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Bedard et al.

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(54) **SNOWMOBILE**

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B62D 55/07 (2006.01)
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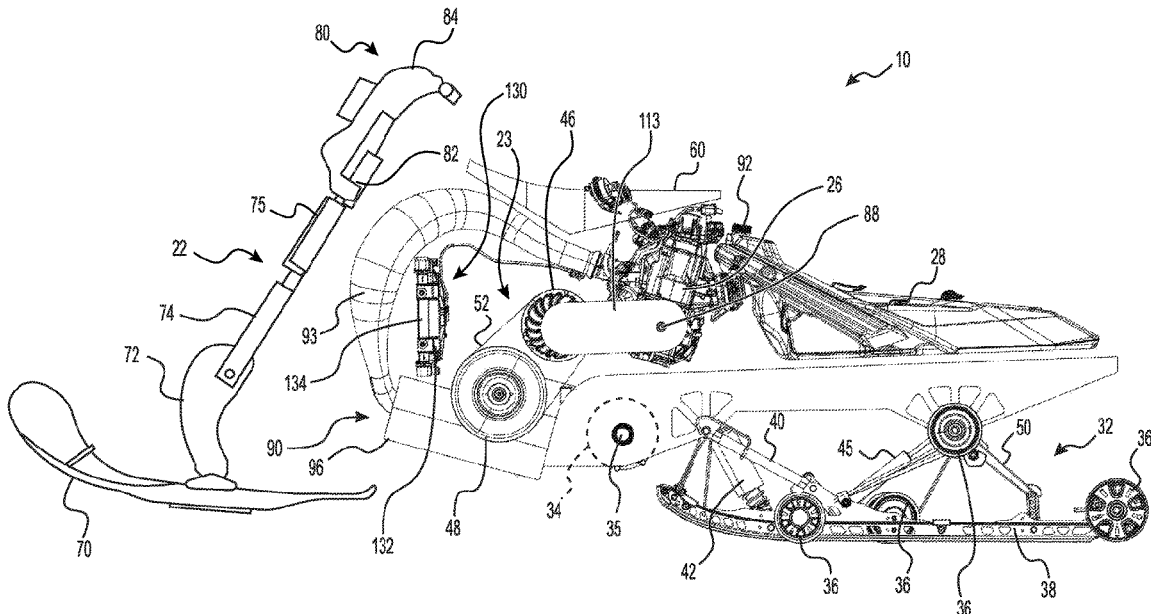
(57) **ABSTRACT**

A snowmobile has a frame, a ski connected to the frame, a seat connected to the frame for accommodating a driver of the snowmobile, a rear suspension assembly operatively connected to the frame, an endless track supported by the rear suspension assembly, a motor supported by the frame, and a continuously variable transmission (CVT) operatively connecting the motor to the endless track. The rear suspension assembly has a suspension assembly drive axle defining a drive axle rotation axis, and a drive sprocket mounted to the drive axle. The motor has a shaft rotatable about a shaft rotation axis. The drive axle rotation axis is positioned forwardly of the shaft rotation axis. The seat is positioned above the motor.

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20 Claims, 9 Drawing Sheets



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- (60) Provisional application No. 62/529,244, filed on Jul. 6, 2017.
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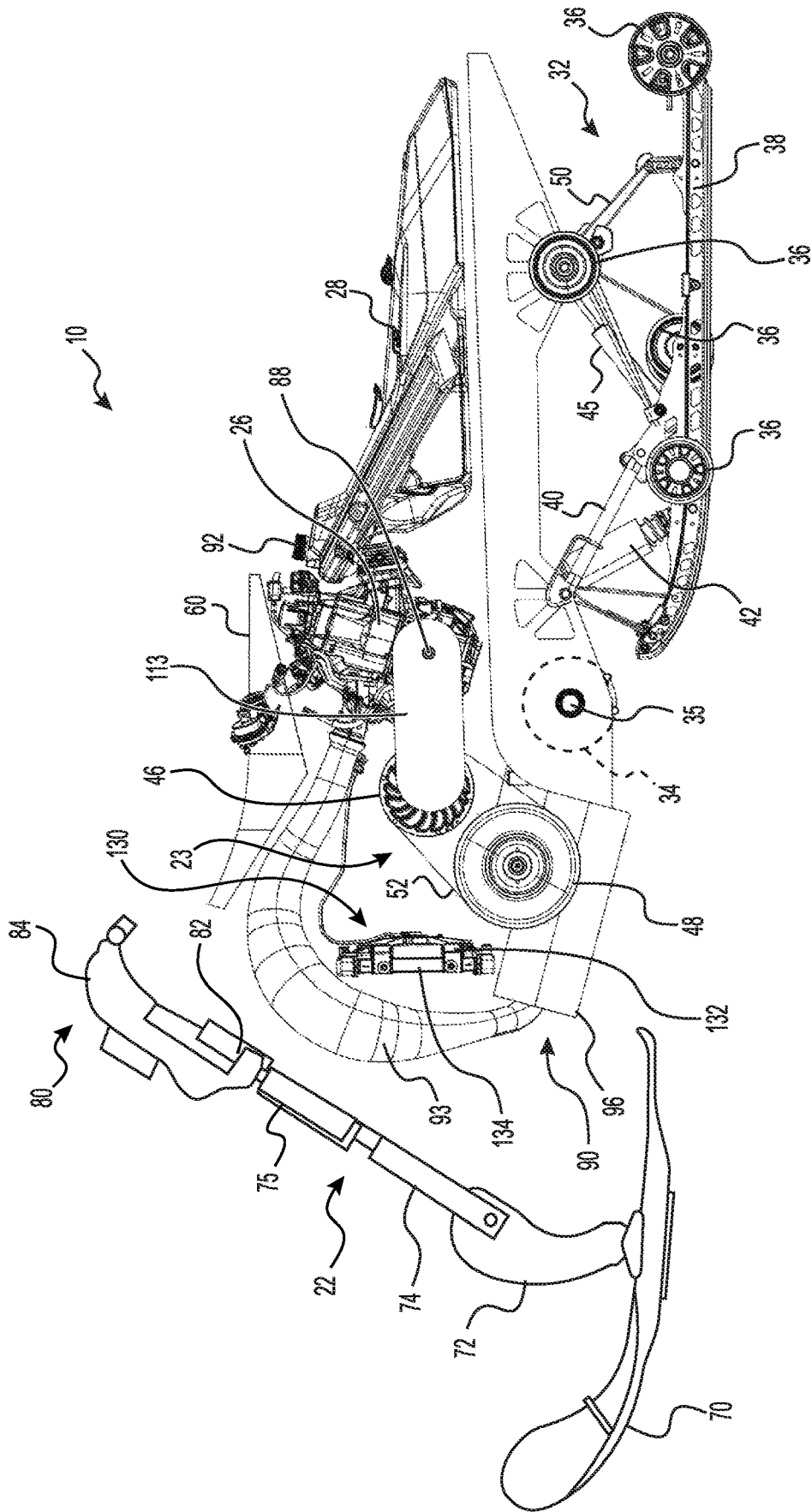


FIG. 2

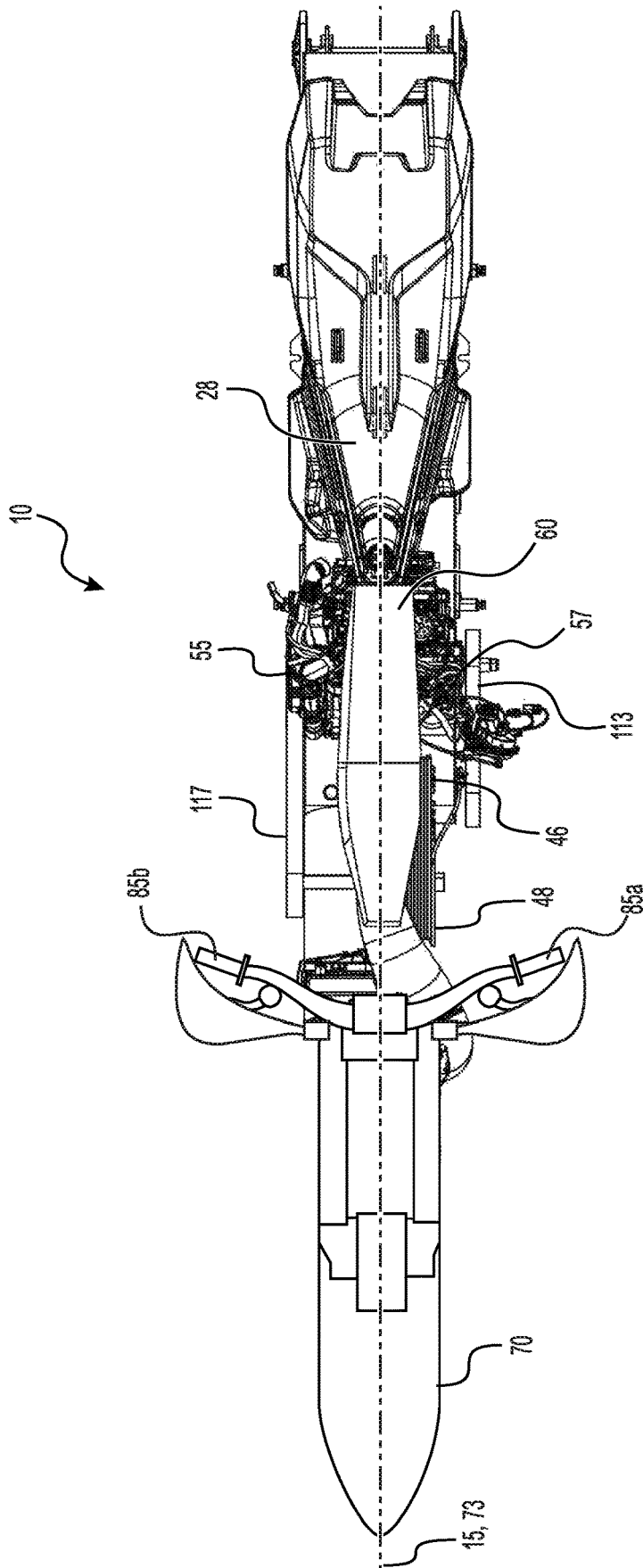


FIG. 3

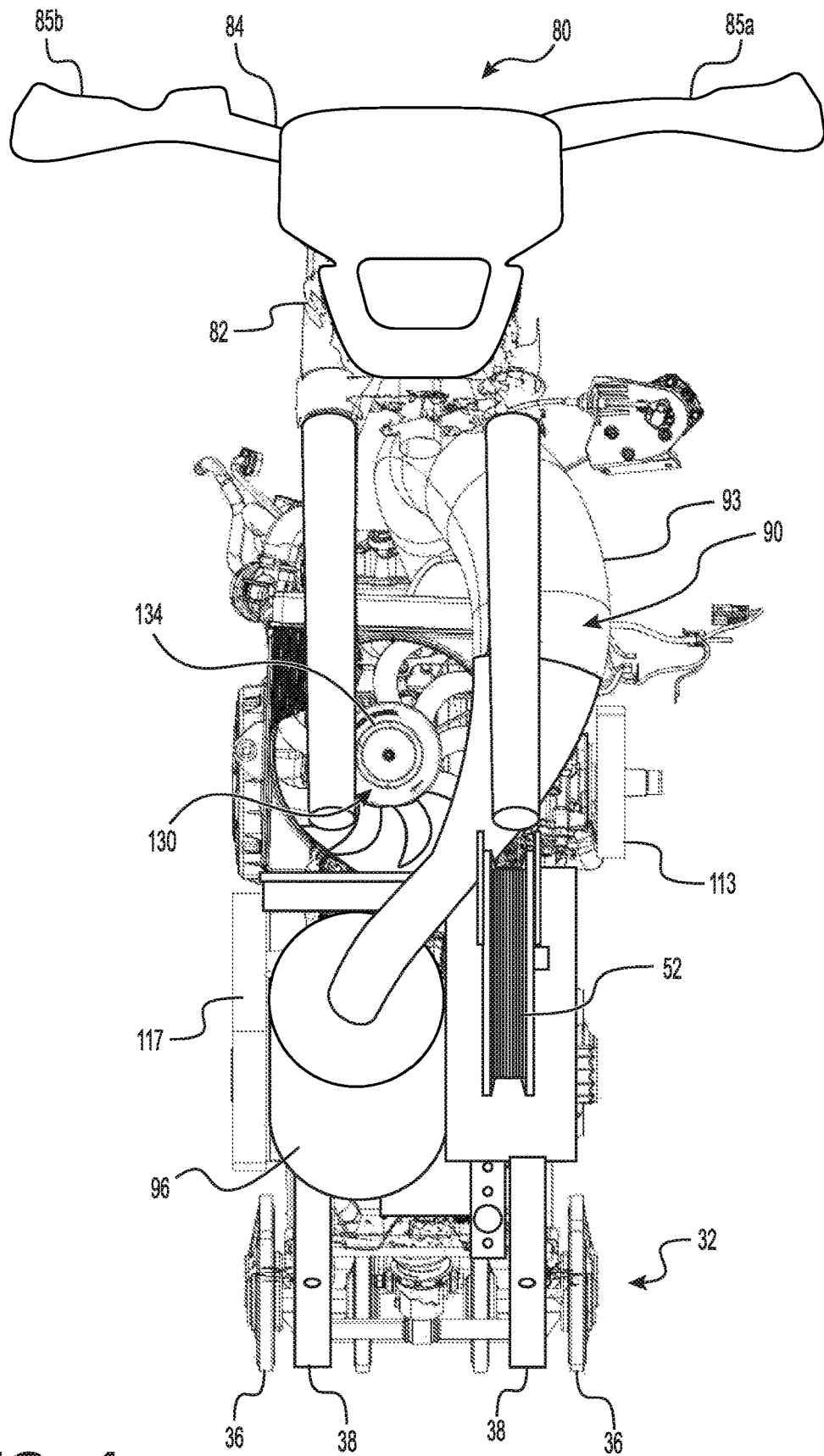


FIG. 4

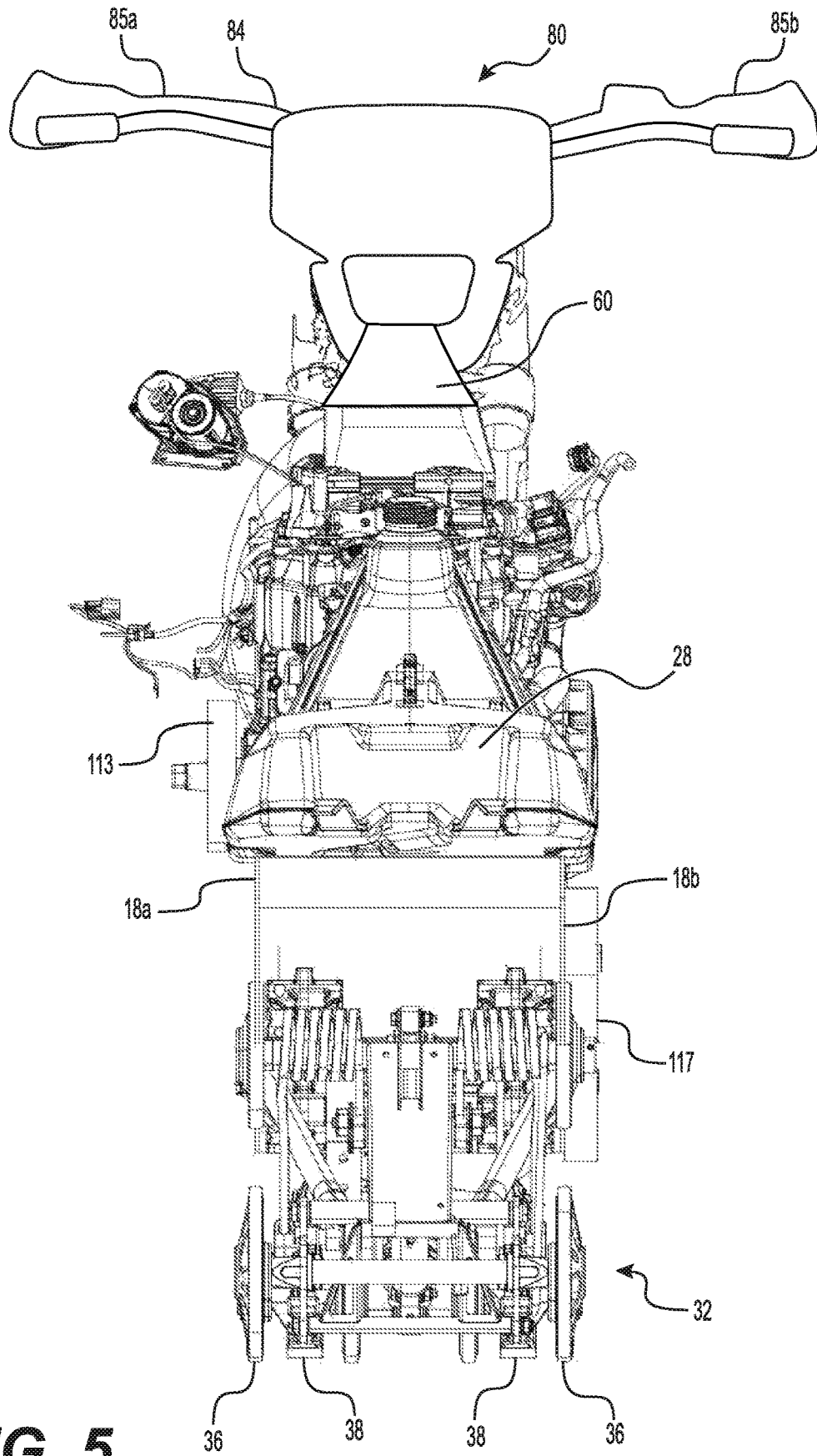


FIG. 5

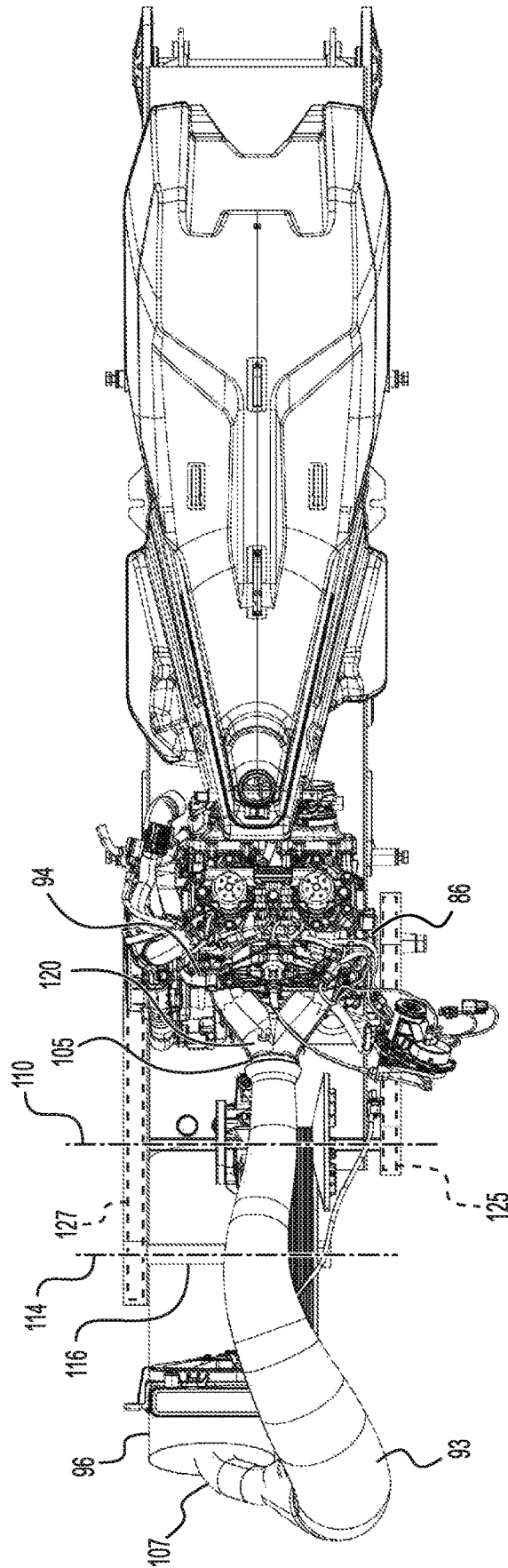


FIG. 6

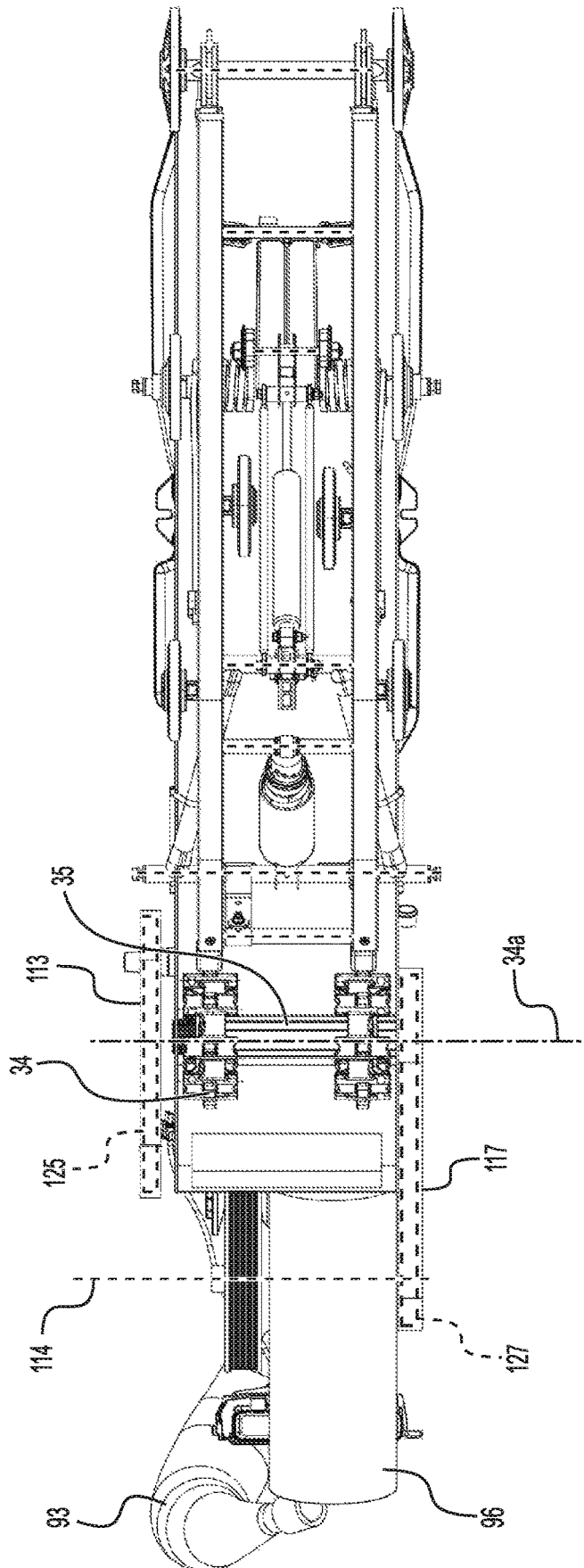


FIG. 7

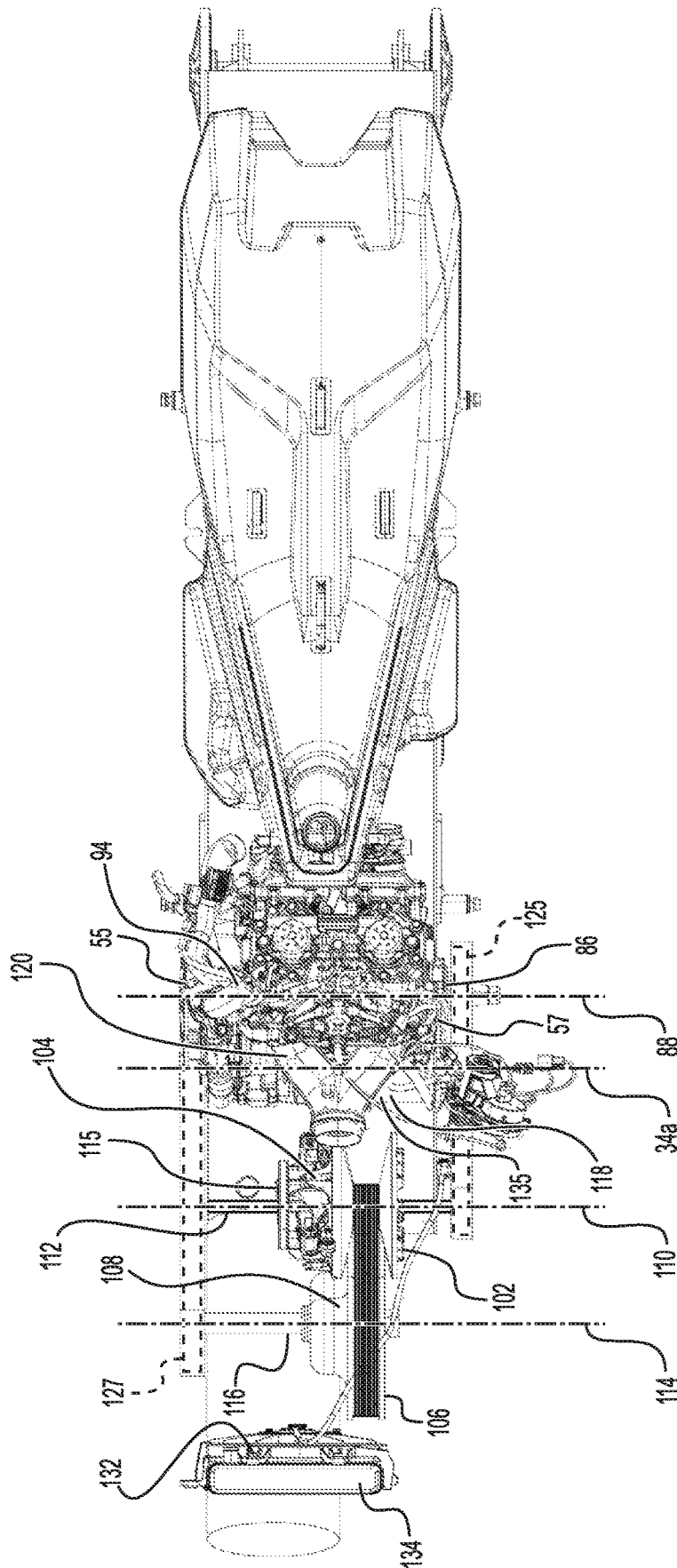


FIG. 8

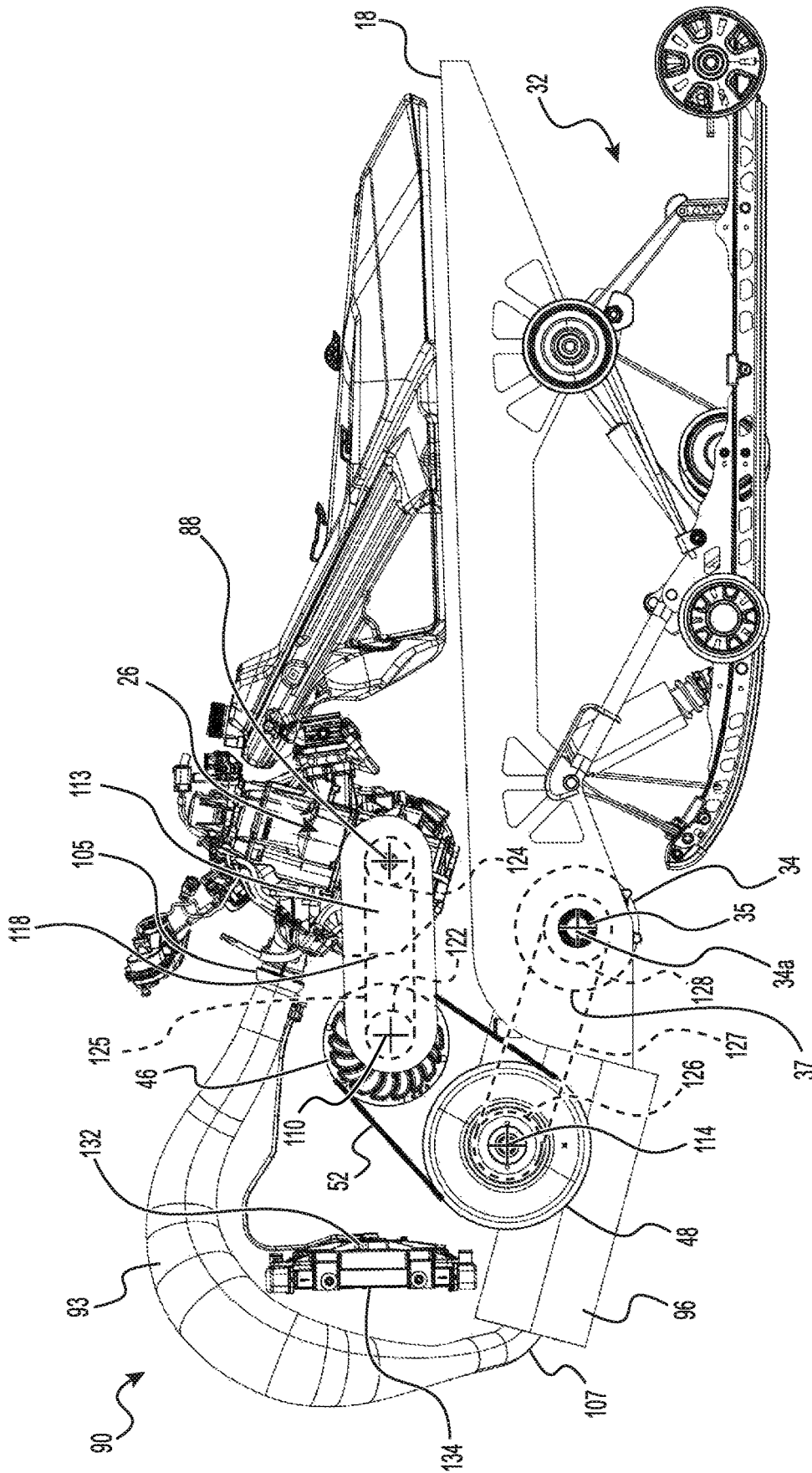


FIG. 9

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SNOWMOBILE

CROSS-REFERENCE

The present application is a continuation of U.S. patent application Ser. No. 16/404,831, filed on May 7, 2019, which is a continuation of U.S. patent application Ser. No. 16/029,278, filed on Jul. 6, 2018, which claims priority to U.S. Provisional Patent Application No. 62/529,244, filed on Jul. 6, 2017, the entirety of each of which is incorporated herein by reference.

TECHNICAL FIELD

The present invention relates generally to a snowmobile, and in particular to a configuration of its motor and transmission.

BACKGROUND

Snowmobiles are designed for travel over snow on a variety of terrains. However, due to its size, a snowmobile may be restricted from navigating areas where obstacles (e.g., vegetation) are dense. Notably, the snowmobile typically includes two laterally-spaced skis which impart a significant width to the snowmobile such that maneuvering between obstacles may be difficult. In order to address this, in some snowmobiles, the skis can be adjusted to be positioned closer to one another. Nevertheless, certain components of the snowmobile's powertrain may still impose a significant width to the snowmobile.

In some cases, a motorcycle may be adapted to travel over snow by replacing its front and rear wheels by a ski and a tracked suspension assembly respectively, thus resulting in a relatively narrow vehicle capable of travelling over snow. However, motorcycles are generally not optimized for winter use and may thus exhibit poor performance when modified as described. For example, due to the configuration of the motorcycle's powertrain (including, for example, its engine and transmission), the weight distributed on the ski and the tracked suspension assembly may not be optimal for travelling over snow. Furthermore, certain components, such as the motorcycle's transmission, may not be suited for interaction with snow.

For these and other reasons, there is a desire for modification to existing snowmobile designs.

SUMMARY

It is an object of the present invention to ameliorate at least some of the inconveniences described above.

In accordance with an aspect of the present technology, there is provided a snowmobile. The snowmobile includes: a frame; a ski connected to the frame; a seat connected to the frame for accommodating a driver of the snowmobile; a rear suspension assembly operatively connected to the frame; an endless track supported by the rear suspension assembly; a motor supported by the frame; and a continuously variable transmission (CVT) operatively connecting the motor to the endless track for driving the endless track. The rear suspension assembly includes: at least one slide rail; a suspension assembly drive axle defining a drive axle rotation axis; a drive sprocket mounted to the drive axle; and a plurality of idler wheels connected to the at least one slide rail. The drive sprocket of the rear suspension assembly is rotatable about the drive axle rotation axis to drive the endless track. The motor includes a shaft rotatable about a shaft rotation axis.

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The drive axle rotation axis is positioned forwardly of the shaft rotation axis of the shaft of the motor. The seat is positioned above the motor.

In some implementations, the CVT includes a primary pulley operatively connected to and driven by the motor, a secondary pulley operatively connected to and driven by the primary pulley, and a transmission belt connecting the primary pulley to the secondary pulley. The primary pulley is rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the shaft rotation axis of the shaft of the motor, the primary pulley being operatively connected to the shaft of the motor by one of a chain and a belt. The secondary pulley is rotatable about a secondary pulley rotation axis. The secondary pulley is operatively connected to the endless track to drive the endless track.

In some implementations, the snowmobile also includes: a primary pulley shaft defining the primary pulley rotation axis, the primary pulley being mounted to the primary pulley shaft to rotate therewith; and a secondary pulley shaft defining the secondary pulley rotation axis, the secondary pulley being mounted to the secondary pulley shaft to rotate therewith, the one of the chain and the belt being operatively connected between the primary pulley shaft and the shaft of the motor.

In some implementations, the primary and secondary pulley shafts are rotatably supported by the frame.

In some implementations, the primary pulley rotation axis extends laterally; and the primary pulley rotation axis is positioned forwardly of the shaft rotation axis of the shaft of the motor.

In some implementations, the secondary pulley rotation axis is positioned forwardly of the primary pulley rotation axis.

In some implementations, the secondary pulley is operatively connected to the drive sprocket of the rear suspension assembly by a link; and the primary and secondary pulleys of the CVT are disposed laterally between the link operatively connecting the secondary pulley to the drive sprocket and the one of the chain and the belt operatively connecting the primary pulley to the shaft of the motor.

In some implementations, the drive axle rotation axis is positioned rearwardly of the secondary pulley rotation axis.

In some implementations, the drive axle rotation axis is positioned rearwardly of the primary pulley rotation axis.

In some implementations, the secondary pulley rotation axis is vertically lower than the primary pulley rotation axis.

In some implementations, the ski is a single laterally centered ski.

In some implementations, the one of the chain and the belt is the chain. The snowmobile also includes: a first sprocket mounted to the shaft of the motor; and a second sprocket mounted to the primary pulley shaft. The chain is connected between the first and second sprockets to operatively connect the shaft of the motor to the primary pulley.

In some implementations, the second sprocket has a smaller diameter than the primary pulley.

In some implementations, the motor is an internal combustion engine, the shaft of the motor is a crankshaft and the shaft rotation axis of the shaft of the motor is a crankshaft rotation axis.

According to another aspect of the present technology, there is provided a snowmobile. The snowmobile includes: a frame; a ski connected to the frame; a seat connected to the frame for accommodating a driver of the snowmobile; a rear suspension assembly operatively connected to the frame; an endless track supported by the rear suspension assembly; a

motor supported by the frame; and a continuously variable transmission (CVT) operatively connecting the motor to the endless track for driving the endless track. The rear suspension assembly includes: at least one slide rail; a suspension assembly drive axle defining a drive axle rotation axis; a drive sprocket mounted to the drive axle; and a plurality of idler wheels connected to the at least one slide rail. The drive sprocket of the rear suspension assembly is rotatable about the drive axle rotation axis to drive the endless track. The motor includes a shaft rotatable about a shaft rotation axis. The drive axle rotation axis is positioned forwardly of the shaft rotation axis of the shaft of the motor. The seat is positioned above the shaft rotation axis of the shaft of the motor.

In some implementations, the CVT includes a primary pulley operatively connected to and driven by the motor, a secondary pulley operatively connected to and driven by the primary pulley, and a transmission belt connecting the primary pulley to the secondary pulley. The primary pulley is rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the shaft rotation axis of the shaft of the motor, the primary pulley being operatively connected to the shaft of the motor by one of a chain and a belt. The secondary pulley is rotatable about a secondary pulley rotation axis. The secondary pulley is operatively connected to the endless track to drive the endless track.

According to another aspect of the present technology, there is provided a snowmobile. The snowmobile includes a frame; a ski connected to the frame; a seat connected to the frame for accommodating a driver of the snowmobile; a rear suspension assembly operatively connected to the frame; an endless track supported by the rear suspension assembly; an internal combustion engine supported by the frame; a continuously variable transmission (CVT) operatively connecting the engine to the endless track for driving the endless track; and a fuel tank supported by the frame and positioned rearwardly of the engine. The rear suspension assembly includes: at least one slide rail; a suspension assembly drive axle defining a drive axle rotation axis; a drive sprocket mounted to the drive axle; and a plurality of idler wheels connected to the at least one slide rail. The drive sprocket of the rear suspension assembly is rotatable about the drive axle rotation axis to drive the endless track. The engine includes a crankshaft rotatable about a crankshaft rotation axis. The drive axle rotation axis is positioned forwardly of the crankshaft rotation axis.

In some implementations, the fuel tank is positioned rearwardly of the seat.

In some implementations, the CVT includes a primary pulley operatively connected to and driven by the motor, a secondary pulley operatively connected to and driven by the primary pulley, and a transmission belt connecting the primary pulley to the secondary pulley. The primary pulley is rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the shaft rotation axis of the shaft of the motor, the primary pulley being operatively connected to the shaft of the motor by one of a chain and a belt. The secondary pulley is rotatable about a secondary pulley rotation axis. The secondary pulley is operatively connected to the endless track to drive the endless track.

In some implementations, the snowmobile also includes: a primary pulley shaft defining the primary pulley rotation axis, the primary pulley being mounted to the primary pulley shaft to rotate therewith; and a secondary pulley shaft defining the secondary pulley rotation axis, the secondary

pulley being mounted to the secondary pulley shaft to rotate therewith, the one of the chain and the belt being operatively connected between the primary pulley shaft and the crankshaft.

For purposes of the present application, terms related to spatial orientation when referring to the snowmobile and components in relation to the snowmobile, such as “forward”, “rearward”, “left”, “right”, “above” and “below”, are as they would be understood by a driver of the snowmobile sitting thereon in a normal riding position, with the snowmobile in a straight ahead orientation (i.e. not steered left or right), and in an upright position (i.e. not tilted). When referring to a component alone, terms related to spatial orientation are described with respect to the component as disposed on the snowmobile.

Implementations of the present invention 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 invention that have resulted from attempting to attain the above-mentioned object may not satisfy this object and/or may satisfy other objects not specifically recited herein.

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

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

FIG. 2 is a left side elevation view of the snowmobile of FIG. 1 with certain components removed to expose part of a frame, an engine and a continuous variable transmission of the snowmobile;

FIG. 3 is a top plan view of the snowmobile as shown in FIG. 2;

FIG. 4 is a front elevation view of the snowmobile as shown in FIG. 2;

FIG. 5 is a rear elevation view of the snowmobile as shown in FIG. 2;

FIGS. 6 and 7 are top and bottom plan views of a portion of the snowmobile of FIG. 1 showing an exhaust system of the snowmobile;

FIG. 8 is a top plan view of the portion of the snowmobile shown in FIGS. 6 and 7 with an exhaust pipe of the exhaust system removed to expose the continuous variable transmission of the snowmobile; and

FIG. 9 is a left side elevation view of the portion of the snowmobile shown in FIG. 6.

DETAILED DESCRIPTION

With reference to FIGS. 1 to 5, a snowmobile 10 includes a front end 12 and a rear end 14 which are defined consistently with a forward travel direction of the snowmobile 10. The snowmobile 10 includes a vehicle body in the form of a frame 16 which includes a rear tunnel 18 and a motor module 20. The tunnel 18 is formed from sheet metal parts assembled to form an inverted U-shape when viewed from the front or rear end 12, 14. The inverted U-shaped tunnel 18 has a left side portion 18a and a right side portion 18b.

A motor 26, which in the present implementation is an internal combustion engine (schematically illustrated in

FIG. 1), is carried in a motor compartment defined in part by the motor module **20** of the frame **16**. The engine **26** provides propulsion of the snowmobile **10**. The internal construction of the engine **26** may be of any known type such as a two-stroke engine, a four-stroke engine or a diesel engine. It is contemplated that the engine **26** could be replaced by other types of motors, such as, but not limited to, an electric motor or an electric/internal combustion hybrid engine. In the present implementation, the engine **26** is a two-stroke, in-line, two cylinder internal combustion engine. The engine **26** has a crankshaft **86** that rotates about a crankshaft rotation axis **88** extending laterally (i.e. generally transversely to a longitudinal axis **15** of the snowmobile **10**). As will be described in more detail further below, the crankshaft **86** drives a drivetrain of the snowmobile **10** for propulsion of the snowmobile **10** on the ground.

A fuel tank **28**, supported on the tunnel **18**, supplies fuel to the engine **26** for its operation. The fuel tank **28** includes a cap **92** covering a fill opening of the fuel tank **28** and disposed behind a seat **60** of the snowmobile **10**.

The snowmobile **10** also comprises an exhaust system **90** for guiding exhaust gas away from the engine **26** to a surrounding environment of the snowmobile **10**. Notably, the exhaust system **90** comprises an exhaust pipe **93** which is fluidly connected to the engine's exhaust ports **94**, and a muffler **96** for reducing an amount of noise emitted by the exhaust system **90**. The exhaust pipe **93** is a tuned pipe in that it has a geometry suitable for improving the efficiency of the engine **26**.

An endless track **30** is positioned generally under the tunnel **18**, and is operatively connected to the engine **26** via a drivetrain including a transmission system **23**. The endless track **30** has a front end **37** and a rear end **39** opposite the front end **37**. The endless track **30** is driven to run about a rear suspension assembly **32** connected to the frame **16** for propulsion of the snowmobile **10**. The endless track **30** has a plurality of lugs **31** extending from an outer surface thereof to provide traction to the endless track **30**.

The rear suspension assembly **32** includes a pair of drive sprockets **34** mounted on a drive axle **35**, multiple idler wheels **36** and a pair of slide rails **38** in sliding contact with the endless track **30**. The drive axle **35** on which the drive sprockets **34** are mounted defines a drive sprocket rotation axis **34a** which extends laterally (i.e., in a lateral direction of the snowmobile **10**). The slide rails **38** are attached to the tunnel **18** by a front suspension arm **40** and a rear suspension arm **50**. The rear suspension assembly **32** further includes a front shock absorber assembly **42** and a rear shock absorber assembly **45**, each of which includes a shock absorber. It is contemplated that the snowmobile **10** could be provided with a different implementation of the rear suspension assembly **32** than the one shown herein.

The seat **60** of the snowmobile **10** is a straddle seat which is connected to the frame **16** and is adapted to accommodate a driver of the snowmobile **10**. In some implementations, the seat **60** may be configured to accommodate a passenger. A footrest **64** is positioned on each side of the snowmobile **10** below the seat **60** to accommodate the driver's feet. Each of the left and right footrests **64** extends generally laterally outwardly from corresponding left and right side portions of the frame **16**.

The snowmobile **10** further comprises fairings **66** which enclose the engine **26**, the transmission system **23** and other components of the powerpack such as an air intake system. The fairings **66** can be removed to allow access to the engine **26** and/or the transmission system **23** and other internal

components of the snowmobile **10** which may be required, for example, for inspection or maintenance of the engine **26** and/or the powerpack.

A ski **70** positioned at the forward end **12** of the snowmobile **10** is attached to the front suspension module **22** of the frame **16** through a spindle **72**. The front suspension module **22** includes a fork **74** and a shock absorber **75**. As shown in FIG. 3, the ski **70** is a single laterally centered ski. In other words, the ski **70** is aligned with a centerline **73** bisecting a width of the snowmobile **10**. It is contemplated that, in some implementations, the snowmobile **10** may comprise two skis (such as the ski **70**) which are positioned close to each other.

A steering assembly **80**, including two front forks **82** and a handlebar **84**, is provided generally forward of the seat **60**. The front forks **82** are rotatably connected to the frame **16**. A lower end of the front forks **82** is connected to the front suspension module **22**. The handlebar **84** is attached to an upper end of the front forks **82**. The handlebar **84** is positioned in front of the seat **60**. The handlebar **84** is operatively connected to the ski **70** such that the handlebar **84** is used to rotate the front forks, and thereby the ski **70**, in order to steer the snowmobile **10**. A left handle **85a** and a right handle **85b** are disposed on left and right sides of the handlebar **84** respectively. A brake actuator (not shown), in the form of a hand brake lever, is provided on the left handle **85a** for braking the snowmobile **10** in a known manner. A throttle operator (not shown) in the form of a twist grip is mounted to the right handle **85b**. Other types of throttle operators, such as a finger-actuated throttle lever and a thumb-actuated throttle lever, are also contemplated.

In this implementation, the snowmobile **10** also comprises a heat exchanger system **130** for cooling the engine **26**. The heat exchanger system **130** comprises a radiator **132** and a fan **134**. The radiator **132** is fluidly connected to the engine **26** such that coolant that is circulated through the engine **26** is received at the radiator **132** where the coolant exchanges heat and is returned to the engine **26**. The fan **134** is configured to blow air through the radiator **132** to aid in the convective heat exchange.

The snowmobile **10** includes other components such as a display cluster, 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.

Turning now to FIGS. 6 to 8, the configuration of the transmission system **23** and the engine **26** will now be described in more detail.

The transmission system **23** is a continuously variable transmission (CVT) and thus offers a continuous range of gear ratios. To that end, the CVT **23** comprises a primary (drive) pulley **46** operatively connected to the engine **26**, a secondary (driven) pulley **48** operatively connected to the endless track **30**, and a transmission belt **52** which operatively connects the primary pulley **46** to the secondary pulley **48**. More particularly, the primary pulley **46** has a pair of opposed frustoconical belt drive sheaves **102**, **104** and the secondary pulley **48** has a pair of opposed frustoconical belt drive sheaves **106**, **108**. The transmission belt **52** is located between the opposed pairs of drive sheaves **102**, **104** and **106**, **108**.

A transmission ratio of the CVT **23** can be changed by moving the sheaves of one of the primary and secondary pulleys **46**, **48** closer together and the sheaves of the other of the primary and secondary pulleys **46**, **48** further apart. This causes the transmission belt **52** to ride higher on one pulley and lower on the other, thus affecting the transmission

ratio of the CVT 23. In order to effect such a change in the transmission ratio of the CVT 23, the primary pulley 46 has centrifugal actuators 115 connected to the drive sheave 104 which is moveable laterally (i.e., in an axial direction of the primary pulley 46) towards and away from the drive sheave 102 which is laterally fixed. As is known, the centrifugal actuators 115 generally consist of centrifugal weights in the form of adjusting arms. Each of the arms is connected to the movable sheave 104 of the primary pulley 46 by a pin, and pivots outwards about its corresponding pin. As they pivot, the arms are in contact with corresponding rollers disposed on a spider fixed relative to the movable sheave 104. When the adjusting arms pivot outwards as a result of centrifugal force, they slide against their corresponding roller and the axially moveable sheave 104 is pushed towards the fixed sheave 102.

The primary pulley 46 has a primary pulley rotation axis 110 extending laterally and which is defined by a primary pulley shaft 112 onto which the primary pulley 46 is mounted. The primary pulley shaft 112 is rotatably supported by the frame 16 (e.g., via bearings). The primary pulley 46 is rotatable with the primary pulley shaft 112 such that the drive sheaves 102, 104 rotate together with the primary pulley shaft 112. The primary pulley 46 is operatively connected to the crankshaft 86 of the engine 26. In particular, in this implementation, a sprocket 122 is mounted on the primary pulley shaft 112 and another sprocket 124 is mounted on the crankshaft 86. A chain 125 operatively connects the sprocket 124 mounted on the crankshaft 86 to the sprocket 122 mounted on the primary pulley shaft 112 such that the crankshaft 86 transmits torque to the primary pulley 46 via the chain 125 and sprockets 122, 124 and thus causes rotation of the primary pulley 46 about the primary pulley rotation axis 110. A chain case 113 covers the chain 125 and sprockets 122, 124. While in this implementation, a link interconnecting the crankshaft 86 to the primary pulley shaft 112 is a chain, the link may be any other suitable type of link in other implementations. For instance, it is contemplated that, in other implementations, instead of sprockets, pulleys are mounted on the crankshaft 86 and the primary pulley shaft 112 and a belt is looped about the pulleys such that the crankshaft 86 transmits torque to the primary pulley 46 via the belt and pulleys. It is contemplated that, in yet other implementations, a gear is mounted on the crankshaft 86 and another gear is mounted on the primary pulley shaft 112. The gear mounted on the crankshaft 86 drives the gear mounted on the primary pulley shaft 112 either directly, or through an intervening component, such as an idler gear.

As mentioned above, the transmission belt 52 operatively connects the primary pulley 46 to the secondary pulley 48 to transmit torque thereto. In particular, as shown in FIG. 2, the transmission belt 52 is looped around both the primary pulley 46 and the secondary pulley 48. In this implementation, the transmission belt 52 is made of rubber, but it is contemplated that it could be made of metal linkages or of a polymer.

The secondary pulley 48 has a secondary pulley rotation axis 114 extending laterally and which is defined by a secondary pulley shaft 116 onto which the secondary pulley 48 is mounted. The secondary pulley shaft 116 is rotatably supported by the frame 16 (e.g., via bearings). The secondary pulley 48 is rotatable with the secondary pulley shaft 116 such that the drive sheaves 106, 108 rotate together with the primary pulley shaft 112. The secondary pulley 48 is operatively connected to the drive sprockets 34 of the rear suspension assembly 32 such that the secondary pulley 48

transmits torque to the drive sprockets 34 which in turn drive the endless track 30. In this implementation, a sprocket 126 is mounted on the secondary pulley shaft 116 and another sprocket 128 is mounted on the drive axle 35. A chain 127 operatively connects the sprocket 126 mounted on the secondary pulley shaft 116 to the sprocket 128 mounted on the drive axle 35 such that the secondary pulley shaft 116 transmits torque to the drive axle 35 via the chain 127 and sprockets 126, 128 and thus causes rotation of the drive sprockets 34 about the drive sprocket rotation axis 34a. A chain case 117 covers the chain 127 and sprockets 126, 128. While in this implementation, a link interconnecting the secondary pulley shaft 116 to the drive axle 35 is a chain, the link may be any other suitable type of link in other implementations. For instance, it is contemplated that, in other implementations, instead of sprockets, pulleys are mounted on the secondary pulley shaft 116 and the drive axle 35 and a belt is looped about the pulleys such that the secondary pulley shaft 116 transmits torque to the drive axle 35 via the belt and pulleys. It is contemplated that, in yet other implementations, a gear is mounted on the secondary pulley shaft 116 and another gear is mounted on the drive axle 35. The gear mounted on the secondary pulley shaft 116 drives the gear mounted on the drive axle 35 either directly, or through an intervening component, such as an idler gear.

With reference to FIGS. 7 to 9, in this implementation, the sprockets 122, 124 and the chain 125 are disposed on a right side of the CVT 23 while the sprockets 126, 128 and the chain 127 are disposed on a left side of the CVT 23. More specifically, the primary pulley 46, the secondary pulley 48 and the transmission belt 52 are positioned laterally between, on one lateral side thereof, the sprockets 122, 124 and the chain 125 which operatively connect the engine 26 to the CVT 23, and on the other lateral side, the sprockets 126, 128 and the chain 127 which operatively connect the CVT 23 to the drive axle 35. In implementations in which pulleys and a belt or other types of drive members (e.g., gears) operatively connect the engine 26 to the CVT 23 and/or the CVT 23 to the drive axle 35, the primary pulley 46 and the secondary pulley 48 are positioned laterally between the drive members that operatively connect the engine 26 to the CVT 23 and the drive members that operatively connect the CVT 23 to the drive axle 35.

As shown in FIGS. 8 and 9, the CVT 23 is positioned forwardly of the engine 26. In other words, a front end 118 of the engine 26 (i.e., a front surface 135 of a cylinder block and crankcase of the engine 26) is disposed rearwardly of the CVT 23 including the primary pulley 46, the secondary pulley 48 and the transmission belt 52. This positioning of the CVT 23 relative to the engine 26 may help minimize a combined lateral extent of the engine 26 and the CVT 23 which, conventionally, are positioned side-by-side (i.e., laterally adjacent).

The primary and secondary pulleys 46, 48 of the CVT 23 are therefore positioned between lateral sides 55, 57 of the engine 26. That is, the primary and secondary pulleys 46, 48 are confined within a lateral extent of the engine 26. Furthermore, the rotation axes 110, 114 of the primary and secondary pulleys 46, 48 of the CVT 23 are both located forwardly of the engine 26. In other words, the primary pulley rotation axis 110 is positioned forwardly of the crankshaft rotation axis 88. Similarly, the secondary pulley rotation axis 114 is positioned forwardly of the crankshaft rotation axis 88. Moreover, the secondary pulley rotation axis 114 is positioned forwardly of the primary pulley

rotation axis **110**. The secondary pulley rotation axis **114** is also vertically lower than the primary pulley rotation axis **110**.

For its part, the engine **26** is positioned further rearward than in conventional snowmobile designs. This distributes a greater proportion of weight of the snowmobile **10** and its driver onto the endless track **30** rather than the ski **70** which may result in improved maneuvering of the snowmobile **10** when travelling over deep snow.

For instance, in this implementation, the engine **26** is fully positioned above (i.e. an entirety of the engine **26** is positioned above) the endless track **30** and rearward of the front end **37** of the endless track **30**. However, it is contemplated that, in some implementations, rather than the entirety, a majority of the engine **26** is positioned above the endless track **30** and rearward of the front end **37** of the endless track **30**, or that only part of the engine **26** is positioned above the endless track **30** and rearward of the front end **37** of the endless track **30**. Moreover, the drive sprocket rotation axis **34a** is positioned forwardly of the crankshaft rotation axis **88**. Furthermore, the seat **60** is positioned above the engine **26**. The engine **26** is positioned above the tunnel **18** of the frame **16**.

Furthermore, the exhaust system **90** of the snowmobile **10** is positioned forwardly of the engine **26**. More specifically, the exhaust pipe **93** has an end **105** and an end **107**. The end **105** of the exhaust pipe **93** is fluidly connected to exhaust ports **94** of the engine **26** via an exhaust manifold **120** of the exhaust system **90**. The end **105** is positioned rearwardly of the primary pulley rotation axis **110**. The exhaust pipe **93** extends forwardly from the end **105** of the exhaust pipe **93** past the secondary pulley rotation axis **114**.

The muffler **96** is fluidly connected to the end **107** of the exhaust pipe **93**. The muffler **96** is positioned particularly low relative to the CVT **23**. Notably, in this implementation, part of the muffler **96** extends below the secondary pulley rotation axis **114**. Thus, as shown in FIG. **9**, the exhaust pipe **93** extends forward from the end **105** of the exhaust pipe **93** past the secondary pulley **48** and downward in front of the secondary pulley **48** where the end **107** of the exhaust pipe **93** is connected to the muffler **96**. The muffler **96** then extends rearward under the secondary pulley **48** from the end **107** of the exhaust pipe **93**.

The radiator **132** and the fan **134** of the heat exchanger system **130** are positioned forwardly of the CVT **23**. More specifically, as shown in FIGS. **8** and **9**, the radiator **132** and the fan **134** are positioned forwardly of the secondary pulley **48**. The exhaust pipe **93** extends forward from the end **105** of the exhaust pipe **93** past the radiator **132** and the fan **134** and downward past the radiator **132** and the fan **134** where the end **107** of the exhaust pipe **93** is connected to the muffler **96**. The muffler **96** then extends rearward under the radiator **132** and the fan **134** from the end **107** of the exhaust pipe **93** and past the radiator **132** and the fan **134**.

Modifications and improvements to the above-described implementations of the present technology 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 technology is therefore intended to be limited solely by the scope of the appended claims.

What is claimed is:

1. A snowmobile comprising:

a frame;

a ski connected to the frame;

a seat connected to the frame for accommodating a driver of the snowmobile;

a rear suspension assembly operatively connected to the frame, the rear suspension assembly comprising:

at least one slide rail;

a suspension assembly drive axle defining a drive axle rotation axis;

a drive sprocket mounted to the drive axle; and

a plurality of idler wheels connected to the at least one slide rail;

an endless track supported by the rear suspension assembly, the drive sprocket of the rear suspension assembly being rotatable about the drive axle rotation axis to drive the endless track;

a motor supported by the frame, the motor comprising a shaft rotatable about a shaft rotation axis, the drive axle rotation axis being positioned forwardly of the shaft rotation axis of the shaft of the motor, the seat being positioned above the motor; and

a continuously variable transmission (CVT) operatively connecting the motor to the endless track for driving the endless track.

2. The snowmobile of claim 1, wherein the CVT comprises:

a primary pulley operatively connected to and driven by the motor, the primary pulley being rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the shaft rotation axis of the shaft of the motor, the primary pulley being operatively connected to the shaft of the motor by one of:

a chain; and

a belt;

a secondary pulley operatively connected to and driven by the primary pulley, the secondary pulley being rotatable about a secondary pulley rotation axis, the secondary pulley being operatively connected to the endless track to drive the endless track; and

a transmission belt connecting the primary pulley to the secondary pulley.

3. The snowmobile of claim 2, further comprising:

a primary pulley shaft defining the primary pulley rotation axis, the primary pulley being mounted to the primary pulley shaft to rotate therewith; and

a secondary pulley shaft defining the secondary pulley rotation axis, the secondary pulley being mounted to the secondary pulley shaft to rotate therewith,

the one of the chain and the belt being operatively connected between the primary pulley shaft and the shaft of the motor.

4. The snowmobile of claim 3, wherein the primary and secondary pulley shafts are rotatably supported by the frame.

5. The snowmobile of claim 2, wherein:

the primary pulley rotation axis extends laterally; and the primary pulley rotation axis is positioned forwardly of the shaft rotation axis of the shaft of the motor.

6. The snowmobile of claim 2, wherein the secondary pulley rotation axis is positioned forwardly of the primary pulley rotation axis.

7. The snowmobile of claim 2, wherein:

the secondary pulley is operatively connected to the drive sprocket of the rear suspension assembly by a link; and the primary and secondary pulleys of the CVT are disposed laterally between the link operatively connecting the secondary pulley to the drive sprocket and the one of the chain and the belt operatively connecting the primary pulley to the shaft of the motor.

8. The snowmobile of claim 2, wherein the drive axle rotation axis is positioned rearwardly of the secondary pulley rotation axis.

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9. The snowmobile of claim 8, wherein the drive axle rotation axis is positioned rearwardly of the primary pulley rotation axis.

10. The snowmobile of claim 2, wherein the secondary pulley rotation axis is vertically lower than the primary pulley rotation axis.

11. The snowmobile of claim 1, wherein the ski is a single laterally centered ski.

12. The snowmobile of claim 3, wherein:
 the one of the chain and the belt is the chain;
 the snowmobile further comprises:
 a first sprocket mounted to the shaft of the motor; and
 a second sprocket mounted to the primary pulley shaft;
 and
 the chain is connected between the first and second sprockets to operatively connect the shaft of the motor to the primary pulley.

13. The snowmobile of claim 12, wherein the second sprocket has a smaller diameter than the primary pulley.

14. The snowmobile of claim 1, wherein:
 the motor is an internal combustion engine; and
 the shaft of the motor is a crankshaft and the shaft rotation axis of the shaft of the motor is a crankshaft rotation axis.

15. A snowmobile comprising:
 a frame;
 a ski connected to the frame;
 a seat connected to the frame for accommodating a driver of the snowmobile;
 a rear suspension assembly operatively connected to the frame, the rear suspension assembly comprising:
 at least one slide rail;
 a suspension assembly drive axle defining a drive axle rotation axis;
 a drive sprocket mounted to the drive axle; and
 a plurality of idler wheels connected to the at least one slide rail;
 an endless track supported by the rear suspension assembly, the drive sprocket of the rear suspension assembly being rotatable about the drive axle rotation axis to drive the endless track;
 a motor supported by the frame, the motor comprising a shaft rotatable about a shaft rotation axis, the drive axle rotation axis being positioned forwardly of the shaft rotation axis of the shaft of the motor, the seat being positioned above the shaft rotation axis of the shaft of the motor; and
 a continuously variable transmission (CVT) operatively connecting the motor to the endless track for driving the endless track.

16. The snowmobile of claim 15, wherein the CVT comprises:
 a primary pulley operatively connected to and driven by the motor, the primary pulley being rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the shaft rotation axis of the shaft of the motor, the primary pulley being operatively connected to the shaft of the motor by one of:
 a chain; and
 a belt;
 a secondary pulley operatively connected to and driven by the primary pulley, the secondary pulley being rotatable about a secondary pulley rotation axis, the secondary

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pulley being operatively connected to the endless track to drive the endless track; and
 a transmission belt connecting the primary pulley to the secondary pulley.

17. A snowmobile comprising:
 a frame;
 a ski connected to the frame;
 a seat connected to the frame for accommodating a driver of the snowmobile;
 a rear suspension assembly operatively connected to the frame, the rear suspension assembly comprising:
 at least one slide rail;
 a suspension assembly drive axle defining a drive axle rotation axis;
 a drive sprocket mounted to the drive axle; and
 a plurality of idler wheels connected to the at least one slide rail;
 an endless track supported by the rear suspension assembly, the drive sprocket of the rear suspension assembly being rotatable about the drive axle rotation axis to drive the endless track;
 an internal combustion engine supported by the frame, the engine comprising a crankshaft rotatable about a crankshaft rotation axis, the drive axle rotation axis being positioned forwardly of the crankshaft rotation axis;
 a continuously variable transmission (CVT) operatively connecting the engine to the endless track for driving the endless track; and
 a fuel tank supported by the frame and positioned rearwardly of the engine.

18. The snowmobile of claim 17, wherein the fuel tank is positioned rearwardly of the seat.

19. The snowmobile of claim 17, wherein the CVT comprises:
 a primary pulley operatively connected to and driven by the engine, the primary pulley being rotatable about a primary pulley rotation axis, the primary pulley rotation axis extending parallel to the crankshaft rotation axis, the primary pulley being operatively connected to the crankshaft by one of:
 a chain; and
 a belt;
 a secondary pulley operatively connected to and driven by the primary pulley, the secondary pulley being rotatable about a secondary pulley rotation axis, the secondary pulley being operatively connected to the endless track to drive the endless track; and
 a transmission belt connecting the primary pulley to the secondary pulley.

20. The snowmobile of claim 19, further comprising:
 a primary pulley shaft defining the primary pulley rotation axis, the primary pulley being mounted to the primary pulley shaft to rotate therewith; and
 a secondary pulley shaft defining the secondary pulley rotation axis, the secondary pulley being mounted to the secondary pulley shaft to rotate therewith,
 the one of the chain and the belt being operatively connected between the primary pulley shaft and the crankshaft.