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(54) **REAR SUSPENSION STOP**

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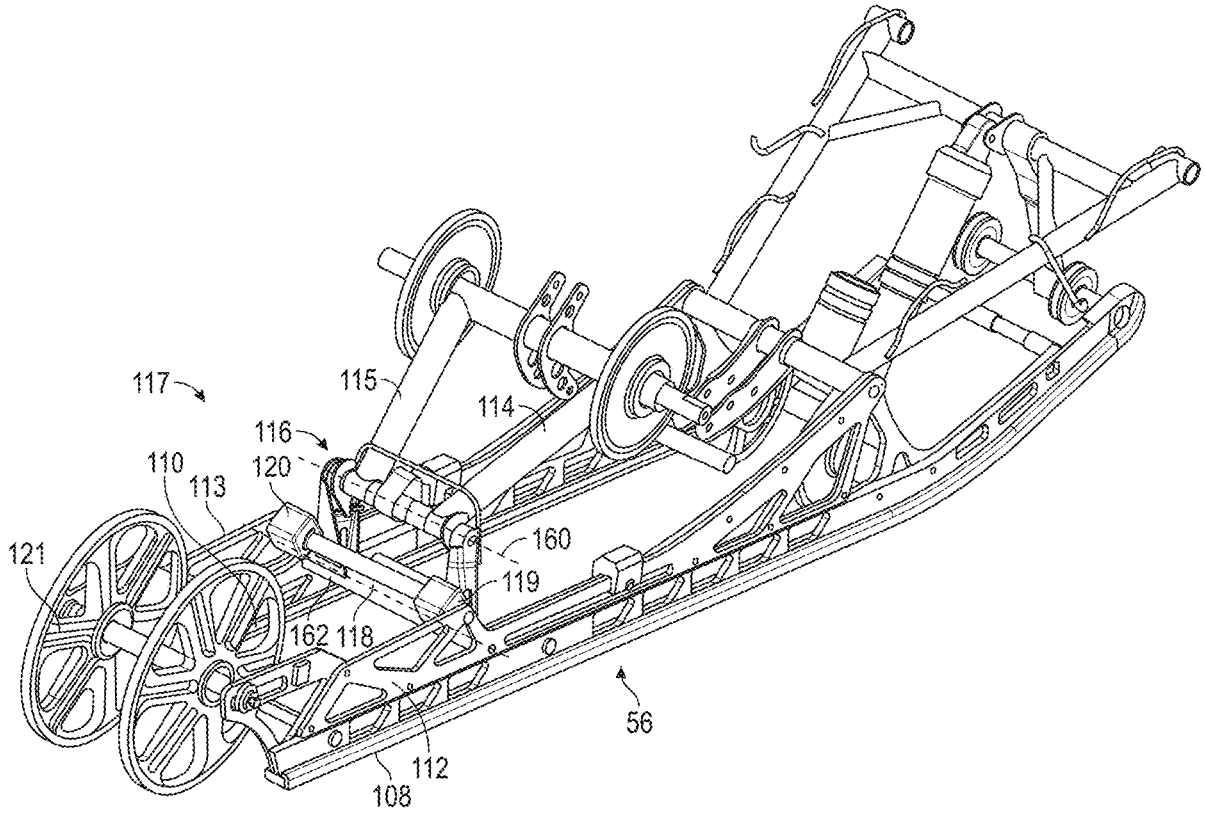
(57) **ABSTRACT**

A snowmobile includes a frame and a tractive assembly pivotably coupled to the frame. The tractive assembly includes a first rail, a second rail, a first crossmember extending between the first rail and the second rail, an arm having a first end pivotably coupled to the frame and an opposing second end, and a stop assembly. The stop assembly includes a second crossmember coupled to the arm, a cam coupled to the second crossmember, a first bracket coupled to first ends of the first crossmember and the second crossmember, a second bracket coupled to opposing second ends of the first crossmember and the second crossmember, and one or more stops coupled to at least one of the first bracket or the second bracket, the one or more stops configured to engage a portion of the cam to selectively prevent rotation of the arm.



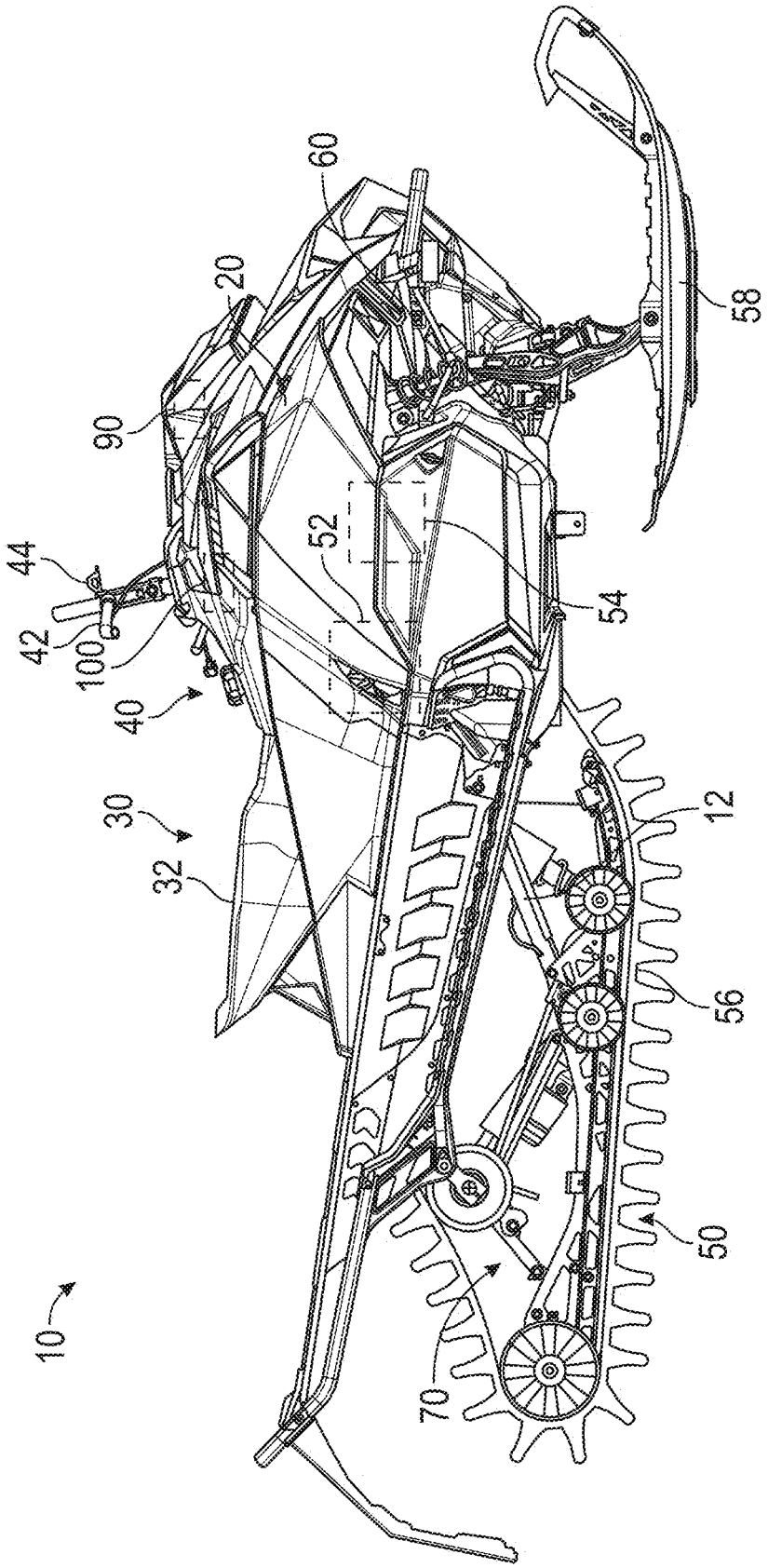
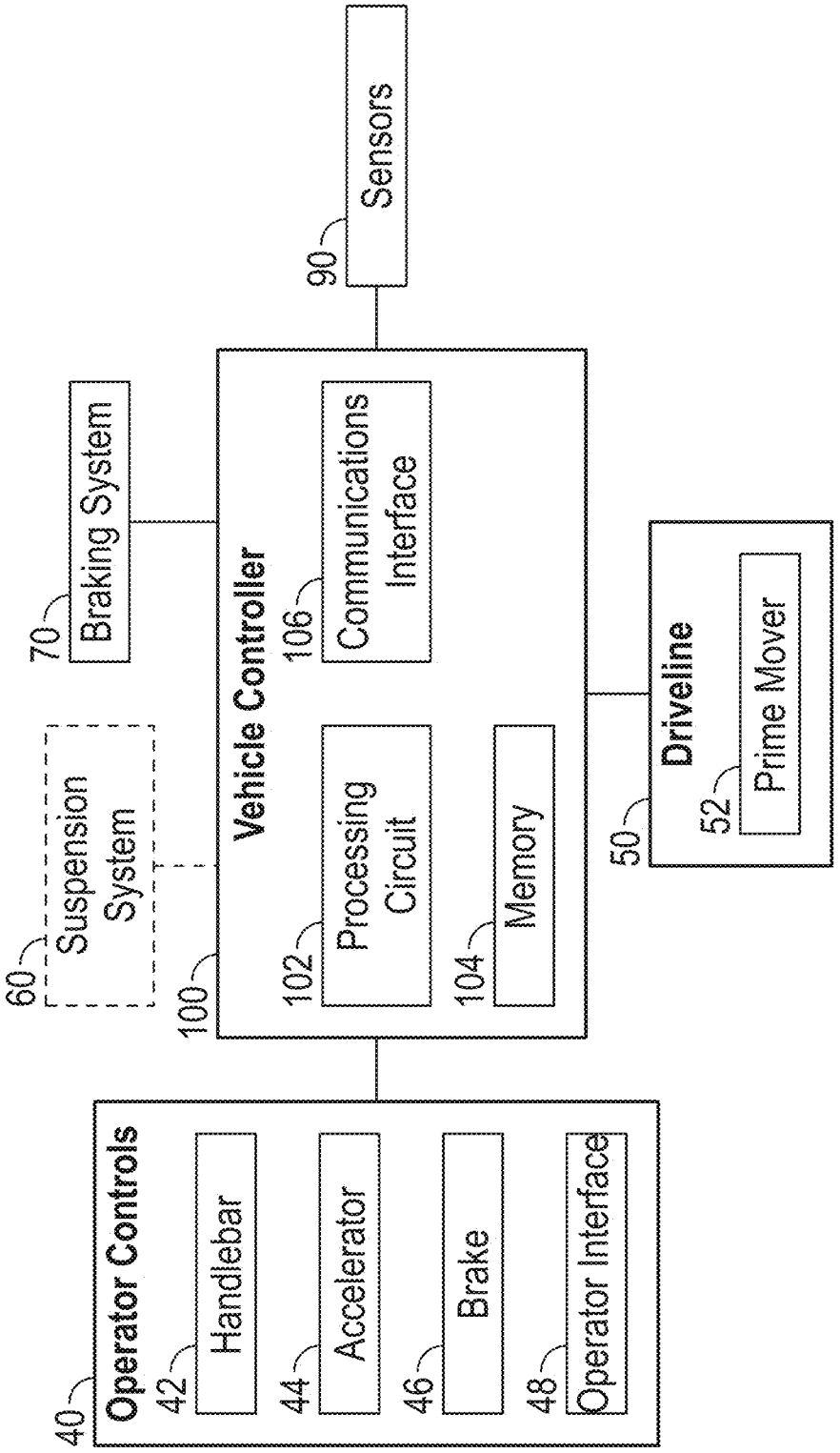


FIG. 1


Sensors
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Braking System
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Communications Interface
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Vehicle Controller
Suspension System
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Processing Circuit
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Memory
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Driveline
Prime Mover
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Operator Controls
Handlebar
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Accelerator
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Brake
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Operator Interface
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FIG. 2

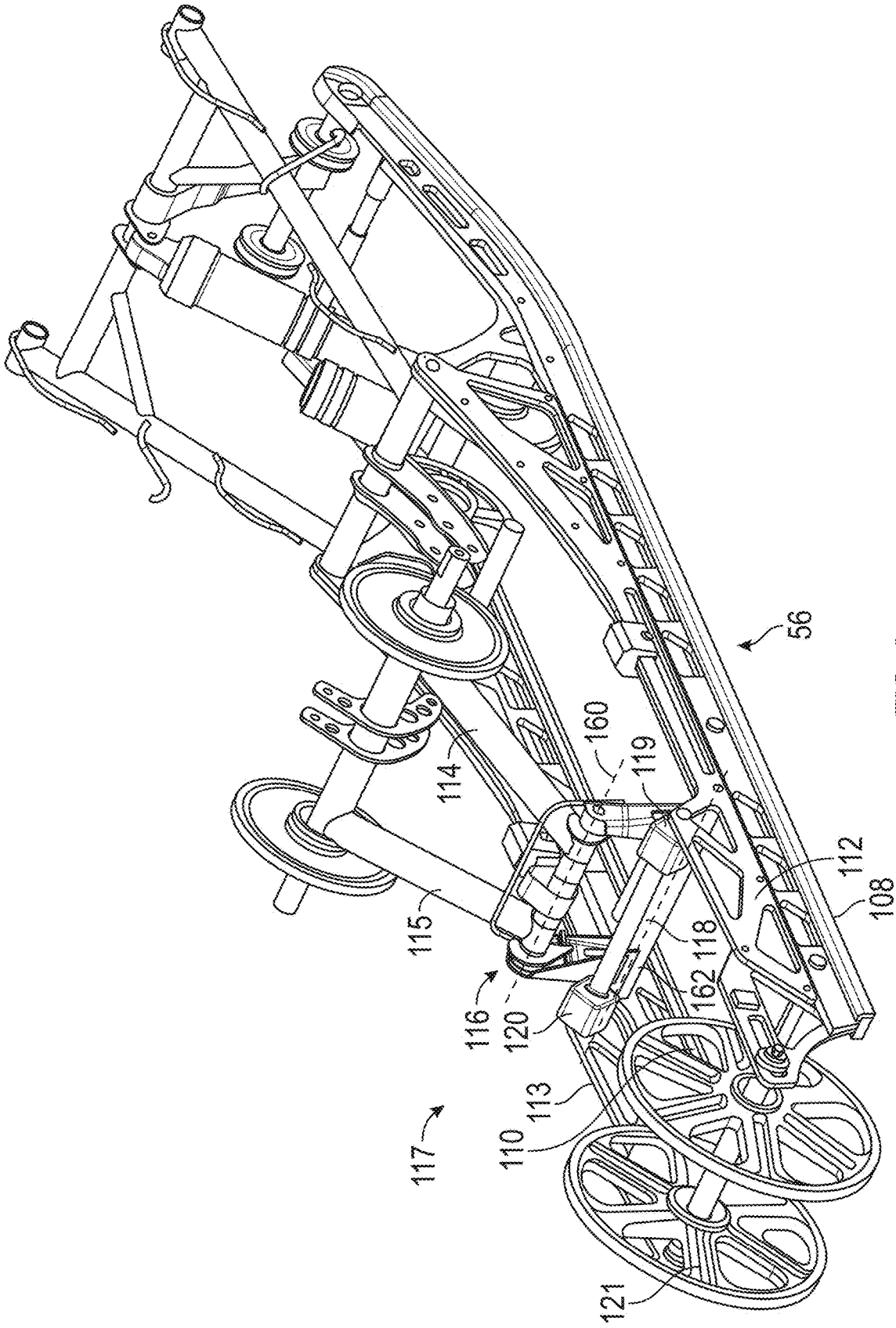

FIG. 3

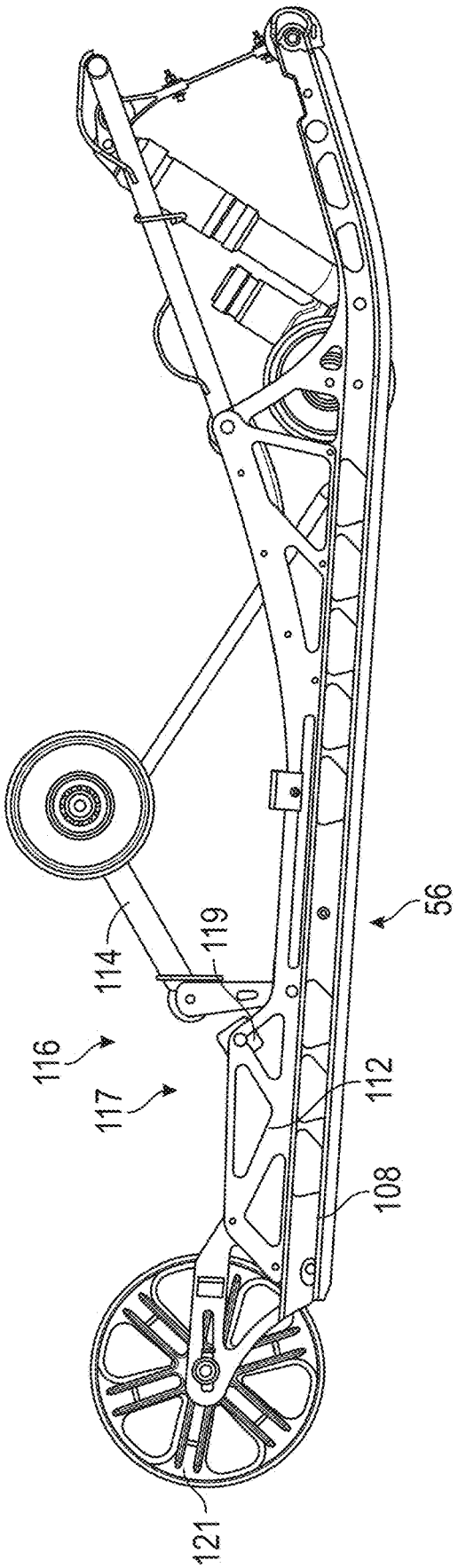

FIG. 4

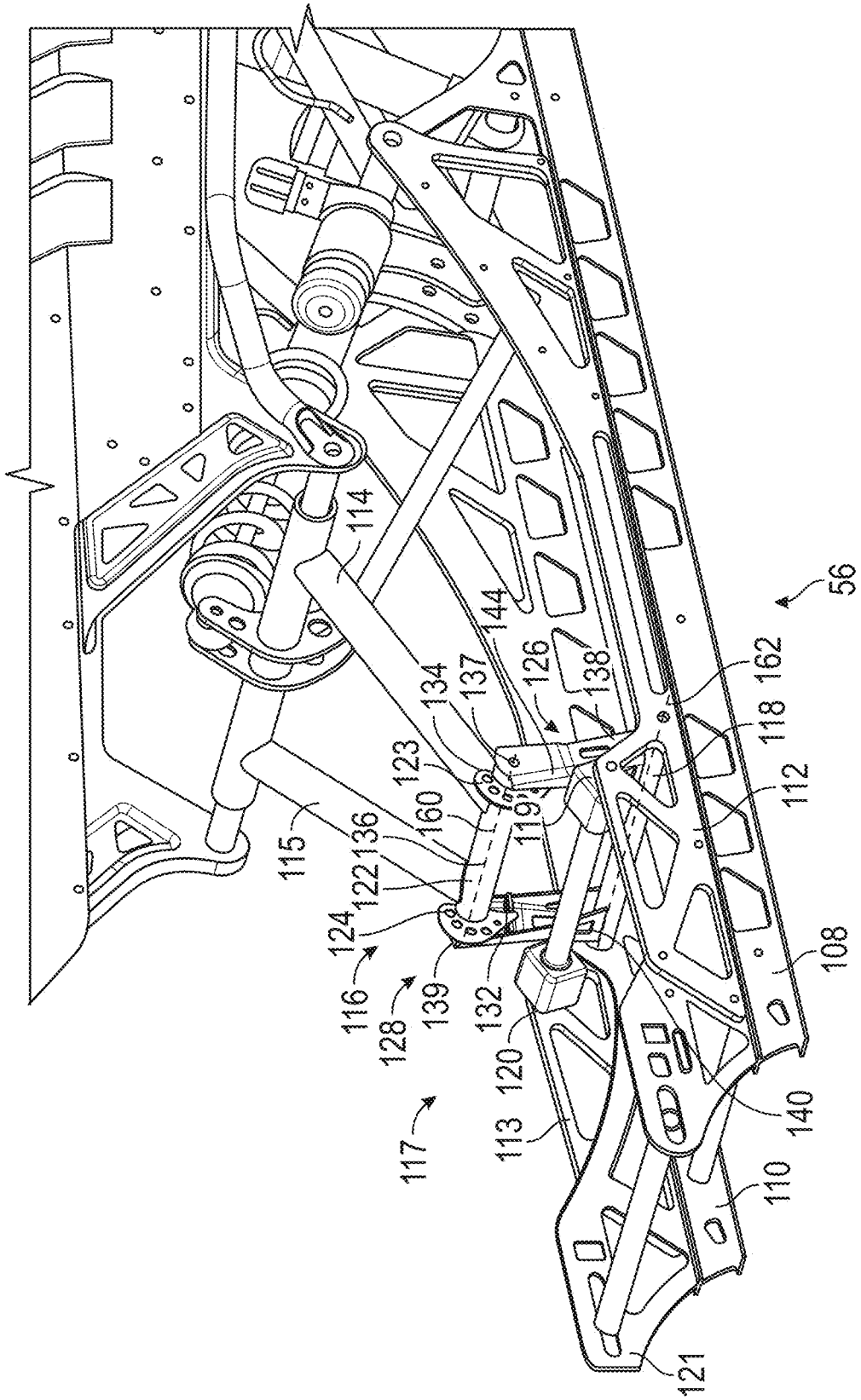
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FIG. 5

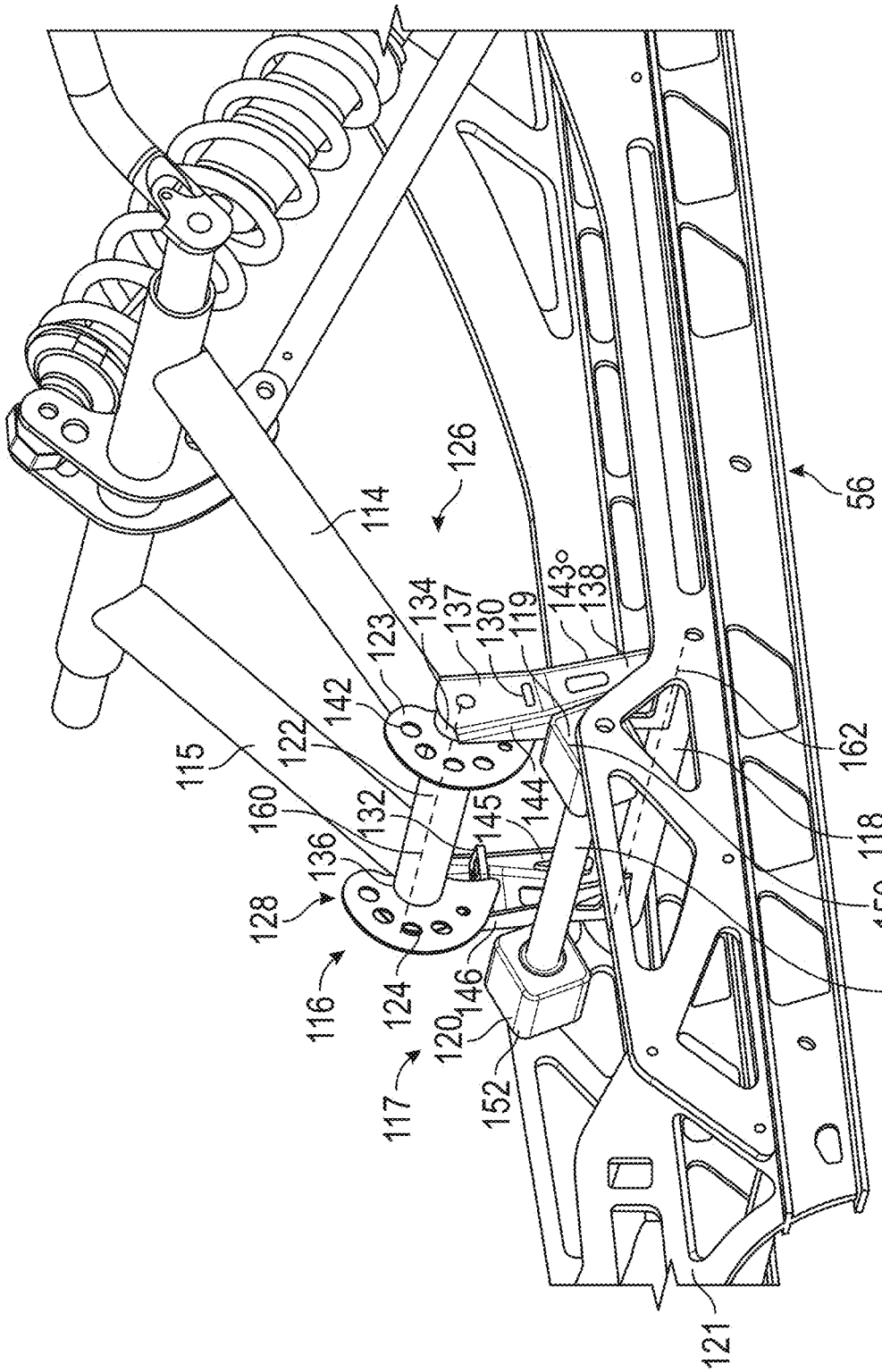
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FIG. 6

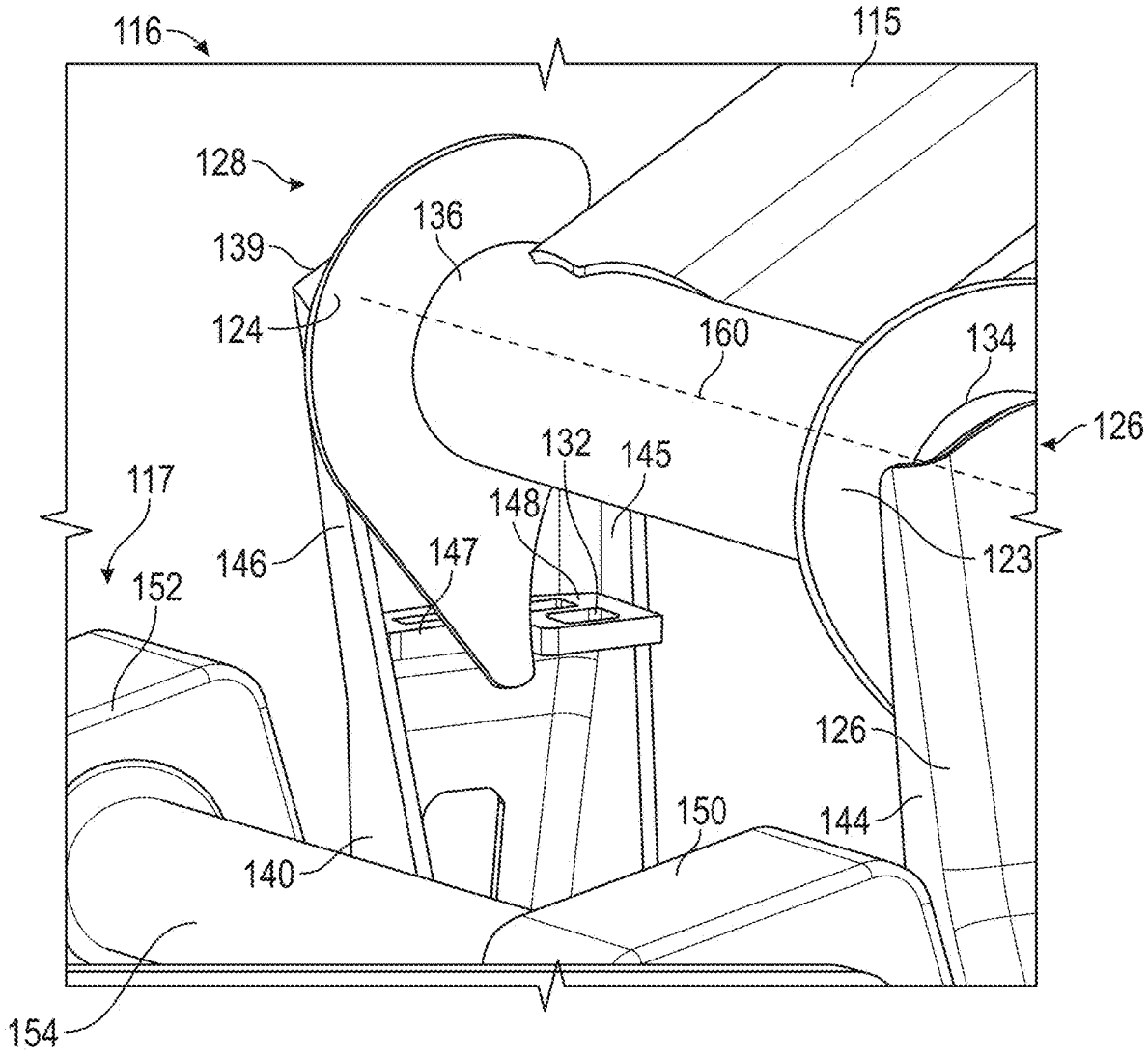
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FIG. 7

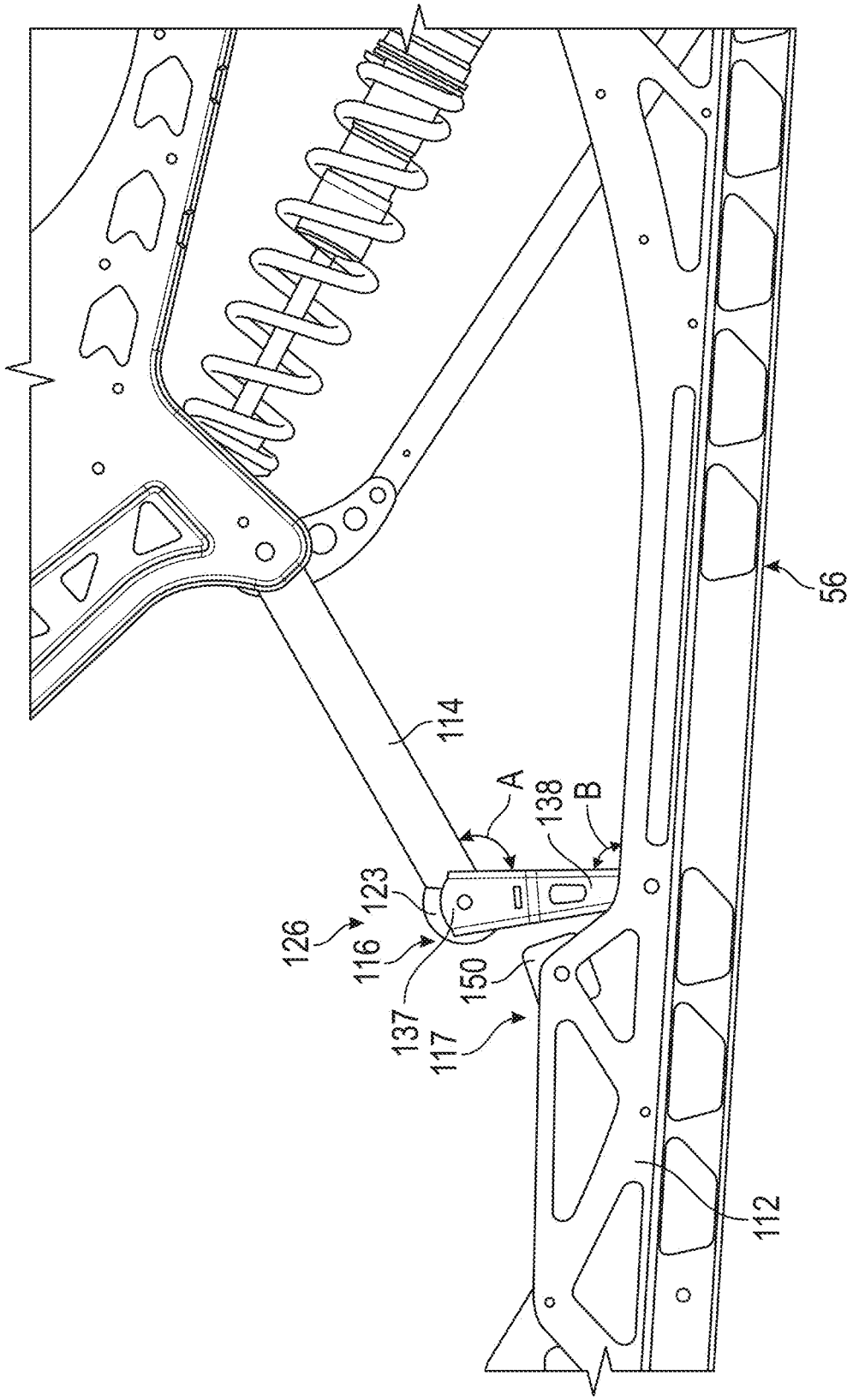

FIG. 8

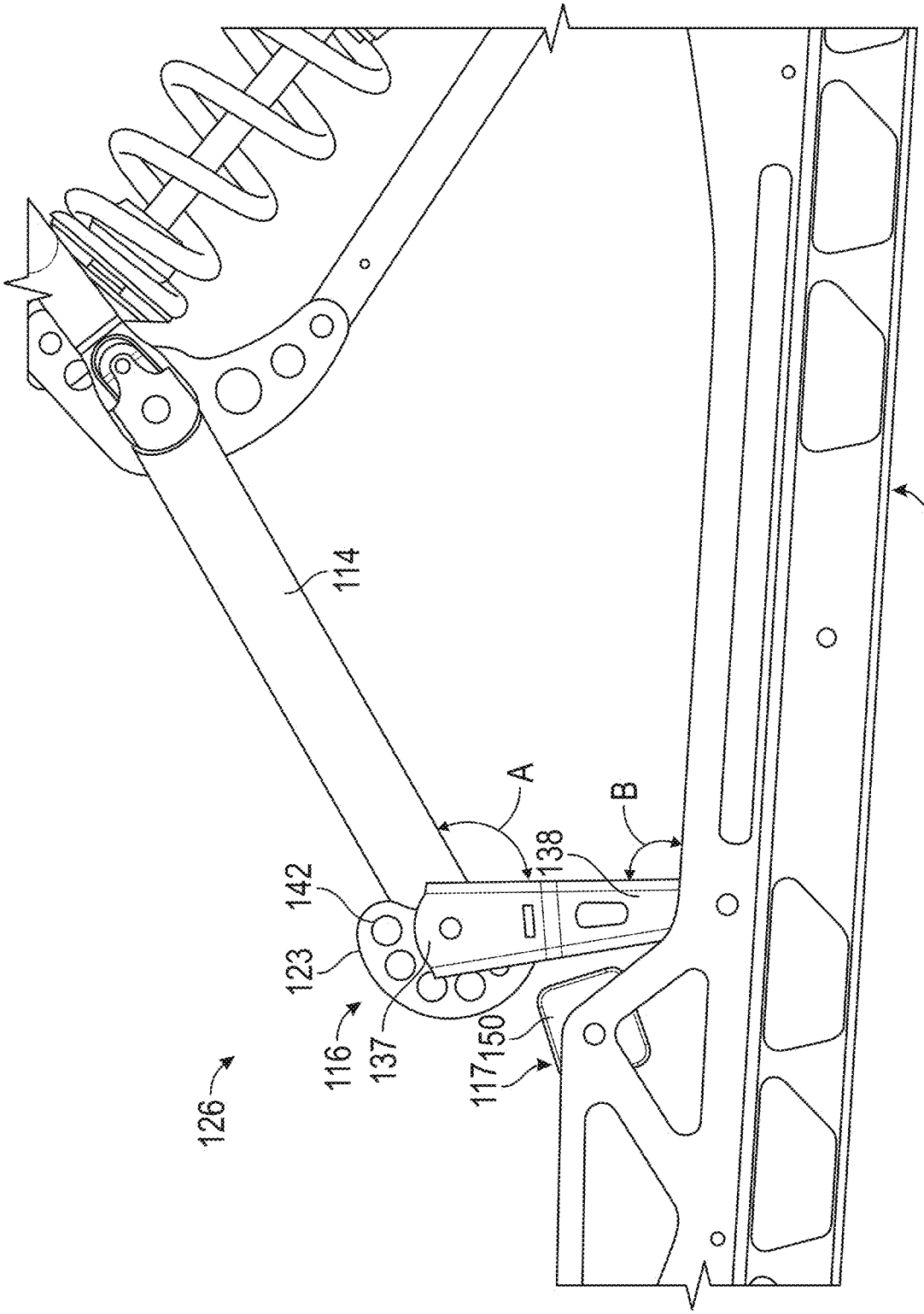

FIG. 9

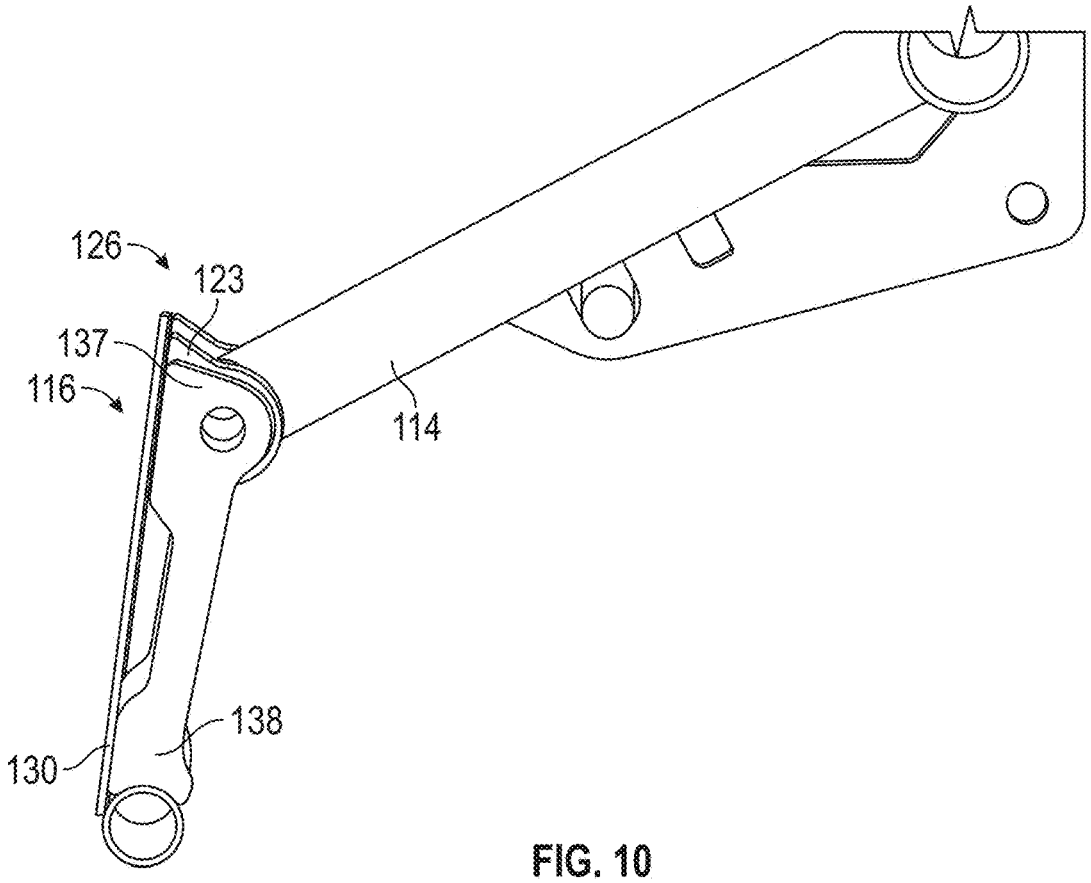
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FIG. 10

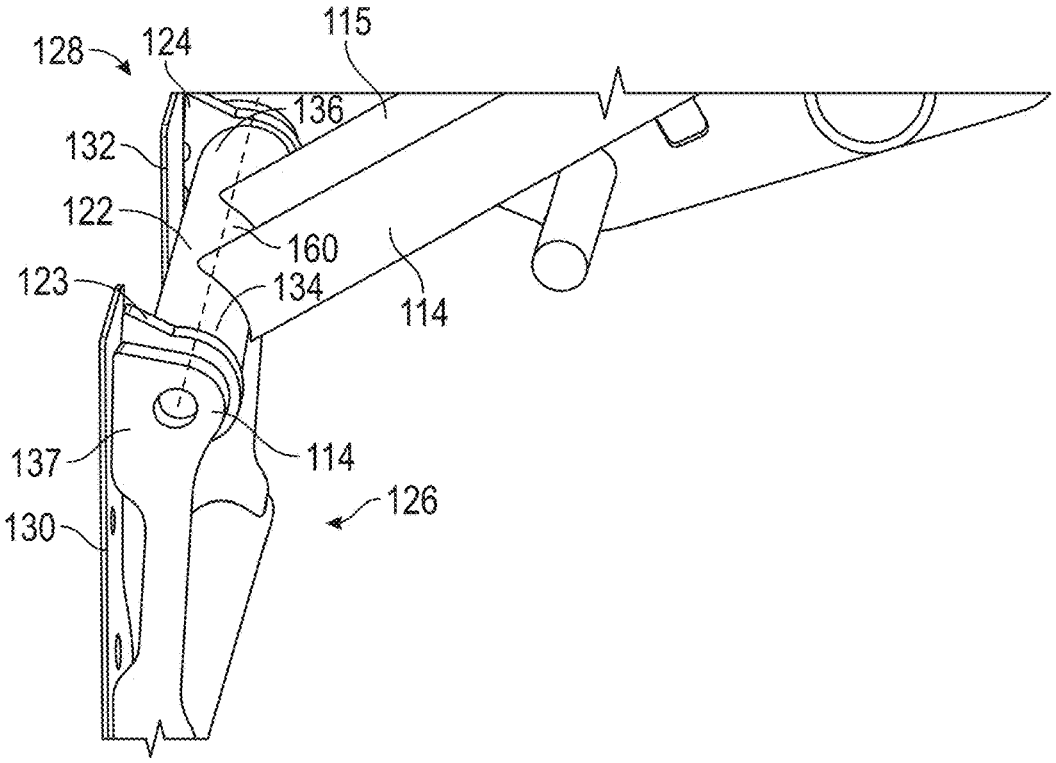
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FIG. 11

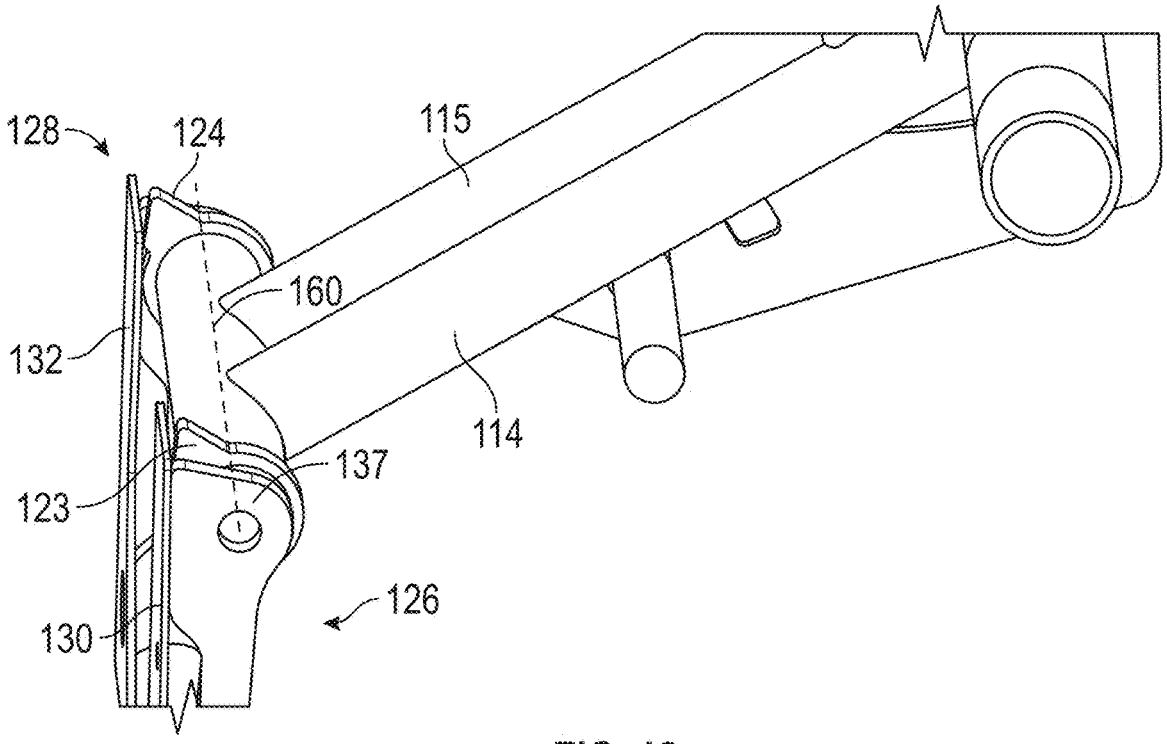
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FIG. 12

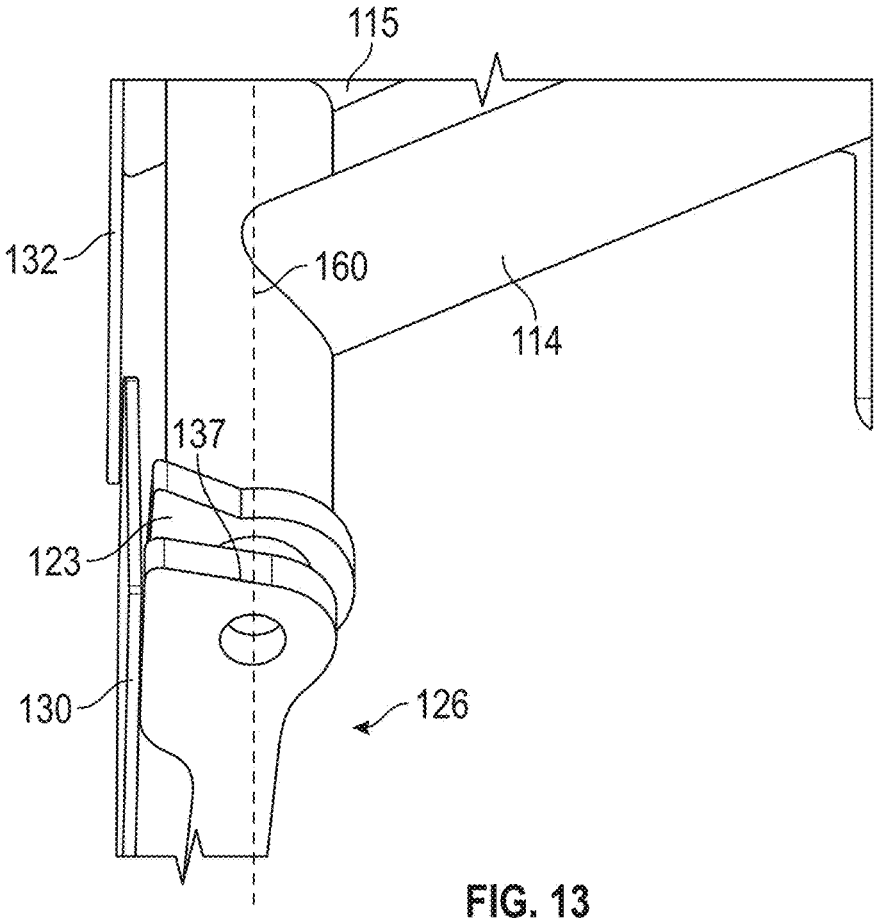
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FIG. 13

REAR SUSPENSION STOP

CROSS-REFERENCE TO RELATED PATENT APPLICATION

[0001] This application claims the benefit of and priority to U.S. Provisional Patent Application No. 63/650,645, filed May 22, 2024, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The present application relates to a suspension stop of a vehicle. More specifically, the present application relates to rear suspension stop of a snowmobile.

SUMMARY

[0003] One embodiment relates to a snowmobile. The snowmobile includes a frame and a tractive assembly pivotably coupled to the frame. The tractive assembly includes a first rail, a second rail, a first crossmember extending between the first rail and the second rail, an arm having a first end pivotably coupled to the frame and an opposing second end, and a stop assembly. The stop assembly includes a second crossmember coupled to the arm, a cam coupled to the second crossmember, a first bracket coupled to first ends of the first crossmember and the second crossmember, a second bracket coupled to opposing second ends of the first crossmember and the second crossmember, and one or more stops coupled to at least one of the first bracket or the second bracket, the one or more stops configured to engage a portion of the cam to selectively prevent rotation of the arm.

[0004] Another embodiment relates to a snowmobile including a frame and a tractive assembly pivotably coupled to the frame. The tractive assembly includes a first rail, a second rail, a first crossmember extending between the first rail and the second rail, a first arm, a second arm, a stop assembly, and a block stop. The first arm has a first end and an opposing second end. The first end is pivotably coupled to the frame. The second arm has a first end and an opposing second end. The first end of the second arm is pivotably coupled to the frame. The stop assembly includes a second crossmember coupled to the first arm and the second arm, a cam coupled to the second crossmember, a first bracket coupled to first ends of the first crossmember and the second crossmember, a second bracket coupled to opposing second ends of the first crossmember and the second crossmember, and one or more stops. The one or more stops are coupled to at least one of the first bracket or the second bracket. The one or more stops are configured to engage a portion of the cam to selectively prevent rotation of the first arm and the second arm. The block stop is configured to engage at least one of the first bracket or the second bracket to selectively prevent rotation of the first bracket and the second bracket. The block stop extends between the first rail and the second rail.

[0005] Still another embodiment relates to a snowmobile including a frame and a tractive assembly pivotably coupled to the frame. The tractive assembly includes a first rail, a second rail, a first crossmember extending between the first rail and the second rail, an arm, a stop assembly, and a block stop. The first arm has a first end and an opposing second end. The first end is pivotably coupled to the frame. A first angle is defined between the arm and the first rail. The stop assembly includes a second crossmember coupled to the arm, a cam coupled to the second crossmember, a first bracket coupled to first ends of the first crossmember and the second crossmember, a second bracket, and one or more stops. A second angle is defined between the arm and the first bracket. The second bracket is coupled to opposing second ends of the first crossmember and the second crossmember. The one or more stops are coupled to at least one of the first bracket or the second bracket. The one or more stops are configured to engage a portion of the cam to selectively prevent rotation of the arm. The second angle is limited by the one or more stops. The block stop is configured to engage at least one of the first bracket or the second bracket to selectively prevent rotation of the first bracket and the second bracket. The block stop extends between the first rail and the second rail. The first angle is limited by the block stop. A first distance from the first crossmember to a rearmost portion of the snowmobile is greater than a second distance from the block stop to the rearmost portion of the snowmobile. A third distance from a surface engaged by the tractive assembly to the first crossmember is less than a fourth distance from the surface engaged by the tractive assembly to the block stop.

[0006] This summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the devices or processes described herein will become apparent in the detailed description set forth herein, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a side view of a vehicle, according to an exemplary embodiment.

[0008] FIG. **2** is a schematic block diagram of the vehicle of FIG. **1**, according to an exemplary embodiment.

[0009] FIG. **3** is a perspective view of a rear portion of the vehicle of FIG. **1** including a rear stop assembly, according to an exemplary embodiment.

[0010] FIG. **4** is a side view of the rear portion of FIG. **3**, according to an exemplary embodiment.

[0011] FIG. **5** is another perspective view of the rear portion of FIG. **3**, according to an exemplary embodiment.

[0012] FIG. **6** is a detailed view of the rear portion of FIG. **5**, according to an exemplary embodiment.

[0013] FIG. **7** is a detailed view of the rear portion of FIG. **6**, according to an exemplary embodiment.

[0014] FIG. **8** is another side view of the rear portion of the vehicle of FIG. **1**, according to an exemplary embodiment.

[0015] FIG. **9** is a detailed view of the rear portion of FIG. **8**, according to an exemplary embodiment.

[0016] FIG. **10** is a side view of a rear stop assembly of the vehicle of FIG. **1**, according to another exemplary embodiment.

[0017] FIG. **11** is a perspective view of the rear stop assembly of FIG. **10**, according to an exemplary embodiment.

[0018] FIG. **12** is another perspective view of the rear stop assembly of FIG. **10**, according to an exemplary embodiment.

[0019] FIG. **13** is another perspective view of the rear stop assembly of FIG. **10**, according to an exemplary embodiment.

DETAILED DESCRIPTION

[0020] Before turning to the figures, which illustrate certain exemplary embodiments in detail, it should be understood that the present disclosure is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology used herein is for the purpose of description only and should not be regarded as limiting.

[0021] According to an exemplary embodiment, a rear stop assembly for a snowmobile is configured to limit an amount of movement and, therefore, an angle between components of a vehicle and a rear tractive assembly thereof. By way of example, the rear stop assembly may be configured to limit movement to a maximum angle by limiting a first angle between a rear arm and a bracket. The rear stop assembly may also be configured to allow a second angle between the bracket and a rail to adjust according to terrain changes. A stop coupled to the bracket is configured to span a distance between a first flange and a second flange of the bracket, causing the stop to reinforce the brackets and act as a structural bracing member to reinforce the bracket. This stop also assists in minimizing the weight of the rear stop assembly. The snowmobile may be more desirable to consumers seeking to summit a hill as effectively as possible without tipping backwards.

Overall Vehicle

[0022] As shown in FIGS. **1** and **2**, a machine or vehicle, shown as vehicle **10**, includes a chassis, shown as frame **12**; a body assembly, shown as body **20**, coupled to the frame **12** and having an occupant portion or section, shown as occupant seating area **30**; operator input and output devices, shown as operator controls **40**, that are disposed within the occupant seating area **30**; a drivetrain, shown as driveline **50**, coupled to the frame **12** and at least partially disposed under the body **20**; a vehicle suspension system, shown as suspension system **60**, coupled to the frame **12** and one or more components of the driveline **50**; a vehicle braking system, shown as braking system **70**, coupled to one or more components of the driveline **50** to facilitate selectively braking the one or more components of the driveline **50**; one or more first sensors, shown as sensors **90**; and a vehicle control system, shown as vehicle controller **100**, coupled to the operator controls **40**, the driveline **50**, the suspension system **60**, the braking system **70**, and the sensors **90**. In some embodiments, the vehicle **10** includes more or fewer components.

[0023] According to an exemplary embodiment, the vehicle **10** is a tracked, winter-focused off-road machine or vehicle configured to be operated on a snowy and/or icy surface (e.g., operated in snow, on ice, etc.). In some embodiments, the tracked, winter-focused off-road machine or vehicle is a lightweight or recreational machine or vehicle such as a snowmobile, a snow bike, a snow scooter, a snow all-terrain vehicle ("ATV"), a snow utility task vehicle ("UTV"), a snow plow machine, and/or another type of lightweight or recreational machine configured to be operated on a snowy and/or icy surface. In other embodiments, the tracked, snow-focused off-road machine or vehicle is a large machine or vehicle such as a snowcat, a snow groomer, a snow plow machine, a tractor, and/or another type of large machine or vehicle configured to be operated on a snowy and/or icy surface. In still other embodiments, the vehicle **10** is a non-tracked, off-road machine or vehicle such as an ATV, a UTV, a dirt bike, and/or another type of non-tracked, off-road machine or vehicle.

[0024] According to the exemplary embodiment shown in FIG. **1**, the occupant seating area **30** includes a first seat, shown as operator seat **32**, configured to support an operator of the vehicle **10**. In some embodiments, the occupant seating area **30** includes a double seat configured to support the operator of the vehicle **10** and a passenger of the vehicle **10** behind the operator, or a triple seat configured to support the operator of the vehicle **10** and two passengers of the vehicle **10** behind the operator. In some embodiments, the occupant seating area **30** includes a second seat positioned rearward of or to the side of the operator seat **32**. The second seat may be configured to support passengers of the vehicle **10**. In some embodiments, in addition to or in place of the second seat, the vehicle **10** includes one or more rear accessories. Such rear accessories may include a ski rack, a bed, a cargo body (e.g., for a storage, etc.), and/or other rear accessories.

[0025] According to an exemplary embodiment, the operator controls **40** are configured to provide an operator with the ability to control one or more functions of and/or provide commands to the vehicle **10** and the components thereof (e.g., turn on, turn off, drive, turn, brake, engage various operating modes, raise/lower an implement, etc.). As shown in FIGS. **1** and **2**, the operator controls **40** include a steering interface (e.g., a handlebar, a steering column, a handlebar assembly, joystick(s), a steering wheel, etc.), shown as handlebar **42**, an accelerator interface (e.g., a pedal, a throttle, a throttle lever, etc.), shown as accelerator **44**, a braking interface (e.g., a brake pedal, a brake lever, a brake arm, etc.), shown as brake **46**, and one or more additional interfaces (e.g., a light control interface, an operational mode interface, etc.), shown as operator interfaces **48**. The operator interface **48** may include one or more displays and one or more input devices. The one or more displays may be or include a touchscreen, an LCD display, a LED display, a speedometer, gauges, warning lights, etc. The one or more input device may be or include buttons, switches, knobs, levers, dials, etc.

[0026] According to an exemplary embodiment, the driveline **50** is configured to propel the vehicle **10**. As shown in FIGS. **1** and **2**, the driveline **50** includes a primary driver, shown as prime mover **52**, an energy storage device, shown as energy storage **54**, a first tractive assembly (e.g., tracks, treads, axles, differentials, etc.), shown as rear tractive assembly **56**, and a second tractive assembly (e.g., skis, runners, slides, etc.), shown as front tractive assembly **58**. In some embodiments, the driveline **50** is a conventional driveline whereby the prime mover **52** is an internal combustion engine and the energy storage **54** is a fuel tank. The internal combustion engine may be a spark-ignition internal combustion engine or a compression-ignition internal combustion engine that may use any suitable fuel type (e.g., diesel, ethanol, gasoline, natural gas, propane, etc.). In some embodiments, the driveline **50** is an electric driveline whereby the prime mover **52** is an electric motor and the energy storage **54** is a battery system. In some embodiments, the driveline **50** is a fuel cell electric driveline whereby the prime mover **52** is an electric motor and the energy storage **54** is a fuel cell (e.g., that stores hydrogen, that produces electricity from the hydrogen, etc.). In some embodiments, the driveline **50** is a hybrid driveline whereby (i) the prime

mover **52** includes an internal combustion engine and an electric motor/generator and (ii) the energy storage **54** includes a fuel tank and/or a battery system.

[0027] According to the exemplary embodiment shown in FIG. **1**, the rear tractive assembly **56** includes a rear tractive element that is configured as a track and the front tractive assembly **58** includes front tractive elements configured as skis. For example, the rear tractive element may be configured as a track configured to engage a snowy surface in order to drive the vehicle **10** and the front skis may be configured to slide or glide along the snowy surface. In some embodiments, the rear tractive assembly **56** includes a plurality of the rear tractive elements configured as tracks. In some embodiments, the front tractive assembly **58** includes front tractive elements that are configured as tracks. In other embodiments, the front tractive assembly **58** and the rear tractive assembly **56** include tractive elements that are configured as wheels.

[0028] According to an exemplary embodiment, the prime mover **52** is configured to provide power to drive the rear tractive assembly **56** (e.g., to provide rear-track drive, etc.). In some embodiments, the prime mover **52** is configured to provide power to drive the rear tractive assembly **56** and/or the front tractive assembly **58** (e.g., to provide front-track drive, to provide all-track drive, etc.). In some embodiments, the driveline **50** includes a transmission device (e.g., a gearbox, a continuous variable transmission ("CVT"), etc.) positioned between (a) the prime mover **52** and (b) the rear tractive assembly **56**. In a non-track arrangement, the rear tractive assembly **56** may include a drive shaft, a differential, and/or an axle. In such non-track arrangement, the rear tractive assembly **56** includes two axles or a tandem axle arrangement. According to an exemplary embodiment, the front tractive assembly **58** is steerable (e.g., using the handlebar **42**). In some embodiments, the rear tractive assembly **56** is additionally or alternatively steerable. In some embodiments, both the rear tractive assembly **56** and the front tractive assembly **58** are fixed and not steerable (e.g., employ skid steer operations).

[0029] In some embodiments, the driveline **50** includes a plurality of prime movers **52**. By way of example, the driveline **50** may include a first of the prime movers **52** that drives a first one of the rear tractive elements and a second of the prime movers **52** that drives a second one of the rear tractive elements when the rear tractive assembly **56** includes two rear tractive elements.

[0030] According to an exemplary embodiment, the suspension system **60** includes one or more suspension components (e.g., shocks, dampers, springs, etc.) positioned between the frame **12** and one or more components (e.g., tractive elements, axles, etc.) of the rear tractive assembly **56** and/or the front tractive assembly **58**. In some embodiments, the vehicle **10** does not include the suspension system **60**.

[0031] According to an exemplary embodiment, the braking system **70** includes one or more braking components (e.g., disc brakes, drum brakes, in-board brakes, axle brakes, etc.) positioned to facilitate selectively braking one or more components of the driveline **50**. In some embodiments, the one or more braking components include one or more rear braking components positioned to facilitate braking one or more components of the rear tractive assembly **56** (e.g., the rear axle, the rear tractive elements, etc.). In some embodiments (e.g., embodiments with two rear tractive elements), the one or more rear braking components include two rear braking components, one positioned to facilitate braking each of the rear tractive elements.

[0032] The sensors **90** may include various sensors positioned about the vehicle **10** to acquire vehicle information or vehicle data regarding operation of the vehicle **10** and/or the location thereof. By way of example, the sensors **90** may include an accelerometer, a gyroscope, a compass, a position sensor (e.g., a GPS sensor, etc.), suspension sensor(s), wheel/track sensors, an audio sensor or microphone, a camera, an optical sensor, a proximity detection sensor, and/or other sensors to facilitate acquiring vehicle information or vehicle data regarding operation of the vehicle **10** and/or the location thereof. According to an exemplary embodiment, one or more of the sensors **90** are configured to facilitate detecting and obtaining vehicle telemetry data including position of the vehicle **10**, whether the vehicle **10** is moving, travel direction of the vehicle **10**, slope of the vehicle **10**, speed of the vehicle **10**, vibrations experienced by the vehicle **10**, sounds proximate the vehicle **10**, suspension travel of components of the suspension system **60**, and/or other vehicle telemetry data.

[0033] The vehicle controller **100** may be implemented as a general-purpose processor, an application specific integrated circuit ("ASIC"), one or more field programmable gate arrays ("FPGAs"), a digital-signal-processor ("DSP"), circuits containing one or more processing components, circuitry for supporting a microprocessor, a group of processing components, or other suitable electronic processing components. According to the exemplary embodiment shown in FIG. **2**, the vehicle controller **100** includes a processing circuit **102**, a memory **104**, and a communications interface **106**. The processing circuit **102** may include an ASIC, one or more FPGAs, a DSP, circuits containing one or more processing components, circuitry for supporting a microprocessor, a group of processing components, or other suitable electronic processing components. In some embodiments, the processing circuit **102** is configured to execute computer code stored in the memory **104** to facilitate the activities described herein. The memory **104** may be any volatile or non-volatile or non-transitory computer-readable storage medium capable of storing data or computer code relating to the activities described herein. According to an exemplary embodiment, the memory **104** includes computer code modules (e.g., executable code, object code, source code, script code, machine code, etc.) configured for execution by the processing circuit **102**. In some embodiments, the vehicle controller **100** may represent a collection of processing devices. In such cases, the processing circuit **102** represents the collective processors of the devices, and the memory **104** represents the collective storage devices of the devices.

[0034] In one embodiment, the vehicle controller **100** is configured to selectively engage, selectively disengage, control, or otherwise communicate with components of the vehicle **10** (e.g., via the communications interface **106**, a controller area network ("CAN") bus, etc.). According to an exemplary embodiment, the vehicle controller **100** is coupled to (e.g., communicably coupled to) components of the operator controls **40** (e.g., the handlebar **42**, the accelerator **44**, the brake **46**, the operator interface **48**, etc.), components of the driveline **50** (e.g., the prime mover **52**), components of the braking system **70**, and the sensors **90**. By way of example, the vehicle controller **100** may send and receive signals (e.g., control signals, location signals, etc.)

with the components of the operator controls **40**, the components of the driveline **50**, the components of the braking system **70**, the sensors **90**, and/or remote systems or devices (via the communications interface **106** as described in greater detail herein).

Rear Suspension Stop

[0035] As shown in FIGS. **3-6** and **7-9**, the rear tractive assembly **56** includes a first longitudinal frame element (e.g., ski, runner, slide, guide, arm, rail, etc.), shown as first trailing arm **108**, a second longitudinal frame element (e.g., ski, runner, slide, guide, arm, rail, etc.), shown as second trailing arm **110**, a first connection brace, shown as first connection brace **112**, and a second connection brace, shown as second connection brace **113**. The first trailing arm **108** is substantially parallel to the second trailing arm **110**. According to an exemplary embodiment, the first trailing arm **108** and the second trailing arm **110** are configured to engage a ground surface (e.g., snow) and guide a lower portion of a track of the rear tractive assembly **56** (see, e.g., FIG. **1**). As shown in FIGS. **3-6** and **7-9**, the first connection brace **112** is coupled to the first trailing arm **108** along an exterior surface (e.g., a surface of the first trailing arm **108** facing towards the surrounding area of the vehicle **10**) of the first trailing arm **108** and the second connection brace **113** is coupled to the second trailing arm **110** along an exterior facing surface (e.g., a surface of the second trailing arm **110** facing towards the surrounding area of the vehicle **10**) of the second trailing arm **110**. In some embodiments, the first connection brace **112** is coupled to the first trailing arm **108** along an interior facing surface (e.g., a surface of the first trailing arm **108** facing towards the second trailing arm **110**, etc.) of the first trailing arm **108**. In some embodiments, the second connection brace **113** is coupled to the second trailing arm **110** along an interior facing surface (e.g., a surface of the second trailing arm **110** facing towards the first trailing arm **108**, etc.) of the first trailing arm **108**.

[0036] As shown in FIGS. **3-9**, the rear tractive assembly **56** includes a first suspension arm, shown as first rear suspension arm **114**, a second suspension arm, shown as second rear suspension arm **115**, a first stop assembly, shown as rear suspension stop **116**, a second stop assembly, shown as block stop **117**, and a first crossmember or connector bar, shown as connecting rod **118**. As shown in FIG. **5**, first or upper ends of the first rear suspension arm **114** and the second rear suspension arm **115** are, and thereby the rear tractive assembly **56** is, pivotably coupled to a portion of the frame **12** of the vehicle **10** and a rear suspension component such as a coil-over suspension element (e.g., via a tubular element connected to the upper ends thereof). As shown in FIGS. **3-9**, opposing second or lower ends of the first rear suspension arm **114** and the second rear suspension arm **115** are coupled to a portion of the rear suspension stop **116**. According to an exemplary embodiment, the lower ends of the first rear suspension arm **114** and the second rear suspension arm **115** are angled towards each other and the upper ends of the first rear suspension arm **114** and the second rear suspension arm **115** are angled away from each other. As shown in FIGS. **3**, **5**, and **6**, the connecting rod **118** extends between the interior surfaces of the first trailing arm **108** and the second trailing arm **110**, and one or more portions (e.g., brackets) of the rear suspension stop **116** are coupled to the connecting rod **118**, as described in greater detail herein.

[0037] As shown in FIGS. **3-9**, the block stop **117** includes (a) a connecting member, shown as a block stop rod **154**, having a first end, shown as first block stop end **119**, coupled to the first connection brace **112** and an opposing second end, shown as second block stop end **120**, coupled to the second connection brace **113**, (b) a first stop feature (e.g., contacting piece), shown as first block **150**, coupled to the block stop rod **154** and positioned proximate the first block stop end **119**, and (c) a second stop feature (e.g., contacting piece), shown as second block **152**, coupled to the block stop rod **154** and positioned proximate the second block stop end **120**. According to an exemplary embodiment, a first distance from the block stop **117** to a rearmost portion **121** of the rear tractive assembly **56** is less than a second distance from the rear suspension stop **116** to the rearmost portion **121** of the rear tractive assembly **56**. A third distance from a surface engaged by the rear tractive assembly **56** to the connecting rod **118** is less than a fourth distance from the surface engaged by the rear tractive assembly **56** to the block stop rod **154**. A fifth distance from the rearmost portion **121** of the rear tractive assembly **56** to the connecting rod **118** is greater than a sixth distance from the rearmost portion **121** of the rear tractive assembly **56** to the block stop rod **154**. In some embodiments the block stop **117** is coupled directly to the first trailing arm **108** and the second trailing arm **110**. In such embodiments, the first connection brace **112** and the second connection brace **113** may be omitted.

[0038] As shown in FIGS. **5-9**, the rear suspension stop **116** includes (a) a second

[0039] crossmember or connector bar, shown as crossmember **122**, having a first end, shown as first crossmember end **134**, and an opposing second end, shown as second crossmember end **136**, (b) a first stop feature (e.g., projection, locking piece, retainer, etc.), shown as first cam **123**, coupled to the crossmember **122** and an positioned proximate the first crossmember end **134**, (c) a second stop feature (e.g., projection, locking piece, retainer, etc.), shown as second cam **124**, coupled to the crossmember **122** and an positioned proximate the second crossmember end **136**, (d) a first support, shown as first bracket **126**, having (i) a first end, shown as upper end **137**, coupled to the first crossmember end **134** of the crossmember **122** and (ii) an opposing second end, shown as lower end **138**, coupled to the connecting rod **118**, and (e) a second support, shown as second bracket **128**, having (i) a first end, shown as upper end **139**, coupled to the second crossmember end **136** of the crossmember **122** and (ii) an opposing second end, shown as lower end **140**, coupled to the connecting rod **118**.

[0040] As shown in FIGS. **5-7**, (a) the lower ends of first rear suspension arm **114** and the second rear suspension arm **115** are coupled to the crossmember **122** and (b) the first cam **123** and the second cam **124** are positioned between the first bracket **126** and the second bracket **128**. The first rear suspension arm **114** is positioned closer to the first bracket **126** and the first cam **123** than the second bracket **128** and the second cam **124**. The second rear suspension arm **115** is positioned closer to the second bracket **128** and the second cam **124** than the first bracket **126** and the first cam **123**. In some embodiments, the first rear suspension arm **114** and the second rear suspension arm **115** are coupled to the crossmember **122** equidistance from the first bracket **126** and the second bracket **128**. According to an exemplary embodiment, the first rear suspension arm **114**, the second rear suspension arm **115**, the crossmember **122**, the first cam **123**,

and the second cam **124** are configured to pivot or rotate (a) together about a first longitudinal axis, shown as center axis **160**, of the crossmember **122** and (b) relative to the upper end **137** of the first bracket **126** and the upper end **139** of the second bracket **128**. In some embodiments, as shown in FIGS. **6** and **9**, the first cam **123** and the second cam **124** define a series of apertures, shown as cam apertures **142**, along the curved periphery thereof.

[0041] As shown in FIGS. **5** and **6**, the first bracket **126** includes a first flange, shown as front flange **143**, and a second flange, shown as rear flange **144**, spaced from the front flange **143**. The front flange **143** and the rear flange **144** extend inward and parallel to the crossmember **122**. The front flange **143** and the rear flange **144** extend inward more at the lower end **138** of the first bracket **126** than at the upper end **137** of the first bracket **126**. Stated another way, the front flange **143** and the rear flange **144** gradually increase in depth from the upper end **137** to the lower end **138**. As shown in FIGS. **5** and **6**, the second bracket **128** includes a first flange, shown as front flange **145**, and a second flange, shown as rear flange **146**, spaced from the front flange **145**. The front flange **145** and the rear flange **146** extend inward and parallel to the crossmember **122**. The front flange **145** and the rear flange **146** extends inward more at the lower end **140** of the second bracket **128** than at the upper end **139** of the second bracket **128**. Stated another way, the front flange **145** and the rear flange **146** gradually increase in depth from the upper end **139** to the lower end **140**. In some embodiments the depth of the flanges is consistent along the length of the first bracket **126** and/or the second bracket **128**.

[0042] As shown in FIGS. **5-7**, the rear suspension stop **116** includes (a) a first retainer, shown as first stop **130**, coupled to an interior surface of the first bracket **126** between the upper end **137**, the lower end **138**, the front flange **143**, and the rear flange **144** thereof and (b) a second retainer, shown as second stop **132**, coupled to an interior surface of the second bracket **128** between the upper end **139**, the lower end **140**, the front flange **145**, and the rear flange **146** thereof. As shown in FIG. **7**, the second stop **132** (and similarly the first stop **130**) includes an attachment portion, shown as base **147**, and a projection portion, shown as projection **148** (shown in FIG. **7**). The base **147** of the first stop **130** and the second stop **132** engages with and is received by an interface (e.g., an aperture) of the first bracket **126** and the second bracket **128**, respectively. The first stop **130** and the second stop **132** span the distance between the flanges of the first bracket **126** and the second bracket **128** such that the first stop **130** and the second stop **132** act as a brace (e.g., a structural bracing member to reinforce the bracket). The projection **148** extends from the base **147**, proximate the front flange **143** of the first bracket **126** and the front flange **145** of the second bracket **128** (e.g., the projections **148** extend along the inner surface of the front flange **143** and the front flange **145**, such that the first stop **130** and the second stop **132** have a "L-shape," etc.). The projections **148** are configured to selectively engage a portion or surface of first cam **123** and the second cam **124** to limit or prevent rotation of the first rear suspension arm **114**, the second rear suspension arm **115**, the crossmember **122**, the first cam **123**, and the second cam **124** are about the center axis **160** of the crossmember **122** more than a pre-configured, first maximum angle in a first rotational direction (e.g., counterclockwise). In some embodiments, the first stop **130** and the second stop **132** are integrated with the first bracket **126** and the second bracket **128** to create a singular piece. In some embodiments, the first stop **130** and the second stop **132** only engage with the front flange **143** and the front flange **145**. In some embodiments, the first stop **130** and the second stop **132** are otherwise shaped, (e.g., a rectangle, a square, an I-shape, an ovular shape, etc.). In some embodiments the first stop **130** and the second stop **132** define apertures to limit the weight thereof.

[0043] According to an exemplary embodiment, the connecting rod **118** is configured to rotate and, thereby, the lower end **138** of the first bracket **126** and the lower end **140** of the second bracket **128** are configured to rotate, about a second longitudinal axis, shown as center axis **162**, of the connecting rod **118**. According to an exemplary embodiment, the first block **150** is configured (e.g., positioned, sized, etc.) to selectively engage with the rear flange **144** of the first bracket **126** and the second block **152** is configured (e.g., positioned, sized, etc.) to selectively engage with the rear flange **146** of the second bracket **128**. The block stop **117** is configured to prevent or limit movement of the lower end **138** of the first bracket **126** and the lower end **140** of the second bracket **128** about the center axis **162** of the connecting rod **118** by more than a pre-configured, second maximum angle in an opposing second rotational direction (e.g., clockwise). Preventing further movement causes front suspension components of the vehicle **10** to also compresses. Therefore, for the first bracket **126** and the second bracket **128** to move any further, both the rear and the front suspension components of the vehicle **10** must be compressed. The second angle adjustment provides a float function that allows the first trailing arm **108** and the second trailing arm **110** to dropout in holes and terrain changes so that the rear tractive assembly **56** can maintain proper traction with the ground (e.g., snow).

[0044] Referring now to FIGS. **8** and **9**, side views of the rear suspension stop **116** and a first angle A and a second angle B are shown. The first angle A is defined between (a) the first rear suspension arm **114** and the second rear suspension arm **115** and (b) the front flange **143** and the front flange **145** of the first bracket **126** and the second bracket **128**, respectively. The second angle B is defined between (a) the first trailing arm **108** and the second trailing arm **110** and (b) the front flange **143** and the front flange **145** of the first bracket **126** and the second bracket **128**, respectively.

[0045] Referring now to FIGS. **10-13**, an alternate embodiment of the rear suspension stop **116** is shown. The rear suspension stop **116** may be similar to the rear suspension stop **116** of FIGS. **3-9**, except as otherwise described herein. The first bracket **126** and the second bracket **128** do not include the flanges. The first stop **130** is configured as a vertical plate that extend between and is coupled to the lower end **138** of the first bracket **126** and the upper end **137** of the first bracket **126**. The second stop **132** is similarly configured as a vertical plate that extends between and is coupled to the lower end **140** of the second bracket **128** and the upper end **139** of the second bracket **128**. The first cam **123** and the second cam **124** rotate about the center axis **160** of the crossmember **122** until the first cam **123** and the second cam **124** contact a face of the first stop **130** and the second stop **132**, respectively.

[0046] As utilized herein with respect to numerical ranges, the terms "approximately," "about," "substantially," and similar terms generally mean +/−10% of the disclosed values, unless specified otherwise. As utilized herein with

respect to structural features (e.g., to describe shape, size, orientation, direction, relative position, etc.), the terms "approximately," "about," "substantially," and similar terms are meant to cover minor variations in structure that may result from, for example, the manufacturing or assembly process and are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the disclosure as recited in the appended claims.

[0047] It should be noted that the term "exemplary" and variations thereof, as used herein to describe various embodiments, are intended to indicate that such embodiments are possible examples, representations, or illustrations of possible embodiments (and such terms are not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

[0048] The term "coupled" and variations thereof, as used herein, means the joining of two members directly or indirectly to one another. Such joining may be stationary (e.g., permanent or fixed) or moveable (e.g., removable or releasable). Such joining may be achieved with the two members coupled directly to each other, with the two members coupled to each other using a separate intervening member and any additional intermediate members coupled with one another, or with the two members coupled to each other using an intervening member that is integrally formed as a single unitary body with one of the two members. If "coupled" or variations thereof are modified by an additional term (e.g., directly coupled), the generic definition of "coupled" provided above is modified by the plain language meaning of the additional term (e.g., "directly coupled" means the joining of two members without any separate intervening member), resulting in a narrower definition than the generic definition of "coupled" provided above. Such coupling may be mechanical, electrical, or fluidic.

[0049] References herein to the positions of elements (e.g., "top," "bottom," "above," "below") are merely used to describe the orientation of various elements in the figures. It should be noted that the orientation of various elements may differ according to other exemplary embodiments, and that such variations are intended to be encompassed by the present disclosure.

[0050] The hardware and data processing components used to implement the various processes, operations, illustrative logics, logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose single-or multi-chip processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, or, any conventional processor, controller, microcontroller, or state machine. A processor also may be implemented as a combination of computing devices, such as a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. In some embodiments, particular processes and methods may be performed by circuitry that is specific to a given function. The memory (e.g., memory, memory unit, storage device) may include one or more devices (e.g., RAM, ROM, Flash memory, hard disk storage) for storing data and/or computer code for completing or facilitating the various processes, layers and modules described in the present disclosure. The memory may be or include volatile memory or non-volatile memory, and may include database components, object code components, script components, or any other type of information structure for supporting the various activities and information structures described in the present disclosure. According to an exemplary embodiment, the memory is communicably connected to the processor via a processing circuit and includes computer code for executing (e.g., by the processing circuit or the processor) the one or more processes described herein.

[0051] The present disclosure contemplates methods, systems, and program products on any machine-readable media for accomplishing various operations. The embodiments of the present disclosure may be implemented using existing computer processors, or by a special purpose computer processor for an appropriate system, incorporated for this or another purpose, or by a hardwired system. Embodiments within the scope of the present disclosure include program products comprising machine-readable media for carrying or having machine-executable instructions or data structures stored thereon. Such machine-readable media can be any available media that can be accessed by a general purpose or special purpose computer or other machine with a processor. By way of example, such machine-readable media can comprise RAM, ROM, EPROM, EEPROM, or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code in the form of machine-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer or other machine with a processor. Combinations of the above are also included within the scope of machine-readable media. Machine-executable instructions include, for example, instructions and data which cause a general purpose computer, special purpose computer, or special purpose processing machines to perform a certain function or group of functions.

[0052] Although the figures and description may illustrate a specific order of method steps, the order of such steps may differ from what is depicted and described, unless specified differently above. Also, two or more steps may be performed concurrently or with partial concurrence, unless specified differently above. Such variation may depend, for example, on the software and hardware systems chosen and on designer choice. All such variations are within the scope of the disclosure. Likewise, software implementations of the described methods could be accomplished with standard programming techniques with rule-based logic and other logic to accomplish the various connection steps, processing steps, comparison steps, and decision steps.

[0053] It is important to note that the construction and arrangement of the vehicle **10** and the systems and components thereof (e.g., the body **20**, the operator controls **40**, the driveline **50**, the suspension system **60**, the braking system **70**, the sensors **90**, the vehicle controller **100**, etc.) as shown in the various exemplary embodiments is illustrative only.

Additionally, any element disclosed in one embodiment may be incorporated or utilized with any other embodiment disclosed herein.

1. A snowmobile comprising:
- a frame; and
- a tractive assembly pivotably coupled to the frame, the tractive assembly including:
  - a first rail;
  - a second rail;
  - a first crossmember extending between the first rail and the second rail;
  - an arm having a first end and an opposing second end, the first end pivotably coupled to the frame; and
  - a stop assembly including:
    - a second crossmember coupled to the arm;
    - a cam coupled to the second crossmember;
    - a first bracket coupled to first ends of the first crossmember and the second crossmember;
    - a second bracket coupled to opposing second ends of the first crossmember and the second crossmember; and
    - one or more stops coupled to at least one of the first bracket or the second bracket, the one or more stops configured to engage a portion of the cam to selectively prevent rotation of the arm.

2. The snowmobile of claim **1**, wherein the tractive assembly includes a block stop configured to engage at least one of the first bracket or the second bracket to selectively prevent rotation of the first bracket and the second bracket, the block stop extending between the first rail and the second rail.

3. The snowmobile of claim **2**, wherein a first angle is defined between the arm and the first bracket and a second angle is defined between the arm and the first rail, the first angle limited by the one or more stops, the second angle limited by the block stop.

4. The snowmobile of claim **2**, wherein a first distance from the first crossmember to a rearmost portion of the snowmobile is greater than a second distance from the block stop to the rearmost portion of the snowmobile.

5. The snowmobile of claim **2**, wherein the block stop includes:
- a block stop rod having a first end and an opposing second end, the block stop rod extending between the first rail and the second rail;
- a first block positioned proximate the first end of the block stop rod and configured to engage the first bracket; and
- a second block positioned proximate the second end of the block stop rod and configured to engage the second bracket.

6. The snowmobile of claim **5**, wherein a first distance from a surface engaged by the tractive assembly to the first crossmember is less than a second distance from the surface engaged by the tractive assembly to the block stop rod.

7. The snowmobile of claim **1**, wherein the one or more stops includes a first stop coupled to an inner surface of the first bracket and a second stop coupled to an inner surface of the second bracket.

8. The snowmobile of claim **7**, wherein the cam is a first cam and the stop assembly includes a second cam coupled to the second crossmember, the second stop configured to engage the second cam, the first stop configured to engage the first cam.

9. The snowmobile of claim **8**, wherein the first stop and the second stop each include:
- a base coupled to a respective one of the first bracket or the second bracket; and
- a projection extending from the base and configured to engage with a respective one of the first cam or the second cam.

10. The snowmobile of claim **8**, wherein each of the first stop and the second stop have an L-shape.

11. The snowmobile of claim **1**, wherein the first bracket includes:
- a rear flange; and
- a front flange, each of the rear flange and the front flange of the first bracket extending towards the second bracket and substantially parallel to the second crossmember.

12. The snowmobile of claim **11**, wherein the second bracket includes:
- a rear flange; and
- a front flange, each of the rear flange and the front flange of the second bracket extending towards the first bracket and substantially parallel to the second crossmember.

13. The snowmobile of claim **12**, wherein the one or more stops include a first stop and a second stop, the first stop coupled to the first bracket and disposed between the rear flange and the front flange of the first bracket, and the second stop coupled to the second bracket and disposed between the rear flange and the front flange of the second bracket.

14. The snowmobile of claim **12**, wherein each of the first bracket and the second bracket has an upper end and a lower end, wherein the lower end is coupled to the first crossmember, the upper end is coupled to the second crossmember, and wherein each of the rear flange and the front flange increases in depth from the upper end to the lower end.

15. The snowmobile of claim **12**, wherein the stop assembly includes a block stop, the block stop including:
- a block stop rod extending between the first rail and the second rail;
- a first block coupled to the block stop rod, the first block configured to engage the rear flange of the first bracket; and
- a second block coupled to the block stop rod, the second block configured to engage the rear flange of the second bracket.

16. The snowmobile of claim **1**, wherein the arm is a first arm and the tractive assembly includes a second arm having a first end and an opposing second end, the first end of the second arm pivotably coupled to the frame, the second crossmember coupled to the second arm.

17. The snowmobile of claim **16**, wherein:
- the cam is a first cam;
- the stop assembly includes a second cam coupled to the second crossmember;
- the first arm is positioned closer to the first bracket and the first cam than the second bracket and the second cam; and
- the second arm is positioned closer to the second bracket and the second cam than the first bracket and the first cam.

18. The snowmobile of claim **17**, wherein the one or more stops include at least one of:

a first plate extending between and coupled to a lower end of the first bracket and an upper end of the first bracket; or

a second plate extending between and coupled to a lower end of the second bracket and an upper end of the second bracket.

19. A snowmobile comprising:

a frame; and

a tractive assembly pivotably coupled to the frame, the tractive assembly including:

a first rail;

a second rail;

a first crossmember extending between the first rail and the second rail;

a first arm having a first end and an opposing second end, the first end pivotably coupled to the frame;

a second arm having a first end and an opposing second end, the first end of the second arm pivotably coupled to the frame;

a stop assembly including:

a second crossmember coupled to the first arm and the second arm;

a cam coupled to the second crossmember;

a first bracket coupled to first ends of the first crossmember and the second crossmember;

a second bracket coupled to opposing second ends of the first crossmember and the second crossmember; and

one or more stops coupled to at least one of the first bracket or the second bracket, the one or more stops configured to engage a portion of the cam to selectively prevent rotation of the first arm and the second arm; and

a block stop configured to engage at least one of the first bracket or the second bracket to selectively prevent rotation of the first bracket and the second bracket, the block stop extending between the first rail and the second rail.

20. A snowmobile comprising:

a frame; and

a tractive assembly pivotably coupled to the frame, the tractive assembly including:

a first rail;

a second rail;

a first crossmember extending between the first rail and the second rail;

an arm having a first end and an opposing second end, the first end pivotably coupled to the frame, a first angle defined between the arm and the first rail;

a stop assembly including:

a second crossmember coupled to the arm;

a cam coupled to the second crossmember;

a first bracket coupled to first ends of the first crossmember and the second crossmember, a second angle defined between the arm and the first bracket;

a second bracket coupled to opposing second ends of the first crossmember and the second crossmember; and

one or more stops coupled to at least one of the first bracket or the second bracket, the one or more stops configured to engage a portion of the cam to selectively prevent rotation of the arm, the second angle limited by the one or more stops; and

a block stop configured to engage at least one of the first bracket or the second bracket to selectively prevent rotation of the first bracket and the second bracket, the block stop extending between the first rail and the second rail, the first angle limited by the block stop;

wherein a first distance from the first crossmember to a rearmost portion of the snowmobile is greater than a second distance from the block stop to the rearmost portion of the snowmobile, and a third distance from a surface engaged by the tractive assembly to the first crossmember is less than a fourth distance from the surface engaged by the tractive assembly to the block stop.

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