmobile travels through snow or when the skis impact the ground or other objects. These additional components further increase the weight of the snowmobile, its complexity, and its manufacturing costs.

Therefore, there is a desire for a frame and suspension assemblies for a snowmobile that address at least some of the inconveniences of the prior art.

SUMMARY

For the purposes of the present application, terms related to spatial orientation such as forward, rearward, front, rear, upper, lower are as they would normally be understood by a rider of the snowmobile sitting thereon in a normal driving position with the snowmobile being upright and steered in a straight ahead direction. In addition, the term "proximal" refers to items or components that are positioned closer to a longitudinal centerline than items or components that are qualified as "distal".

According to one aspect of the present technology, there is provided a snowmobile having a frame including a motor module having a front portion defining a cross member and further defining an aperture below the cross member, a tunnel connected rearward of the motor module, and a suspension module connected forward of the motor module.

The snowmobile further has a motor received in the motor module, a handlebar connected to the frame, a front left ski and a front right ski both operatively connected to the handlebar, an endless drive track operatively connected to the tunnel and to the motor, a front left suspension assembly operatively connecting the front left ski to the suspension module and to the motor module. The front left suspension assembly includes a left suspension arm having a left proximal end positioned longitudinally forward of the front portion of the motor module, and a left proximal fastener connecting the left proximal end to the front portion of the motor module about a left pivot axis. The snowmobile further has a front right suspension assembly operatively connecting the front right ski to the suspension module and to the motor module. The front right suspension assembly includes a right suspension arm having a right proximal end positioned longitudinally forward of the front portion of the motor module, and a right proximal fastener connecting the right proximal end to the front portion of the motor module about a right pivot axis. A line extending from the left pivot axis to the right pivot axis is contained in the cross member.

In some implementations, the motor module includes a bottom panel, a left part connected to the bottom panel, and a right part connected to the bottom panel.

In some implementations, the left part includes a left cast part, and the right part includes a right cast part.

In some implementations, the cross member has a left cross member segment formed integrally with an upper front portion of the left part, and the cross member has a right cross member segment formed integrally with an upper front portion of the right part.

In some implementations, the left and right cross member segments overlap, and the left and right cross member segments are connected together using at least one fastener.

In some implementations, the left and right cross member segments have a C-shaped cross section.

In some implementations, the left cross member segment has a left proximal portion and a left distal portion. The left proximal portion has a left proximal top portion. The left distal portion has a left distal top portion. The left distal top portion is longitudinally longer than the left proximal top portion. The right cross member segment has a right proximal portion and a right distal portion. The right proximal portion has a right proximal top portion. The right distal portion has a right distal top portion. The right distal top portion is longitudinally longer than the right proximal top portion.

In some implementations, the left part has a left bottom portion, and the left part has a left protrusion extending from the left bottom portion toward the right part. The right part has a right bottom portion, and the right part has a right protrusion extending from the right bottom portion toward the left part. The left and right protrusions overlap, and the left and right protrusions are connected together using at least one fastener.

In some implementations, the at least one fastener is a huck bolt.

In some implementations, the left bottom portion has a left bracket extending on a bottom face of the left bottom portion. A left nut is received in the left bracket. The right bottom portion has a right bracket extending on a bottom face right bottom portion. A right nut is received in the right bracket.

In some implementations, the suspension module has an interior portion. The left suspension arm is an upper left suspension arm. The left proximal end is an upper left proximal end. The left pivot axis is an upper left pivot axis.

The left proximal fastener is an upper left proximal fastener. The front left suspension assembly further has a lower left suspension arm. The lower left suspension arm has lower front and rear left members. The lower left rear member has a lower left rear proximal end positioned longitudinally between the motor module and the suspension module, the lower left rear proximal end pivoting about a lower left rear pivot axis extending through the interior portion of the suspension module. The front left suspension assembly further has a lower left rear proximal fastener passing through the lower left rear proximal end and extending from the interior portion of the suspension module to the motor module, the lower left rear proximal fastener thereby pivotally connecting the lower left suspension arm to the suspension module and to the motor module about the lower rear left pivot axis. The right suspension arm is an upper right suspension arm. The right proximal end is an upper right proximal end. The right pivot axis is an upper right pivot axis. The right proximal fastener is an upper right proximal fastener. The front right suspension assembly further has a lower right suspension arm. The lower right suspension arm has lower front and rear right members. The lower right rear member has a lower right rear proximal end positioned longitudinally between the motor module and the suspension module, the lower right rear proximal end pivoting about a lower right rear pivot axis extending through the interior portion of the suspension module. The front right suspension assembly further has a lower right rear proximal fastener passing through the lower right rear proximal end and extending from the interior portion of the suspension module to the motor module, the lower right rear proximal fastener thereby pivotally connecting the lower right suspension arm to the suspension module and to the motor module about the lower right rear pivot axis.

In some implementations, the snowmobile further has a left shock absorber assembly connected between the lower left suspension arm and the suspension module, and a right shock absorber assembly connected between the lower right suspension arm and the suspension module.

In some implementations, the lower front left member has a lower front left proximal end positioned below a front portion of the suspension module. The lower front left proximal end pivots about a lower front left axis extending in the interior portion of the suspension module. The front left suspension assembly further includes a lower front left proximal fastener passing through the lower front left proximal end of the lower front left member and extending in the interior portion of the suspension module, the lower front left proximal fastener thereby pivotally connecting the lower front left member to the front portion of the suspension module. The lower front right member has a lower front right proximal end positioned below the front portion of the suspension module. The lower front right proximal end pivots about a lower front right axis extending in the interior portion of the suspension module. The front right suspension assembly further includes a lower front right proximal fastener passing through the lower front right proximal end of the lower front right member and extending in the interior portion of the suspension module, the lower front right proximal fastener thereby pivotally connecting the lower front right member to the front portion of the suspension module.

In some implementations, the snowmobile further has a plate positioned longitudinally forward of the motor module, and rearward of the upper left proximal end and the upper right proximal end.

In some implementations, the plate extends laterally between the upper left proximal fastener and the upper right proximal fastener.

In some implementations, the plate is connected to the motor module using the upper left proximal fastener and the upper right proximal fastener.

In some implementations, the snowmobile further has a plate positioned longitudinally rearward of the cross member, the plate being connected to the motor module and covering the aperture below the cross member.

Implementations of the present technology each have at least one of the above-mentioned aspects, but do not necessarily have all of them. It should be understood that some aspects of the present technology that have resulted from attempting to attain the above-mentioned object may not satisfy this object and/or may satisfy other objects not specifically recited herein.

Additional and/or alternative features, aspects, and advantages of implementations of the present technology will become apparent from the following description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present technology, as well as other aspects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

FIG. 1 is a left side elevation view of a snowmobile;

FIG. 2 is a left side elevation view of a frame of the snowmobile of FIG. 1, with a suspension module separated therefrom;

FIG. 3 is a front, left side perspective view of the frame of FIG. 2;

FIG. 4 is a top plan view of the frame of FIG. 2;

FIG. 5 is a top, rear, right side perspective view of the suspension module of FIG. 2;

FIG. 6 is an exploded, top, rear, right side perspective view of the suspension module of FIG. 5, with a cross bar;

FIG. 7 is a rear elevation view of the suspension module of FIG. 5;

FIG. 8 is a top plan view of the suspension module of FIG. 5;

FIG. 9 is a top, rear, right side perspective view of a motor module;

FIG. 10 is an exploded, top, rear, right side perspective view of the motor module of FIG. 9, with fasteners omitted;

FIG. 11 is an exploded, top plan view of the motor module of FIG. 9;

FIG. 12A is a front elevation view of the motor module of FIG. 9;

FIG. 12B is a front elevation view of the motor module of FIG. 9 according to one variant having a plate connected thereto;

FIG. 12C is a top, rear, right side perspective view of the motor module of FIG. 9 according to another variant having an alternative implementation of a plate connected thereto;

FIG. 12D is a top, rear, right side perspective view of the motor module of FIG. 12C, with the plate disconnected from the motor module.

FIG. 13 is a left side elevation view of the motor module of FIG. 9;

FIG. 14 is a front elevation view of the frame of FIG. 2, with the suspension module omitted;

FIG. 15 is a front, left side perspective view of the frame portions of FIG. 14;

5

FIG. 16 is a top, front, left side perspective view of the frame of FIG. 14, with upper left and right suspension arms connected to the motor module;

FIG. 17A is an enlarged view of the portion XVII of the frame of FIG. 16;

FIG. 17B is an enlarged view of the portion XVII of the frame of FIG. 16 having the motor module presented in FIG. 12B;

FIG. 18 is a left side elevation view of the frame of FIG. 2, with the suspension module connected to the frame and front suspension assemblies connected to the frame;

FIG. 19 is an enlarged view of the portion XIX of the frame and suspension assemblies of FIG. 18;

FIG. 20 is a bottom, rear, left side perspective view of the frame of FIG. 18, with a right shock absorber assembly omitted;

FIG. 21 is an enlarged view of the portion XXI of the frame of FIG. 20;

FIG. 22 is a front elevation view of the frame of FIG. 18, with the right shock absorber assembly omitted;

FIG. 23 is a top plan view of the frame and front suspension assemblies of FIG. 18;

FIG. 24 is an enlarged view of the portion XXIV of the frame and front suspension assemblies of FIG. 23;

FIG. 25 is a cross-sectional view of the frame and front suspension assemblies of FIG. 18 taken along line XXV-XXV of FIG. 23;

FIG. 26 is an enlarged view of the portion XXVI of the frame and front suspension assemblies of FIG. 25;

FIG. 27 is top, rear, left side cross-sectional perspective view of the frame and front suspension assemblies of FIG. 18 taken along line VII-XXVII of FIG. 23;

FIG. 28 is an enlarged view of the portion XXVIII of the frame of FIG. 27;

FIG. 29 is a partially exploded left side elevation view of the frame of FIG. 2, with a lower left suspension arm; and

FIG. 30 is an enlarged view of portion XXX of the frame and the lower left suspension arm of FIG. 29.

DETAILED DESCRIPTION

Referring to FIGS. 1, 4 and 24, a snowmobile 20 will be described. The snowmobile 20 has a front end 22 and a rear end 23, which are defined consistently with the forward travel direction of the snowmobile 20. The snowmobile 20 includes a frame 25. The frame 25 includes a tunnel 27, a motor module 29 and a suspension module 32. A longitudinal centerline 37 (FIG. 4) extends between the front end 22 and the rear end 23 of the snowmobile 20 and splits the frame 25 into a left longitudinal side 39 and a right longitudinal side 41. For the purpose of the present application, the components that are qualified as "left" or "right" are positioned on the corresponding left longitudinal side 39 and right longitudinal side 41 of the frame 25.

Front left and right suspension assemblies 34, 35 are connected to the suspension module 32 and to the motor module 29 (FIGS. 21 and 24). The connection of the front left and right suspension assemblies 34, 35 to the suspension module 32 and to the motor module 29 will be described in detail below. A motor 36, which is schematically illustrated in FIG. 1, is received in the motor module 29. In the present implementation, the motor 36 is a two-stroke, two-cylinder, internal combustion engine. However, it is contemplated that other types of motors could be used such as, but not limited to, an electric motor or a four-stroke internal combustion engine.

6

An endless drive track 38 is disposed under the tunnel 27. The endless drive track 38 is operatively connected to the engine 36 through a continuously variable transmission (CVT, not shown) and other components not described herein. The endless drive track 38 is suspended for movement relative to the frame 25, by a rear suspension assembly 40. The rear suspension assembly 40 includes a pair of spaced apart slide rails 42, rear suspension arms 44, 46 and shock absorbers 48, 50. The slide rails 42 engage the internal side of the endless drive track 38. The rear suspension arms 44, 46 and the shock absorbers 48, 50 pivotally connect the tunnel 27 to the slide rails 42. The endless drive track 38 is driven to run about the rear suspension assembly 40 for propulsion of the snowmobile 20. A plurality of wheels 52 define the path over which the endless drive track 38 travels.

A fuel tank 54 is supported on top of the tunnel 27. A seat 56 is disposed on the fuel tank 54 and is adapted to support a rider. Two footrests 58 (FIG. 4) are positioned on opposite sides of the tunnel 27 below the seat 56 to support the rider's feet. The footrests 58 are integrally formed with the tunnel 27.

A left ski assembly 60 is positioned at the front end 22 of the snowmobile 20. A right ski assembly (not shown) is also positioned at the front end 22 of the snowmobile 20. The right ski assembly is, in some implementations, a mirror image of the left ski assembly 60.

The left ski assembly 60 includes a left ski 62 and a corresponding left ski leg 64. The left ski assembly 60 is operatively connected to the suspension module 32 and to the motor module 29 via the front left suspension assembly 34. The front left suspension assembly 34 includes an upper left suspension arm 66, a lower left suspension arm 68 and a left shock absorber assembly 70. The left shock absorber assembly 70 includes a left spring 72.

Referring to FIGS. 1 and 24, the right ski assembly (shown in part) includes a right ski (not shown) and a right ski leg 74 connected to the suspension module 32 and to the motor module 29 via the front right suspension assembly 35. The front right suspension assembly 35 includes an upper right suspension arm 76, a lower right suspension arm 78, and a right shock absorber assembly 80. The right shock absorber assembly 80 includes a right spring 82.

The left and right ski legs 64, 74 are pivotally connected to the corresponding upper and lower suspension arms 66, 68, 76, 78 respectively, and the corresponding shock absorber assembly 70, 80 is connected between the corresponding lower suspension arms 68, 78 and the suspension module 32 of the frame 25.

Referring to FIG. 1, a steering assembly 84 including a steering column 86 and a handlebar 88 is supported by the frame 25. The steering column 86 is attached at its upper end to the handlebar 88, which is positioned forward of the seat 56. The steering column 86 is operatively connected to the ski legs 64, 74 by steering rods 72 in order to steer the left ski 62 and the right ski, and thereby the snowmobile 20, when the handlebar 88 is turned.

Fairings 90 enclose the engine 36 and the CVT, and provide an external shell that protects the engine 36 and the CVT. The fairings 90 include a hood and one or more side panels that can be opened to allow access to the engine 36 and the CVT when this is required, for inspection or maintenance of the engine 36 and/or the CVT for example. A windshield 92 is connected to the fairings 90 forward of the handlebar 88. It is contemplated that the windshield 92 could be attached directly to the handlebar 88.

Referring to FIGS. 2 to 4, the frame 25 of the snowmobile 20 will be described in more detail. The suspension module

32 is disposed near the front end 22 of the snowmobile 20. The suspension module 32 has a front portion 94 and a rear portion 96. The motor module 29 is disposed rearward of the suspension module 32. The motor module 29 has a front portion 98 and a rear portion 100. The front portion 98 of the motor module 29 abuts the rear portion 96 of the suspension module 32. The connection between the motor module 29 and the suspension module 32 will be described in further detail below. The tunnel 27 is disposed rearward of the motor module 29. The tunnel 27 has a front portion 102 and a rear portion 104, the rear portion defining the rear end 23 of the snowmobile 20. The rear portion 100 of the motor module 29 may be connected to the front portion 102 of the tunnel 27 by any suitable means known in the art. For example, the motor module 29 may be welded or bolted to the tunnel 27. The tunnel 27 has rear frame members 106 connected to the tunnel 27 and extending to an apex 112 to which the steering column 86 is connected. Front left and right members 108, 110 are connected to the suspension module 32 and extend to the apex 112. Middle left and right members 114, 116 are connected between the apex 112 and the motor module 29.

Referring to FIGS. 5 to 8 and 24, the suspension module 32 will be described in more detail. The suspension module 32 includes left and right parts 120, 122. The left and right parts 120, 122 of the suspension module 32 are cast parts. Other manufacturing methods are also contemplated. The left and right parts 120, 122 are connected together using welding or any other suitable connection technique known in the art. The suspension module 32 also includes a crossbar 124 extending between an upper left portion 126 and an upper right portion 128 of the suspension module 32. The upper left portion 126 includes left tabs 127 for connecting the left shock absorber assembly 70 (FIG. 24), and the upper right portion 128 includes right tabs 129 for connecting the right shock absorber assembly 80 (FIG. 24). Below each upper portion 126, 128, the suspension module 32 has left and right side walls 130, 132. The left and right side walls 130, 132 have a respective aperture 134, 136 allowing passage of the left and right steering rods 72 (FIG. 1) connecting the steering column 86 to the ski legs 64, 74. Left and right upper flanges 131, 133 extend laterally from the left and right side walls 130, 132 and include left and right tabs 135, 137.

When the left and right parts 120, 122 of the suspension module 32 are connected, the suspension module 32 has a bottom wall 138 extending between the front portion 94 and the rear portion 96 of the suspension module 32. A drain hole 140 is defined in the bottom wall 138 to drain water from the suspension module 32.

As illustrated in FIGS. 5 to 8 and 24, in the front portion 94, the suspension module 32 has a front wall 142 with an aperture 144 defined therein. Below the front wall 142, the suspension module 32 has lower front left and right tabs 146, 148. In the rear portion 96, the suspension module 32 has a rear wall 150 with left and right holes 152, 154 defined therein. The rear portion 96 also includes rear left and right flanges 156, 158 defining holes 160 allowing passage of fasteners (not shown) connecting the suspension module 32 to the motor module 29 as the motor module 29 has corresponding holes 162 defined on the front portion 98 of the motor module 29 (FIG. 12A). The suspension module 32 could also be connected to the motor module 29 using any other suitable technique known in the art, such as welding. The left and right side walls 130, 132, the front and rear walls 142, 150 and the bottom wall 138 define an interior portion 164 of the suspension module 32.

Referring to FIGS. 9 to 13, the motor module 29 will be described in more detail. The motor module 29 includes a bottom panel 170 and left and right parts 172, 174. The left and right parts 172, 174 are connected to the bottom panel 170 using fasteners (not shown). The left and right parts 172, 174 could be connected to the bottom panel 170 using any other suitable technique known in the art, such as bonding or welding. The left and right parts 172, 174 are cast parts while the bottom panel 170 is made from sheet metal. Other manufacturing techniques are also contemplated. At the rear portion 100 of the motor module 29, the bottom panel 170 has an upwardly extending portion 171 adapted to abut the front portion 102 of the tunnel 27 so that connection therebetween can be performed. The motor module 29 may be connected to the tunnel 27 by any suitable means known in the art. For example, the motor module 29 may be riveted to the tunnel 27.

The left part 172 defines a left side wall 176 of the motor module 29. The left side wall 176 defines a U-shaped recess 178 therein. The right part 174 defines a right side wall 180 of the motor module 29. The right side wall 180 has an aperture 182 defined therein.

As best seen in FIGS. 10 and 11, the left part 172 has a left bottom portion 184 and a left protrusion 186 extends from the left bottom portion 184 toward the right part 174. The right part 174 has a right bottom portion 188 and a right protrusion 190 extends from the right bottom portion 188 toward the left part 172. The left and right protrusions 186, 190 overlap and are connected together using three fasteners 192. In the present implementation, the fasteners 192 are huck bolts. It is contemplated that other fasteners could be used, and that more or less than three fasteners could be used. The bottom panel 170 and the left and right parts 172, 174 are further connected together using at least one of bonding and fastening techniques known in the art. When connected together, the bottom panel 170 and the left and right parts 172, 174 define a bottom wall 194 of the motor module 29. The bottom wall 194 has a convex bottom face 196 toward the front portion 98 of the motor module 29 (FIG. 13).

Referring to FIGS. 12A, 12B and 13, forward of the bottom panel 170, the left bottom portion 184 has a left bracket 198 extending on a bottom face 199 thereof. The right bottom portion 188 has a right bracket 200 extending on a bottom face 201 thereof. When the left and right parts 172, 174 are connected together, the left bracket 198 and the right bracket 200 form a bracket 202 extending from the convex bottom face 196 of the bottom wall 194. The bracket 202 has a vertical portion 203 extending downwardly from the convex bottom face 196 and the bracket 202 also has a horizontal portion 205 extending rearwardly and perpendicularly to the vertical portion 203. The bracket 202 defines a nut cavity 210 at the rear of the vertical portion 203, above the horizontal portion 205 and below the convex bottom face 196.

The left bracket 198 has a hole 207 defined in the vertical portion 203. The left bracket 198 receives a left nut 204 (FIGS. 13 and 28) in the nut cavity 210. The right bracket 200 has a hole 209 defined in the vertical portion 203. The right bracket 200 receives a right nut 206 (FIG. 26) in the nut cavity 210. Both the left nut 204 and the right nut 206 are held in place in the nut cavity 210 by surfaces in their corresponding left and right brackets 198, 200 such that when a fastener, such as a bolt, is fastened thereto, there is no need to prevent rotation of the left and right nuts 204, 206 using a tool. As illustrated in FIG. 13, the vertical portion 203 extends perpendicularly to the fastening axes of the left

and right nuts **204**, **206**, and the horizontal portion **205** extends rearwardly and perpendicularly to the vertical portion **203**. The horizontal portion **205** thus forms a portion of the bottom wall **194** of the motor module **29**.

Referring to FIGS. **9** to **12B**, the front portion **98** of the motor module **29** will be described in more detail. The front portion **98** includes a front wall **212** where are defined the holes **162** corresponding to the holes **160** defined in the suspension module **32** for connection of the motor module **29** to the suspension module **32** using fasteners (not shown). The front portion **98** also defines a cross member **214** and an aperture **216** below the cross member **214**. The cross member **214** is formed of a left cross member segment **218** formed integrally with an upper front portion of the left part **172**. The cross member **214** is further formed of a right cross member segment **220** formed integrally with an upper front portion of the right part **174**. The left and right cross member segments **218**, **220** are connected together using two fasteners **222**. It is contemplated that the left and right cross member segments **218**, **220** could be connected together using more or less than two fasteners **222**. It is also contemplated that the left and right cross member segments **218**, **220** could be connected using any other suitable technique known in the art, such as welding. The left and right cross member segments **218**, **220** have a C-shaped cross section (FIG. **10**). Other suitable cross section profiles, such as an I-shaped cross section, are contemplated.

Referring to FIG. **12B** illustrating one variant of the motor module **29**, the left and right cross member segments **218**, **220** are welded together and form the cross member **214**. A plate **215** is disposed longitudinally forward of the front portion **98** of the motor module **29** and connected to the cross member **214**. The plate **215** is shaped and configured to be received inside the C-shaped cross-section of the left and right cross member segments **218**, **220**. The plate **215** is connected to the left and right cross member segments **218**, **220** using fasteners, such as rivets. Any other suitable technique known in the art could be used to connect the plate **215** to the left and right cross member segments **218**, **220**, such as bonding or welding.

Referring to FIGS. **11** to **12B**, the left cross member segment **218** has a left proximal portion **219** and a left distal portion **221**. The left proximal portion **219** has a left proximal top portion **219a** and the left distal portion **221** has a left distal top portion **221a**. The left distal top portion **221a** is longitudinally longer than the left proximal top portion **219a**. Similarly, the right cross member segment **220** has a right proximal portion **223** and a right distal portion **225**. The right proximal portion **223** has a right proximal top portion **223a** and the right distal portion **225** has a right distal top portion **225a**. The right distal top portion **225a** is longitudinally longer than the right proximal top portion **223a**. Toward the left and right distal portions **221**, **225** of the cross member **214**, left and right upper holes **224**, **226** are defined in the front wall **212** of the motor module **29**. Referring to FIG. **12B**, the plate **215** also has holes aligned with left and right upper holes **224**, **226**.

Referring to FIGS. **12C** and **12D** illustrating another variant of the motor module **29**, a plate **215'** is positioned longitudinally rearward of the cross member **214**. The plate **215'** covers the aperture **216** below the cross member **214**. In some implementations, the plate **215'** is made of sheet metal and is configured to conform to the profile of the front portion **98** of the motor module **29**. A plurality of holes **163** are defined on the plate **215'**. Each one of the holes **163** is aligned with a corresponding hole **162** defined in the motor module **29** and a corresponding hole **160** defined in the

suspension module **32**. The plate **215'**, the motor module **29** and the suspension module **32** are connected together, at least partially, using fasteners **163'**. The upper portion of the plate **215'** includes holes **165** defined therein. The holes **165** are aligned with corresponding holes **162'** defined in the motor module **29**, such that fasteners (not shown) may be used to further connect the plate **215'** to the motor module **29**. The upper portion of the plate **215'** also includes two holes **165'** defined therein. The two holes **165'** allow passage of the two fasteners **222** used to connect together the left and right cross member segments **218**, **220**. As such, the plate **215'** is further connected to the motor module **29** by the two fasteners **222**. It is contemplated that the plate **215'** could be further connected to the motor module **29** using any other suitable technique known in the art, such as bonding or welding.

Referring back to FIG. **12A**, the aperture **216** defined in the front portion **98** of the motor module **29** has a width **228**. The width **228** is taken horizontally and perpendicularly to the longitudinal centerline **37** of the frame **25** of the snowmobile **20**. The motor module **29** has an overall width **230**. The overall width **230** of the motor module **29** is taken horizontally and perpendicularly to the longitudinal centerline **37** of the frame **25** of the snowmobile **20**. A ratio of the width **228** of the aperture **216** over the overall width **230** of the motor module **29** is 0.3 or more. In some implementations, the ratio is 0.4 or more.

In addition, the aperture **216** has a height **232**. The height **232** is taken vertically and perpendicularly to the longitudinal centerline **37** of the frame **25** of the snowmobile **20**. The motor module **29** has an overall height **234**. The overall height **234** of the motor module **29** is taken vertically and perpendicularly to the longitudinal centerline **37** of the frame **25** of the snowmobile **20**. A ratio of the height **232** of the aperture **216** over the overall height **234** of the motor module **29** is 0.25 or more. In some implementations, the ratio is 0.28 or more.

Still referring to FIG. **12A**, holes **207**, **209** are separated by a center-to-center distance **236**. The upper holes **224**, **226** are separated by a distance **238**. A ratio of the distance **236** over the distance **238** is 0.1 or less. In some implementations, the ratio is 0.08 or less. A ratio of the width **228** of the aperture **216** over the distance **238** is 1.25 or more. In some implementations, the ratio is 1.30 or more.

With reference to FIGS. **14** to **30**, the left and right front suspension assemblies **34**, **35** and their connection to the motor module **29** and to the suspension module **32** will be described in more detail.

The left and right front suspension assemblies **34**, **35** are connected to the left and right ski legs **64**, **74**. An upper front tab **240** of the left ski leg **64** is connected to the upper left suspension arm **66** at a distal end **242** thereof through a ball joint **244** (FIG. **24**). A lower front tab **246** of the left ski leg **64** is connected to the lower left suspension arm **68** at a distal end **248** thereof through a ball joint **250**. The left ski leg **64** may pivot and rotate with respect to a left ski leg pivot axis **252** passing through the ball joints **244**, **250** (FIG. **22**). Similarly, an upper front tab **254** of the right ski leg **74** is connected to the upper right suspension arm **76** at a distal end **256** thereof through a ball joint **258** (FIG. **24**). A lower front tab **260** of the right ski leg **74** is connected to the lower right suspension arm **78** at a distal end **262** thereof through a ball joint **264**. The right ski leg **74** may pivot and rotate with respect to a right ski leg pivot axis **266** passing through the ball joints **258**, **264** (FIG. **22**).

The upper left suspension arm **66** has upper left front and rear members **270**, **272** meeting at the distal end **242**. The

11

upper left front member 270 includes an upper left front proximal end 272 (FIG. 19), and the upper left rear member 272 includes an upper left rear proximal end 274 (FIG. 17). Similarly, the upper right suspension member 76 has upper right front and rear members 276, 278 meeting at the distal end 256. The upper right front member 276 includes an upper right front proximal end 280 (FIG. 17), and the upper right rear member 278 includes an upper right rear proximal end 282.

The upper left front proximal end 272 is connected to the suspension module 32 by an upper left front proximal fastener 284 passing through the upper left front proximal end 272 and extending through the left tab 135 of the suspension module 32 (FIG. 8). The upper left front proximal fastener 284 pivotally connects the upper left front member 270 to the suspension module 32 about an upper front left pivot axis 286 (FIG. 24). Similarly, the upper right front proximal end 280 is connected to the suspension module 32 by an upper right front proximal fastener 288 passing through the upper right front proximal end 280 and extending through the right tab 137 of the suspension module 32 (FIG. 8). The upper right front proximal fastener 288 pivotally connects the upper right front member 276 to the suspension module 32 about an upper front right pivot axis 290.

The upper left rear proximal end 274 is positioned longitudinally forward of the front portion 98 of the motor module 29 (FIG. 17). The upper left rear proximal end 274 is connected to the motor module 29 by an upper left rear proximal fastener 292 passing through the upper left rear proximal end 274 and extending through the upper left hole 224 of the motor module 29 (FIG. 12A). The upper left rear proximal fastener 292 pivotally connects the upper left rear member 272 to the motor module 29 about an upper rear left pivot axis 294 (FIGS. 17 and 19). Similarly, the upper right rear proximal end 282 is positioned longitudinally forward of the front portion 98 of the motor module 29 (FIG. 17). The upper right rear proximal end 282 is connected to the motor module 29 by an upper right rear proximal fastener 296 (FIG. 17) passing through the upper right rear proximal end 282 and extending through the upper right hole 226 of the motor module 29 (FIG. 12A). The upper right rear proximal fastener 296 pivotally connects the upper right rear member 278 to the motor module 29 about an upper rear right pivot axis 298 (FIG. 19). Referring to FIGS. 12A and 17A, it can be seen that a line 299 extending from the upper rear left pivot axis 294 to the upper rear right pivot axis 298 is completely contained in the cross member 214.

Referring to the variant of the motor module 29 shown in FIGS. 12B and 17B, the plate 215 is disposed rearward of the upper left rear proximal end 274 and the upper right rear proximal end 282. The plate 215 is further connected to the cross member 214 of the motor module 29 upon connection of the upper left rear proximal end 274 using the upper left rear proximal fastener 292 and the upper right rear proximal end 282 using the upper right rear proximal fastener 296. Such connection of the plate 215 is complementary to its fastened connection to the motor module 29 described above. In some embodiments, the plate 215 is further connected to the motor module 29 using the upper left rear proximal fastener 292 and the upper right rear proximal fastener 296. The plate 215 extends laterally between the upper rear left pivot axis 294 and the upper rear right pivot axis 298. In the variant shown in FIG. 17B where the plate 215 is connected to the cross member 214, modifications to at least one of the motor module 29, the upper left rear proximal end 274, the upper right rear proximal end 282, the

12

upper left rear proximal fastener 292 and the upper right rear proximal fastener 296 are contemplated to take into account the thickness of the plate 215 so that the configuration of the left and right front suspension arms 66, 76 presented in FIG. 17B remain similar to the left and right front suspension arms 66, 76 presented in FIG. 17A. Referring to FIGS. 12B and 17B, the line 299 extending between the upper left hole 224 and the upper right hole 226 is completely contained in the cross member 214 and in the plate 215.

The lower left suspension arm 68 has lower left front and rear members 300, 302 meeting at the distal end 248 (FIGS. 24 and 30). The lower left front member 300 includes a lower left front proximal end 304, and the lower left rear member 302 includes a lower left rear proximal end 306. Similarly, the lower right suspension member 78 has lower right front and rear members 308, 310 meeting at the distal end 262 (FIG. 24). The lower right front member 308 includes a lower right front proximal end 312 (FIG. 21), and the lower right rear member 310 includes a lower right rear proximal end 314.

The lower left front proximal end 304 is positioned below the front portion 94 of the suspension module 32 and longitudinally forward of the bottom wall 138 of the suspension module 32. The lower left front proximal end 304 is connected to the suspension module 32 by a lower left front proximal fastener 316 passing through the lower left front proximal end 306 and extending through the lower front left tabs 146 of the suspension module 32 (FIGS. 6, 22 and 24). The lower left front proximal fastener 316 extends in the interior portion 164, above the bottom wall 138 of the suspension module 32 (FIGS. 19 and 24). The lower left front proximal fastener 316 pivotally connects the lower left front member 300 to the suspension module 32 about a lower front left pivot axis 318 (FIGS. 19 and 24). The lower front left pivot axis 318 extends through the interior portion 164, above the bottom wall 138 of the suspension module 32 (FIG. 19). Similarly, the lower right front proximal end 312 is positioned below the front portion 94 of the suspension module 32 and longitudinally forward of the bottom wall 138 of the suspension module 32. The lower right front proximal end 312 is connected to the suspension module 32 by a lower right front proximal fastener 320 (FIG. 22) passing through the lower right front proximal end 312 and extending through the lower front right tab 148 of the suspension module 32 (FIGS. 6, 22 and 24). The lower right front proximal fastener 320 extends in the interior portion 164, above the bottom wall 138 of the suspension module 32. The lower right front proximal fastener 320 pivotally connects the lower right front member 308 to the suspension module 32 about a lower front right pivot axis 322 (FIG. 24). The lower front right pivot axis 322 extends through the interior portion 164, above the bottom wall 138 of the suspension module 32 (FIG. 26). Referring to FIGS. 22 and 24, a plate 323 is connected to the front portion 94 of the suspension module 32. The plate 323 is disposed forward of the lower front left and right tabs 146, 148 shown in FIG. 6. The plate 323 extends laterally and has holes defined therein for receiving the lower front left and right proximal fasteners 316, 320. It is contemplated that the plate 323 could also be welded to the suspension module 32.

Referring to FIGS. 24, 26 and 30, a distance 324 between the lower front left and right pivot axes 318, 322 is less than twice an outside diameter 325 of one of the lower front left proximal end 304 and the lower right front proximal end 312. As the lower front left proximal end 304 and the lower right front proximal end 312 are cylindrical, the outside diameter 325 is measured as shown in FIGS. 26 and 30.

13

The lower left rear proximal end **306** is positioned longitudinally between the motor module **29** and the suspension module **32** (FIGS. **21** and **28** to **30**). The lower left rear proximal end **306** is connected to the suspension module **32** and to the motor module **29** by a lower left rear proximal fastener **326** passing through the lower left rear proximal end **306** and extending in the interior portion **164**, above the bottom wall **138** of the suspension module **32**. More particularly, the lower left rear proximal fastener **326** extends from the interior portion **164** of the suspension module **32**, through the hole **152** (FIG. **7**), through the lower left rear proximal end **306**, to the left bracket **198** through the hole **207** (FIG. **12A**) and is fastened to the left nut **204**. The lower left rear proximal fastener **326** pivotally connects the lower left rear member **302** to the suspension module **32** and to the motor module **29** about a lower rear left pivot axis **328**. The lower rear left pivot axis **328** extends through the interior portion **164**, above the bottom wall **138** of the suspension module **32** (FIG. **28**). Similarly, the lower right rear proximal end **314** is positioned longitudinally between the motor module **29** and the suspension module **32** (FIGS. **21**, **25** and **26**). The lower right rear proximal end **314** is connected to the suspension module **32** and to the motor module **29** by a lower right rear proximal fastener **332** passing through the lower right rear proximal end **314** and extending in the interior portion **164**, above the bottom wall **138** of the suspension module **32**. More particularly, the lower right rear proximal fastener **332** extends from the interior portion **164** of the suspension module **32**, through the hole **154** (FIG. **7**), through the lower right rear proximal end **314**, to the right bracket **200** through the hole **209** (FIG. **12A**) and is fastened to the right nut **206**. The lower right rear proximal fastener **332** pivotally connects the lower right rear member **310** to the suspension module **32** and to the motor module **29** about a lower rear right pivot axis **334**. The lower rear right pivot axis **334** extends through the interior portion **164**, above the bottom wall **138** of the suspension module **32** (FIG. **26**).

The lower left rear proximal fastener **326** and the lower right rear proximal fastener **332** connect the corresponding lower left rear member **302** and lower right rear member **310** to the suspension module **32** and to the motor module **29**. The lower left rear proximal fastener **326** and the lower right rear proximal fastener **332** also connect the suspension module **32** and the motor module **29** together.

Referring to FIG. **12A**, the distance **236** corresponds to a distance between the lower left and right rear pivot axes **328**, **334** (FIG. **24**). The distance **236** is less than twice an outside diameter **330** (FIGS. **26** and **30**) of one of the lower left and right rear proximal ends **306**, **314**. As the lower rear left proximal end **306** and the lower right rear proximal end **314** are cylindrical, the outside diameter **330** is measured as shown in FIGS. **26** and **30**.

Referring to FIG. **24**, the lower front and rear left pivot axes **318**, **328** are coaxial. Similarly, the lower front and rear right pivot axes **322**, **334** are coaxial. In addition, the lower front and rear left pivot axes **318**, **328** are parallel to the lower front and rear right pivot axes **322**, **334**.

Referring to FIGS. **19**, **24**, **26** and **28**, the snowmobile **20** further has a torsion bar assembly **340**. The torsion bar assembly **340** includes a torsion bar **342**. The torsion bar **342** extends across the motor module **29**. A left end **344** of the torsion bar **342** is connected to an upper left linkage **346** which is connected to a lower left linkage **348**. The lower left linkage **348** is connected to the lower left rear member **302**. A right end **350** of the torsion bar **342** is connected to an upper right linkage **352** which is connected to a lower

14

right linkage **354** (FIGS. **21** and **26**). The lower right linkage **354** is connected to the lower right rear member **310**.

Modifications and improvements to the above-described implementations of the present may become apparent to those skilled in the art. The foregoing description is intended to be exemplary rather than limiting. The scope of the present is therefore intended to be limited solely by the scope of the appended claims.

What is claimed is:

1. A snowmobile comprising:

a frame comprising:

- a motor module having a bottom wall and a front portion, the front portion defining a cross member and further defining an aperture below the cross member, the cross member being positioned above the bottom wall, and the aperture being defined between the cross member and the bottom wall;
- a tunnel connected rearward of the motor module; and
- a suspension module connected forward of the motor module;

a motor received in the motor module;

a handlebar connected to the frame;

a front left ski and a front right ski both operatively connected to the handlebar;

an endless drive track operatively connected to the tunnel and to the motor;

a front left suspension assembly operatively connecting the front left ski to the suspension module and to the motor module, the front left suspension assembly comprising:

- a left suspension arm having a left proximal end positioned longitudinally forward of the front portion of the motor module; and

- a left proximal fastener connecting the left proximal end to the front portion of the motor module about a left pivot axis;

a front right suspension assembly operatively connecting the front right ski to the suspension module and to the motor module, the front right suspension assembly comprising:

- a right suspension arm having a right proximal end positioned longitudinally forward of the front portion of the motor module; and

- a right proximal fastener connecting the right proximal end to the front portion of the motor module about a right pivot axis; and

a line extending from the left pivot axis to the right pivot axis is contained in the cross member.

2. The snowmobile according to claim 1, wherein the motor module comprises:

a bottom panel defining at least partially the bottom wall of the motor module;

a left part connected to the bottom panel; and

a right part connected to the bottom panel.

3. The snowmobile according to claim 2, wherein:

the left part comprises a left cast part; and

the right part comprises a right cast part.

4. The snowmobile according to claim 2, wherein:

the cross member has a left cross member segment formed integrally with an upper front portion of the left part; and

the cross member has a right cross member segment formed integrally with an upper front portion of the right part.

5. The snowmobile according to claim 4, wherein:

the left and right cross member segments overlap; and

15

the left and right cross member segments are connected together using at least one fastener.

6. The snowmobile according to claim 4, wherein the left and right cross member segments have a C-shaped cross section.

7. The snowmobile according to claim 6, wherein:
 the left cross member segment has a left proximal portion and a left distal portion;
 the left proximal portion has a left proximal top portion; the left distal portion has a left distal top portion;
 the left distal top portion is longitudinally longer than the left proximal top portion;
 the right cross member segment has a right proximal portion and a right distal portion;
 the right proximal portion has a right proximal top portion;
 the right distal portion has a right distal top portion; and the right distal top portion is longitudinally longer than the right proximal top portion.

8. The snowmobile according to claim 2, wherein:
 the left part has:
 a left bottom portion; and
 a left protrusion extending from the left bottom portion toward the right part;
 the right part has:
 a right bottom portion; and
 a right protrusion extending from the right bottom portion toward the left part;
 the left and right protrusions overlap; and
 the left and right protrusions are connected together using at least one fastener.

9. The snowmobile according to claim 8, wherein the at least one fastener is a huck bolt.

10. The snowmobile according to claim 8, wherein:
 the left bottom portion has a left bracket extending on a bottom face of the left bottom portion;
 a left nut is received in the left bracket;
 the right bottom portion has a right bracket extending on a bottom face right bottom portion; and
 a right nut is received in the right bracket.

11. The vehicle according to claim 1, wherein:
 the suspension module has an interior portion;
 the left suspension arm is an upper left suspension arm;
 the left proximal end is an upper left proximal end;
 the left pivot axis is an upper left pivot axis;
 the left proximal fastener is an upper left proximal fastener;
 the front left suspension assembly further has a lower left suspension arm;
 the lower left suspension arm has lower front and rear left members;
 the lower left rear member has a lower left rear proximal end positioned longitudinally between the motor module and the suspension module, the lower left rear proximal end pivoting about a lower left rear pivot axis extending through the interior portion of the suspension module;
 the front left suspension assembly further has a lower left rear proximal fastener passing through the lower left rear proximal end and extending from the interior portion of the suspension module to the motor module, the lower left rear proximal fastener thereby pivotally connecting the lower left suspension arm to the suspension module and to the motor module about the lower rear left pivot axis;
 the right suspension arm is an upper right suspension arm;
 the right proximal end is an upper right proximal end;

16

the right pivot axis is an upper right pivot axis;
 the right proximal fastener is an upper right proximal fastener;
 the front right suspension assembly further has a lower right suspension arm;
 the lower right suspension arm has lower front and rear right members;
 the lower right rear member has a lower right rear proximal end positioned longitudinally between the motor module and the suspension module, the lower right rear proximal end pivoting about a lower right rear pivot axis extending through the interior portion of the suspension module; and
 the front right suspension assembly further has a lower right rear proximal fastener passing through the lower right rear proximal end and extending from the interior portion of the suspension module to the motor module, the lower right rear proximal fastener thereby pivotally connecting the lower right suspension arm to the suspension module and to the motor module about the lower right rear pivot axis.

12. The snowmobile according to claim 11, further comprising:
 a left shock absorber assembly connected between the lower left suspension arm and the suspension module; and
 a right shock absorber assembly connected between the lower right suspension arm and the suspension module.

13. The vehicle according to claim 11, wherein:
 the lower front left member has a lower front left proximal end positioned below a front portion of the suspension module;
 the lower front left proximal end pivots about a lower front left axis extending in the interior portion of the suspension module;
 the front left suspension assembly further comprises a lower front left proximal fastener passing through the lower front left proximal end of the lower front left member and extending in the interior portion of the suspension module, the lower front left proximal fastener thereby pivotally connecting the lower front left member to the front portion of the suspension module;
 the lower front right member has a lower front right proximal end positioned below the front portion of the suspension module;
 the lower front right proximal end pivots about a lower front right axis extending in the interior portion of the suspension module; and
 the front right suspension assembly further comprises a lower front right proximal fastener passing through the lower front right proximal end of the lower front right member and extending in the interior portion of the suspension module, the lower front right proximal fastener thereby pivotally connecting the lower front right member to the front portion of the suspension module.

14. The snowmobile according to claim 11, further comprising a plate positioned longitudinally forward of the motor module, and rearward of the upper left proximal end and the upper right proximal end.

15. The snowmobile according to claim 14, wherein the plate extends laterally between the upper left proximal fastener and the upper right proximal fastener.

16. The snowmobile according to claim 14, wherein the plate is connected to the motor module using the upper left proximal fastener and the upper right proximal fastener.

17

17. The snowmobile according to claim 1, further comprising a plate positioned longitudinally rearward of the cross member, the plate being connected to the motor module and covering the aperture below the cross member.

* * * * *

5

18