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(54) **SNOWMOBILE STEERING SYSTEM**

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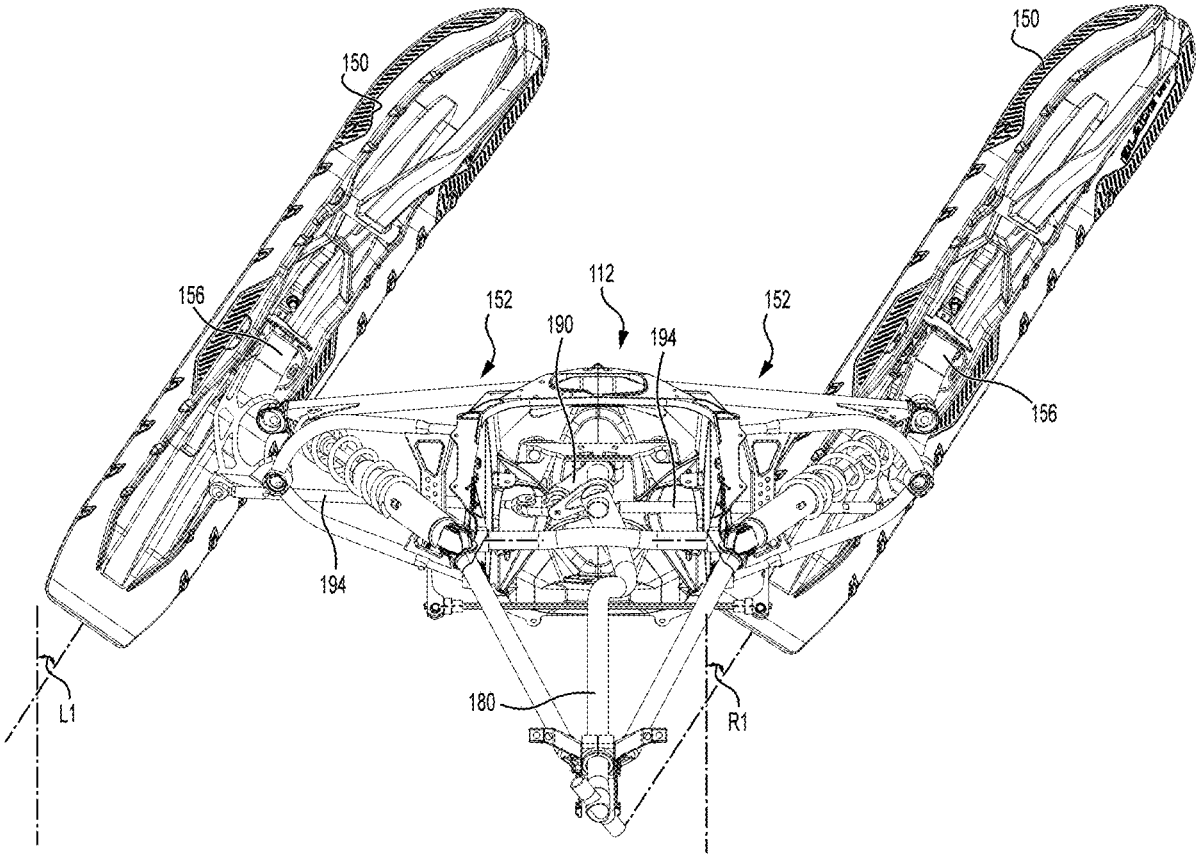
(57) **ABSTRACT**

A snowmobile has: a frame having a tunnel; a seat disposed at least in part over the tunnel; a motor supported by the frame; an endless drive track disposed at least in part under the tunnel, the endless drive track being driven by the motor; a steering system including a handlebar, the handlebar being pivotally connected to the frame; a left ski operatively connected to the steering system; and a right ski operatively connected to the steering system. The steering system is configured such that, in response to the handlebar being turned for making a left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by a greater angle than the left ski; and in response to the handlebar being turned for making a right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by a greater angle than the right ski.



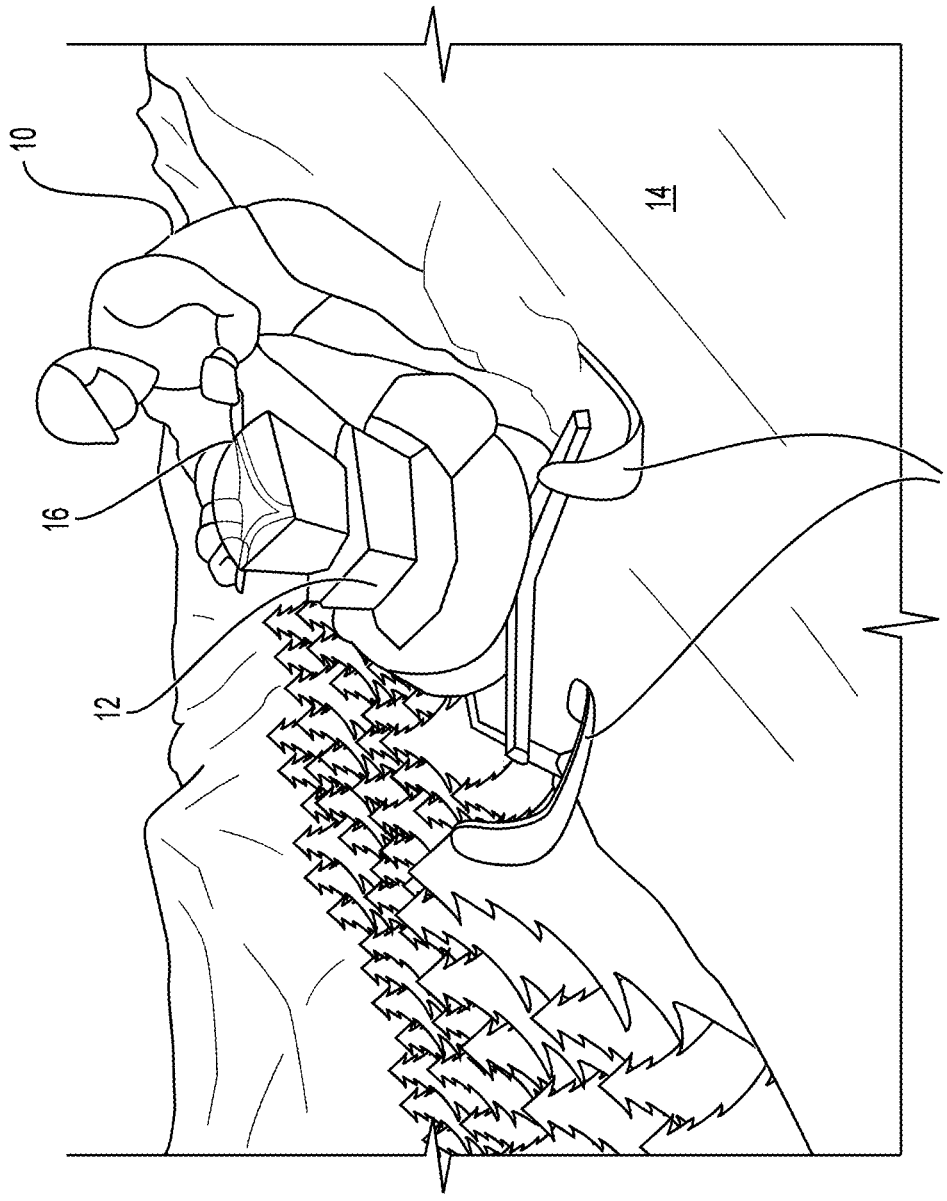


FIG. 1
(PRIOR ART)

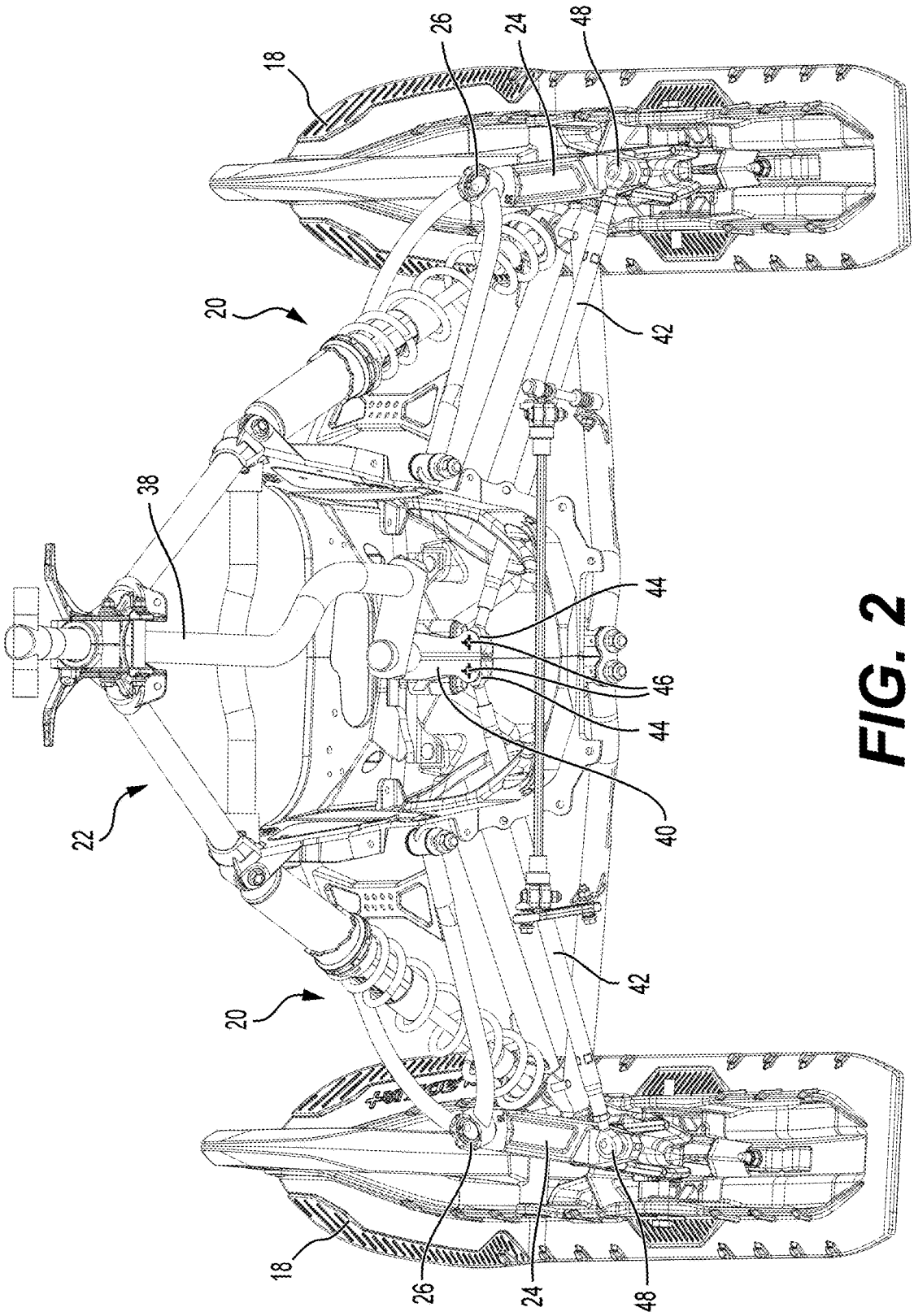


FIG. 2
(PRIOR ART)

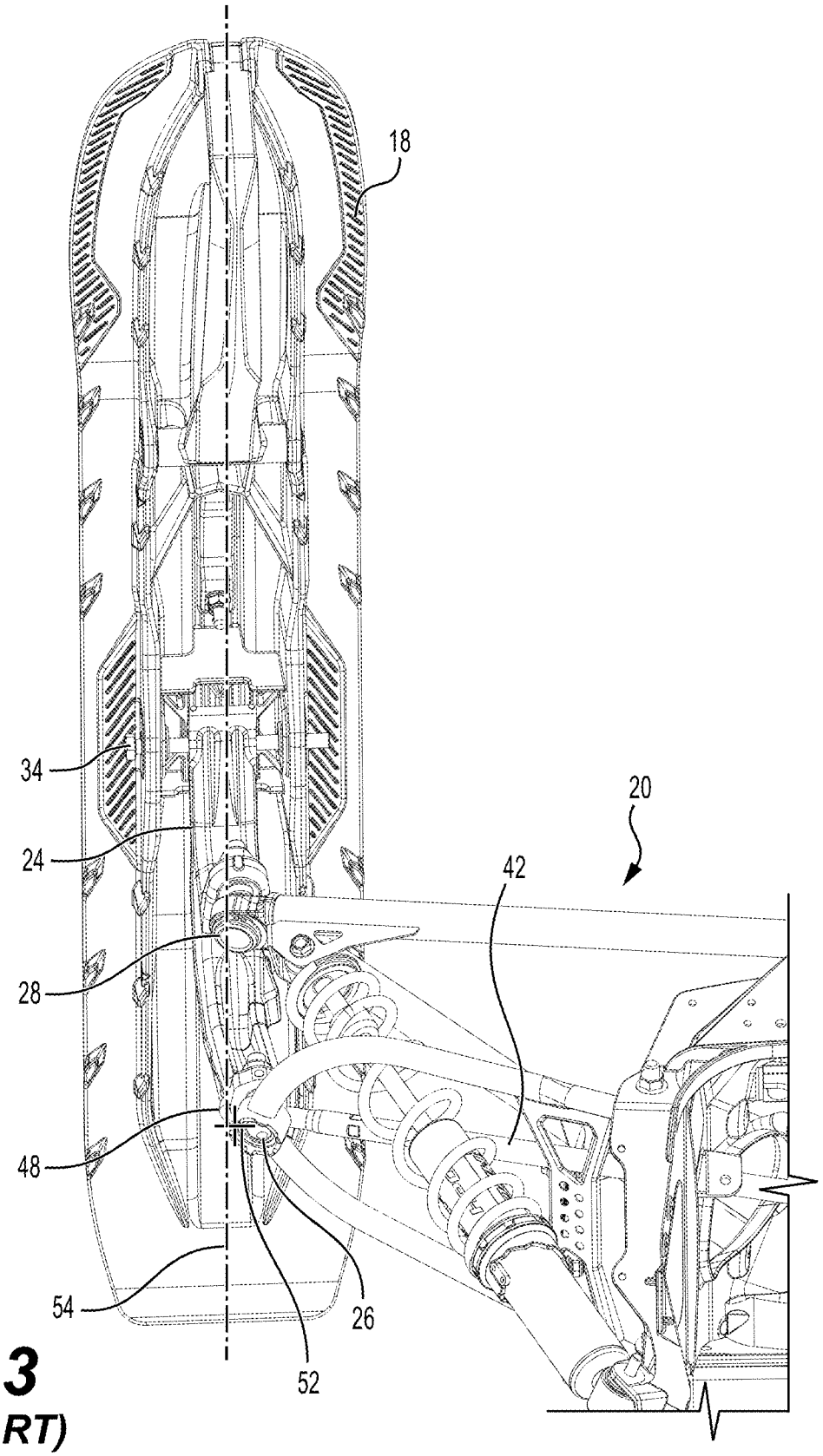


FIG. 3
(PRIOR ART)

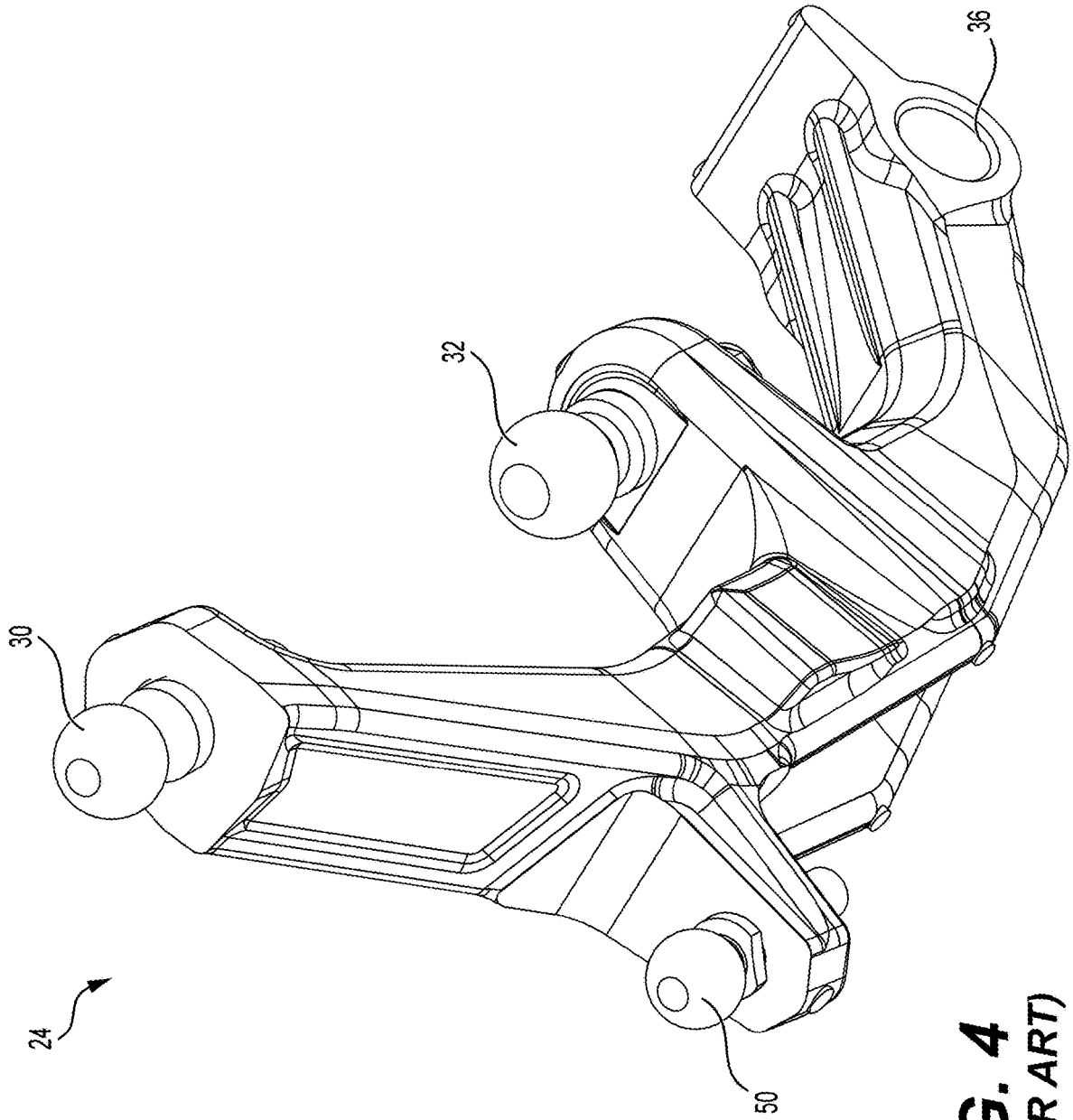


FIG. 4
(PRIOR ART)

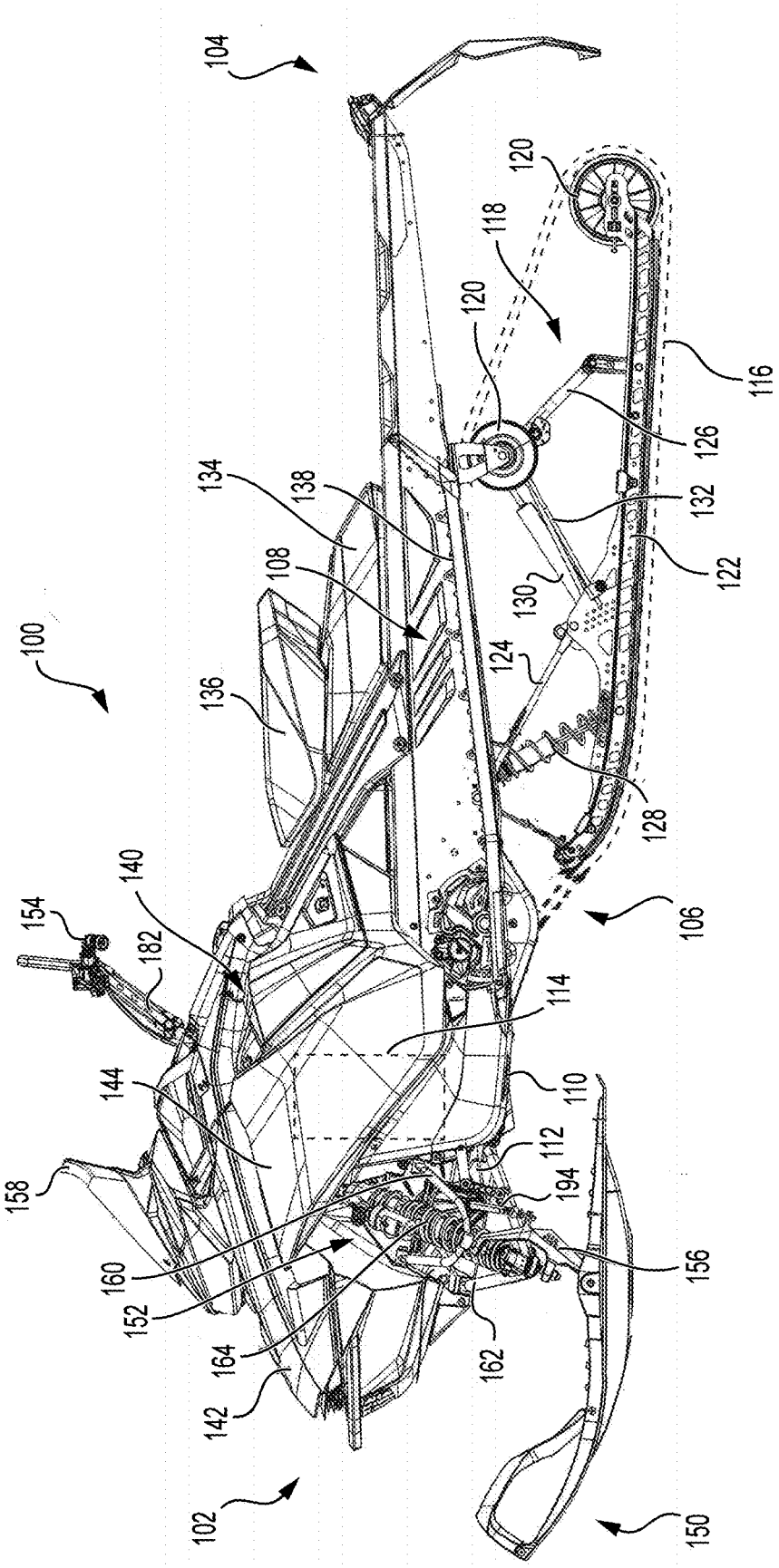

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FIG. 5

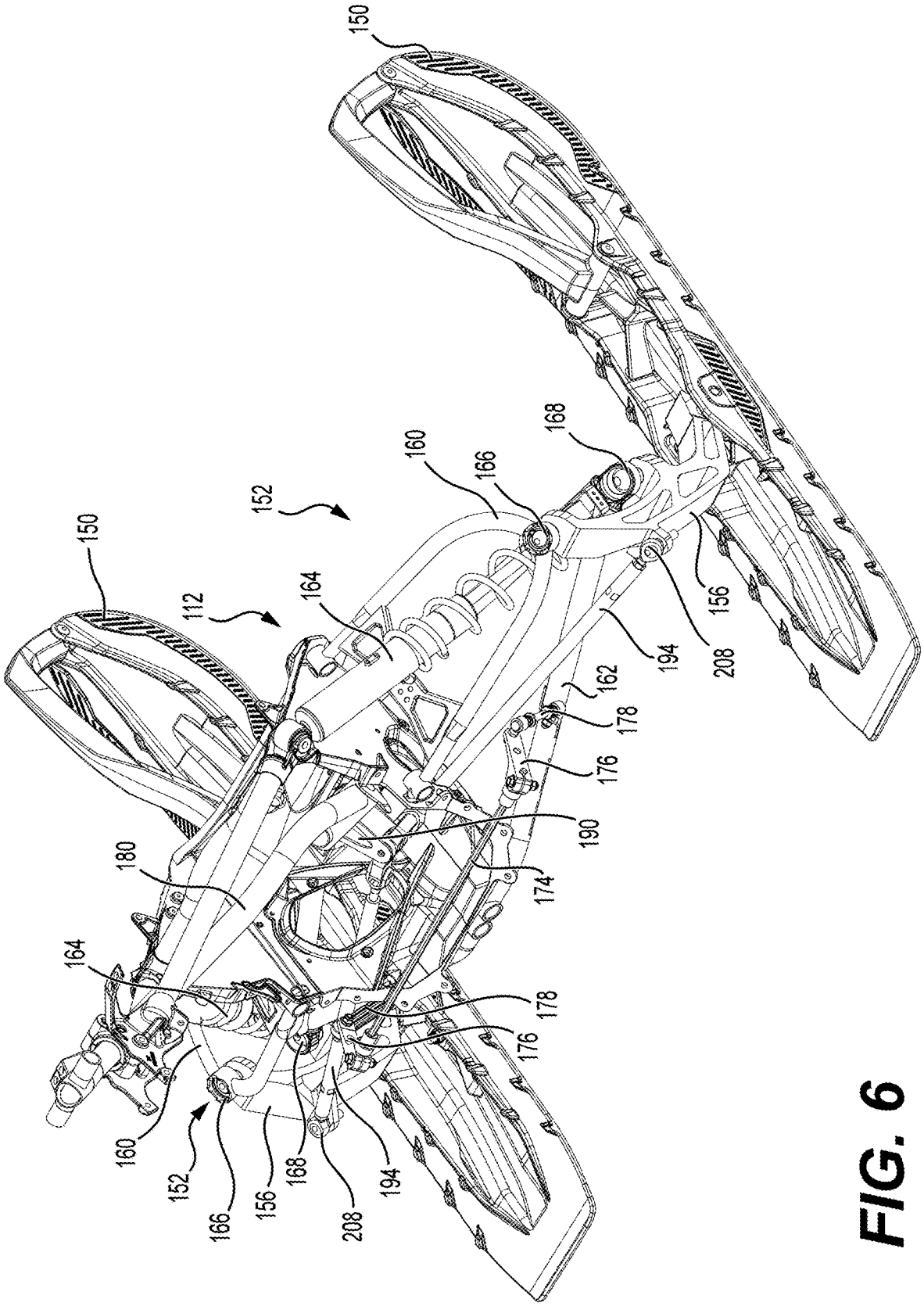
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FIG. 6

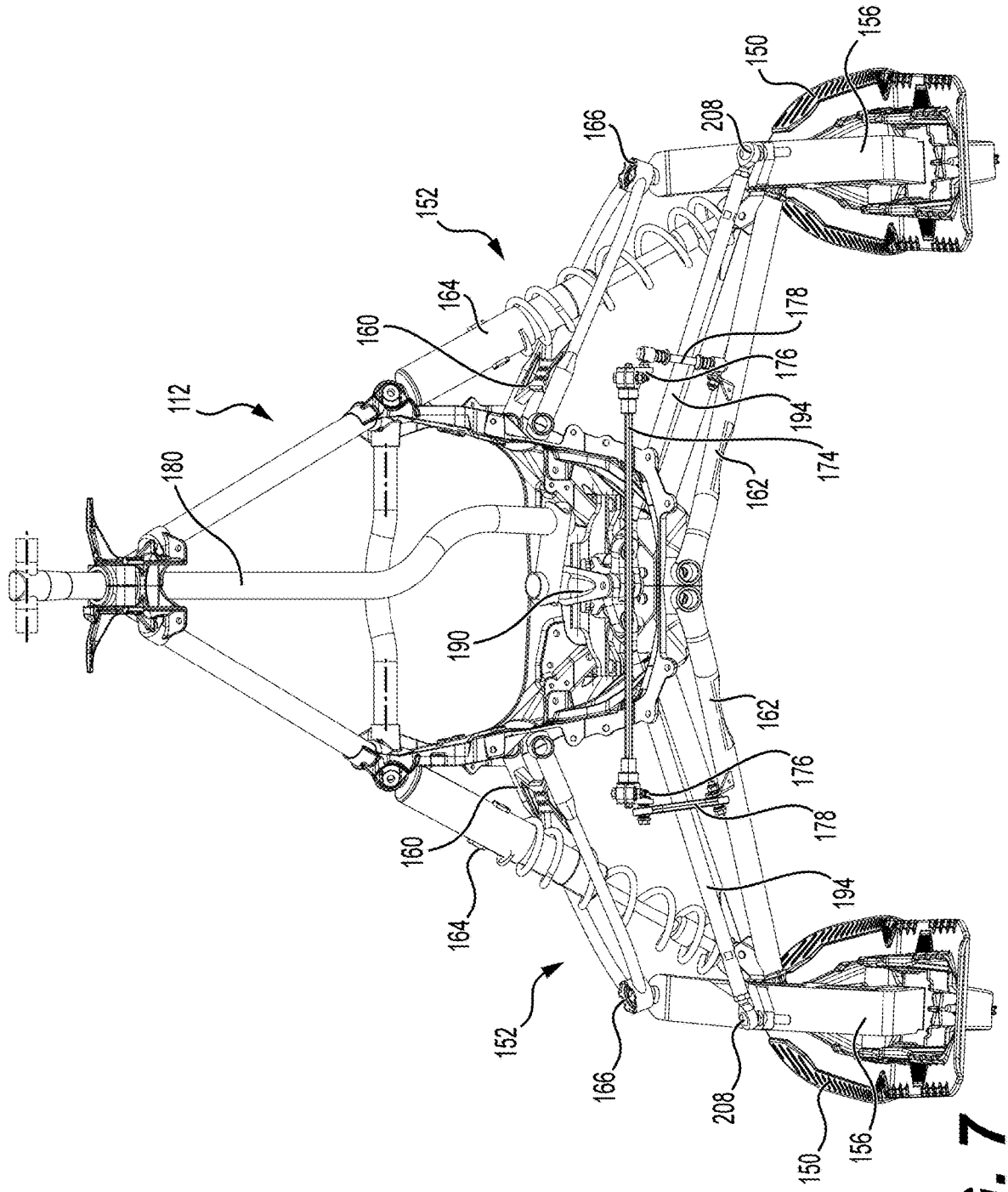

FIG. 7

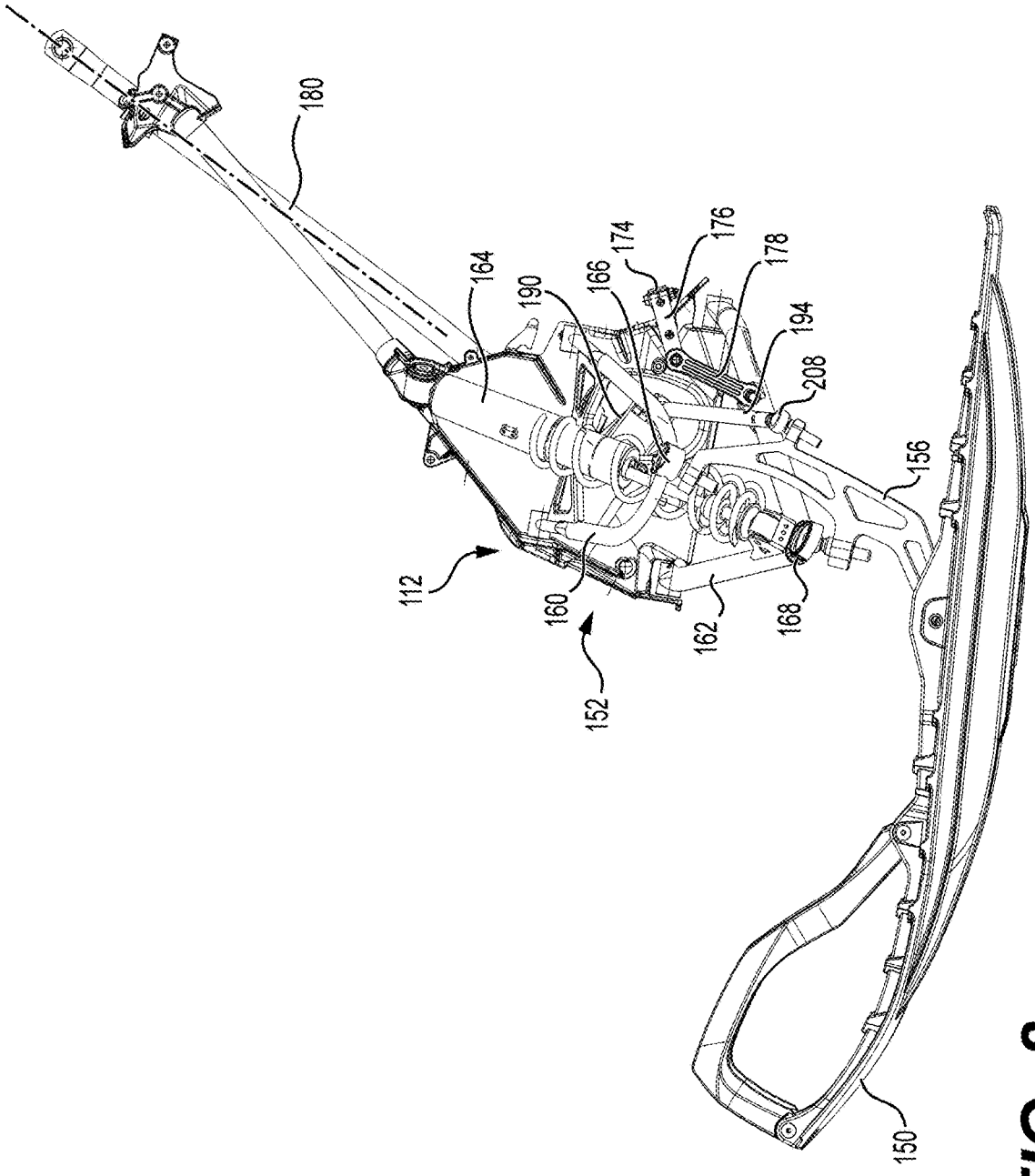

FIG. 8

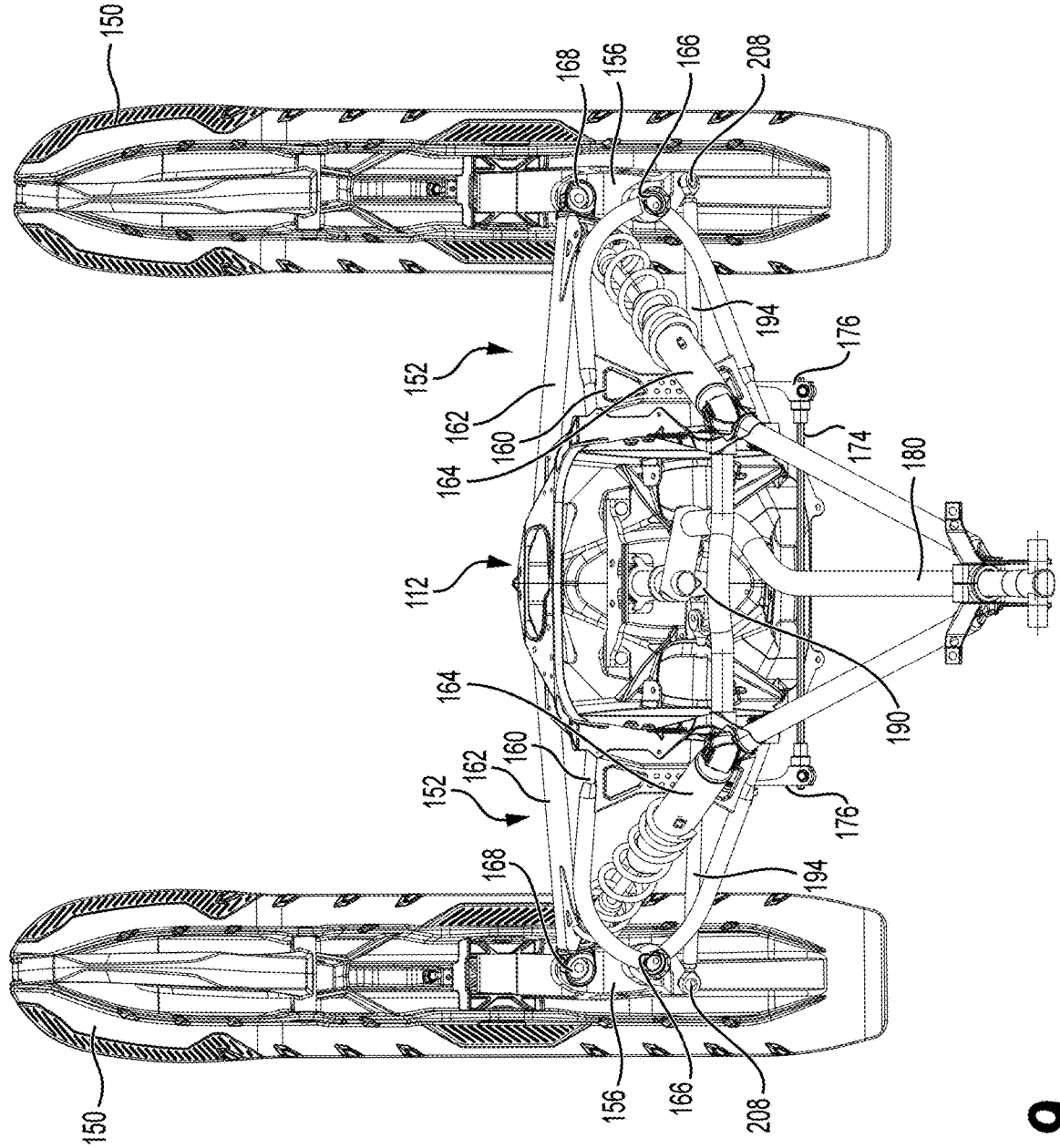
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FIG. 9

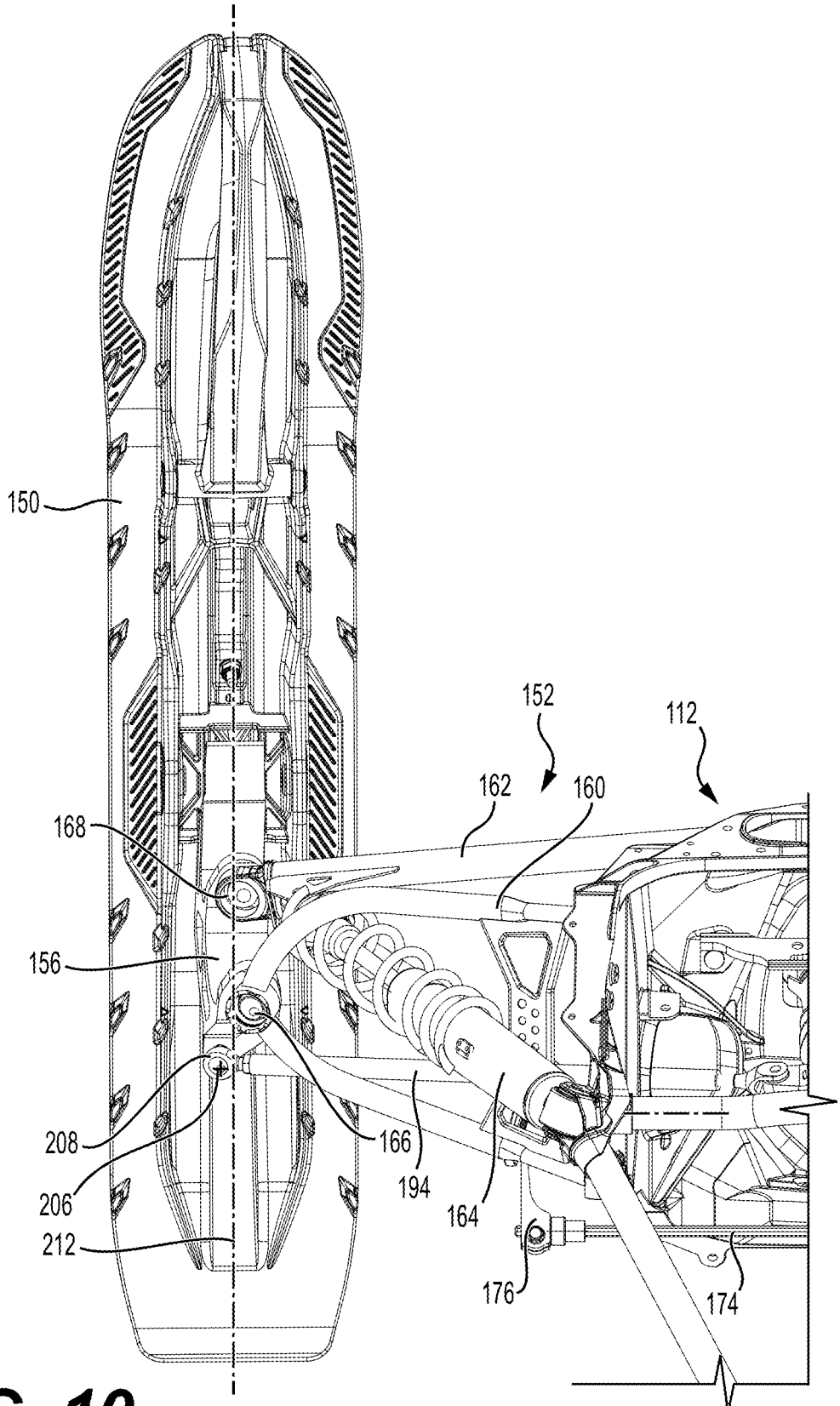

FIG. 10

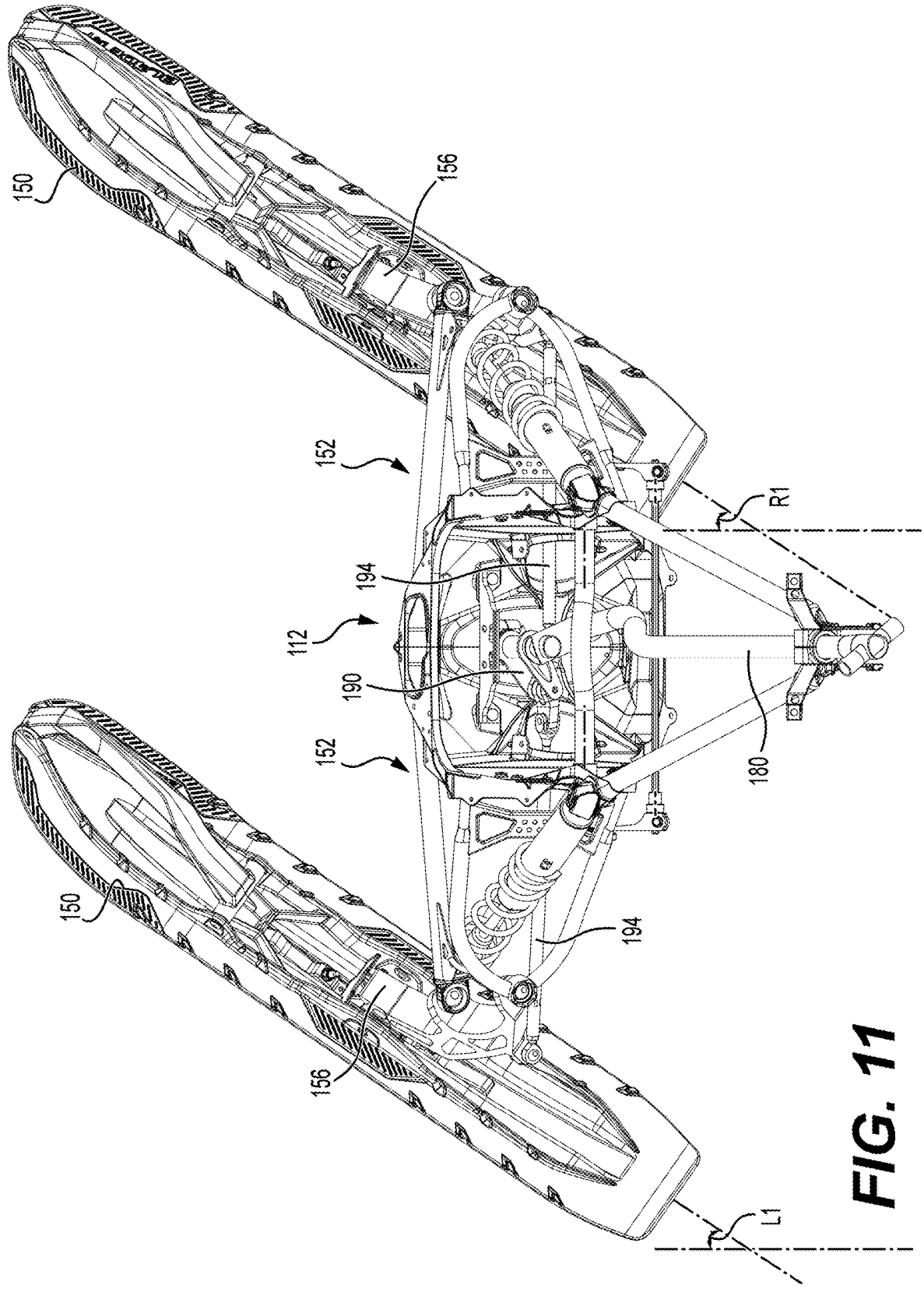

FIG. 11

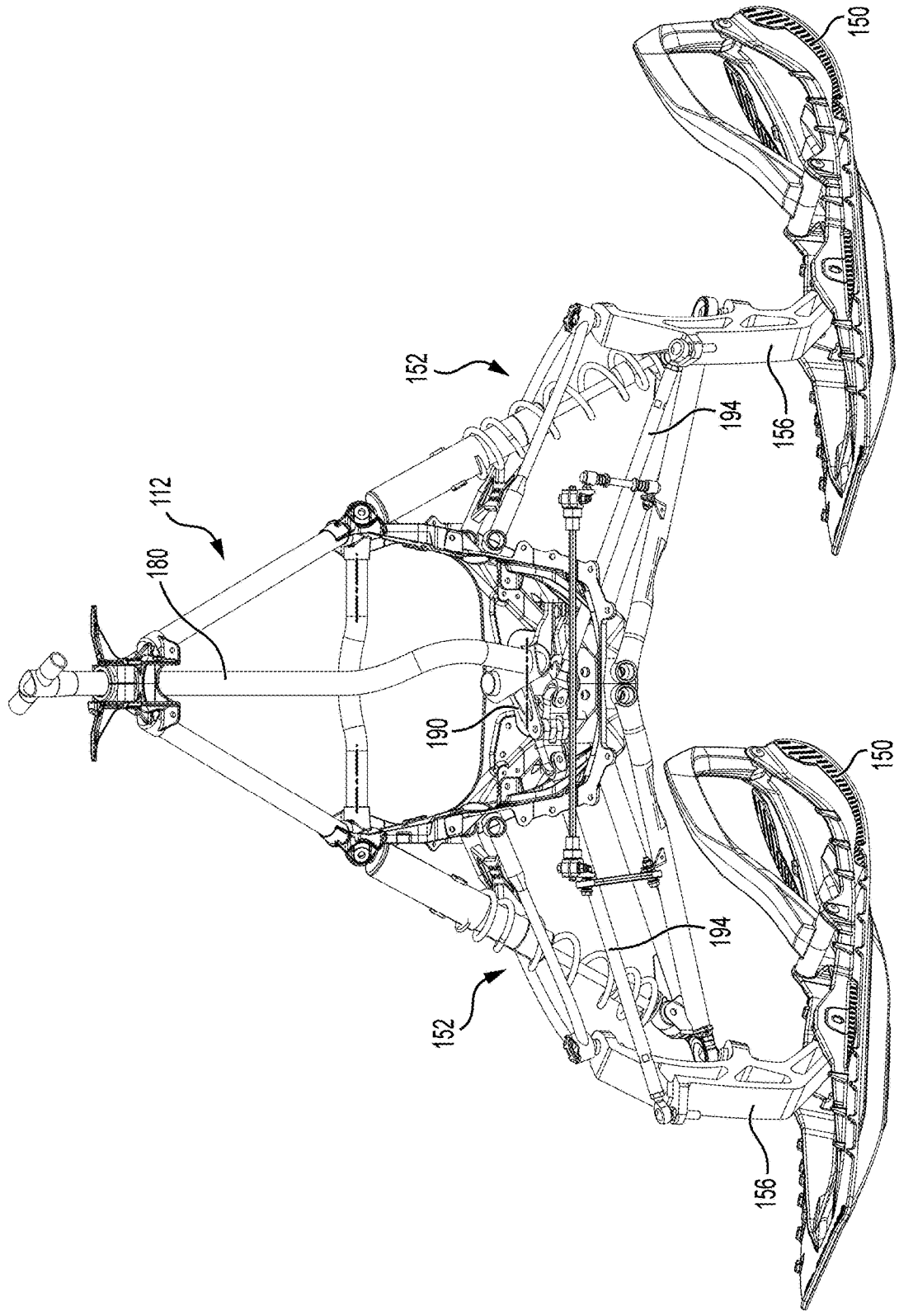

FIG. 12

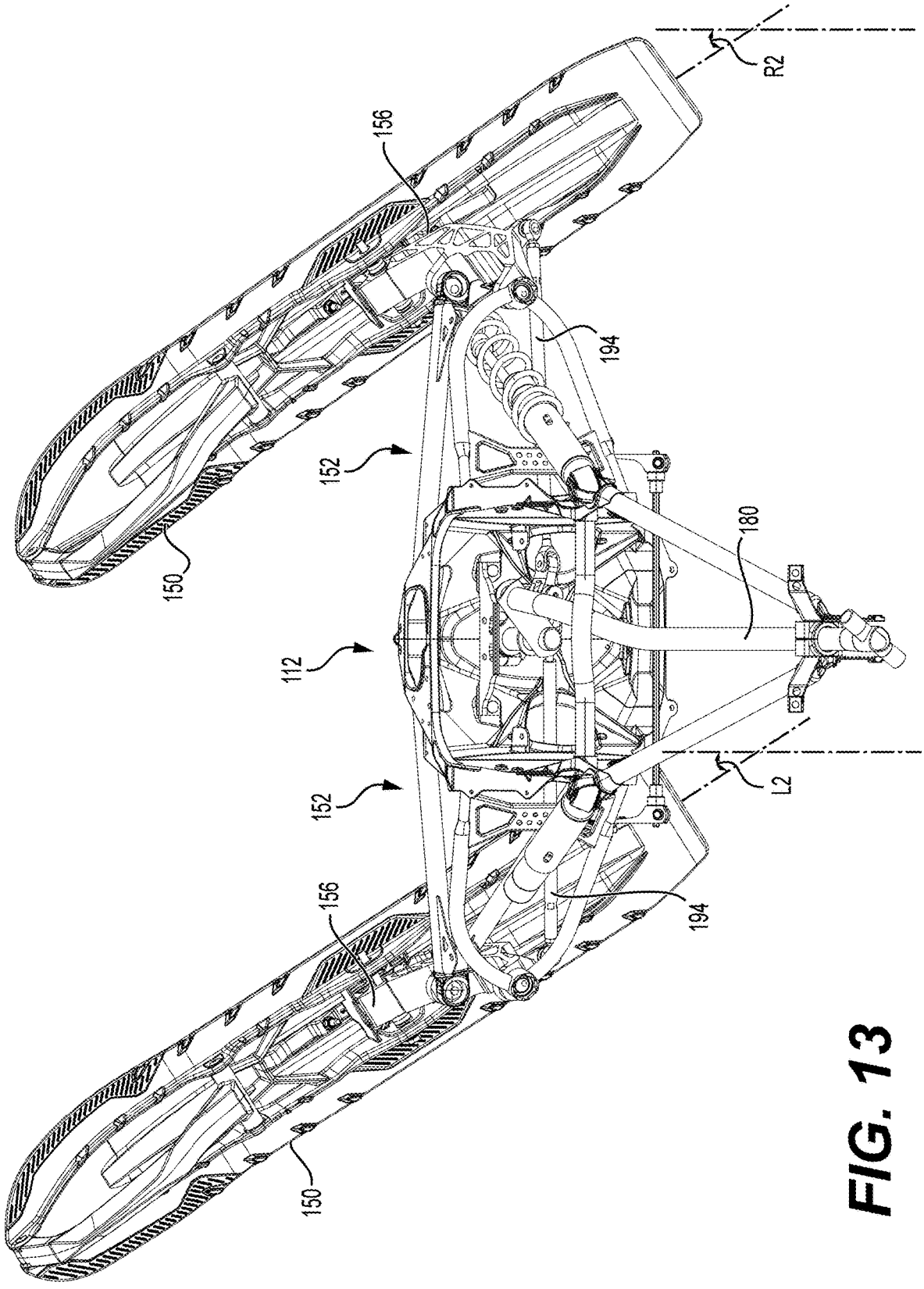

FIG. 13

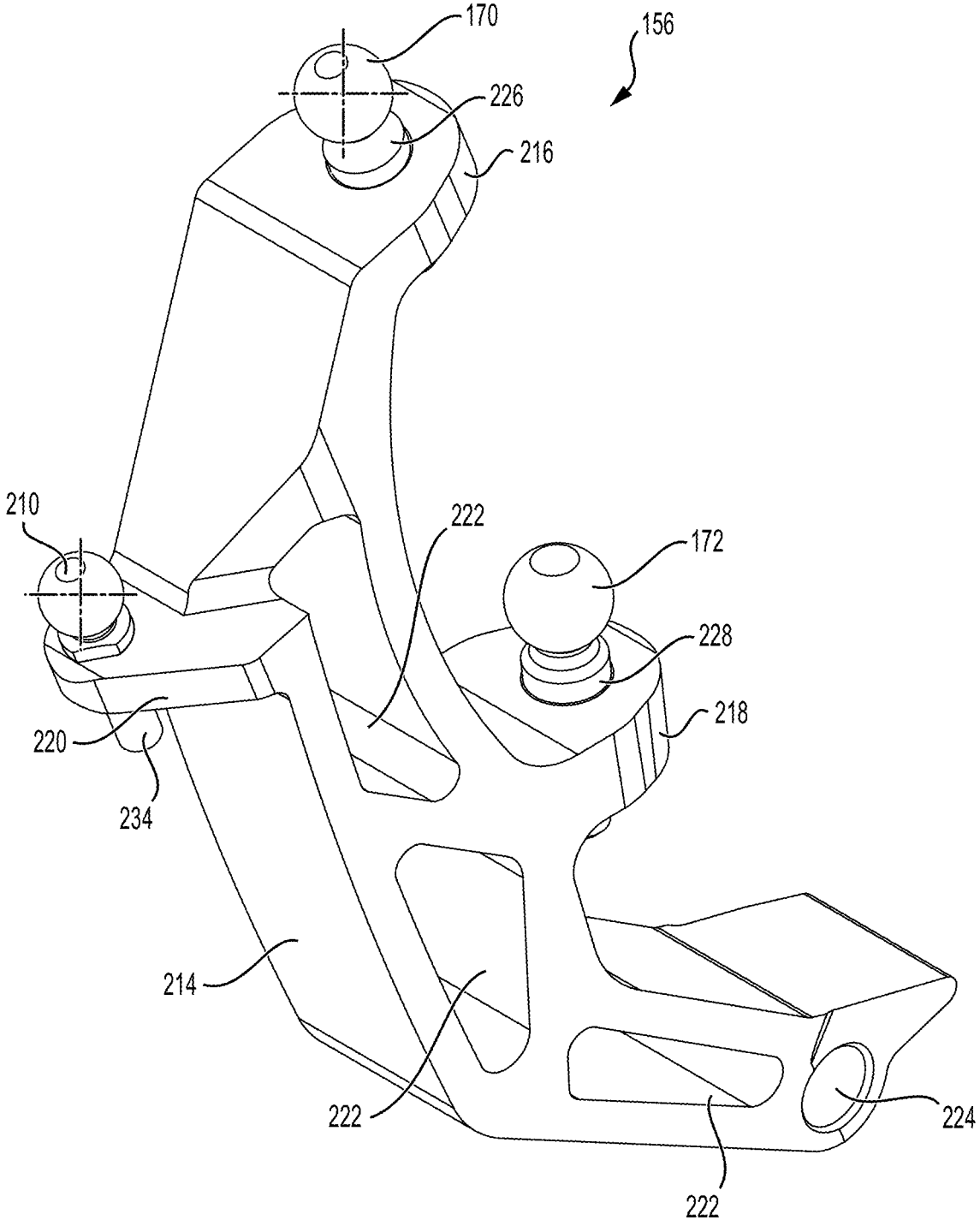

FIG. 14

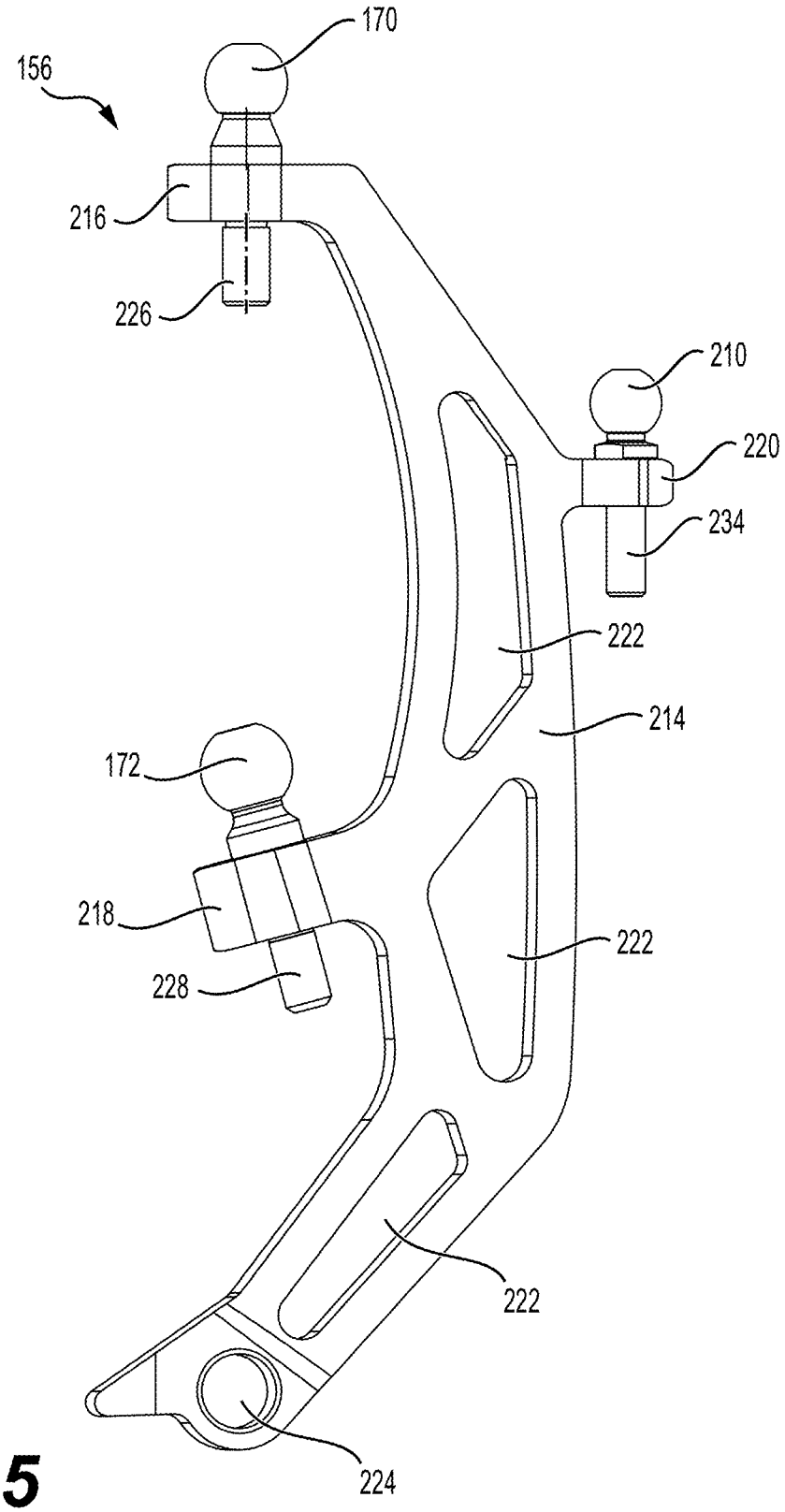

FIG. 15

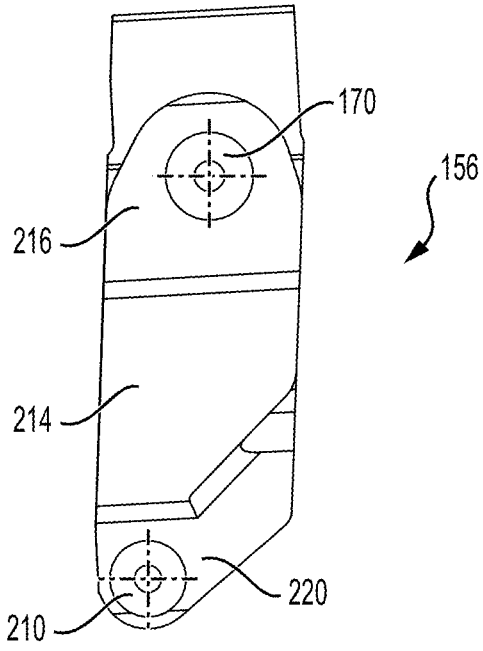

FIG. 16

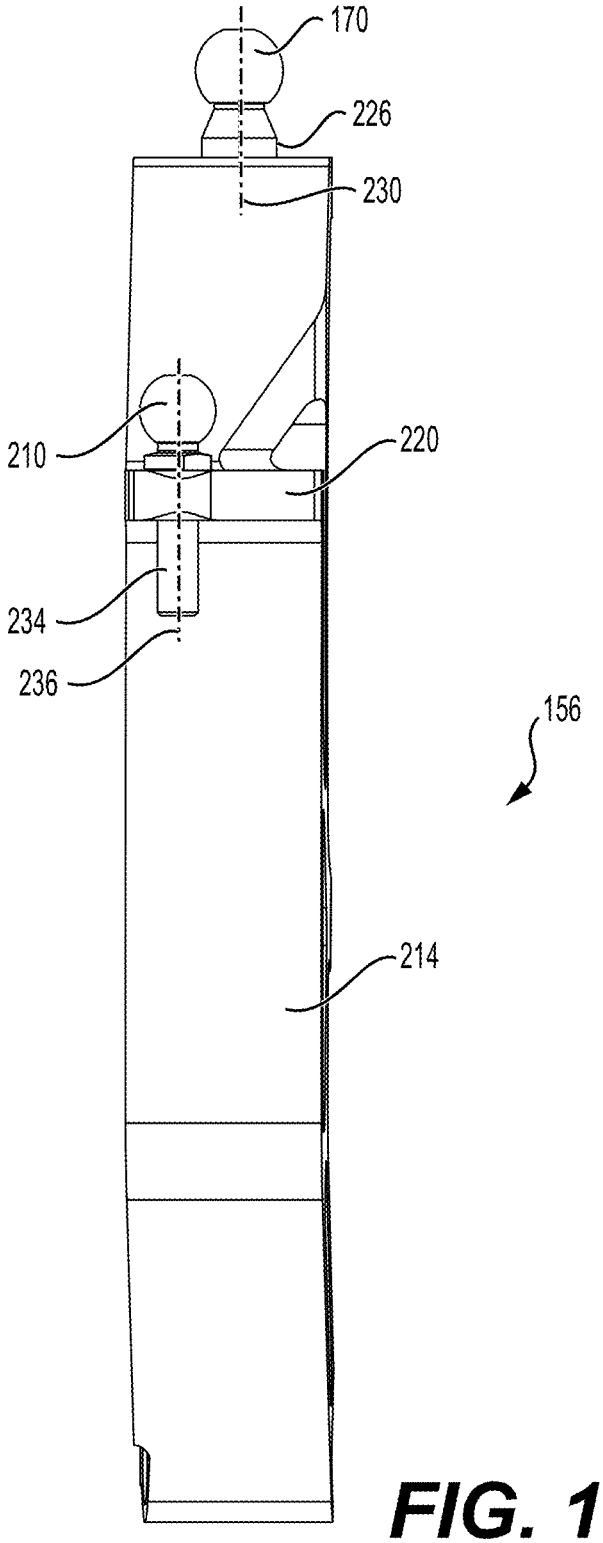

FIG. 17

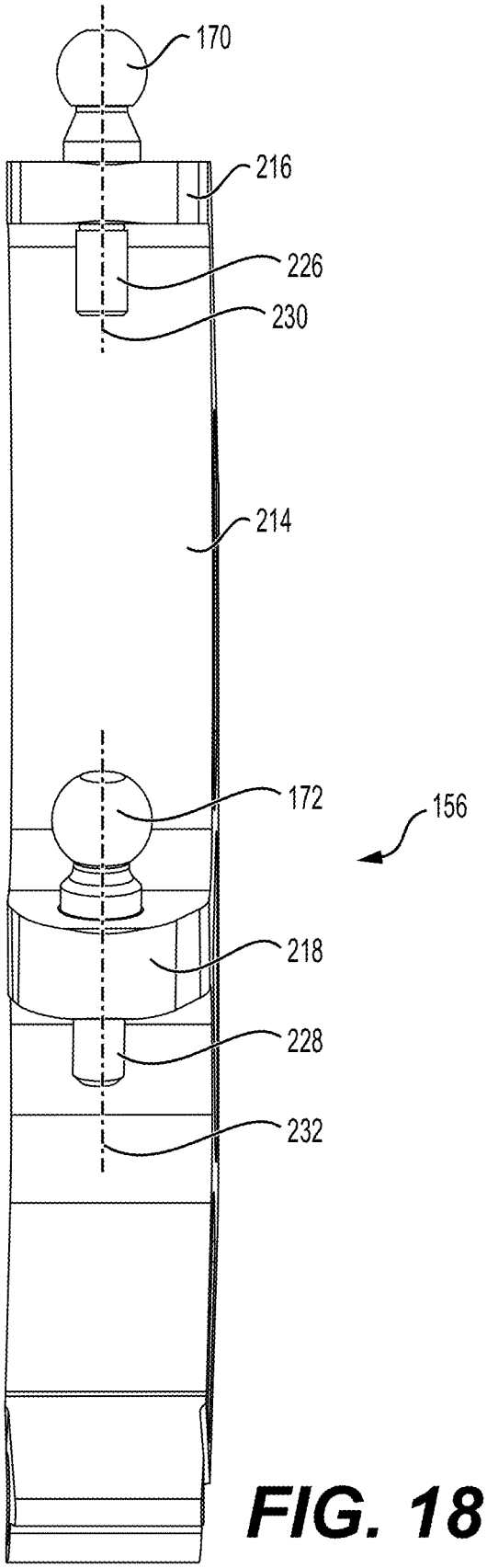

FIG. 18

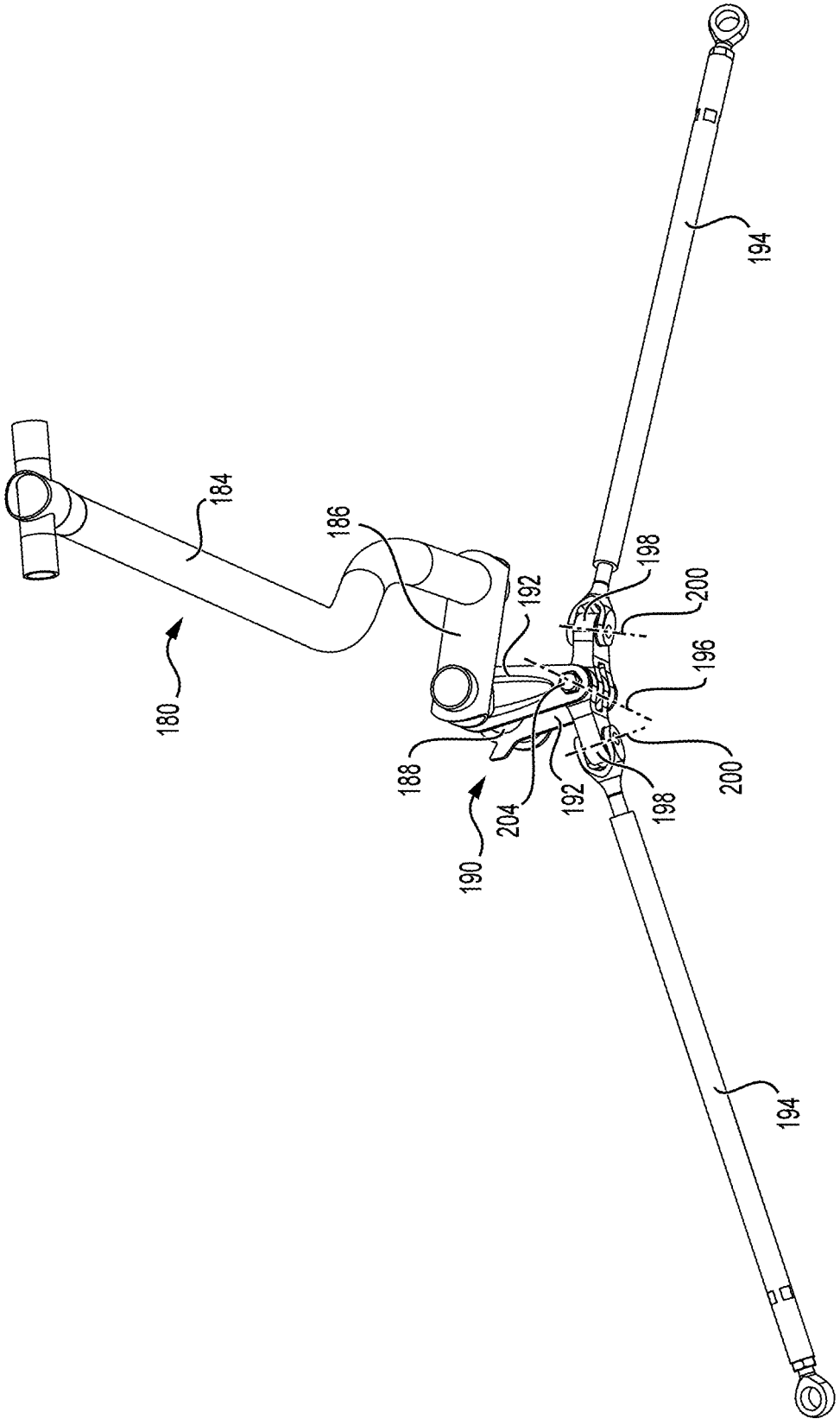

FIG. 19

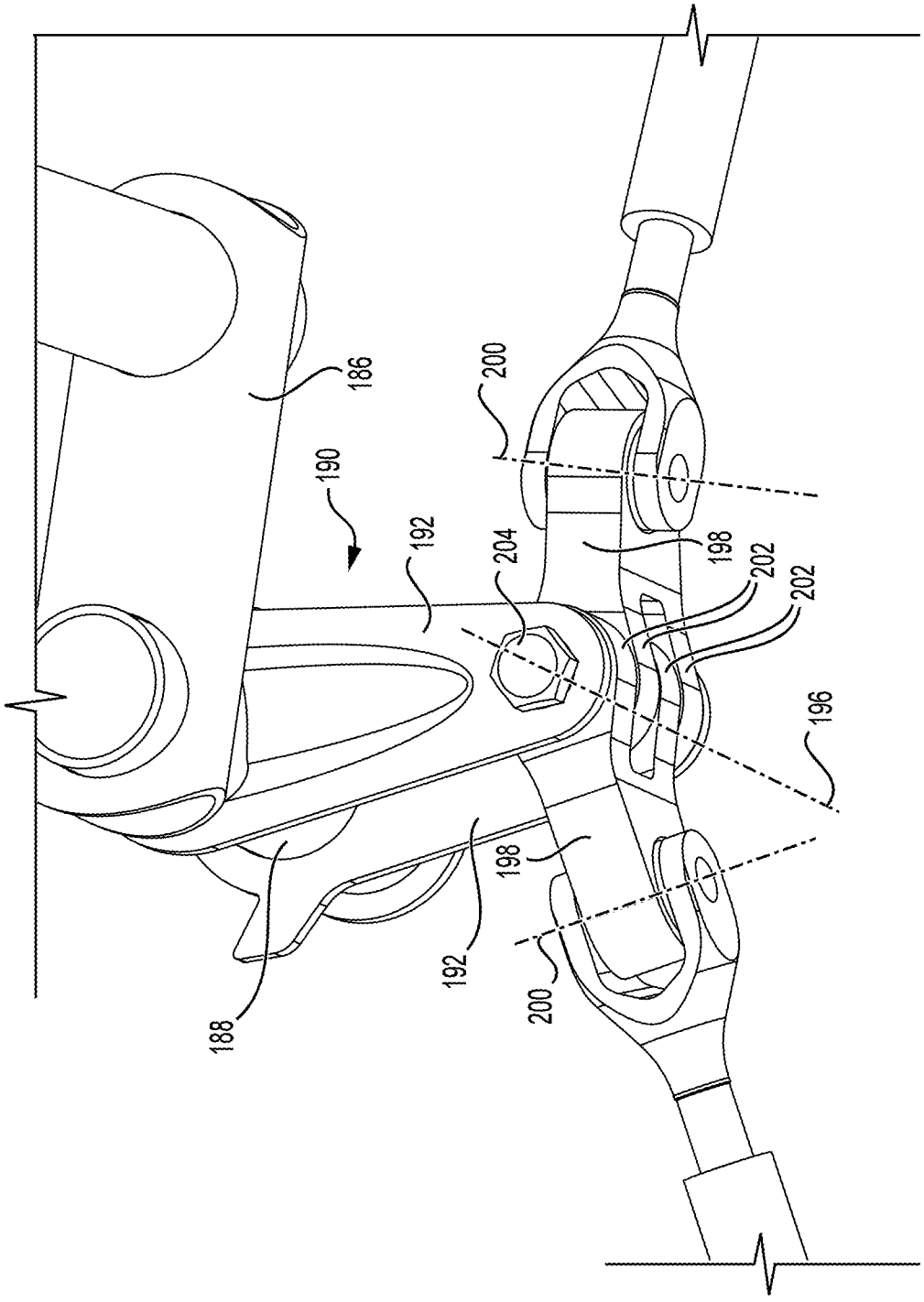

FIG. 20

SNOWMOBILE STEERING SYSTEM

REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to U.S. Provisional Patent Application No. 63/578,746, filed Aug. 25, 2023, the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present technology relates to snowmobiles and steering systems for snowmobiles.

BACKGROUND

[0003] Some snowmobile operators operate their snowmobiles in a maneuver known as side-hilling. Side-hilling is used when the snowmobile moves along the side of a hill (or mountain) such that the uphill direction of the hill is on one side of the snowmobile.

[0004] FIG. **1** illustrates an example of a snowmobile operator **10** on a snowmobile **12** performing side-hilling on a hill **14**. The operator **10** actuates an accelerator (not shown) of the snowmobile **12** such that the snowmobile **12** moves along the side of the hill **14**. As can be seen, as the snowmobile **12** moves along the side of the hill **14**, the operator **10** tilts the snowmobile **12** toward an uphill side of the hill **14**. To help maintain the snowmobile **12** tilted, the body of the operator **12** is positioned on the uphill side of the hill **14** so as to counterbalance the weight of the snowmobile **12**, and the operator **12** counter-steers the snowmobile **12**. To counter-steer the snowmobile **12**, the operator **10** turns the handlebar **16** of the snowmobile **12** such that the front ends of the skis **18** of the snowmobile **12** point away from the side of the hill **14** as shown in FIG. **1**. Depending on how steep the hill **14** is, the operator **10** may not have to completely get off the seat (not shown) of the snowmobile **12** in order to counterbalance the weight of the snowmobile **12**. The angle by which the hill-side ski **18** (i.e. the left ski of the snowmobile **12** in the example of FIG. **1**) also has an impact on how easy it is to maintain the side-hilling maneuver. The more the hill-side ski **18** can be turned, the easier side-hilling will be. As such, one way of making side-hilling easier consists in increasing the angle by which the hill-side ski **18** can be turned away from the hill **14**.

[0005] One way of achieving this consists in allowing the handlebar **16** to be turned more. However, past a certain angle of turning of the handlebar **16**, components of the steering system of the snowmobile **12** come into contact with other components of the snowmobile **12**, thereby limiting by how much the handlebar **16** can be turned, and also potentially damaging the components of the snowmobile **12** that come into contact. To avoid this from happening, snowmobile manufacturers typically install stoppers to limit by how much the handlebar **16** can be turned.

[0006] Some ways to help the skis **18** to be turned more while preventing contact between components of the steering system of the snowmobile **12** and other components of the snowmobile **12** consist in changing the ski stance (i.e. the distance between the skis **18**) and/or the degree of toe of the skis **18** (i.e. the angle between the skis **18** and a longitudinal line when the handlebar is steered to make the snowmobile **12** move straight ahead). However changing the ski stance and/or toe to increase the degree of turning of the skis **18** can have negative impacts on the balance and handling to the snowmobile **12** when not side-hilling.

[0007] With reference to FIGS. **2** to **4**, a prior art steering system and associated components will be described.

[0008] Left and right front suspension assemblies **20** are connected between a chassis suspension module **22**, which forms part of the frame of the snowmobile **12**, and left and right ski legs **24**. The front suspension assemblies **20** are double A-arm suspension assemblies **20**. The front suspension assemblies **20** are connected to the ski legs **24** via upper and lower ball joints **26**, **28**. The balls **30**, **32** of the upper and lower ball joints **26**, **28** can be clearly seen on the left ski leg **24** shown in FIG. **4**. The skis **18** are pivotally connected to the bottom of the ski legs **24** via pins **34** (shown in FIG. **3** for the left side) inserted through the skis **18** and apertures **36** defined in the bottom of the ski leg **24** (shown in FIG. **4** for the left ski leg **24**).

[0009] A steering column **38** is pivotally supported by the chassis suspension module **22**. The handlebar **16** connects to a top of the steering column **38**. A pitman arm **40** is connected to a lower end of the steering column **38**. Left and right tie rods **42** are pivotally connected between the pitman arm **40** and their respective ski legs **24**. The tie rods **42** are pivotally connected to the pitman arm **40** via ball joints **44**. The tie rods **42** pivot relative to the pitman arm **40** about separate axes **46**. The tie rods **42** are pivotally connected to their respective ski legs **24** via ball joints **48**. The ball **50** of the ball joint **48** of the left tie rod **42** can be clearly seen on the left ski leg **24** shown in FIG. **4**. As can be seen in FIG. **3** for the left side of the steering system, with the handlebar **16** steered for the snowmobile **12** to move straight ahead, the pivot axis **52** about which the tie rod **42** pivots relative to the ski leg **24** is disposed laterally inward of a longitudinal centerline **54** of the ski **18**.

[0010] As can be seen, there are many components that all move relative to each other during operation of the snowmobile **12**, making any change to the steering system difficult as such changes may result in components coming into contact with each other.

[0011] In the above steering system, when the handlebar **16** is turned the ski **18** on the inside of the turn is turned by a greater angle than the ski **18** on the outside of the ski **18**. For example, when making a right turn, the right ski **18** is turned clockwise by a greater angle than the left ski **18**. This is known as Ackerman steering. As such, when side-hilling, as shown in FIG. **1**, the ski **18** that is in the air, in this example the right ski **18**, is turned more than the hill-side ski **18**, in this case the left ski **18**.

[0012] Therefore, there is a desire for a snowmobile having a steering system having an increased angle of steering of a hill-side ski for side-hilling.

SUMMARY

[0013] It is an object of the present technology to ameliorate at least some of the inconveniences present in the prior art.

[0014] According to one aspect of the present technology, there is provided a snowmobile having: a frame having a tunnel; a seat disposed at least in part over the tunnel; a motor supported by the frame; an endless drive track disposed at least in part under the tunnel, the endless drive track being driven by the motor; a steering system including a handlebar, the handlebar being pivotally connected to the frame; a left ski operatively connected to the steering

system; and a right ski operatively connected to the steering system. The steering system is configured such that, in response to the handlebar being turned for making a left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by a greater angle than the left ski; and in response to the handlebar being turned for making a right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by a greater angle than the right ski.

[0015] In some embodiments, the steering system further includes: a steering column connected to the handlebar; a pitman arm connected to a lower end of the steering column; a left ski leg connected to the left ski; a left tie rod pivotally connected between the left ski leg and the pitman arm; a right ski leg connected to the right ski; and a right tie rod pivotally connected between the right ski leg and the pitman arm.

[0016] In some embodiments, the left tie rod is pivotally connected to the pitman arm about a first axis; and the right tie rod is pivotally connected to the pitman arm about the first axis.

[0017] In some embodiments, a left arm pivotally connected to the pitman arm about the first axis; and a right arm pivotally connected to the pitman arm about the first axis. The left tie rod is pivotally connected to the pitman arm via the left arm. The right tie rod is pivotally connected to the pitman arm via the right arm.

[0018] In some embodiments, the left tie rod is pivotally connected to the left arm about a second axis; the right tie rod is pivotally connected to the right arm about a third axis; and the second and third axes are generally perpendicular to the first axis.

[0019] In some embodiments, the first axis extends more vertically than the second and third axes.

[0020] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 2 degrees more than the left ski; and in response to the handlebar being turned at its maximum for making the right turn: the left ski is turned clockwise, as viewed from above the snowmobile, by at least 2 degrees more than the right ski.

[0021] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 3 degrees more than the left ski; and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 3 degrees more than the right ski.

[0022] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 32 degrees, and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 32 degrees.

[0023] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 35 degrees; and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 35 degrees.

[0024] In some embodiments, the left tie rod is pivotally connected to the left ski leg about a left pivot axis; and the right tie rod is pivotally connected to the right ski leg about a right pivot axis. With the handlebar steered for the snowmobile to move straight ahead: the left pivot axis is disposed laterally outward of a longitudinal centerline of the left ski; and the right pivot axis is disposed laterally outward of a longitudinal centerline of the right ski.

[0025] According to another aspect of the present technology, there is provided a method for side-hilling a snowmobile having two skis comprising: actuating an accelerator of the snowmobile such that the snowmobile moves along a side of a hill; and tilting the snowmobile toward an uphill side of the hill. The method also comprises turning a handlebar of the snowmobile such that: front ends of the two skis of the snowmobile point away from the side of the hill; a hill-side ski of the two skis is turned by a first angle; another one of the two skis is turned by a second angle; and the first angle is greater than the second angle.

[0026] According to another aspect of the present technology, there is provided a snowmobile having: a frame having a tunnel; a seat disposed at least in part over the tunnel; a motor supported by the frame; an endless drive track disposed at least in part under the tunnel, the endless drive track being driven by the motor; a steering system; a left ski operatively connected to the steering system; and a right ski operatively connected to the steering system. The steering system includes: a handlebar pivotally connected to the frame; a steering column connected to the handlebar; a pitman arm connected to a lower end of the steering column; a left ski leg connected to the left ski; a left tie rod pivotally connected between the left ski leg and pitman arm, the left tie rod being pivotally connected to the left ski leg about a left pivot axis, the left tie rod being pivotally connected to the pitman arm about a first axis; a right ski leg connected to the right ski; and a right tie rod pivotally connected between the right ski leg and the pitman arm, the right tie rod being pivotally connected to the right ski leg about a right pivot axis, the right tie rod being pivotally connected to the pitman arm about the first axis. With the handlebar steered for the snowmobile to move straight ahead: the left pivot axis is disposed laterally outward of a longitudinal centerline of the left ski; and the right pivot axis is disposed laterally outward of a longitudinal centerline of the right ski.

[0027] In some embodiments, a left arm pivotally connected to the pitman arm about the first axis; and a right arm pivotally connected to the pitman arm about the first axis. The left tie rod is pivotally connected to the pitman arm via the left arm. The right tie rod is pivotally connected to the pitman arm via the right arm.

[0028] In some embodiments, the left tie rod is pivotally connected to the left arm about a second axis; the right tie rod is pivotally connected to the right arm about a third axis; and the second and third axes are generally perpendicular to the first axis.

[0029] In some embodiments, the first axis extends more vertically than the second and third axes.

[0030] In some embodiments, in response to the handlebar being turned at its maximum for making a left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 2 degrees more than the left ski; and in response to the handlebar being turned at its maximum for

making a right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 2 degrees more than the right ski.

[0031] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn: the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 3 degrees more than the left ski; and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 3 degrees more than the right ski

[0032] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 32 degrees; and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 32 degrees.

[0033] In some embodiments, in response to the handlebar being turned at its maximum for making the left turn, the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 35 degrees; and in response to the handlebar being turned at its maximum for making the right turn, the left ski is turned clockwise, as viewed from above the snowmobile, by at least 35 degrees.

[0034] In the context of the present specification, unless expressly provided otherwise, the words "first", "second", "third", etc. have been used as adjectives only for the purpose of allowing for distinction between the nouns that they modify from one another, and not for the purpose of describing any particular relationship between those nouns.

[0035] For purposes of the present application, terms related to spatial orientation when referring to a vehicle and components in relation to the vehicle, such as "vertical", "horizontal", "forwardly", "rearwardly", "left", "right", "above" and "below", are as they would be understood by a driver of the vehicle sitting thereon in an upright driving position, with the vehicle steered straight-ahead and being at rest on flat, level ground.

[0036] Embodiments of the present technology each have at least one of the above-mentioned object and/or 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.

[0037] Additional and/or alternative features, aspects, and advantages of embodiments of the present technology will become apparent from the following description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] 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:

[0039] FIG. **1** is an illustration of a snowmobile and its rider during side-hilling;

[0040] FIG. **2** is a rear perspective view of a portion of a frame, skis, steering system and front suspension system of a prior art snowmobile;

[0041] FIG. **3** is a close-up top view of a left ski region of the components of FIG. **2**;

[0042] FIG. **4** is a perspective view, taken from a rear, right side, of a left ski leg of the components of FIG. **2**;

[0043] FIG. **5** is a left side elevation view of a snowmobile according to the present technology;

[0044] FIG. **6** is a perspective view taken from a rear, right side of a portion of a frame, skis, steering system and front suspension system of the snowmobile of FIG. **5**, with the steering system being steered to move straight ahead;

[0045] FIG. **7** is a rear elevation view of the components of FIG. **6**;

[0046] FIG. **8** is a left side elevation view of the components of FIG. **6**;

[0047] FIG. **9** is a top plan view of the components of FIG. **6**;

[0048] FIG. **10** is a close-up top view of a left ski region of the components of FIG. **6**;

[0049] FIG. **11** is a top plan view of the components of FIG. **6**, with the steering system being steered for making a right turn;

[0050] FIG. **12** is a rear elevation view of the components of FIG. **11**;

[0051] FIG. **13** is a top plan view of the components of FIG. **6**, with the steering system being steered for making a left turn;

[0052] FIG. **14** is a perspective view, taken from a rear, right side, of a left ski leg of the components of FIG. **6**;

[0053] FIG. **15** is a left side elevation view of the left ski leg of FIG. **14**;

[0054] FIG. **16** is a top plan view of the left ski leg of FIG. **14**;

[0055] FIG. **17** is a rear elevation view of the left ski leg of FIG. **14**;

[0056] FIG. **18** is a front elevation view of the left ski leg of FIG. **14**;

[0057] FIG. **19** is a perspective view, taken from a rear, left side, of a steering column, pitman arm, arms, and tie rods of the components of FIG. **6**, with the steering column being steered to move straight ahead; and

[0058] FIG. **20** is a close-up top view of a pitman arm region of the components of FIG. **19**.

DETAILED DESCRIPTION

[0059] The present disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including", "comprising", or "having", "containing", "involving" and variations thereof herein, is meant to encompass the items listed thereafter as well as, optionally, additional items. In the following description, the same numerical references refer to similar elements.

[0060] The present technology will be described with reference to the snowmobile **100** of FIG. **1**. The snowmobile **100** has a front end **102** and a rear end **104** which are defined consistently with a travel direction of the snowmobile **100**. The snowmobile **100** includes a vehicle body in the form of a frame **106** which includes a tunnel **108**, a motor module **110**, and a chassis suspension module **112**. The tunnel **108**

is formed from sheet metal parts assembled to form an inverted U-shape when viewed from the front or rear end **102**, **104**.

[0061] A motor **114**, schematically illustrated, is supported in a motor compartment defined by the motor module **110** of the frame **106** and provides, in part, propulsion of the snowmobile **100**. In the illustrated embodiment, the motor **114** is an internal combustion engine **114**, but it is contemplated that it could be, for example, an electric motor.

[0062] An endless drive track **116** (shown schematically) is positioned generally under the tunnel **108** and is operatively connected to the motor **114** via a drivetrain including a belt transmission system (not shown). The endless drive track **116** is driven to run about a rear suspension assembly **118** connected to the frame **106** for propulsion of the snowmobile **100**.

[0063] The rear suspension assembly **118** includes multiple idler wheels **120** and a pair of slide rails **122** in sliding contact with the endless drive track **116**. The slide rails **122** are attached to the tunnel **108** by a front suspension arm **124** and a rear suspension arm **126**. A front shock absorber assembly **128** and a rear shock absorber **130** with adjacent torsion springs **132** bias the slide rails **122** away from the tunnel **108**.

[0064] A fuel tank **134** is disposed on top of the tunnel **108**. A straddle seat **136** is positioned on top of the fuel tank **134**. As such, the seat **136** is supported by the tunnel **108**. The seat **136** is adapted to accommodate the user of the snowmobile **100**. A footrest **138** is positioned on each side of the snowmobile **100** below the seat **136** to accommodate the user's feet. Each of the left and right footrests **138** extends generally laterally outwardly from the sides of the tunnel **108**. In the illustrated embodiment, each side portion of the tunnel **108** is bent laterally outwardly at its bottom edge to form the corresponding footrest **138**. It is however contemplated that the footrest **138** could be formed separately from and be connected to the tunnel **108**.

[0065] At the front end **102** of the snowmobile **100**, body panels **140** enclose the motor **114** and other components of the powerpack such as a transmission or air intake system. The body panels **140** include a hood **142** which can be removed/opened to allow access to the motor **114** and other internal components of the snowmobile **100** from the top and the front which may be required, for example, for inspection or maintenance of the motor **114** and/or the powerpack. The body panels **140** also include two side panels **144** extending along the left and right sides of the snowmobile **100**. The side panels **144** are both removably connected to the frame **106** and/or to other body panels **140** and can be removed/opened to access the internal components from the corresponding lateral side.

[0066] Two skis **150** positioned at the forward end **102** of the snowmobile **100** are attached to the chassis suspension module **112** through front suspension assemblies **152**. The front suspension assemblies **152** will be described in more detail below.

[0067] A steering system is provided to steer the skis **150**. The steering system includes a handlebar **154** disposed forward of the seat **136**. The handlebar **154** is operatively connected to ski legs **156** as will be described in more detail below. The ski legs **156** are pivotally connected to the skis **150**. The handlebar **54** is used to rotate the ski legs **156**, and thereby the skis **150**, in order to steer the snowmobile **100**. A wind deflector **158** is provided in front of the handlebar **154**.

[0068] The snowmobile **100** includes other components such as a display cluster, an exhaust system, an air intake system, and the like. As it is believed that these components would be readily recognized by one of ordinary skill in the art, further explanation and description of these components will not be provided herein.

[0069] Turning now to FIGS. **6** to **10**, the front suspension assemblies **152** will be described in more detail. The front suspension assemblies **152** are double A-arm suspension assemblies **152**. As the left and right front suspension assemblies **152** are mirror images of each other, only the left front suspension assembly **152** will be described below. Corresponding elements of the right front suspension assembly **152** have been labeled with the same reference numerals as the component of the left front suspension assembly **152**.

[0070] The left suspension assembly **152** has an upper A-arm **160**, a lower A-arm **162**, and a shock absorber assembly **164**. The right ends of the upper and lower A-arms **160**, **162** are pivotally connected to the left side of the chassis suspension module **112**. The left ends of the upper and lower A-arms **160**, **162** are pivotally connected to the left ski leg **156** via upper and lower ball joints **166**, **168**. The balls **170**, **172** of the upper and lower ball joints **166**, **168** can be clearly seen on the left ski leg **156** in FIG. **14**. The shock absorber assembly **164** is pivotally connected at its upper end to the left side of the chassis suspension module **112** and at its lower end to the lower A-arm **162**.

[0071] A torsion bar **174** is connected between the lower A-arms **162** of the left and right front suspension assemblies **152**. Arms **176** are pivotally connected to the ends of the torsion bar **174**. Rods **178** pivotally connect the arms **176** to the lower A-arms **162**.

[0072] The steering system will now be described in more detail with reference to FIGS. **5** to **10**, **19** and **20**. A steering column **180** is pivotally supported by the chassis suspension module **112**. The handlebar **154** connects to a top of the steering column **180** via a steering column extension **182** (FIG. **2**). It is contemplated that the steering column extension **182** could be omitted and that the handlebar **154** could be connected directly to the top of the steering column **180**. With reference to FIG. **19**, the steering column **180** has three portions **184**, **186**, **188**. The portion **184**, which include the top end of the steering column **180**, has an upper straight section and a lower curved section. The portion **186** is connected to the lower end of the portion **184** and extend perpendicularly therefrom. The portion **188**, which includes the lower end of the steering column **180**, connects to the end of the portion **186**. The portion **188** and the upper straight section of the portion **184** are co-axial. The steering column **180** has the shape shown to provide space for other components of the snowmobile **100**. It is contemplated that the steering column **180** could have other shapes. For example, it is contemplated that the steering column **180** could be a single straight tube.

[0073] A pitman arm **190** is connected to the lower end of the steering column **180**. With the handlebar **154** steered for the snowmobile **100** to move straight ahead, as in FIGS. **5** to **10**, **19** and **20**, the pitman arm **190** extends rearward from the portion **188** of the steering column **180**. The pitman arm **190** is rotationally fixed relative to the steering column **180** such that when the steering column **180** turns, the pitman

arm **190** turns with it. As best seen in FIG. **20**, the pitman arm **190** has upper and lower parts **192** that are spaced from one another.

[0074] Left and right tie rods **194** are pivotally connected between the pitman arm **190** and their respective ski legs **156**. As best seen in FIGS. **19** and **20**, the tie rods **194** are pivotally connected to the pitman arm **190** about the same axis **196**. More specifically, the inner ends of the left and right tie rods **194** are pivotally connected to left and right arms **198** that are connected to the pitman arm **190** about the axis **196**. Each tie rod **194** pivotally connects to its respective arm **198** about an axis **200**. The axes **200** are generally perpendicular to the axis **196**. The axis **196** extends more vertically than the axes **200**. As can be seen in FIG. **20**, each arm **198** has two fingers **202**. The fingers **202** of the arms **198** interlace and are received between the upper and lower parts **192** of the pitman arm **190**. A bolt **204** extends through the part **192** of the pitman arm **190** and the fingers **202** of the arms **198**.

[0075] The outer ends of the left and right tie rods **194** are pivotally connected to their respective ski legs **156** about left and right pivots axes **206** (shown in FIG. **10** for the left tie rod **194**) via ball joints **208**. The ball **210** of the ball joint **208** of the left tie rod **194** can be clearly seen on the left ski leg **156** in FIG. **14**. The pivot axes **206** pass through the centers of the balls **210** of their respective ball joints **208**. As can be seen in FIG. **10** for the left side of the steering system, with the handlebar **154** steered for the snowmobile **100** to move straight ahead, the pivot axis **206** about which the tie rod **194** pivots relative to the ski leg **156** is disposed laterally outward of a longitudinal centerline **212** of the ski **150**.

[0076] Turning now to FIGS. **14** to **18**, the left ski leg **156** will be described in more detail. The right ski leg **156** is a mirror image of the left ski leg **156**. The ski leg **156** has a ski leg body **214** and tabs **216**, **218**, **220** integrally formed with the ski leg body **214**. The ski leg body **214** is generally hockey stick shaped. The ski leg body **214** has hollowed out portions **222** for weight reduction. It is contemplated the hollowed portions **222** could be omitted. An aperture **224** is defined in a lower end of the ski leg body **214**. The ski **150** is pivotally connected to the bottom of the ski legs **156** via a pin (not shown) inserted through the ski **150** and the apertures **224** defined in the bottom of the ski leg **156**. The tab **216** extends forward of the ski leg body **214** from a top end thereof. A threaded shank **226** integrally formed with the ball **170** is threaded through the tab **216** to fasten the ball **170** to the tab **216**. The tab **218** extends forward of the ski leg body **214** vertically below the tab **216**. A threaded shank **228** integrally formed with the ball **172** is threaded through the tab **218** to fasten the ball **172** to the tab **218**. As can be seen in FIG. **18**, the axes **230**, **232** of the shanks **226**, **228** are laterally aligned. The tab **220** extends rearward of the ski leg body **214**. A threaded shank **234** integrally formed with the ball **210** is threaded through the tab **220** to fasten the ball **210** to the tab **220**. As can be seen in FIG. **17**, the axis **236** of the shank **234** is disposed laterally to the left of the axis **230** of the shank **226**. As such, the center of the ball **210** is disposed laterally outward (i.e. to the left) of the center of the balls **170**, **172** with the handlebar **154** steered for the snowmobile **100** to move straight ahead. When the handlebar **154** is turned to steer the ski **150**, the ski leg **156** turns about an axis passing through the centers of the balls **170**, **172**.

[0077] When the handlebar **154** is turned, the steering column **180** and the pitman arm **190** turn in the same direction as the handlebar **154**, and the pitman arm **190** pushes on one of the tie rods **194** and pulls on the other one of the tie rods **194**. As a result, the ski legs **156** and the skis **150** are turned. In the present steering system, the ski **150** that is on the outside of the turn is turned by a greater angle than the ski **150** that is on the inside of the turn. This is the opposite of what happens in the prior art system described above with respect to the snowmobile **12** in FIGS. **1** to **4** (i.e. the ski **18** that is on the outside of the run is turned by a smaller angle than the ski **18** that is on the inside of the turn). As such, with the position of the ski legs **24** relative to the steering column **38** being the same as the position of the ski legs **156** relative to the steering column **180**, for the same degree of turning of the handlebars **16**, **154**, the ski **150** on the outside of the turn of the present technology turns by a greater angle than the ski **18** on the outside of the turn of the prior art. As such, as previously explained, the steering system of the present technology is advantageous when side-hilling.

[0078] With reference to FIGS. **11** and **12**, in response to the handlebar **154** being turned at its maximum for making a right turn, the pitman arm **190** pushes the left tie rod **194** to the left and pulls the right tie rod **194** to the left. As a result, as viewed from above the snowmobile **100** as in FIG. **11**, the ski legs **156** and the skis **150** are turned clockwise. The left ski **150** is turned by an angle L**1** and the right ski **150** is turned by an angle R**1**. In some embodiments, the angle L**1** is at least 2 degrees more than the angle R**1**. In some embodiments, the angle L**1** is at least 3 degrees more than the angle R**1**. In some embodiment, the angle L**1** is at least 32 degrees. In some embodiment, the angle L**1** is at least 35 degrees. In the present embodiment the angle L**1** is 36 degrees and the angle R**1** is 33 degrees, but other angles are contemplated.

[0079] With reference to FIG. **13**, in response to the handlebar **154** being turned at its maximum for making a left turn, the pitman arm **190** pushes the right tie rod **194** to the right and pulls the left tie rod **194** to the right. As a result, as viewed from above the snowmobile **100** as in FIG. **13**, the ski legs **156** and the skis **150** are turned counterclockwise. The left ski **150** is turned by an angle L**2** and the right ski **150** is turned by an angle R**2**. In some embodiments, the angle R**2** is at least 2 degrees more than the angle L**2**. In some embodiments, the angle R**2** is at least 3 degrees more than the angle L**2**. In some embodiment, the angle R**2** is at least 32 degrees. In some embodiment, the angle R**2** is at least 35 degrees. In the present embodiment the angle R**2** is 36 degrees and the angle L**2** is 33 degrees, but other angles are contemplated.

[0080] For performing side-hilling with the snowmobile **100**, the operator of the snowmobile **100** actuates an accelerator (not shown) provided on a right side of the handlebar **154** such that the snowmobile **100** moves along the side of the hill. As the snowmobile **100** moves along the side of the hill, the operator tilts the snowmobile **100** toward an uphill side of the hill, as in the prior art shown in FIG. **1**. To help maintain the snowmobile **100** tilted, the body of the operator is positioned on the uphill side of the hill so as to counterbalance the weight of the snowmobile **100**, and the operator counter-steers the snowmobile **100**. To counter-steer the snowmobile **100**, the operator turns the handlebar **154** of the snowmobile **100** such that the front ends of the skis **150** point away from the side of the hill. As a result of the steering system of the present technology, the hill-side ski

150 is turned by a greater angle than the other ski **150**. This is advantageous because for the distance between the skis **150** of the snowmobile **100** being the same as the distance between the skis **18** of the prior art snowmobile **12**, for the same degree of turning of the handlebars **16**, **154**, the hill-side ski **150** of the snowmobile **100** will turn away from the hill by a greater angle than the hill-side ski **18** of the snowmobile **12**.

[0081] Modifications and improvements to the above-described embodiments of the present invention 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 invention is therefore intended to be limited solely by the appended claims.

What is claimed is:

1. A snowmobile comprising:

a frame having a tunnel;

a seat disposed at least in part over the tunnel;

a motor supported by the frame;

an endless drive track disposed at least in part under the tunnel, the endless drive track being driven by the motor;

a steering system including a handlebar, the handlebar being pivotally connected to the frame;

a left ski operatively connected to the steering system;

a right ski operatively connected to the steering system,

the steering system being configured such that:

in response to the handlebar being turned for making a left turn:

the right ski is turned counterclockwise, as viewed from above the snowmobile, by a greater angle than the left ski; and

in response to the handlebar being turned for making a right turn:

the left ski is turned clockwise, as viewed from above the snowmobile, by a greater angle than the right ski.

2. The snowmobile of claim **1**, wherein the steering system further includes:

a steering column connected to the handlebar;

a pitman arm connected to a lower end of the steering column;

a left ski leg connected to the left ski;

a left tie rod pivotally connected between the left ski leg and the pitman arm;

a right ski leg connected to the right ski; and

a right tie rod pivotally connected between the right ski leg and the pitman arm.

3. The snowmobile of claim **1**, wherein:

in response to the handlebar being turned at its maximum for making the left turn:

the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 2 degrees more than the left ski; and

in response to the handlebar being turned at its maximum for making the right turn:

the left ski is turned clockwise, as viewed from above the snowmobile, by at least 2 degrees more than the right ski.

4. The snowmobile of claim **3**, wherein:

in response to the handlebar being turned at its maximum for making the left turn:

the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 3 degrees more than the left ski; and

in response to the handlebar being turned at its maximum for making the right turn:

the left ski is turned clockwise, as viewed from above the snowmobile, by at least 3 degrees more than the right ski.

5. The snowmobile of claim **3**, wherein:

in response to the handlebar being turned at its maximum for making the left turn:

the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 32 degrees; and

in response to the handlebar being turned at its maximum for making the right turn:

the left ski is turned clockwise, as viewed from above the snowmobile, by at least 32 degrees.

6. The snowmobile of claim **5**, wherein:

in response to the handlebar being turned at its maximum for making the left turn:

the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 35 degrees; and

in response to the handlebar being turned at its maximum for making the right turn:

the left ski is turned clockwise, as viewed from above the snowmobile, by at least 35 degrees.

7. The snowmobile of claim **1**, wherein:

the left tie rod is pivotally connected to the left ski leg about a left pivot axis;

the right tie rod is pivotally connected to the right ski leg about a right pivot axis; and

with the handlebar steered for the snowmobile to move straight ahead:

the left pivot axis is disposed laterally outward of a longitudinal centerline of the left ski; and

the right pivot axis is disposed laterally outward of a longitudinal centerline of the right ski.

8. A method for side-hilling a snowmobile having two skis comprising:

actuating an accelerator of the snowmobile such that the snowmobile moves along a side of a hill;

tilting the snowmobile toward an uphill side of the hill; and

turning a handlebar of the snowmobile such that:

front ends of the two skis of the snowmobile point away from the side of the hill;

a hill-side ski of the two skis is turned by a first angle;

another one of the two skis is turned by a second angle; and

the first angle is greater than the second angle.

9. A snowmobile comprising:

a frame having a tunnel;

a seat disposed at least in part over the tunnel;

a motor supported by the frame;

an endless drive track disposed at least in part under the tunnel, the endless drive track being driven by the motor;

a steering system;
a left ski operatively connected to the steering system; and
a right ski operatively connected to the steering system,
the steering system including:
a handlebar pivotally connected to the frame;
a steering column connected to the handlebar;
a pitman arm connected to a lower end of the steering column;
a left ski leg connected to the left ski;
a left tie rod pivotally connected between the left ski leg and the pitman arm, the left tie rod being pivotally connected to the left ski leg about a left pivot axis, the left tie rod being pivotally connected to the pitman arm about a first axis;
a right ski leg connected to the right ski; and
a right tie rod pivotally connected between the right ski leg and the pitman arm, the right tie rod being pivotally connected to the right ski leg about a right pivot axis, the right tie rod being pivotally connected to the pitman arm about the first axis,
with the handlebar steered for the snowmobile to move straight ahead:
the left pivot axis being disposed laterally outward of a longitudinal centerline of the left ski; and
the right pivot axis being disposed laterally outward of a longitudinal centerline of the right ski.

10. The snowmobile of claim **9**, wherein:
in response to the handlebar being turned at its maximum for making a left turn:
the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 2 degrees more than the left ski; and
in response to the handlebar being turned at its maximum for making a right turn:
the left ski is turned clockwise, as viewed from above the snowmobile, by at least 2 degrees more than the right ski.

11. The snowmobile of claim **10**, wherein:
in response to the handlebar being turned at its maximum for making the left turn:
the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 3 degrees more than the left ski; and
in response to the handlebar being turned at its maximum for making the right turn:
the left ski is turned clockwise, as viewed from above the snowmobile, by at least 3 degrees more than the right ski.

12. The snowmobile of claim **10**, wherein:
in response to the handlebar being turned at its maximum for making the left turn:
the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 32 degrees; and
in response to the handlebar being turned at its maximum for making the right turn:
the left ski is turned clockwise, as viewed from above the snowmobile, by at least 32 degrees.

13. The snowmobile of claim **12**, wherein:
in response to the handlebar being turned at its maximum for making the left turn:
the right ski is turned counterclockwise, as viewed from above the snowmobile, by at least 35 degrees; and
in response to the handlebar being turned at its maximum for making the right turn:
the left ski is turned clockwise, as viewed from above the snowmobile, by at least 35 degrees.

* * * * *