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(54) **VEHICLE AND ADJUSTABLE STEERING SHAFT THEREFOR**

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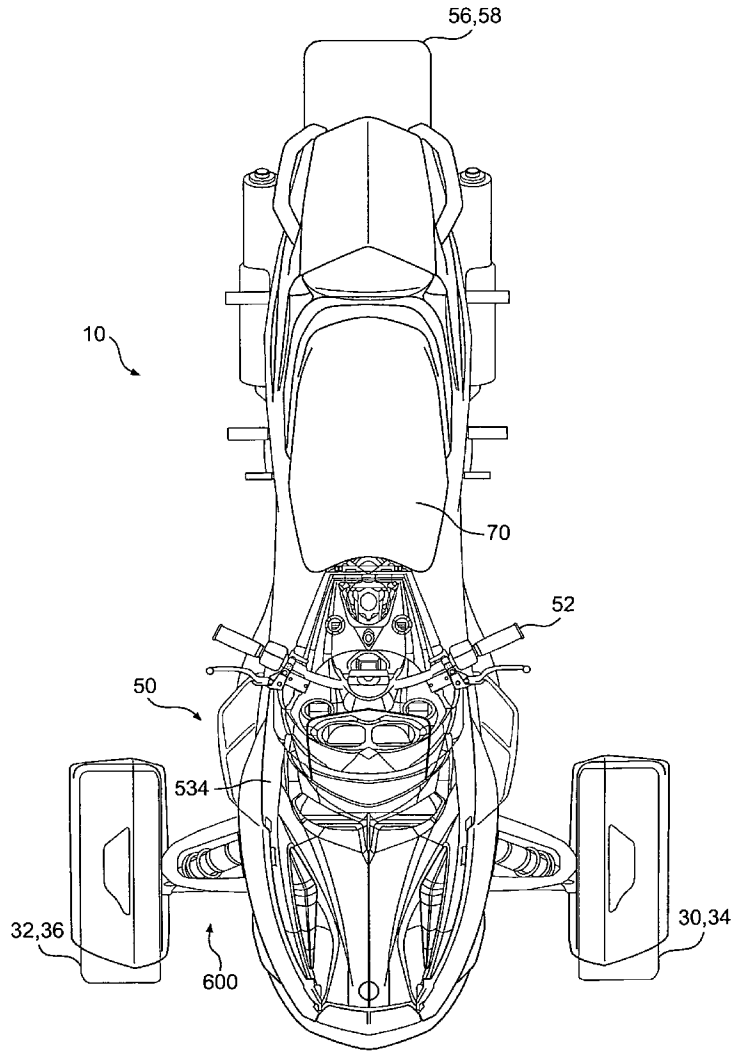
(52) **U.S. Cl.** **180/210**

(57) **ABSTRACT**

A vehicle includes a frame, an engine supported on the frame, and straddle-type seat disposed on the frame. The frame includes tubular members that interconnect to create a strong, light, rigid frame assembly. A steering bracket is provided on the frame that allows for variable positioning of a steering shaft operatively connected to a handlebar mechanism to define a plurality of handlebar mechanism positions. The steering shaft has an offset portion that allows the steering shaft to remain spaced from an engine when the handlebar mechanism is moved to a position closer to the rear of the vehicle.



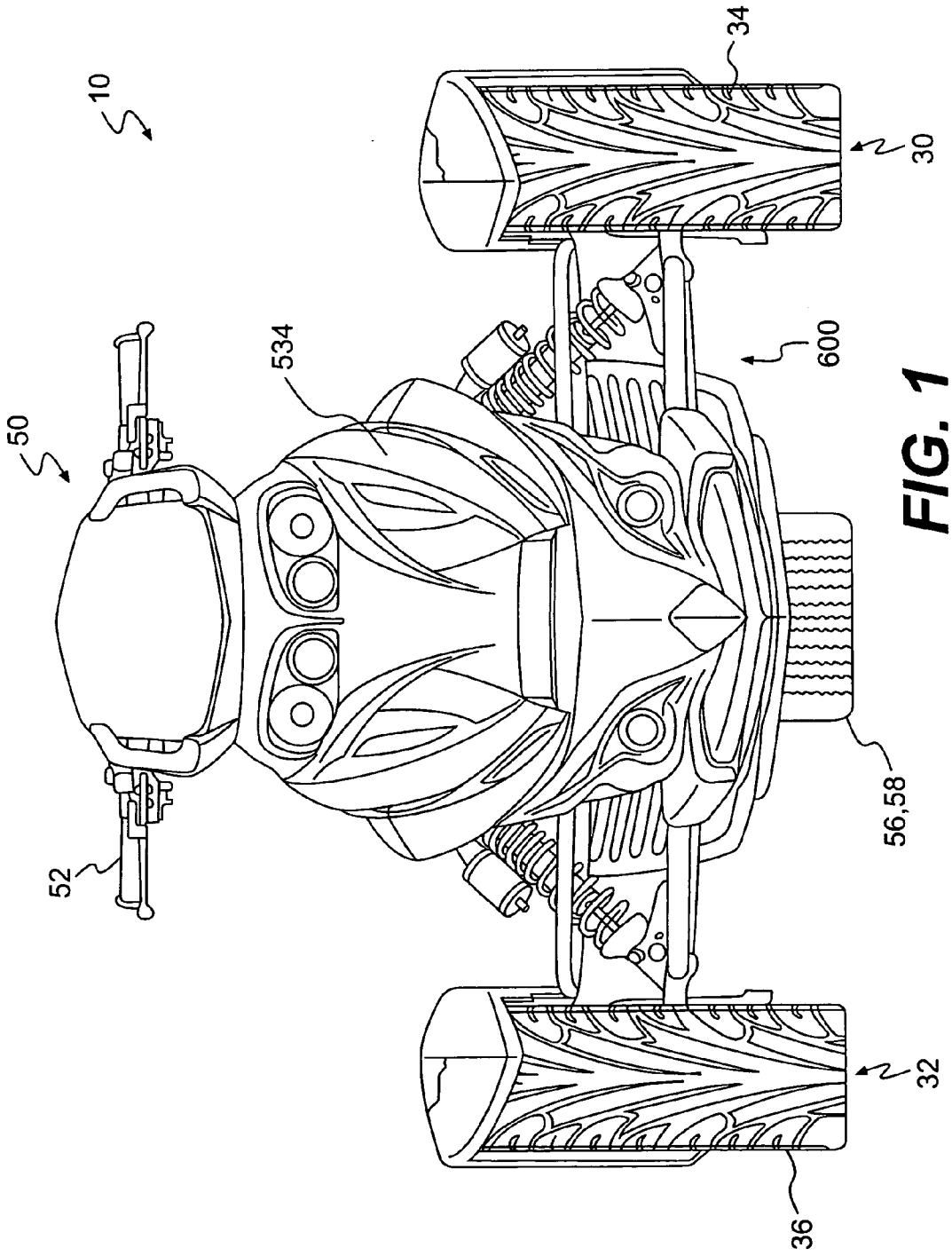


FIG. 1

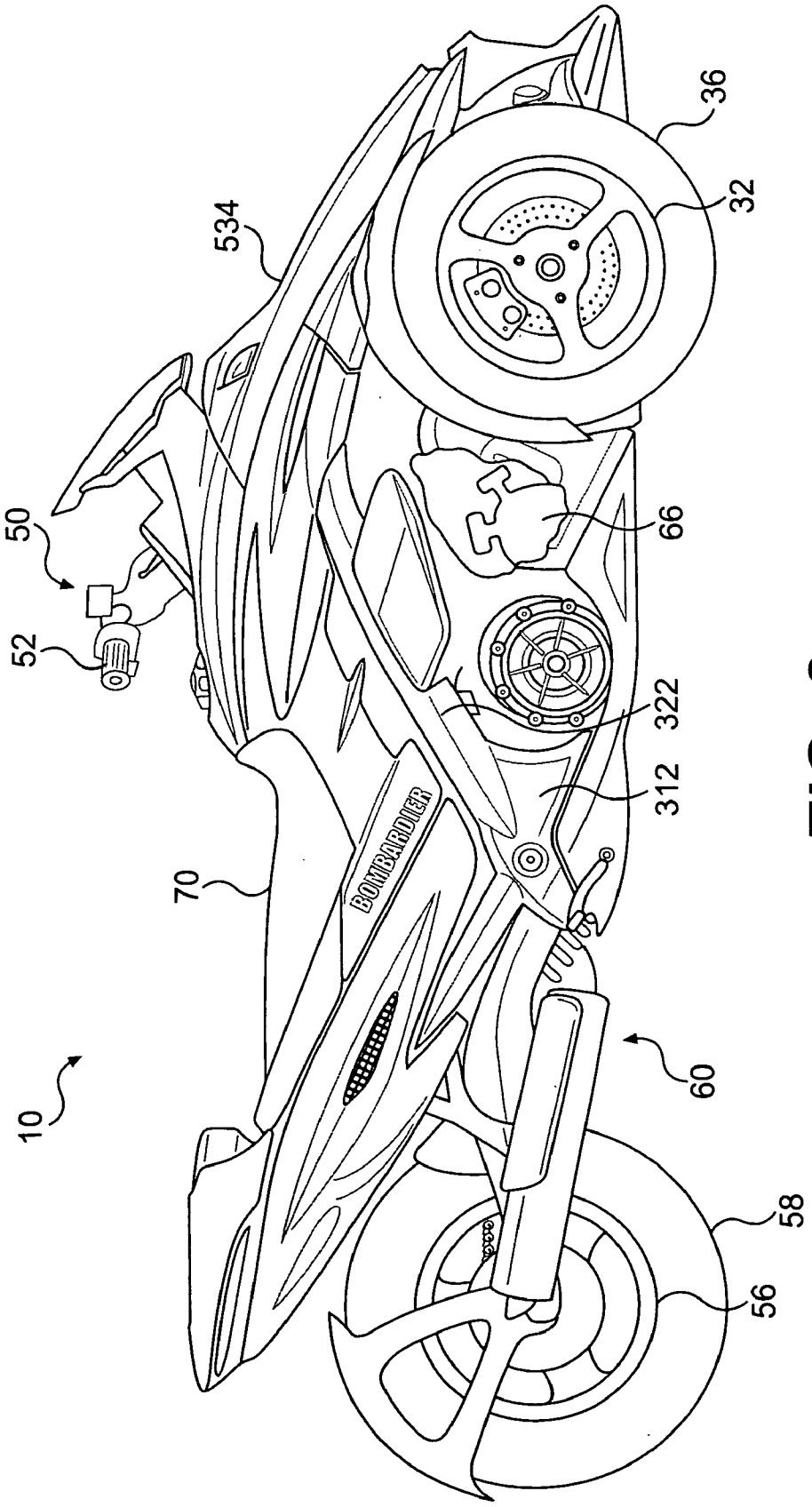


FIG. 2

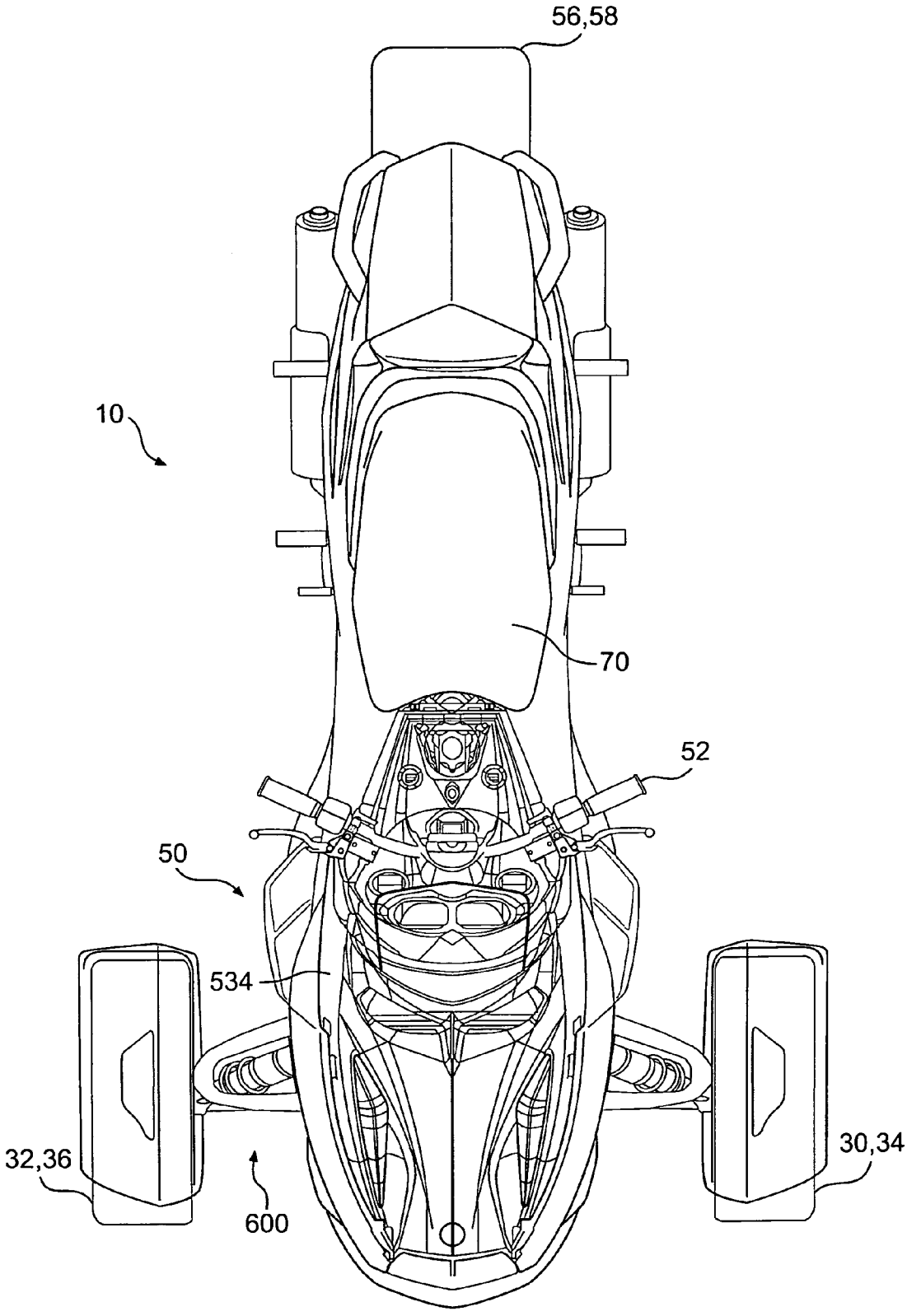


FIG. 3A

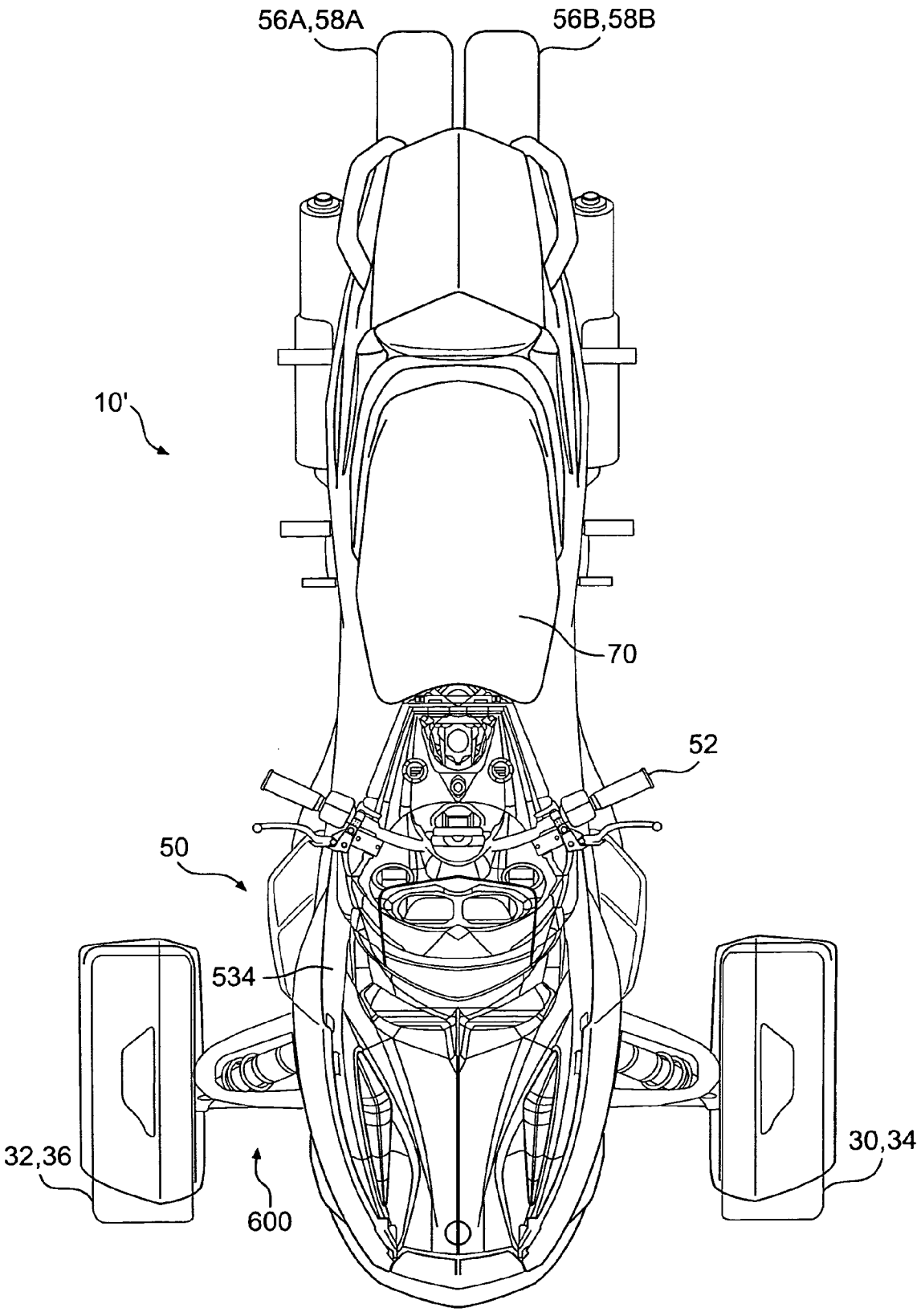


FIG. 3B

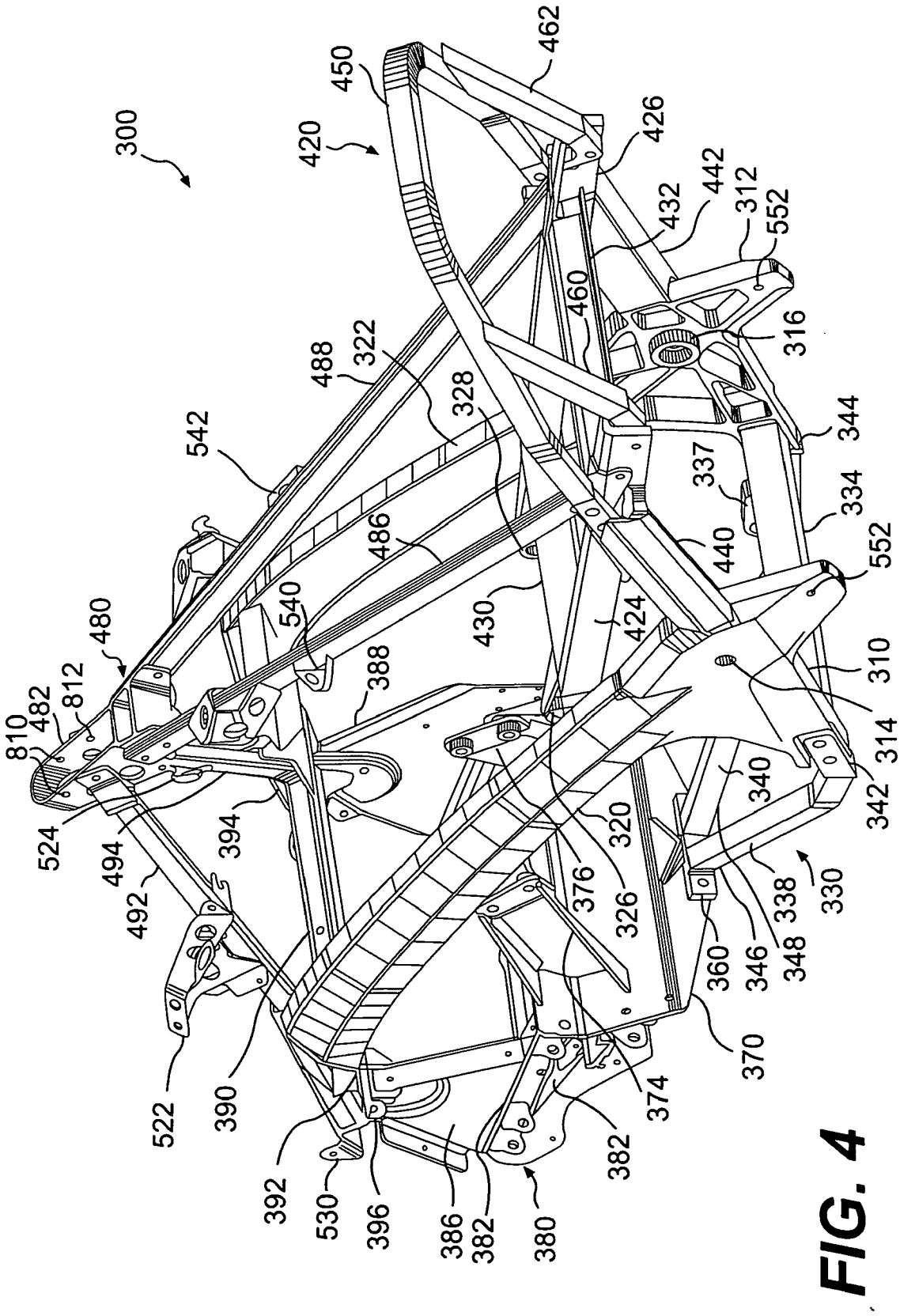

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FIG. 4

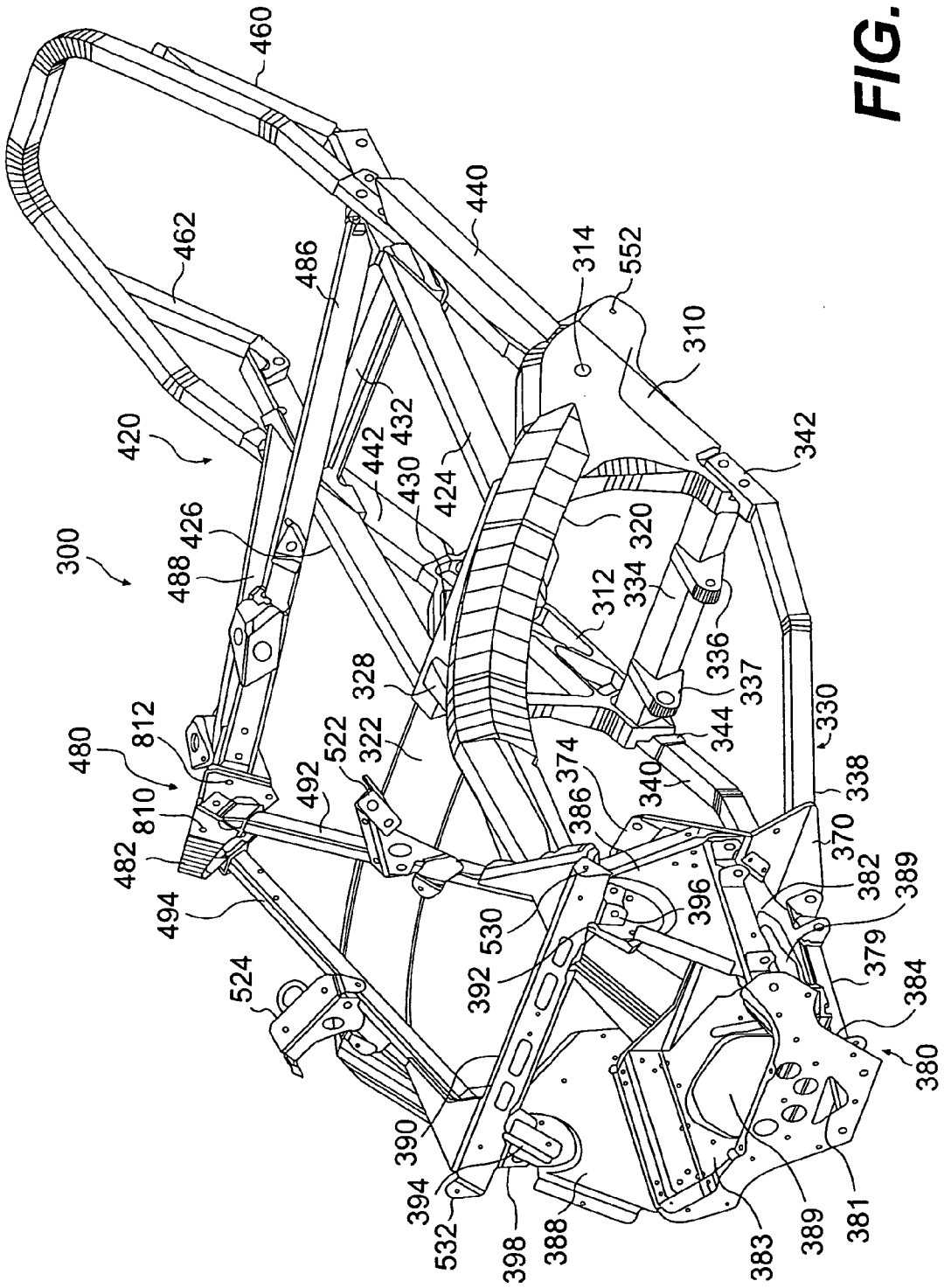
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FIG. 5

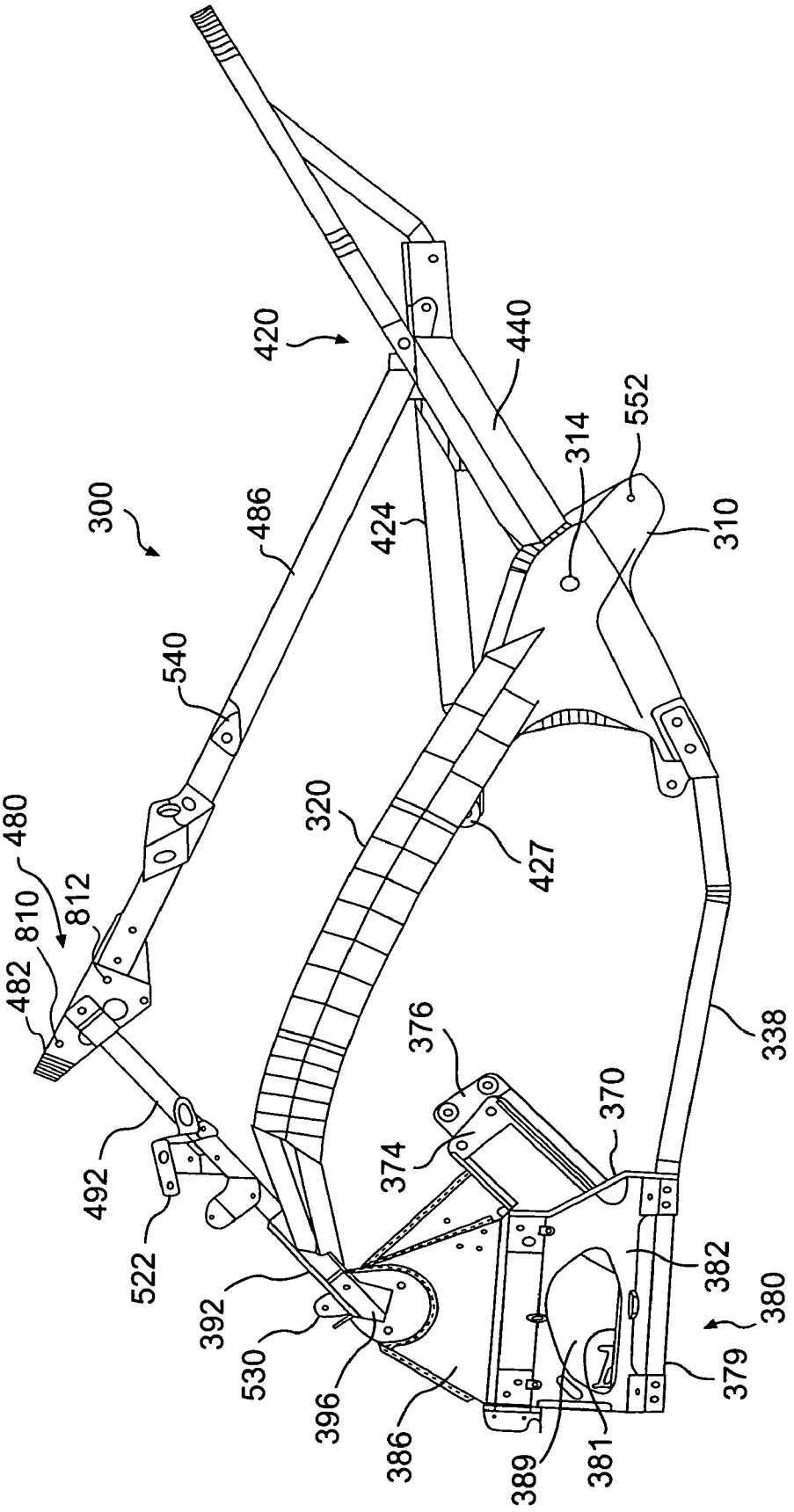
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FIG. 6

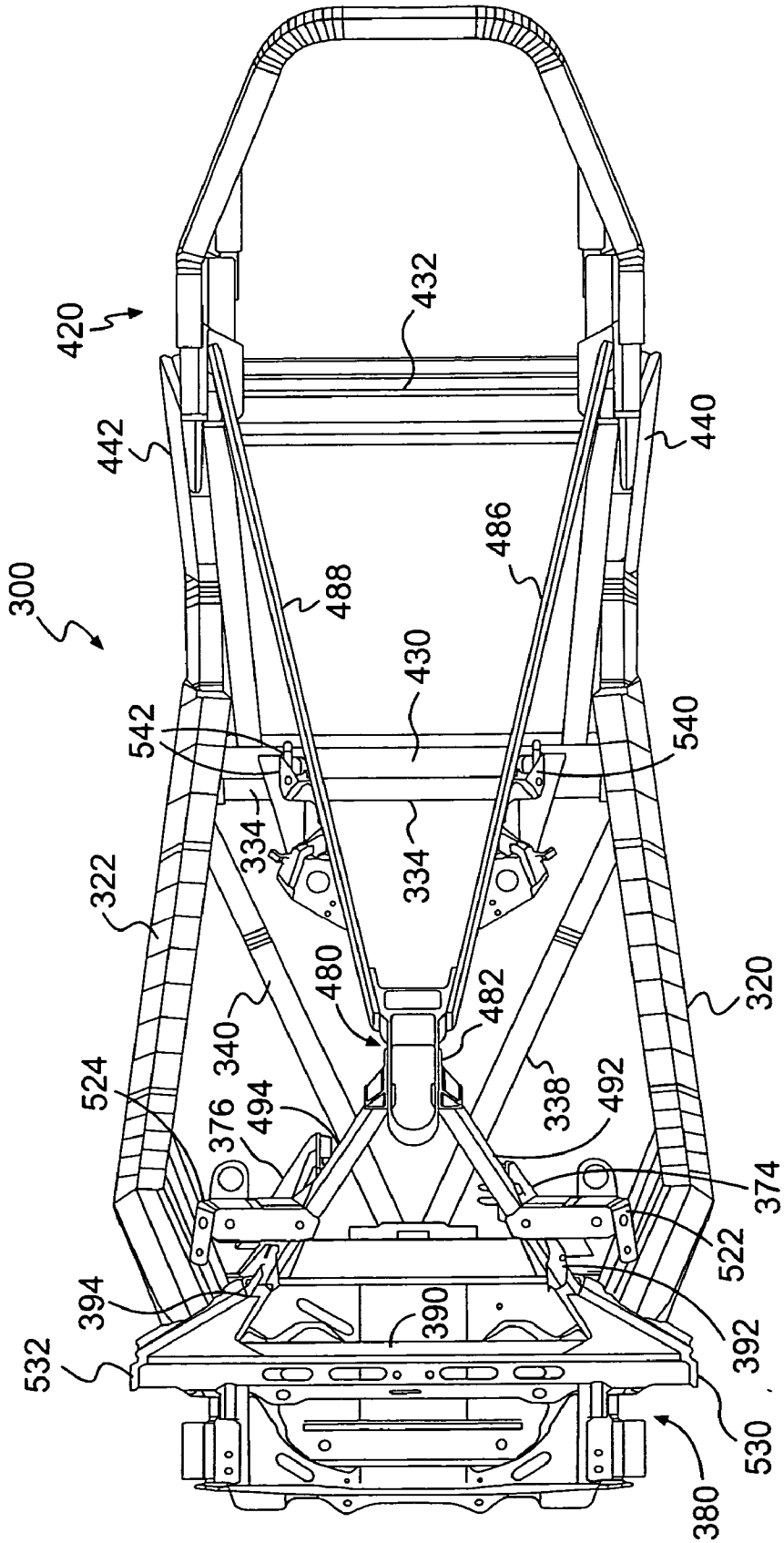
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FIG. 7

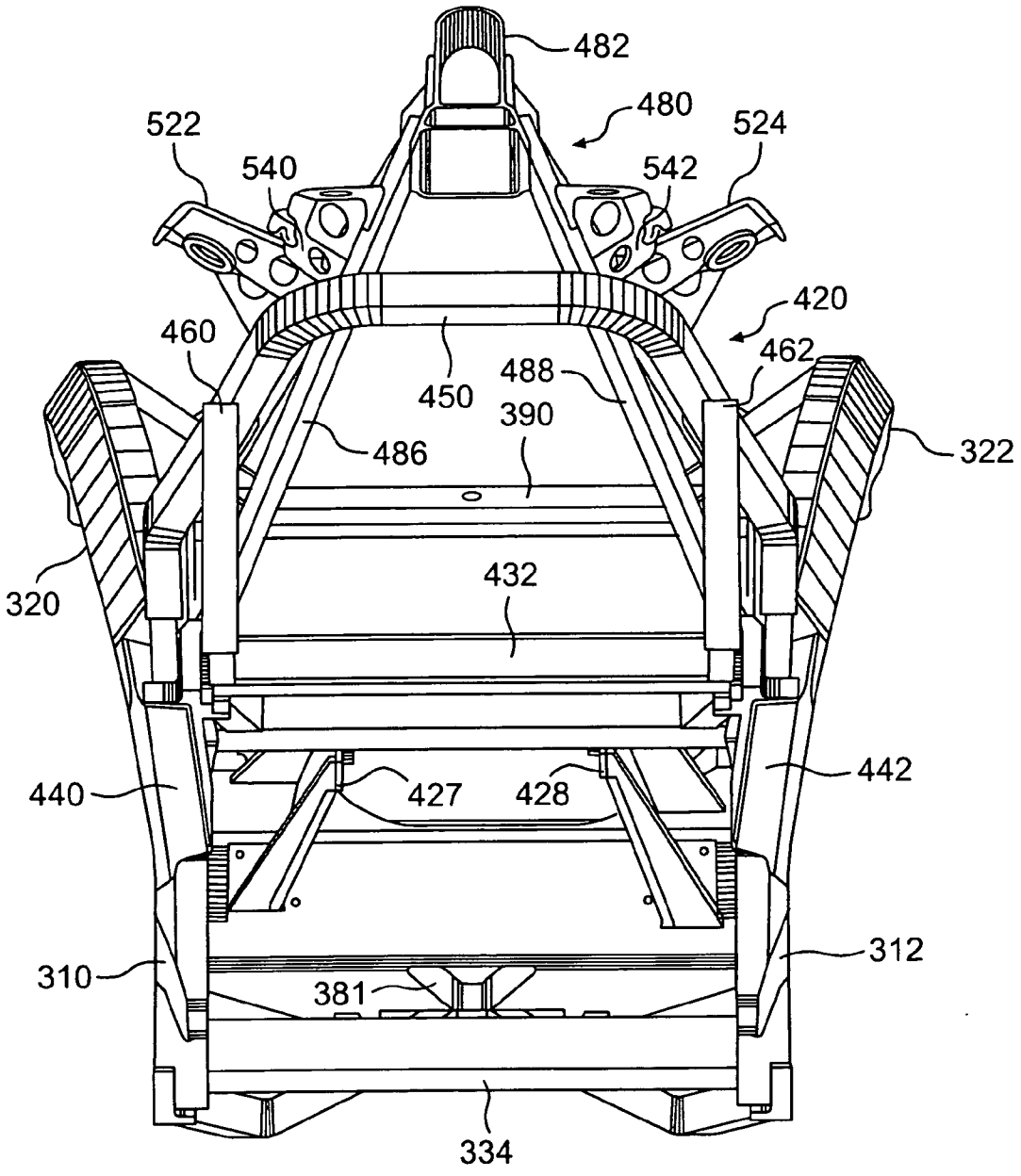
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FIG. 8

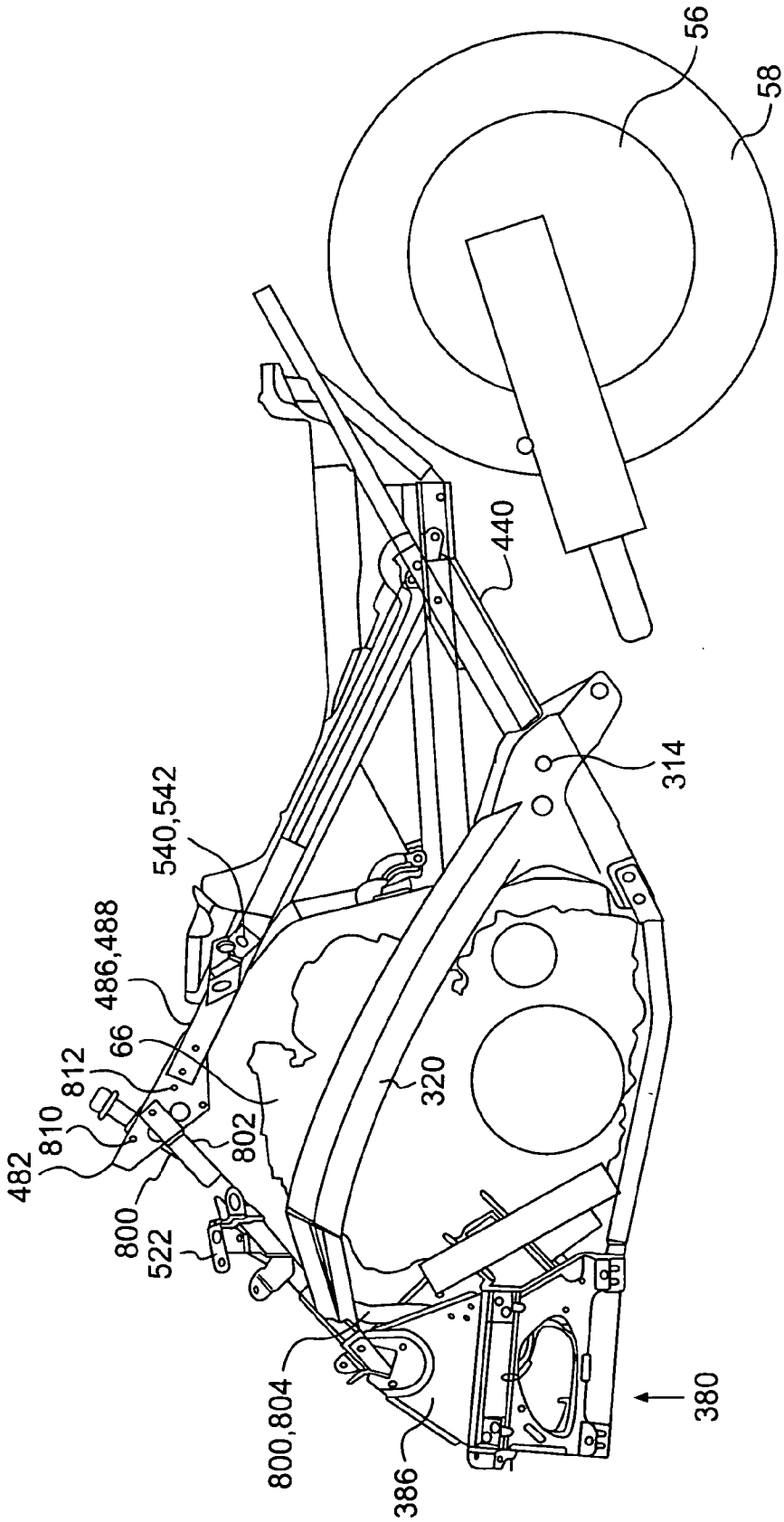
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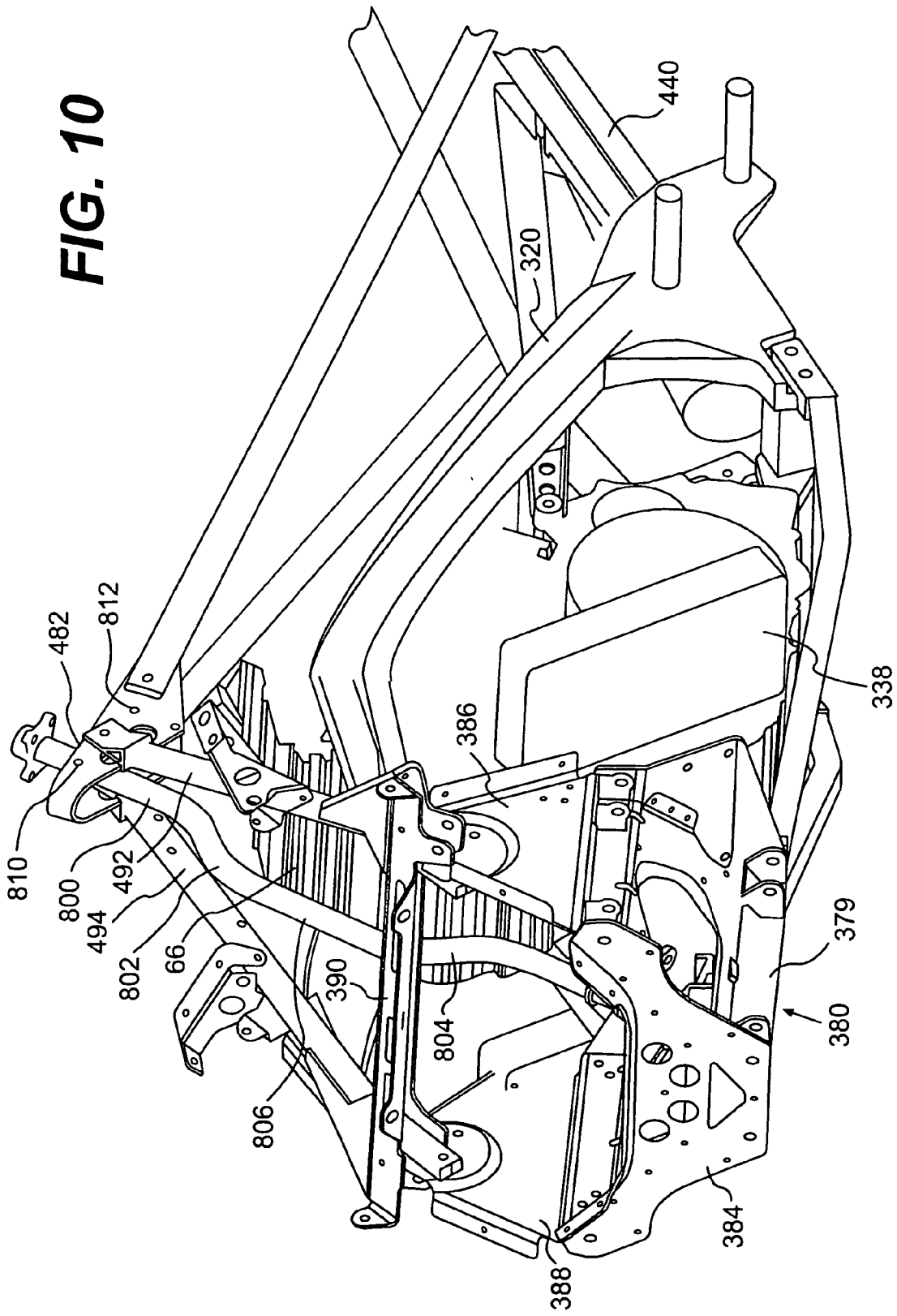
FIG. 9

FIG. 10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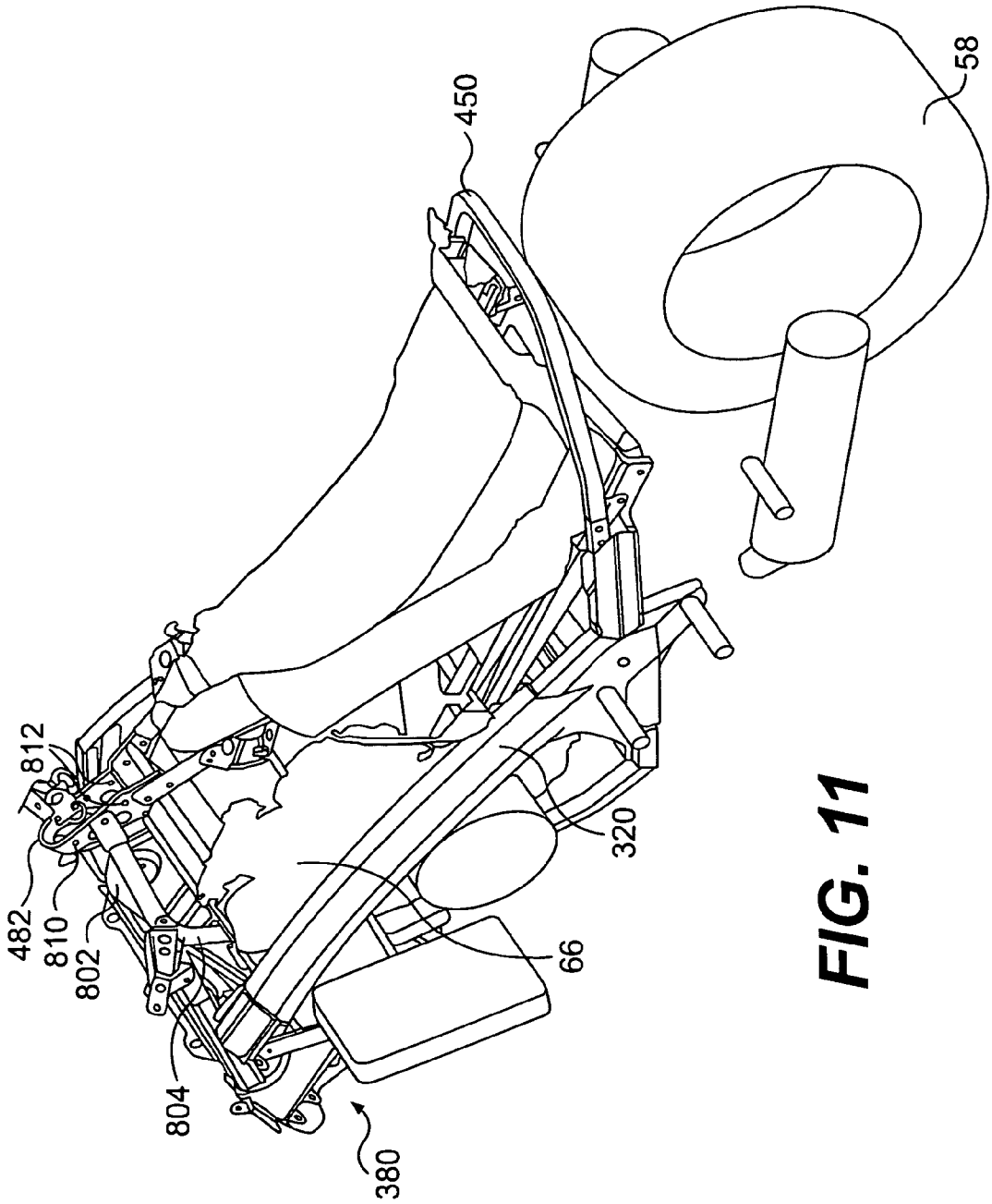

FIG. 11

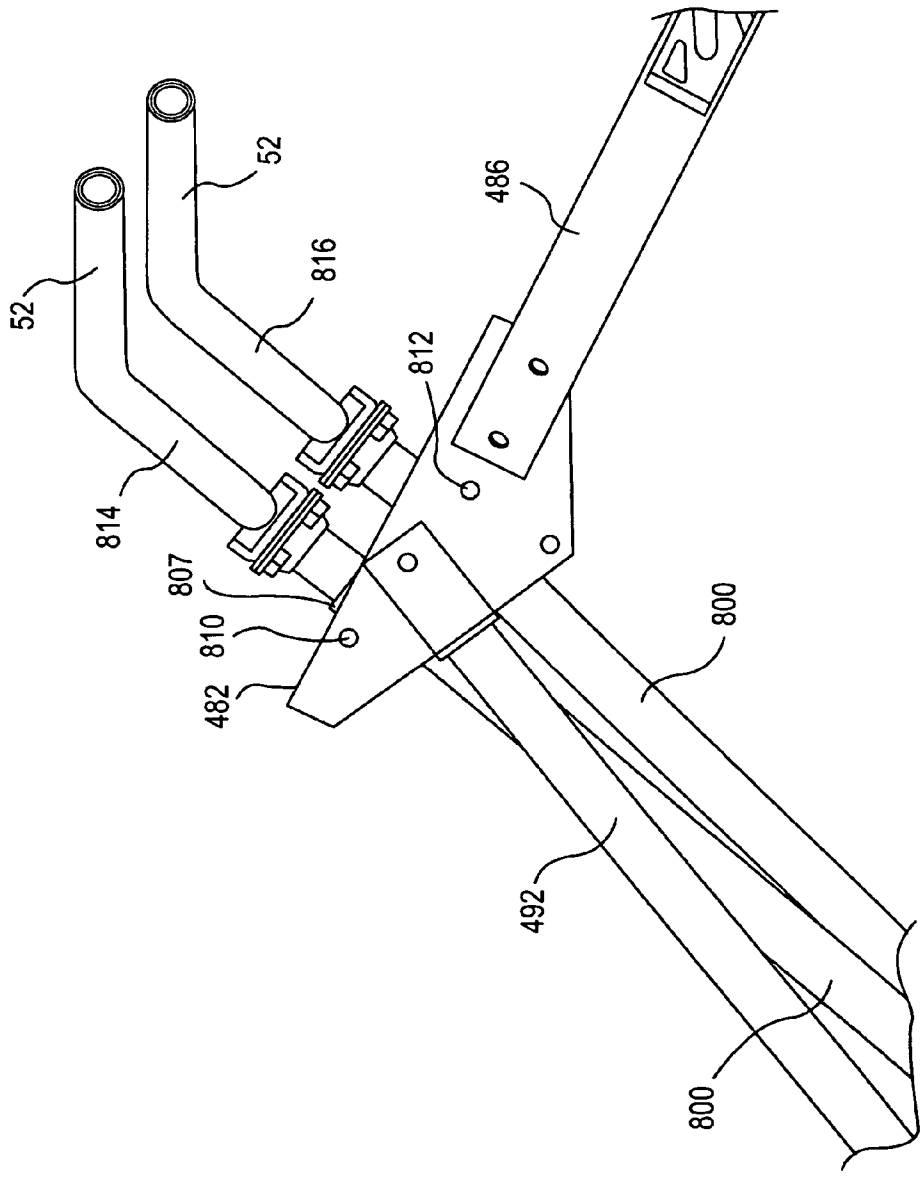

FIG. 12

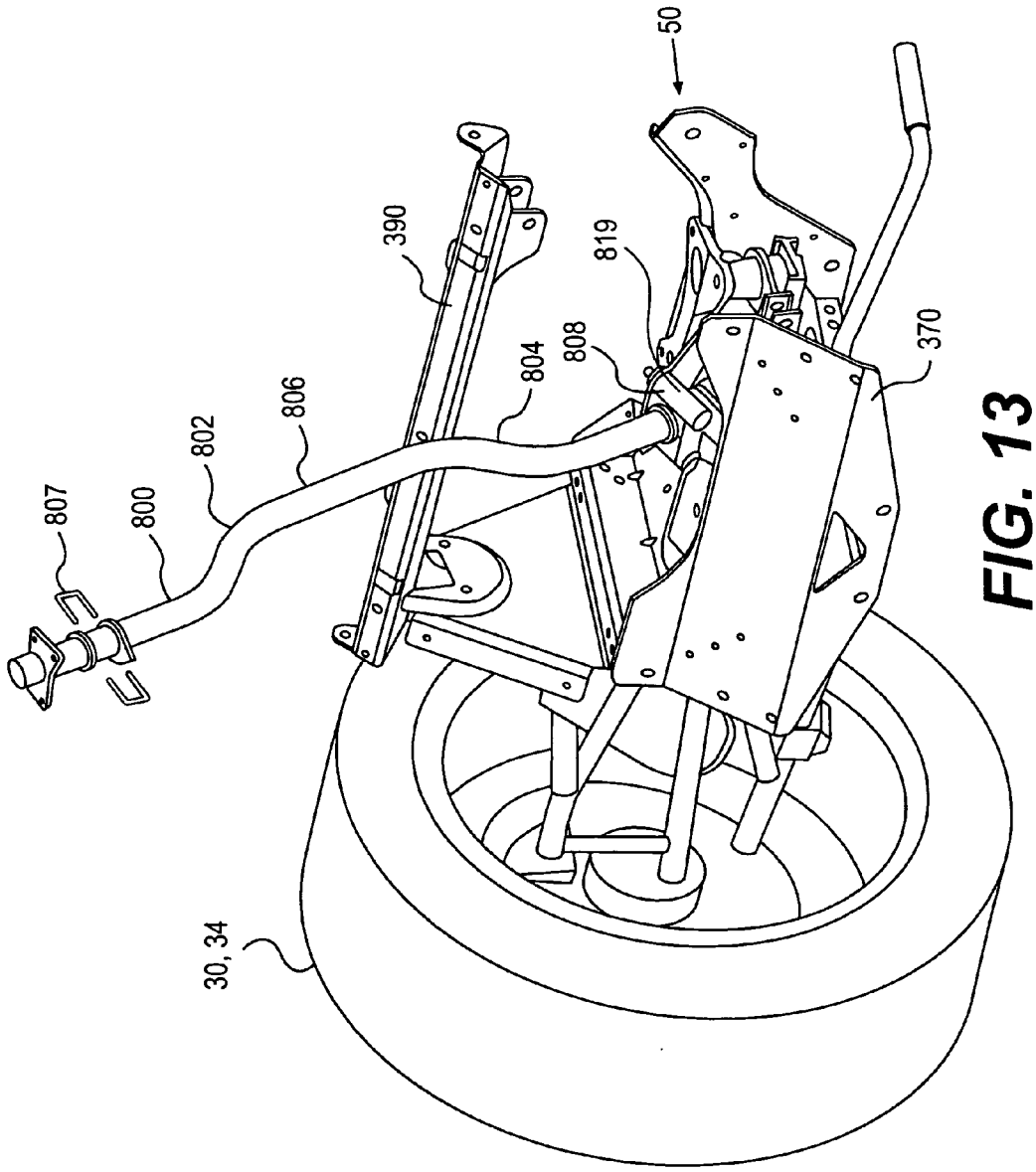

FIG. 13

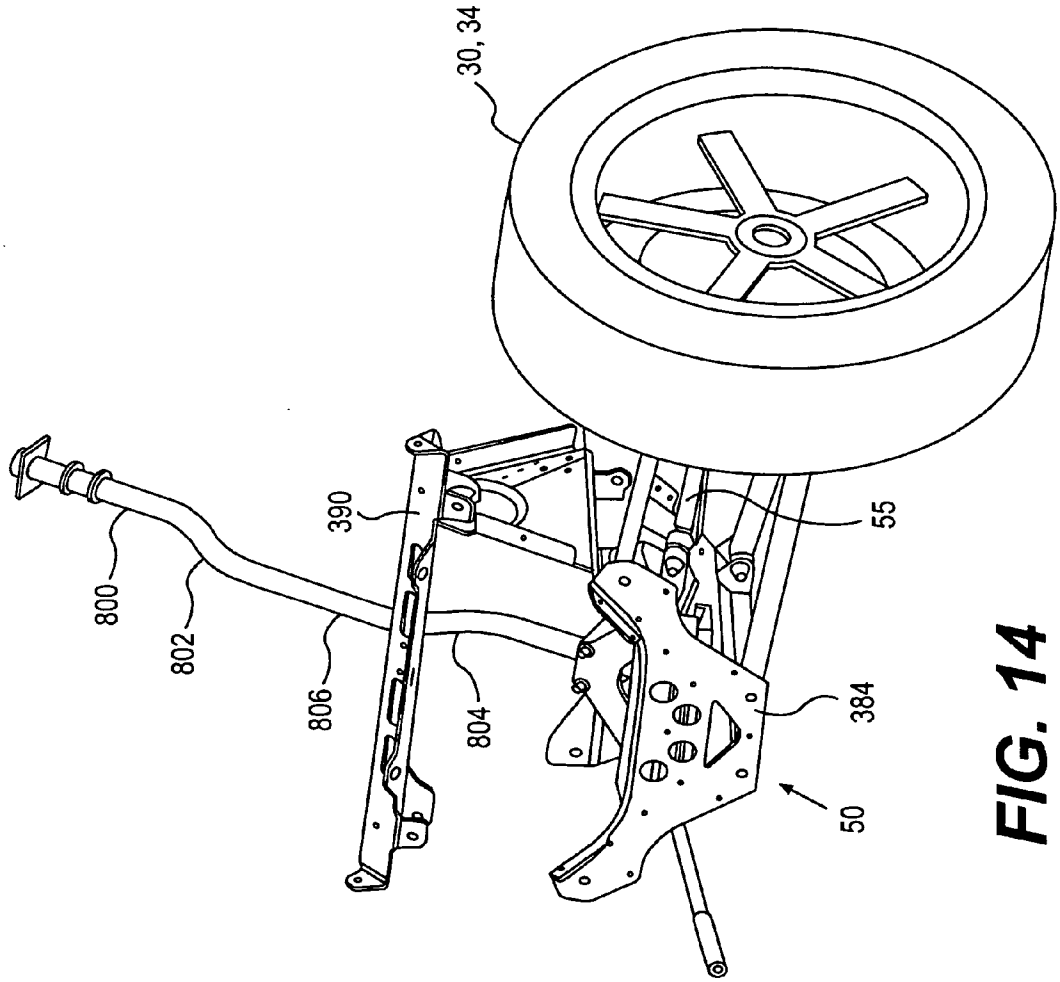

FIG. 14

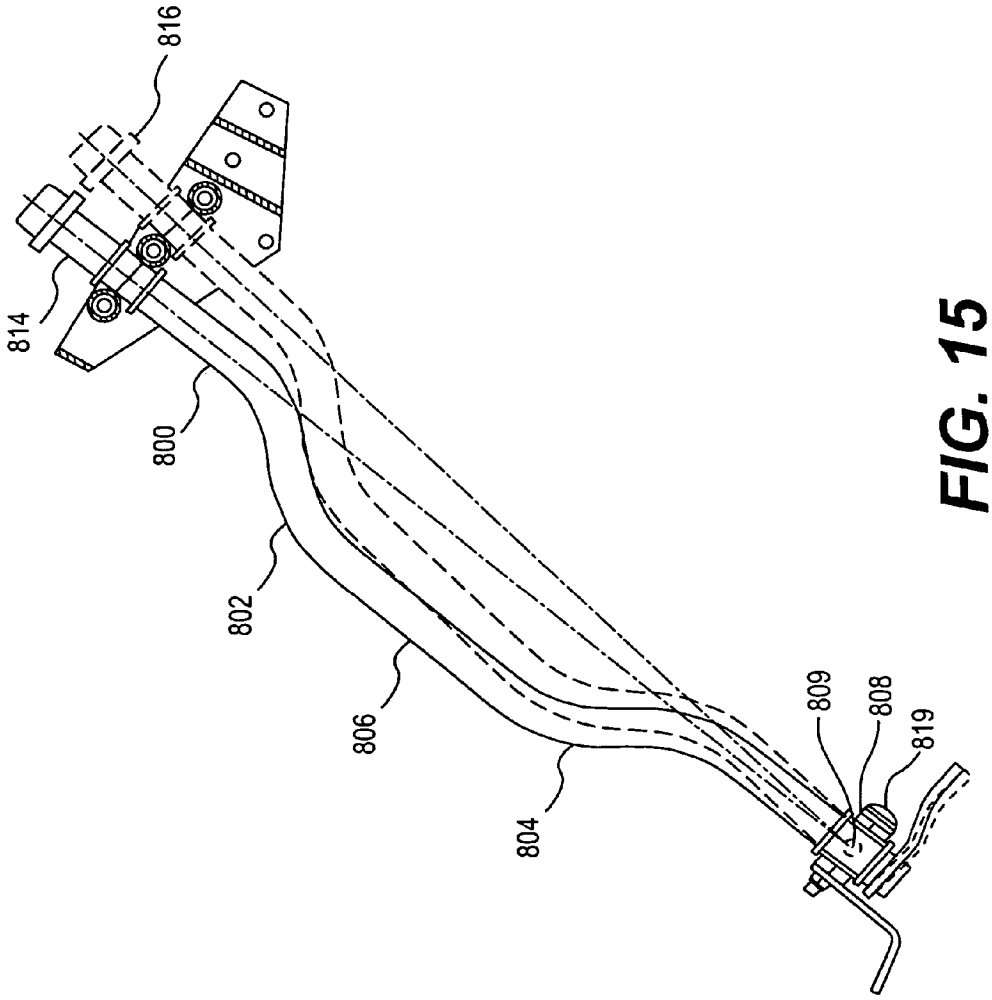

FIG. 15

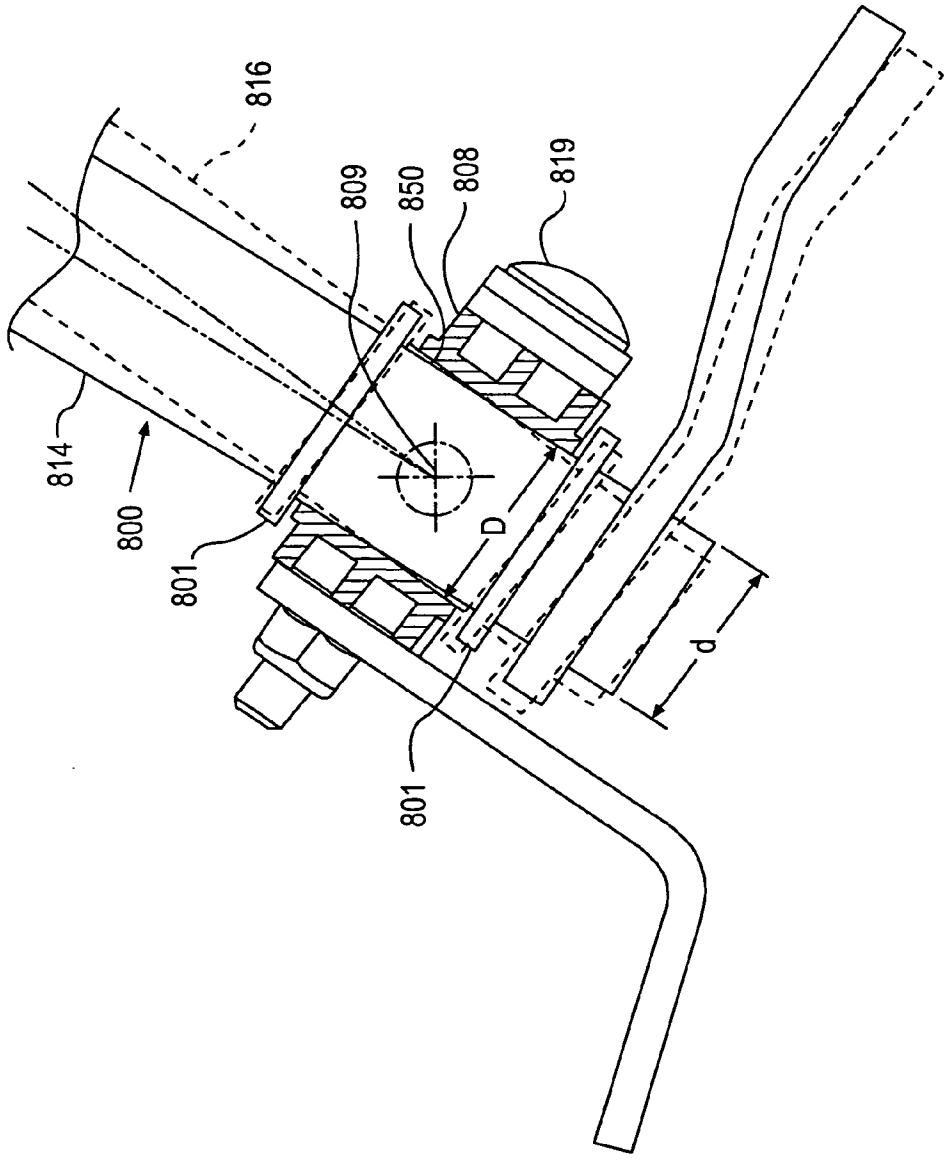

FIG. 16

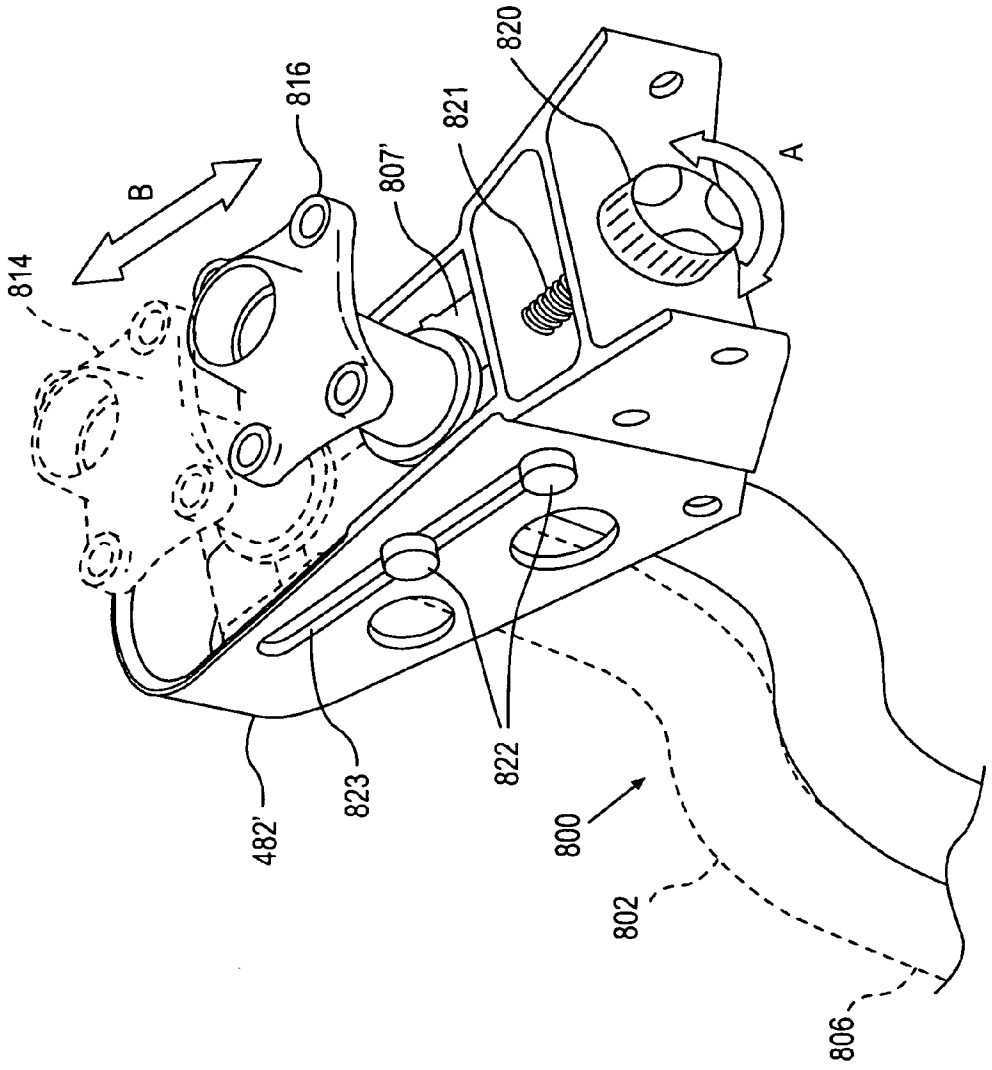

FIG. 17

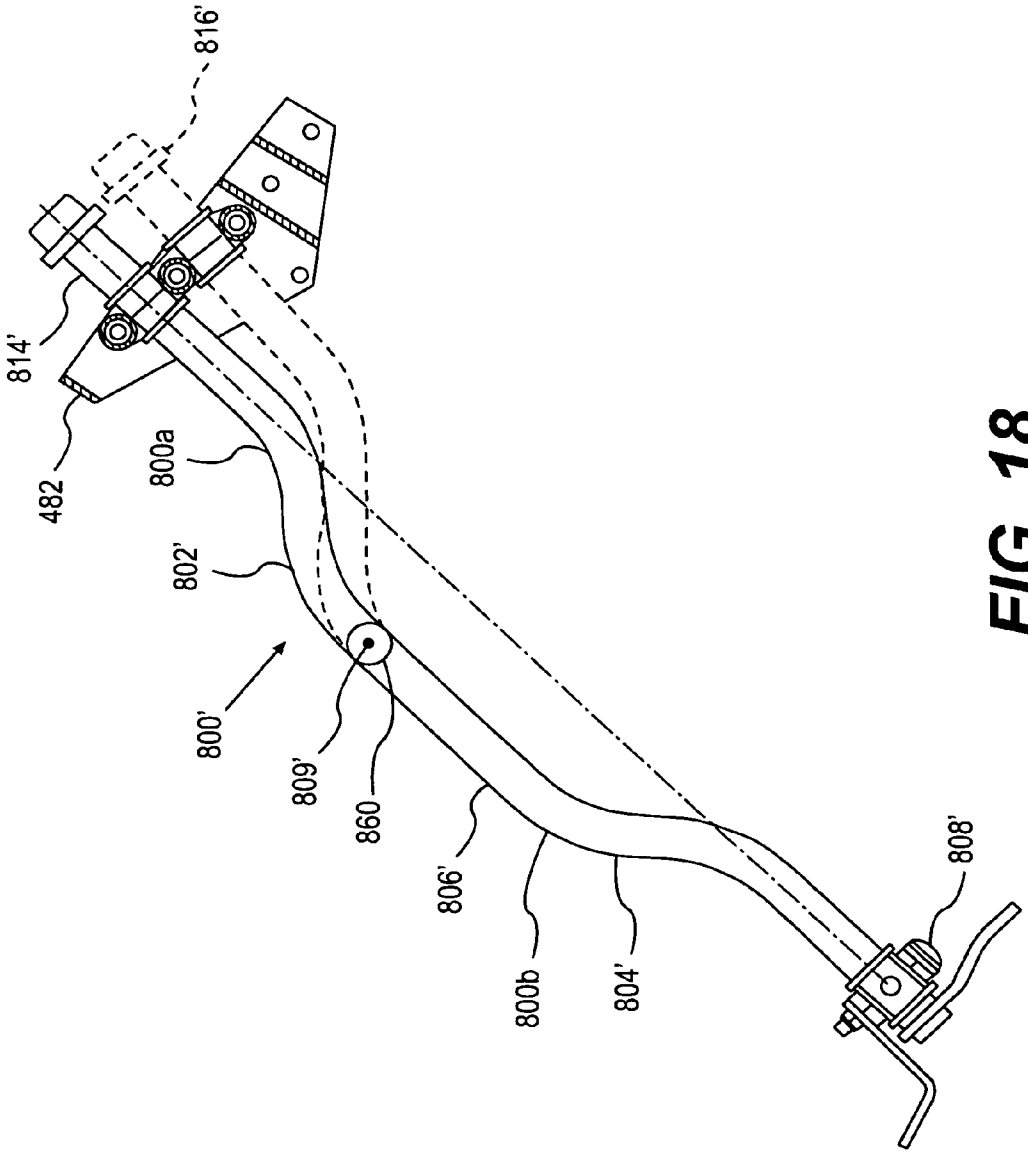

FIG. 18

VEHICLE AND ADJUSTABLE STEERING SHAFT THEREFOR

[0001] This application claims priority to U.S. Provisional Applications 60/358,397 and 60/358,400, both filed Feb. 22, 2002, the entire contents of which are herein incorporated by reference. This application is related, but does not claim priority, to U.S. application Ser. No. 09/877,212, filed Jun. 11, 2001, the entire contents of which are herein incorporated by reference.

[0002] This application is related but does not claim priority to the following U.S. provisional applications that were filed on Feb. 22, 2002: No. 60/358,362, No. 60/358,390, No. 60/358,394; No. 60/358,395; No. 60/358,396; No. 60/358,398; No. 60/358,436; and, No. 60/358,439 and any non-provisional patent applications claiming priority to the same.

[0003] This application is also related but does not claim priority to U.S. provisional application No. 60/358,737, which was filed on Feb. 25, 2002, and U.S. provisional application No. 60/418,355, which was filed on Oct. 16, 2002, and any non-provisional patent applications claiming priority to the same. The entirety of the subject matter of these applications is incorporated by reference herein.

[0004] This application is also related to but does not claim priority to U.S. Design Application 29/155,964 filed on Feb. 22, 2002, and U.S. Design Application 29/156,028 filed on Feb. 23, 2002.

[0005] This application is also related to but does not claim priority to U.S. patent application Ser. No. 10/346,188 and U.S. patent application Ser. No. 10/346,189 which were filed on Jan. 17, 2003. The entirety of the subject matter of these applications is incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0006] 1. Field of the invention

[0007] The present invention relates generally to a three-wheel vehicle, more particularly, to a tiltable steering column for a three-wheel vehicle that provides variable steering positions for a handlebar mechanism.

[0008] 2. Description of Related Art

[0009] Generally, recreational vehicles, such as All Terrain Vehicles ("ATVs"), typically are commercialized with two different riders in mind. The first type of rider seeks an ATV that is a utility vehicle, capable of rugged off-road, back-woods use and designed for carrying equipment, etc. One current example of such an ATV is the Traxter™ ATV manufactured by Bombardier Inc. of Montreal, Quebec, Canada. The second type of rider seeks a high performance ATV that is designed for sport activities. This rider, typically, is not interested in an ATV that is designed for rugged back-woods use or for carrying equipment. One current example of such an ATV is the DS 650™ also manufactured by Bombardier Inc. of Montreal, Quebec, Canada. Other manufacturers of ATVs have commercialized similar vehicles.

[0010] Utility and sport ATVs represent extremes in the design of recreational vehicles. Manufacturers also have commercialized vehicles that offer various combinations of utility and sport features. However, to date, no manufacturer has offered a single recreational vehicle that may be adapted to different riders or different riding styles, at least to some extent.

[0011] ATVs are not the only types of vehicles that are commercialized around the utility/sport model. As may be appreciated by consumers, other recreational vehicles, including motorcycles and snowmobiles, are also sold in this manner.

[0012] For example, Bombardier Inc. manufactures and sells a utility snowmobile known as the Grand Touring™ snowmobile. That vehicle is designed to accommodate more than one individual (in some cases). It is also designed for carrying at least a modest payload. At the other extreme, Bombardier Inc. manufactures and sells the MXZ™ snowmobile, which is a high-performance sport vehicle. As with ATVs, Bombardier Inc. also manufactures several other models of snowmobiles that are hybrid combinations of touring and sport features.

[0013] As a subset of the utility/sport spectrum, manufacturers have recognized that purchasers appreciate adjustability in their vehicles.

[0014] In particular, consumers appreciate the ability to change the way in which they are positioned on a vehicle depending upon their mood, personality, body type, and ride type, among others. For example, for one riding excursion, a consumer may desire to adjust the riding parameters associated with his vehicle so that the riding position is more aggressive. For another riding excursion, the same rider may wish to have a more touring-style positioning.

[0015] It is also common for consumers to want to adjust the parameters that define the riding position so that the vehicle is more comfortable for that particular consumer. While manufacturers such as Bombardier Inc. endeavor to design a vehicle that suits well a large variety of body sizes and types, consumers have individual preferences that are sometimes outside of the optimal engineering parameters. Despite this, no manufacturer has previously offered a recreational vehicle where the consumer may adjust the riding position to suit his or her personal needs.

[0016] Motorcycles are also deficient in this regard. As with ATVs and snowmobiles, motorcycles typically are designed around the same basic parameters. Namely, manufacturers usually manufacture and sell at least a touring and a sport motorcycle. To satisfy the wide variety in consumer choice, motorcycle manufacturers also make a variety of vehicles between these two extremes.

[0017] Regardless of the type of recreational vehicle considered, the same deficiency in the prior art exists.

[0018] This same deficiency exists for three-wheeled vehicles. A few examples of three-wheeled vehicles are disclosed as part of the prior art.

[0019] U.S. Pat. No. 4,787,470 ("the '470 patent") discloses a three-wheel vehicle with two front wheels and a sole rear wheel having a body formed by an ATV frame carrying two front fenders, one rear fender, and a straddle-type seat. The '470 patent describes no features that permit a rider to adjust any of the positioning parameters of the vehicle.

[0020] U.S. Pat. No. 4,662,468 ("the '468 patent") also discloses a three-wheel vehicle with two front wheels and a

sole rear wheel. The three-wheel vehicle of the '468 patent uses a conventional snowmobile chassis that is modified by attaching two driving wheels at its front end. This patent also fails to describe any features that permit the operator to change or adjust riding position parameters.

[0021] U.S. Pat. No. 5,564,517 ("the '517 patent") discloses a snowmobile conversion frame kit which includes two wheels with a steering assembly in the front and a rear wheel with a swing arm in the rear. The kit is designed to be secured to a conventional snowmobile chassis. As with the other vehicles, there is nothing in the patent to suggest that the riding parameters of the vehicle may be adjusted in any manner.

[0022] As discussed above, a need has arisen for a construction that provides at least a modest degree of adjustability and/or flexibility in rider positioning.

[0023] This need remains unaddressed by the prior art.

SUMMARY OF THE INVENTION

[0024] The present invention provides a three-wheel vehicle and an adjustable steering shaft that provides for variable positioning of a handlebar mechanism operatively connected to the steering shaft.

[0025] The variable positioning of the handlebar mechanism allows for adjustment of the handlebar mechanism to accommodate riders of different sizes and to provide different riding positions for a rider.

[0026] The handlebar mechanism may be positioned further from the seat position to accommodate taller riders and/or to provide a relaxed (e.g., touring) riding position for the rider.

[0027] The handlebar may be positioned closer to a defined seat position to accommodate a shorter rider and/or to provide an aggressive (e.g., racing) riding position for the

[0028] Accordingly, the present invention provides for a three-wheel vehicle, which includes a frame, a straddle-type seat disposed on the frame, and an engine supported by the frame. At least three wheels are suspended on the frame, a first wheel being at a front and a second wheel being at a rear of the frame. At least one of the three wheels is operatively driven by the engine. The vehicle also includes a steering shaft operatively connected to at least one of the three wheels and a steering bracket that supports the steering shaft in a plurality of selective positions.

[0029] Other aspects of the present invention will be made apparent from the description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] For a better understanding of the present invention as well as other objects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

[0031] **FIG. 1** is front view of a three-wheel vehicle according to the present invention;

[0032] **FIG. 2** is a side view of the vehicle shown in **FIG. 1**;

[0033] **FIG. 3A** is a top view of the vehicle shown in **FIGS. 1 and 2**;

[0034] **FIG. 3B** is a top view of an alternate embodiment of the vehicle shown in **FIGS. 1 and 2**;

[0035] **FIG. 4** is a perspective view of a frame assembly according to the present invention, as viewed from the rear left side;

[0036] **FIG. 5** is a perspective view of the frame assembly, as viewed from the forward left side;

[0037] **FIG. 6** is a left side view of the frame assembly;

[0038] **FIG. 7** is a top view of the frame assembly;

[0039] **FIG. 8** is a rear view of the frame assembly;

[0040] **FIG. 9** is a partial side view of the frame assembly and a steering shaft of the steering assembly in a first position according to the present invention;

[0041] **FIG. 10** is a perspective view of the frame assembly, including the steering assembly and fuel tank, as viewed from the forward left side;

[0042] **FIG. 11** is a perspective view of the frame assembly, including the steering assembly and fuel tank, as viewed from the rear left side;

[0043] **FIG. 12** is a close-up left side view detail of the connection point between the handlebars and the frame assembly, illustrating the variable positioning of the handlebars;

[0044] **FIG. 13** is a perspective view of the steering shaft, the front left wheel and a portion of the steering assembly as viewed from the rear right side;

[0045] **FIG. 14** is a perspective view of the steering shaft, the front left wheel and a portion of the steering assembly as viewed from the front left side;

[0046] **FIG. 15** is a schematic illustration of an adjustable steering shaft arrangement according to an embodiment of the present invention;

[0047] **FIG. 16** is a schematic illustration of a connection of the adjustable steering shaft shown in **FIG. 15** to a front suspension sub-frame;

[0048] **FIG. 17** is a schematic illustration of an adjustable steering shaft arrangement according to another embodiment of the present invention; and

[0049] **FIG. 18** is a schematic illustration of an adjustable steering shaft arrangement according to another embodiment of the present invention.

DETAILED DESCRIPTION

[0050] Before delving into the specific details of the present invention, it should be noted that the conventions "left,""right,""front,""rear,""up," and "down" are defined according to the normal, forward travel direction of the vehicle being discussed. As a result, the "left" side of a vehicle corresponds to the left side of a rider seated in a forward-facing position on the vehicle.

[0051] FIGS. **1-3A** illustrate a three-wheel vehicle **10** according to the present invention. Left and right laterally spaced front wheels **30**, **32**, with left and right tires **34**, **36**, are supported by a front suspension system **600**. The front suspension system **600** is supported by a frame assembly **300** (**FIG. 4**). A steering assembly **50** is mounted to the

frame assembly **300** and includes a handlebar mechanism **52** that is operatively connected to the front wheels **30, 32** to steer the vehicle **10**. The steering assembly **50** is preferably a progressive steering system.

[**0052**] A rear wheel **56** and tire **58** are supported by a rear suspension system **60**. The rear suspension system **60** is supported by the frame assembly **300**. For purposes of the following description, it should be appreciated that the rear wheel **56** may be include a single rim or may include a multi-rim arrangement having a rigid connection between the rims to form the wheel. It should also be appreciated that each rim accommodates a tire. In the case of a multi-rim arrangement, the plurality of rear tires may be in contact with one another or spaced from each other or a combination of spaced and touching.

[**0053**] The wheels **30, 32, 56** are all preferably 15 inch wheels. The tires **34, 36, 58** preferably are automotive tires suitable for road use. It would be appreciated by those skilled in the art, however, the wheels **30, 32, 56** may be of any other size without deviating from the scope of the present invention.

[**0054**] An engine **66** (**FIGS. 2 and 9**) is supported by the frame assembly **300** and operatively connected to the rear wheel **56** to power the vehicle **10**. It should be appreciated that the engine, alternatively, may be operatively connected to one or both of the front wheels, or to all of the wheels.

[**0055**] Since the vehicle **10** is designed for road use, the engine **66** preferably is selected to produce an output power of 75 horsepower or more. A 1000 cc ROTAX™ V-type internal combustion engine is preferred. However, any other engine size or type of engine may be used instead. Moreover, the engine **66** may be designed to produce less than 75 horsepower without deviating from the scope of the present invention. In addition, a fuel cell or electric motor may be used instead of the engine **66**.

[**0056**] Preferably, the frame assembly **300** is designed to provide sufficient structural rigidity so that the frame assembly **300** withstands the forces experienced during high performance operation of the vehicle **10**.

[**0057**] A cushioned rider seat **70** is mounted to the frame assembly **300** between the forward wheels **30, 32** and the rear wheel **56**.

[**0058**] Referring to **FIG. 3**B, an alternate embodiment of a three-wheel vehicle **10'** according to the present invention includes a plurality of rear wheels and tires **56**A, **56**B and **58**A, **58**B. While two rear wheels **56**A, **56**B are shown, any number greater than two also may be employed without deviating from the scope of the present invention.

[**0059**] Referring to FIGS. **4-10**, the frame assembly **300** of the vehicle **10** includes left and right laterally spaced rear suspension plates **310, 312**. The rear suspension plates **310, 312** generally form vertically and longitudinally extending reinforced plates. The rear suspension plates **310, 312** are preferably made of a strong light material such as cast aluminum. Left and right laterally extending swing arm pivot bores **314, 316** are centrally disposed on each rear suspension plate **310, 312** to accommodate pivotal mounting of a rear swing arm **400** (**FIG. 9**).

[**0060**] Laterally spaced left and right upper spars **320, 322** extend upwardly and forwardly from upper forward portions of the left and right rear suspension pates **310, 312**, respectively. While not required, the upper spars **320, 322** in this embodiment are welded or otherwise integrally formed with the rear suspension plates **310, 312**. The upper spars **320, 322** extend arcuately slightly upwardly as they progress forwardly to provide an attractive shape to the frame assembly **300** when viewed from the side. As illustrated in **FIG. 2**, the outer sides of the right upper spar **322** is visible from the right side of the vehicle **10**. The left upper spar **320** is similarly visible from the left side of the vehicle **10**.

[**0061**] An engine cradle assembly **330** extends forwardly from the lower front ends of the rear suspension plates **310, 312**. The engine cradle assembly **330** includes a rear engine support cross brace **334** that extends laterally between the lower front ends of the left and right rear suspension plates **310, 312**. Laterally spaced left and right lower rear engine anchors **336, 337** extend forwardly from the engine support cross brace **334**. The lower rear engine anchors **336, 337** are preferably welded to the engine support cross brace **334**.

[**0062**] The engine cradle assembly **330** also includes left and right lower spars **338, 340** having rearward portions **342, 344** that are bolted to the lower forward ends of the left and right rear suspension plates **310, 312**, respectively. The lower spars **338, 340** extend forwardly and laterally inwardly from their respective rearward portions to their forward portions **346, 348**. A laterally extending lower spar bracket **360** is connected to the forward portions **346, 348** of the lower spars **338, 340**. The lower spar bracket **360** is preferably welded to the forward portions **346, 348** of the lower spars **338, 340**. The left and right lower spars **338, 340** and the engine support cross brace **334** generally form a triangle when viewed from above.

[**0063**] The engine cradle assembly **330** further includes a forward engine cradle plate **370** that is connected, preferably with bolts, to a forward portion of the lower spar bracket **360**. The plate **370** generally extends vertically and laterally and includes several small bends along lateral fold lines that improve the rigidity of the plate **370**. Left and right forward engine anchors **374, 376** extend rearwardly and upwardly from the plate **370** and include engine mounting holes. The engine anchors **374, 376** are preferably welded or otherwise permanently fixed to the engine cradle plate **370**.

[**0064**] As the rearward portions **342, 344** of the lower spars **338, 340** are bolted to the rear suspension plates **310, 312** and the lower spar bracket **360** is bolted to the engine cradle plate **370**, the lower spars **338, 342** and the lower spar bracket **360** may be detached from the frame assembly **300** in order to provide access to the engine without further disassembly of the components of the frame assembly **300**.

[**0065**] A front suspension sub-frame **380** is connected, preferably with bolts, to a forward end of the engine cradle plate **370**. The front suspension sub-frame **380** includes a longitudinally extending tubular beam **381**. The beam **381** is an extruded hollow member having a generally trapezoidal or triangular cross section with the long parallel edge of the trapezoid on top (**FIG. 8**). A generally V-shaped plate **379** includes left and right outwardly extending side panels **382, 383** that extend upwardly, outwardly and longitudinally from a generally flat longitudinally-oriented vertex. The V-shaped plate **379** forms a "V" when viewed from the front. The tubular beam **381** is connected, preferably by welding, to the inside of the vertex of the V-shaped plate **379** to form

a V-shaped assembly. The outwardly extending side panels **382, 383** include large central apertures **389** through which tie rods **55** of the steering assembly **50** extend. The rear edge of the V-shaped assembly is connected, preferably by rivets, welds or bolts, to the engine cradle plate **370**, whose lateral bends follow the rear edge of the V-shape assembly (**FIG. 6**).

[**0066**] The sub-frame **380** further includes a vertically and laterally extending forward transverse plate **384** that is connected, preferably with welds, rivets or bolts, to the front end of the V-shaped assembly. Together, the variously oriented plates/panels **370, 382, 383384** and the tubular beam **381** provide a strong, rigid front suspension sub-frame **380** onto which the front suspension **600** is mounted.

[**0067**] Left and right vertically and longitudinally extending side panels **386, 388** extend upwardly from the left and right outwardly extending panels **382, 383**, respectively, of the V-shaped assembly. Each side panel **386, 388** forms a triangle having a flat lower side attached to the flat upper edge of the corresponding outwardly extending side panel **382, 383** of the V-shaped assembly. Each vertically extending side panel **386, 388** may be welded to its corresponding outwardly extending side panel **382, 383**. Alternatively, each vertically extending side panel **386, 388** may be integrally formed with its corresponding outwardly extending side panel **382, 383**, a bend in the sheet material of the V-shaped plate **379** defining the attachment edge between adjoining panels **382, 386** and **383, 388**.

[**0068**] A laterally extending front cross brace **390** connects between upper ends of the side panels **386, 388** (i.e., at the upper vertices of the triangles formed by the side panels **386, 388**) of the front suspension sub-frame **380** at left and right connection points **392, 394**. Forward ends of the left and right upper spars **320, 322** likewise connect to the front cross brace at the left and right connection points **392, 394**, respectively. The front cross brace **390** extends laterally outwardly beyond the connection points **392, 394** on its left and right sides to provide left and right shock absorber anchors **396, 398**. The front cross brace **390** preferably bolts, or otherwise removably fastens, to the front suspension sub-frame **380** and the upper spars **320, 322**.

[**0069**] A pyramid-shaped upper structural support assembly **480** extends upwardly from left and right tank support members **424, 426** and connection points **392, 394** to a steering column bracket **482**. Left and right upper column rear members **486, 488** connect between the rearward portions of the left and right tank support members **424, 426**, respectively, and the steering column bracket **482**. Each upper column rear member **486, 488** extends upwardly, forwardly, and inwardly from the rearward portion of its respective tank support member **424, 426** to the steering column bracket **482**. Consequently, the left upper column rear member **486**, right upper column rear member **488**, and the rearward suspension cross brace **432** generally form a triangle when viewed from the rear and/or top.

[**0070**] The upper structural support assembly **480** further comprises left and right upper column front members **492, 494** connected between the left and right connection points **392, 394**, respectively, on the front cross brace **390** and the steering column bracket **482**. Each upper column front member **492, 494** extends upwardly, rearwardly, and inwardly from its respective connection point **392, 394** on the front cross-brace **390** to the steering column bracket **482**. Consequently, the upper column front members **492, 494** and front cross brace **390** generally form a triangle when viewed from the front and/or top.

[**0071**] The steering column bracket **482** may alternatively be mounted to any other convenient portion of the frame assembly **300**. For example, if the upper support assembly **480** were eliminated, a steering column bracket could be supported by a cross brace that extends between the upper spars **320, 322**. Alternatively, the steering column bracket could be supported by one or both of the upper spars **320, 322** directly. Generally, the steering shaft **53** may be pivotally connected to any two frame assembly **300** components, e.g., the front suspension sub-frame **380**, the upper spars **320, 322**, the upper support assembly **480**, front cross brace **390**, etc. The steering shaft **800** may alternatively be pivotally connected to just one frame assembly **300** component.

[**0072**] While the pyramid-shaped upper support assembly **480** is not required for the structural strength and/or rigidity of the frame assembly **300**, the upper support assembly **480** provides anchor points for a variety of vehicle **10** components. For example, the fuel tank **481** is supported by the upper support assembly **480**. The upper support assembly **480** need not be included in a frame assembly **300** according to the present invention. For example, if the upper support assembly **480** were eliminated, a steering bracket like the steering column bracket **482** could be mounted to any other suitable component of the frame assembly **300**. Similarly, other components that are illustrated as being mounted to the upper support assembly **480** could either be eliminated, moved or mounted to other frame assembly **300** components without deviating from the scope of the present invention.

[**0073**] Left and right forward upper fairing anchors **522, 524** are mounted at intermediate portions of the left and right front braces **492, 494**, respectively. Similarly, left and right forward lower fairing anchors **530, 532** are formed at the left and right ends of the front cross brace **390**. The forward fairing **534**, which is preferably made of fiberglass with a gelcoat, is attached to the body anchors **522, 524, 530, 532**.

[**0074**] Referring to FIGS. **9-16**, a steering shaft **800** is connected to the handlebar mechanism **52** at an upper end of the steering shaft **800**. The steering shaft **800** is connected at a bottom end thereof to a bearing or bushing **808** (**FIG. 13**) connected to the steering assembly **50** that turns front wheels **30, 32** upon rotation of the handlebar mechanism **52**. To accommodate the variable positioning of the steering shaft **800** and the handlebar mechanism **52**, the steering shaft **800** includes upper and lower bends **802, 804** that provide an offset portion **806** of the steering shaft **800**. The offset portion **806** ensures that the steering shaft **800** remains spaced from the engine **66** when moved from a first position **814** to a second position **816**.

[**0075**] Referring to FIGS. **12-14**, the steering shaft **800** passes through a bearing or bushing **807** at its upper end that is connected to the steering bracket **482** at either first or second pairs of holes **810, 812**. The pairs of holes **810, 812** define the first and second positions **814, 816** of the steering shaft **800**. It should be appreciated that a single hole on one side of the steering bracket **482** may define a position of the steering shaft **800**. Referring to **FIGS. 9 and 10**, the steering shaft **800** is shown in the first position **814**. When the steering shaft **800** is moved to the second position **816**, the

offset portion **806** remains spaced from the engine **66**. As shown in **FIG. 9**, the steering shaft **800** is shown in the first position **814** spaced from the engine **66**. A straight steering shaft would be spaced from the engine **66** in the first position **814**. However, in order to allow for variable positioning of the steering shaft **800**, the offset portion **806** is necessary to ensure that the steering shaft **800** remains spaced from the engine **66** when the steering shaft **800** is moved from the first position **814** to the second position **816**.

[**0076**] The position of the steering shaft **800** in front of the engine provides several advantages, some of which are detailed below.

[**0077**] First, with the steering shaft in front of the engine **66**, the engine **66** may be positioned in the frame assembly **300** at a lower position than would be possible if the engine **66** were positioned in front of the steering shaft **800**. Moreover, the engine **66** may be placed in a position that is more centrally located than if the engine were positioned in front of the steering shaft **800**. The placement of the engine **66** in the location generally illustrated in **FIG. 9** assures that the vehicle **10** will have a low center of gravity that is more centrally positioned beneath the operator of the vehicle. With the center of gravity of the vehicle positioned in this manner, the vehicle is very stable, even at higher speeds, as would be experienced during road use.

[**0078**] Second, positioning the steering shaft **800** in front of the engine **66** facilitates access to the engine **66** after the engine cradle assembly **330** is removed. With the steering shaft **800** positioned in front of the engine **6**, there are no steering components that extend rearwardly and beneath the engine. As a result, the engine is more accessible when the engine cradle assembly is removed.

[**0079**] Other advantages of the positioning of the steering shaft **800** in front of the engine **66** may be appreciated by those skilled in the art.

[**0080**] Referring to **FIGS. 15 and 16**, the lower end of the steering shaft **800** is supported by the bearing or bushing **808** and pivots about a pivot point **809**. The bearing or bushing **808** includes a bore **850** through which the steering shaft **800** passes. The bore **850** has a diameter D that is larger than the diameter d of the steering shaft **800**. As shown in **FIGS. 13 and 16**, the bearing or bushing **808** includes separable parts secured together by a fastener **819**. The steering shaft **800** has flanges **801** on the lower end that allow the steering shaft **800** to pivot about the pivot point **809** and prevent the steering shaft **800** from being removed from the bearing or bushing **808** in a longitudinal direction of the bore **850**.

[**0081**] The adjustability of the steering shaft **800**, and the adjustability of the handlebar mechanism **52**, allows the handlebar mechanism **52** to be positioned closer to the rider in the second position **816** to allow for a more aggressive, or racing, riding stance. The handlebar mechanism **52** may also be positioned farther from the rider in the first position **814** to provide a more relaxed, or touring, riding stance. The steering shaft **800** thus has two positions for a single rider or a different positions for different riders. The adjustability of the steering shaft **800** also accommodates different size upper bodies and arm lengths of various riders.

[**0082**] Although the steering bracket **482** is shown with two pairs of holes **810**, **812** that define two positions of the steering shaft **800**, it should be appreciated that the steering bracket **482** may be constructed to provide for more than two positions by the provision of additional pairs of holes or to provide infinite variation of the position of the handlebar mechanism **52**, such as by the provision of a slot. Referring to **FIG. 17, a** steering bracket **482'** according to an alternate embodiment of the present invention includes a slot **823** that accepts projections **822** of a bearing or bushing **807'**. It should be appreciated that the bearing or bushing **807'** may have a single projection. The bearing or bushing **807'** receives a threaded member **821**. A knob **820** is fixed to the threaded member **821** and is rotatable as indicated by arrow A. Rotation of the knob **820** causes the bearing or bushing **807'** to move in the direction of arrow B along the slot **823**. Rotation of the knob **820** and movement of the bearing or bushing **807'** provides an infinite number of positions for the steering shaft **800**.

[**0083**] Referring to **FIG. 18**, an alternate embodiment of a steering shaft **800'** according to the present invention includes a pivot point **809'** that is positioned intermediate the ends of the steering shaft **800'**. An articulated member **860**, for example a hinge, a universal joint, a crown spline joint, or an elastic member, formed for example of rubber, is provided between the ends of the steering shaft **800'** and allows a top portion **800***a* of the steering shaft **800'** to pivot between a first position **814'** and a second position **816'**. A lower portion **800***b* of the steering shaft **800'** is fixed in a bearing **808'**. Although the articulated member **860** is shown in the offset portion **806'**, it should be appreciated that the articulated member **860** may be provided intermediate the upper bend **802'** and the upper end of the steering shaft **800'**, or between the lower bend **804'** and the lower end of the steering shaft **800'**, or at any position intermediate the ends of the steering shaft **800'**. It should also be appreciated that the steering shaft **800'** may be used with a positioning device similar to the positioning device shown in **FIG. 12** or with a positioning device similar to the positioning device shown in **FIG. 17**.

[**0084**] The foregoing illustrated embodiments are provided to illustrate the structural and functional principles of the present invention and are not intended to be limiting. To the contrary, the principles of the present invention are intended to encompass any and all changes, alterations and/or substitutions within the spirit and scope of the invention.

What is claimed is:

1. A three-wheel vehicle, comprising:

a frame;

a straddle-type seat disposed on the frame;

an engine supported by the frame;

at least three wheels suspended on the frame, a first wheel being at a front and a second wheel being at a rear of the frame, wherein at least one of the three wheels is operatively driven by the engine;

a steering shaft operatively connected to at least one of the three wheels; and

a steering bracket that supports the steering shaft in a plurality of selective positions.

2. A vehicle according to claim 1, wherein the steering bracket includes a plurality of holes, each pair defining a selected position of the steering shaft.

3. A vehicle according to claim 1, wherein the steering shaft includes first and second bends and an offset portion between the first and second bends.

4. A vehicle according to claim 1, further comprising a bearing that supports the steering shaft, wherein the first bearing is connected to the steering bracket.

5. A vehicle according to claim 1, further comprising a bearing that supports the steering shaft, wherein the bearing is connected to a steering assembly operatively connected between the steering shaft and the at least one wheel operatively connected to the steering shaft.

6. A vehicle according to claim 3, further comprising first and second bearings that support the steering shaft, wherein the first bearing is connected to the steering bracket, the second bearing is connected to a steering assembly of the vehicle and the offset portion is positioned between the first and second bearings.

7. A vehicle according to claim 1, wherein the frame includes left and right upper column front members and left and right upper column rear members, wherein the members define a pyramid shaped structure.

8. A vehicle according to claim 7, wherein the steering bracket is attached to an apex of the pyramid shaped structure.

9. A vehicle according to claim 8, wherein the frame includes an engine cradle below the apex and the engine is attached to the frame within the engine cradle.

10. A vehicle according to claim 9, wherein the steering bracket defines at least a first position where the steering shaft is spaced a first distance from the engine and a second position where the steering shaft is spaced a second distance from the engine, and the first distance is greater than the second distance.

11. A vehicle according to claim 1, wherein the at least three wheels comprises two front wheels and a single rear wheel.

12. A vehicle according to claim 1, wherein the at least three wheels each include a tire suitable for road use.

13. A vehicle according to claim 1, wherein the at least one wheel operatively connected to the engine is a rear wheel.

14. A vehicle according to claim 1, wherein the at least one wheel operatively connected to the engine is a front wheel.

15. A vehicle according to claim 1, wherein the at least three wheels comprise four wheels including two front wheels and two rear wheels.

16. A vehicle according to claim 1, wherein at least a portion of the steering shaft is pivotable amongst the plurality of selective positions.

17. A vehicle according to claim 16, wherein the steering shaft is supported by the steering bracket at a first end and pivotally supported at a second end opposite the first end.

18. A vehicle according to claim 17, wherein the second end is pivotally supported by a bearing at the second end.

19. A vehicle according to claim 16, wherein the steering shaft is supported by the steering bracket at a first end and supported at a second end opposite the first end, and the portion of the steering shaft is pivotable about a point between the first and second ends by an articulated member.

20. A vehicle according to claim 17 or 19, wherein the first end of the steering shaft is supported by a bearing in the steering bracket, the bearing being supported in the steering bracket movable relative to the bracket, and a threaded member operatively connects the bearing to the steering bracket to move the bearing amongst the plurality of selective positions.

21. A vehicle according to claim 19, wherein the articulated member is one of a hinge, a universal joint, a crown spline joint, and an elastic member.

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