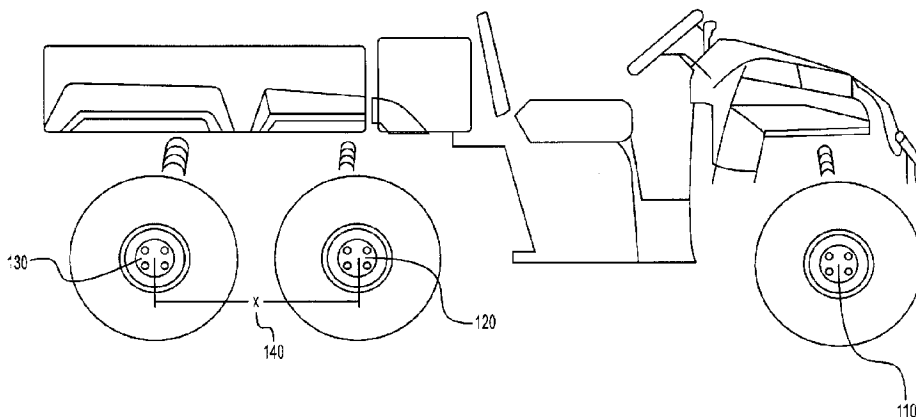




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(54) Title: TRACTION SYSTEM FOR A VEHICLE



(57) **Abrégé/Abstract:**

A traction system for a vehicle is disclosed. The traction system has a frame which rotationally supports a plurality of road wheels, a first idler wheel, a second idler wheel. The traction system also has a pivot member that has a first end and a second end. The first end is connected to the frame such that the pivot member can pivot about a pivot point in a longitudinal and a transverse direction. The second end of the pivot member rotationally supports a first drive wheel. A second drive wheel is supported by the frame. The first and second drive wheels are connectable to the vehicle. The traction system further has an endless traction band that surrounds the frame plurality of road wheels, the first and second idler wheels and the first and second drive wheels when the first and second drive wheels are connected to the vehicle.

## ABSTRACT

A traction system for a vehicle is disclosed. The traction system has a frame which rotationally supports a plurality of road wheels, a first idler wheel, a second idler wheel. The traction system also has a pivot member that has a first end and a second end. The first end is connected to the frame such that the pivot member can pivot about a pivot point in a longitudinal and a transverse direction. The second end of the pivot member rotationally supports a first drive wheel. A second drive wheel is supported by the frame. The first and second drive wheels are connectable to the vehicle. The traction system further has an endless traction band that surrounds the frame plurality of road wheels, the first and second idler wheels and the first and second drive wheels when the first and second drive wheels are connected to the vehicle.

## TRACTION SYSTEM FOR A VEHICLE

### CROSS-REFERENCE

[0001] The present patent application is a divisional of commonly owned Canadian Patent Application No. 2,757,049, entitled "Traction System For A Vehicle", filed on November 9, 2011.

5 The present patent application claims the benefits of priority of U.S. Provisional Patent Application No. 61/411,532, entitled "Independent Suspension Traction System for a Vehicle" and filed at the United States Patent and Trademark Office on November 9, 2010.

### TECHNICAL FIELD

[0002] This technology generally relates to the field of traction assemblies and track systems used  
10 to replace one or more wheels on normally wheeled vehicles. The present technology more particularly relates to traction assemblies and track systems used to replace two or more wheels.

### BACKGROUND

[0003] Track systems for use as wheel replacement on typically wheeled vehicles are known in the art. Indeed, several configurations of track systems have been proposed throughout the years in  
15 order to generally improve different aspects and characteristics such as the riding behaviour. In addition, track systems have been used on different types of wheeled vehicles such, but not limited to, ail-terrain vehicles (ATV), farming equipment such as tractors, snow grooming equipment, etc.

[0004] Though track systems generally improve several characteristics of the vehicles such as traction and floatation, particularly over soft terrain, it remains that track systems are typically  
20 retrofitted on existing vehicles which were initially designed to support wheels.

[0005] In that sense, the configuration of the vehicle which wheels are replaced by track systems is typically not adapted to readily receive such track systems. This is particularly true for vehicles having multiples axles such as 6 wheels ATVs.

[0006] Hence, despite ongoing developments in the field of track systems, there is still room for  
25 further improvements for track systems configured to be used on wheeled vehicles having at least 6 wheels. Generally, those vehicles have more than two traction wheels at the rear. As of today, some systems allow the installation of track system for four propulsion wheels. However, these prior art

systems substantially or completely reduce the suspension elements efficiency, which, as a consequence, limits the propulsion potential on rough terrain as the track contact with the terrain is often inappropriate.

## SUMMARY

5 [0007] The present technology provides an independent suspension track system for a vehicle having more than four wheels, such as an ATV or farming equipment, that replaces at least two of the vehicle's wheels. The track system allows the independent displacement of the drive sprockets of the track system according to the movement of the suspension elements.

10 [0008] The independent suspension traction system of the present technology comprises a main frame, at least one typically fixed drive sprocket, at least one idler wheel pivotally mounted at each extremity of the main frame, a plurality of road wheels pivotally mounted to the main frame, at least one pivot, at least one mobile drive sprocket, at least one tension adjustment system and an endless traction band. The main frame typically, though not necessarily, comprises a plurality of sections, typically two. The frame sections are moveable with respect to each other. The tension adjustment  
15 system allows tension to be increased or decreased on the endless traction band typically by screwing or unscrewing a push bolt which pushes the sections of the frame in opposite directions.

[0009] In accordance with the principles of the technology, the pivot allows a lateral movement between the fixed drive sprocket and mobile drive sprocket and a vertical camber angle between each wheel for the back and forth movements of the suspension elements of the wheeled vehicle.  
20 The pivot is positioned on the main frame to ensure that the tension applied on the endless traction band stays uniform regardless of the lateral and vertical displacement of the traction system.

[0010] In accordance with the principles of the present technology, due to its particular configuration, the independent suspension traction system also generally maintains the contact patch of the traction band of the track system substantially parallel to the ground over which the vehicle is  
25 operated, and that, substantially independently of the position (e.g. extended, normal or retracted) of the suspension of the vehicle.

[0011] The independent suspension traction system of the present technology is particularly useful when used on all-terrain vehicles ("ATV"), such as the ones having two front wheels and four rear wheels.

[0012] Other and further aspects and advantages of the present technology will be obvious upon an understanding of the illustrative embodiments about to be described. Various advantages not referred to herein will occur to one skilled in the art upon employment of the technology in practice.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5 [0013] The above and other objects, features and advantages of the technology will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

[0014] Figure 1A is a side view of an all-terrain vehicle without an independent suspension traction system and where the distance between the axes of the wheels is identified as X.

10 [0015] Figure 1B is a side view of an all-terrain vehicle without an independent suspension traction system showing the variation of the distance between the axes of the wheels, when the suspensions have not travelled the same distances on each wheel.

[0016] Figure 1C is a rear view of the suspension elements showing in a compressed state (dotted line) and in a rest state (solid line) and showing a camber angle ( $\theta$ ) between the axis of the wheel and a vertical axis resulting from the suspension displacement.

15 [0017] Figure 2 is a side view of the complete independent suspension traction system.

[0018] Figure 3A is a side view of the main frame and the related components.

[0019] Figure 3B is a perspective view of the main frame and the related components.

[0020] Figure 3C is a top view of the main frame and the related components.

20 [0021] Figure 4A is a close-up side view of a pivot member.

[0022] Figure 4B is perspective view of the independent suspension traction system without the traction band and with the pivot member being exploded.

[0023] Figure 5 is a side view of the independent suspension traction system where the suspension has travelled a distance identified as  $\Delta x$ .

25 [0024] Figure 6A is a rear view of a complete assembly showing a different camber angle ( $\theta$ ) of each sprocket.

[0025] Figure 6B is a rear view of a complete assembly showing two suspension means at rest and having a difference of  $\Delta y$  between the alignment of the sprockets.

#### DETAILED DESCRIPTION

5 [0026] A novel traction system for vehicle having generally more than four wheels will be described hereinafter. Although the present technology is described in terms of specific illustrative embodiments, it is to be understood that the embodiments described herein are by way of example only and that the scope of the technology is not intended to be limited hereby.

10 [0027] The present technology relates to an independent suspension traction system for a vehicle having generally more than four wheels and using an endless traction band and a plurality of wheels for propulsion.

[0028] Referring first to Figure 1A, for illustration purpose, a vehicle 100 having more than four wheels without an independent suspension traction system, typically an all-terrain vehicle ("ATV"), is presented. Specifically, the ATV 100 has six wheels, two wheels 110 located at the front, which are used to steer and/or to tract the ATV 100, and four wheels 120 and 130 located at the rear of the  
15 ATV for traction purposes. As shown in Figures 1A and 1B, a fixed horizontal distance ("X") 140 separates the axis of the wheel 130 from the axis of the wheel 120.

[0029] Now referring to Figure 1B, the rear wheels 120 and 130 of the vehicle 100 are shown in a given position while the vehicle 100 travels over uneven terrain, with the wheel 120 being pushed up by the uneven terrain relative to the wheel 130. While the horizontal distance between the two  
20 axes of the wheels 120 and 130 remains X (140), the linear distance between each axis of the wheels 120 and 130 changes to  $X+\Delta x$  (150).

[0030] A traction system in accordance with the principles of the present technology takes into account such variation in the distance between the two wheels 120, 130 it replaces. A first embodiment of the independent suspension traction system 200 is shown in Figure 2. As shown in  
25 Figure 5, the independent suspension traction system 200 accommodates a change ( $\Delta x$ ) in the linear distance (X) (Figure 1B) between the two rear wheels 120, 130 that it replaces, which change ( $\Delta x$ ) results from the wheel 120 being pushed up by the uneven terrain relative to the wheel 130 as shown in Figure 1B.

[0031] Now referring to Figures 1A and 2, the present embodiment is a replacement traction system 200 for the two rear wheels 120 and 130 of the ATV 100 and helps the ATV 100 to travel on rough and uneven terrains.

5 [0032] Now referring to Figure 2, the independent suspension traction system 200 comprises a main frame 210, at least one fixed drive wheel 220 rotationally mounted to the main frame 210, at least one idler wheel 221 rotationally mounted at each extremity of the main frame 210, a plurality of road wheels 222 rotationally mounted to the main frame 210, at least one pivot member 230 pivotally attached to the main frame 210, at least one mobile drive wheel 240, at least one tension adjustment system 250 and an endless traction band 260.

10 [0033] In the present embodiment, the at least one fixed drive wheel 220 and at least one mobile drive wheel 240 are sprocket wheels.

[0034] Each drive wheel 220 and 240 is attached to an axle shaft of the vehicle. In the present embodiment, all drive wheels are attached to a rear axle drive shaft.

15 [0035] Now referring to Figure 3A, Figure 3B and Figure 3C, in the present embodiment, the main frame 210 is typically made of rigid material, such as aluminum, steel or any appropriate plastic composite, and comprises a plurality of sections, typically two, namely sections 212 and 213. The sections 212 and 213 are moveable with respect to each other. A first frame section 212 comprises an aperture 214 in which a rolling mechanism, typically bearings, is installed, and an extension 216, typically rectangular with rounded corners.

20 [0036] A second frame section 213, typically moveable with respect to the first frame section 212, comprises a plurality of apertures 211 used to fix the pivot member 230, a passage or cavity 217, and at least one enclosure 218 used to hold at least one tension retainer 251. The apertures 211 are positioned on a section of the main frame 210 to ensure that the mobile drive sprocket 240 (shown on Figures 2 and 5) applies a constant tension on the endless traction band 260 during the pivotal  
25 movement of the mobile drive sprocket 240 induced by the variation of the angle of the pivot member 230 (shown on Figures 2 and 5). The cavity 217 has a slidingly compatible shape with the extension 216 in order to allow the adjustment of the tension of the independent suspension traction system 200 through at least one push bolt mechanisms 251.

[0037] The main frame 210 comprises a plurality of laterally extending shafts 215 having apertures 219. The wheels 221 and 222 rotate around retainers fixed in the said apertures 219.

[0038] Now referring to Figure 4A and Figure 4B, the pivot member 230 provides lateral movement between the fixed drive sprocket 220 and the moveable drive sprocket 240 and allows the pivoting of the moveable drive sprocket 240 about a shaft 235 via which the pivot member 230 is pivotally supported at one of its ends on the main frame 210. In this implementation, the pivot member 230 defines an aperture 231, typically having a cylindrical shape, at one extremity thereof. The aperture 234 retains a rolling mechanism 261, such as bearings, supporting the sprocket wheel 240 and allowing the sprocket wheel 240 to rotate relative to the pivot member 230. At its other extremity, the pivot member 230 has a ball joint 232. The ball joint 232 defines a typically cylindrical passage and has an elastomeric bushing 233 slidingly fitted therein, as shown on Figure 4A, allowing the pivot member 230 to pivot laterally (see angle  $\theta$  in Figure 6A) and longitudinally (see arrows in Figure 5), and to move laterally as shown with dimension line  $\Delta y$  in Figure 6B. It is contemplated that the pivot member 230 could have any structure instead of the ball joint 232 that could provide the lateral and the pivotal movements of the pivot member 230.

[0039] As shown in Figure 4A, the elastomeric bushing 233 defines an aperture 234 therethrough. The length 237 between the centre of the aperture 231 and of the centre of the aperture 234 is relative to the diameter of the mobile drive sprocket 220 and to the position of the apertures 211 on the main frame 210 in order to ensure that the tension applied on the endless traction band 260 is substantially constant. The initial angle between the pivot member 230 and the main frame 210 is calculated to ensure that the tension from the endless traction band 260 is advantageously applied on the main frame 210 compared to the tension applied to the suspension elements of the ATV.

[0040] Now referring to Figure 4B, the shaft 235 is slid through the apertures 211 and the aperture 234 of the pivot member 230 and secured by a fastener 236.

[0041] Now referring back to Figure 2, the tension adjustment system 250 comprises at least one push bolt 251, at least one nut 252 and at least one bolt stopper 253. By screwing or unscrewing the nut 252, the second frame section 213 slides away or toward the first frame section 212, causing the tension in the endless track 260 to be increased or decreased.

[0042] Now referring to Figure 6A and 6B, the independent suspension traction system 200 allows the pivot member 230 and the mobile drive sprocket 240 to pivot by a camber angle of  $\theta$  relative to

a generally vertical position. Also, the traction system 200 allows a lateral movement  $\Delta y$  between the fixed drive sprocket 220 and the mobile drive sprocket 240. The possible camber angle and lateral movement help the endless traction band 260 stay in contact with terrain independently of the positions of the suspension.

5 [0043] In another embodiment, a unitary frame would replace the plurality of sections 212 and 213. In this embodiment, the tension adjustment system would also be replaced by pivoting idler wheels. The idler wheels, once pivoted in one direction, would release tension in the endless traction band 260. When pivoted in another direction, the idler wheel would correctly tension the endless traction band 260.

10 [0044] In another embodiment, the traction system 200, while being attached to two axle shafts of the vehicle 100 may be attached to one or no drive shaft. In such embodiments, one or more drive wheels 120 or 140, while being slidingly attached to two axle shafts of the vehicle 100, would remain tractably passive.

[0045] While illustrative and presently preferred embodiments of the technology have been  
15 described in detail hereinabove, it is to be understood that the inventive concepts may be otherwise variously embodied and employed.

## CLAIMS

1. A traction system for a vehicle having a first shaft supporting a first wheel on one of a left side and a right side of the vehicle, a second shaft supporting a second wheel on the one of the left side and the right side of the vehicle, a third shaft supporting a third wheel on the one of the left side and the right side of the vehicle, a fourth shaft supporting a fourth wheel on the other one of the left side and the right side of the vehicle, the fourth wheel being opposite the first wheel, a fifth shaft supporting a fifth wheel on the other one of the left side and the right side of the vehicle, the fifth wheel being opposite the second wheel, and a sixth shaft supporting a sixth wheel on the other one of the left side and the right side of the vehicle, the sixth wheel being opposite the third wheel, the traction system comprising:

- a frame;
- a plurality of road wheels rotationally supported by the frame;
- a first idler wheel rotationally supported by the frame at a rear portion of the frame;
- a second idler wheel rotationally supported by the frame at a front portion of the frame;
- a pivot member having a first end and a second end opposite the first end, the first end of the pivot member being pivotably connected to the frame to pivot about a pivot point in a longitudinal direction and a transverse direction;
- a first drive wheel being rotationally supported by the second end of the pivot member and being connectable to the first shaft of the vehicle to replace the first wheel of the vehicle; and
- a second drive wheel being rotationally supported by the frame and being connectable to the second shaft of the vehicle to replace the second wheel of the vehicle;

the plurality of road wheels, the first idler wheel, the second idler wheel, the pivot member, the first drive wheel and the second drive wheel being sized and positioned relative to the frame such that an endless traction band is mountable around the plurality of road wheels, the first idler wheel, the second idler wheel, the first drive wheel and the

second drive wheel when the first drive wheel is connected to the first shaft of the vehicle.

2. The traction system of claim 1, wherein the pivot point is movable laterally relative to the frame.

3. The traction system of claim 1 or 2, wherein:

- the first drive wheel is rotationally supported by the second end of the pivot member to rotate about a rotation axis; and
- the pivot point is positioned rearward of the rotation axis when the first drive wheel is connected to the first shaft of the vehicle in place of the first wheel and the second drive wheel is connected to the second shaft of the vehicle in place of the second wheel.

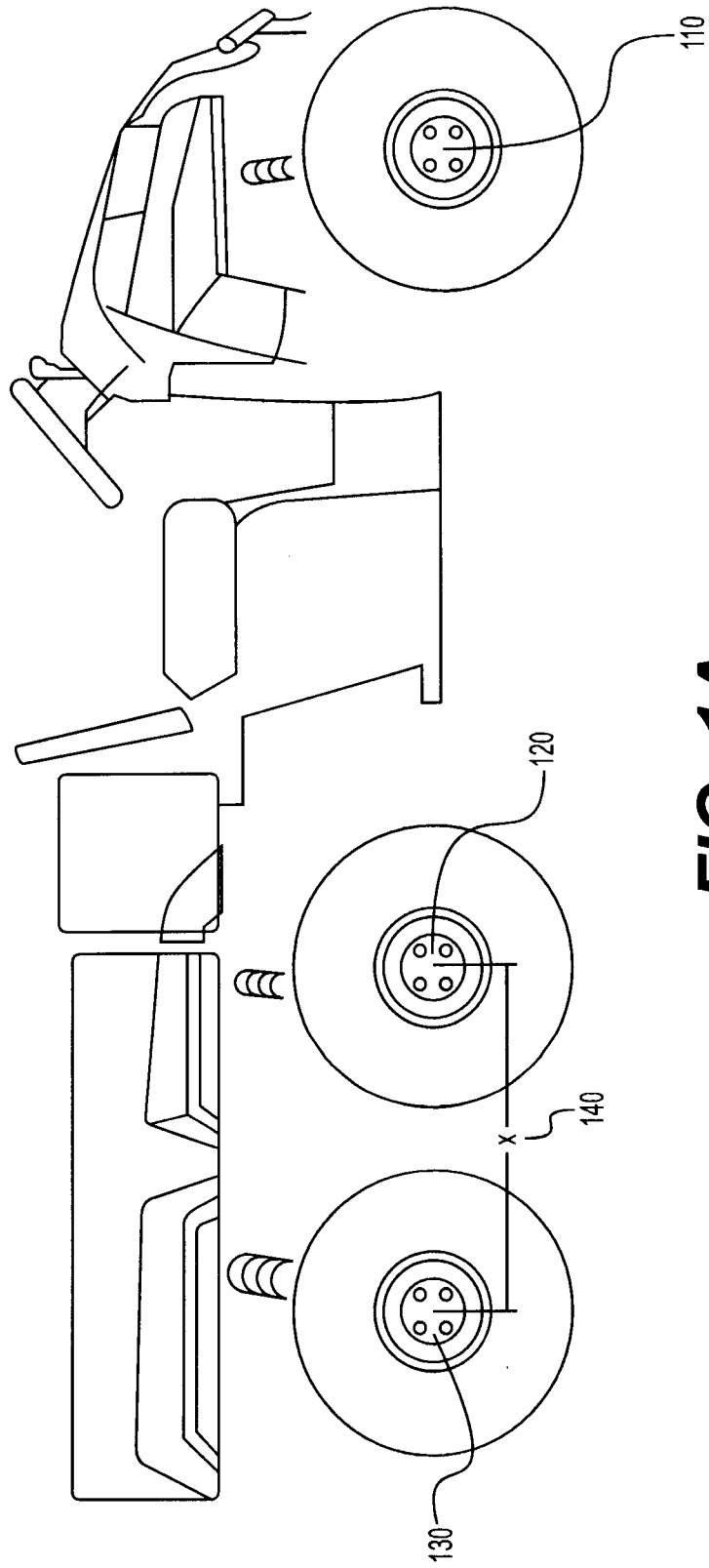
4. The traction system of claim 3, wherein the pivot point is positioned downward of the rotation axis when the first drive wheel is connected to the first shaft of the vehicle in place of the first wheel and the second drive wheel is connected to the second shaft of the vehicle in place of the second wheel.

5. The traction system of any one of claims 1 to 4, wherein:

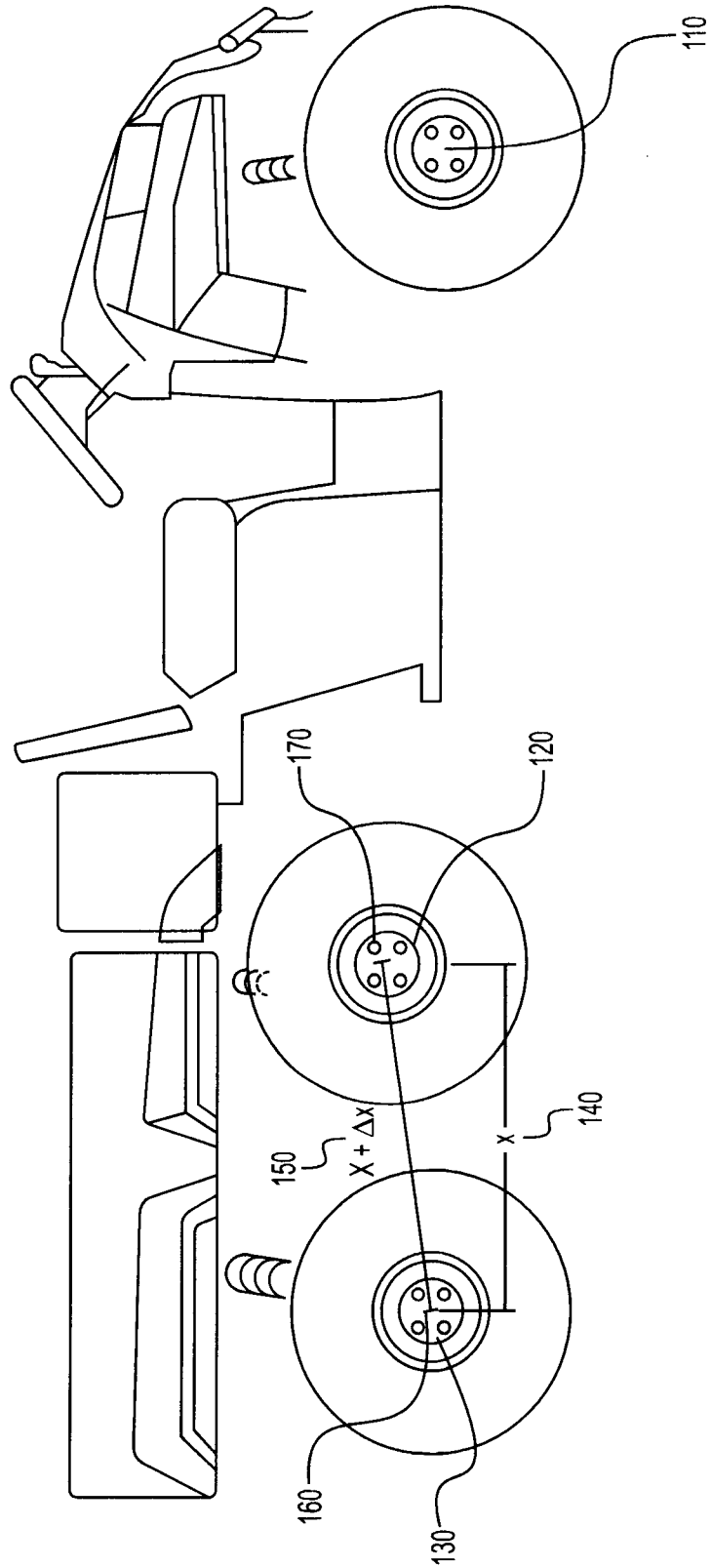
- the frame includes a first section and a second section connected to the first section via a tension adjustment system;
- the tension adjustment system is operable to adjust a position of the first section relative to the second section in the longitudinal direction;
- the first end of the pivot member is pivotably connected to the first section to pivot about the pivot point; and
- the second drive wheel is rotationally supported by the second section.

6. The traction system of claim 5, wherein the first section is at least in part in front of the second section when the first drive wheel is connected to the first shaft of the vehicle in place of the first wheel and the second drive wheel is connected to the second shaft of the vehicle in place of the second wheel.

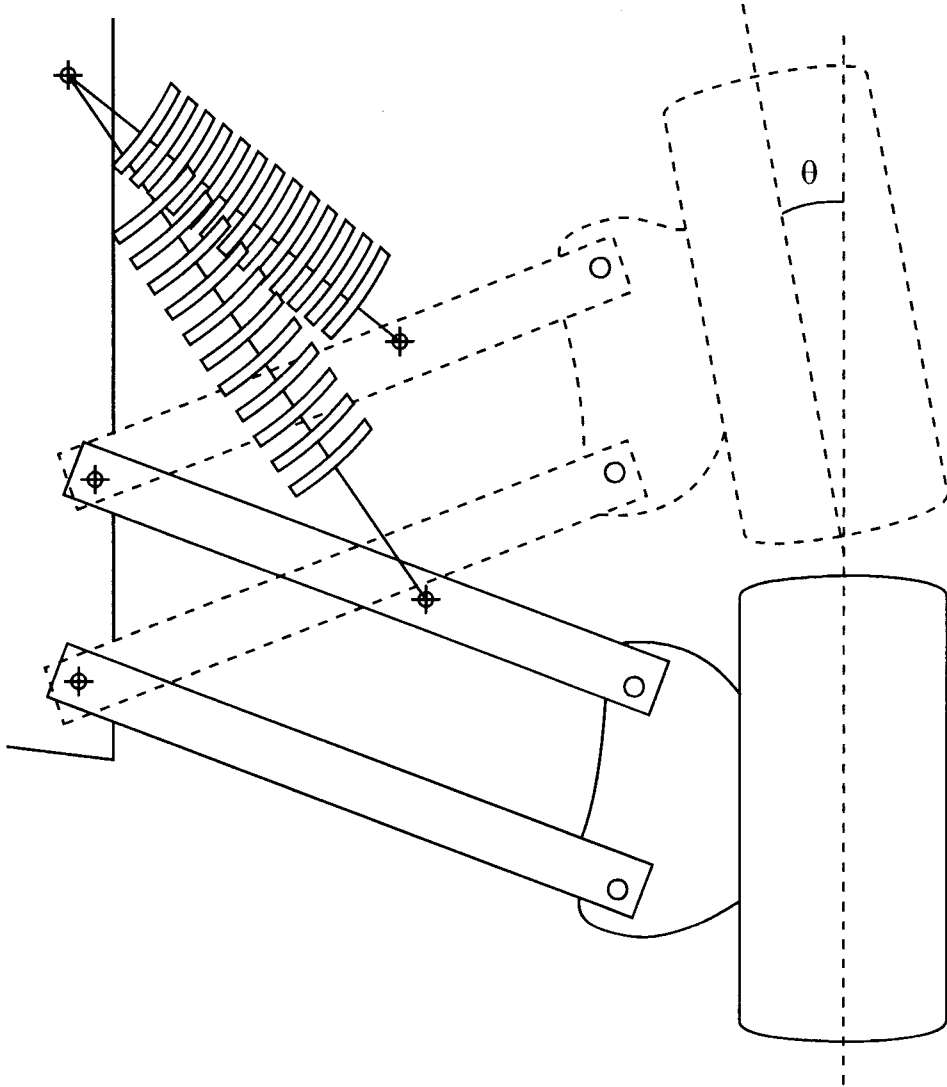
7. The traction system of any one of claims 1 to 6, wherein:
  - the first idler wheel is rotationally supported by the frame at a forward-facing extremity of the frame; and
  - the second idler wheel is rotationally supported by the frame at a rearward-facing extremity of the frame.
8. The traction system of any one of claims 1 to 7, wherein the first drive wheel is a sprocket wheel.
9. The traction system of any one of claims 1 to 8, wherein the second drive wheel is a sprocket wheel.
10. The traction system of any one of claims 1 to 9, wherein:
  - the first end of the pivot member includes a ball joint;
  - the ball joint is mounted onto an elongate member to pivot about the pivot point in the longitudinal direction and the transverse direction; and
  - the elongate member is attached to the frame.
11. The traction system of any one of claims 1 to 10, wherein:
  - the first end of the pivot member includes a ball joint;
  - the ball joint is mounted onto an elongate member that is attached to the frame; and
  - the ball joint is pivotable about the pivot point in the longitudinal direction and the transverse direction.
12. The traction system of claim 10 or 11, wherein the ball joint includes an elastomeric bushing mounted over the elongate member.
13. The traction system of claim 12, wherein:
  - the ball joint defines an aperture therethrough;
  - the elastomeric bushing is slidingly fitted in the aperture; and
  - the elongate member is received through the aperture.



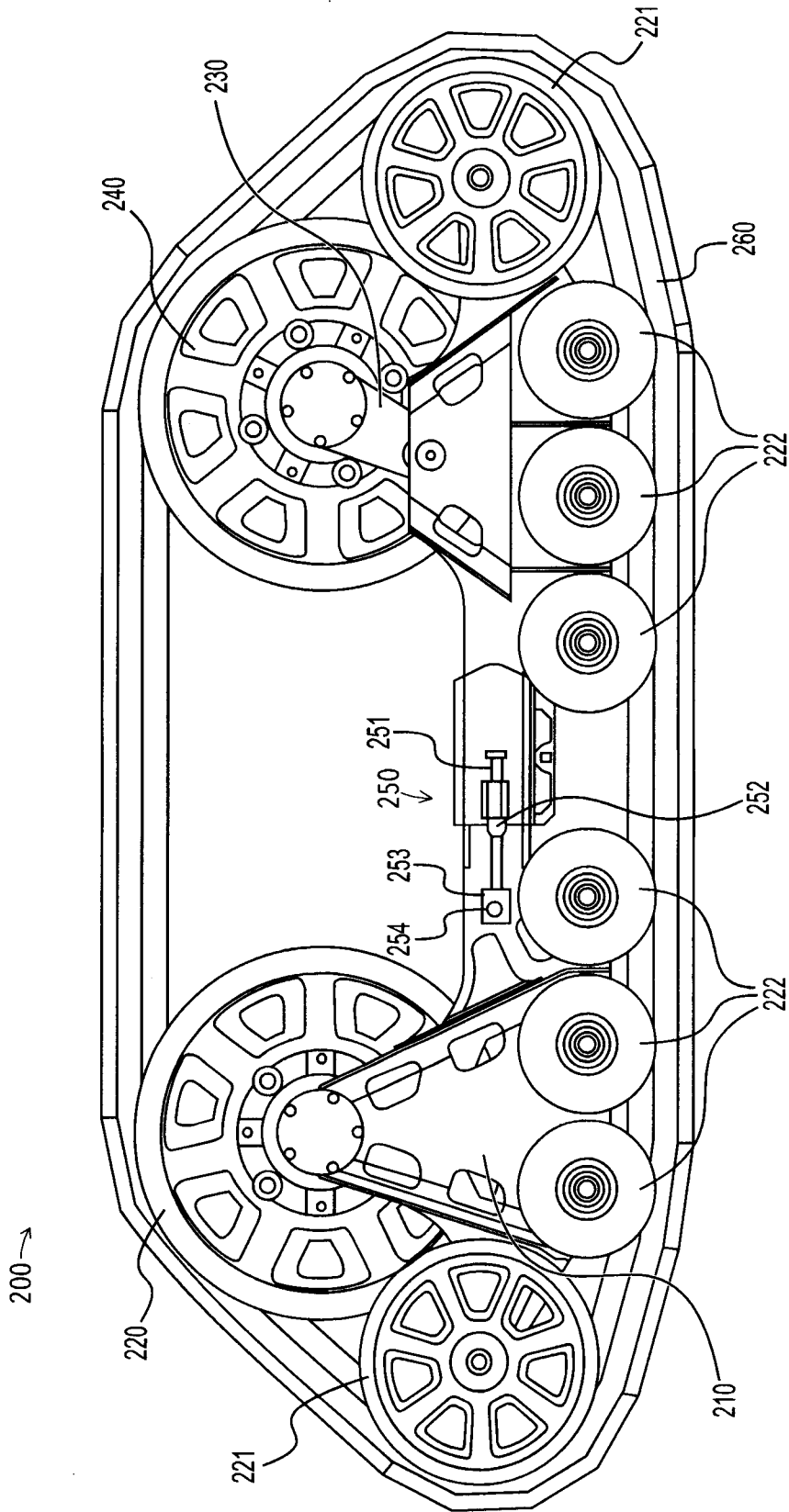
**FIG. 1A**



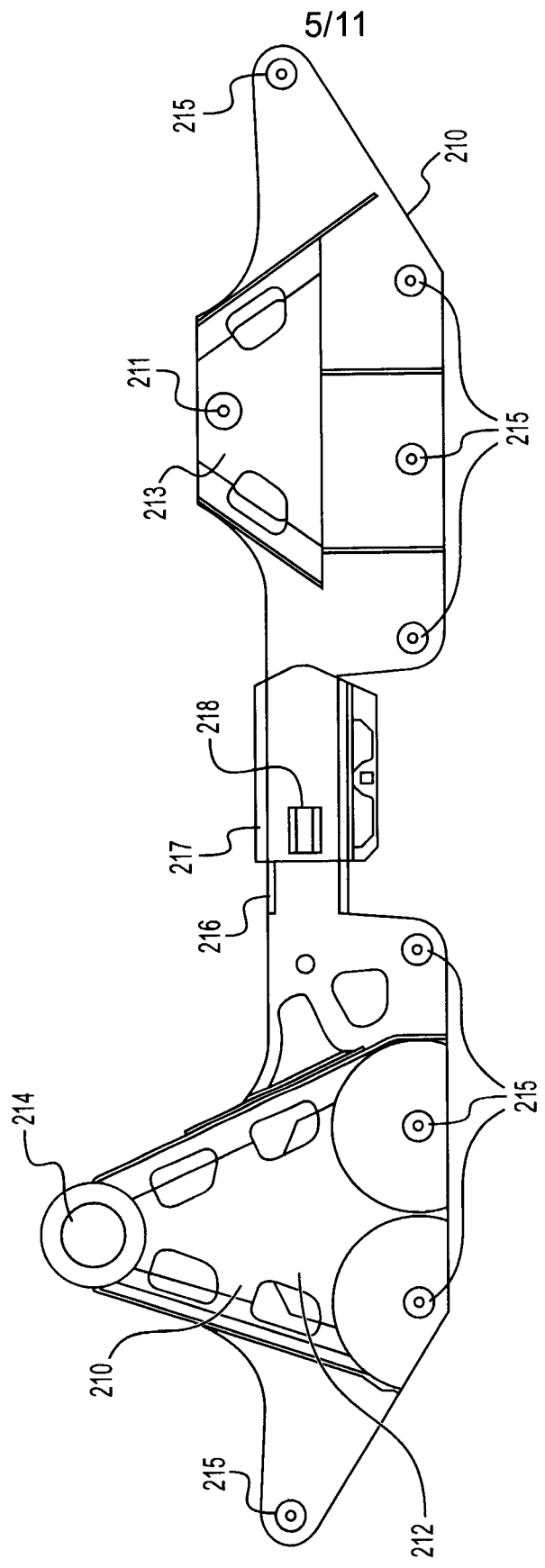
**FIG. 1B**



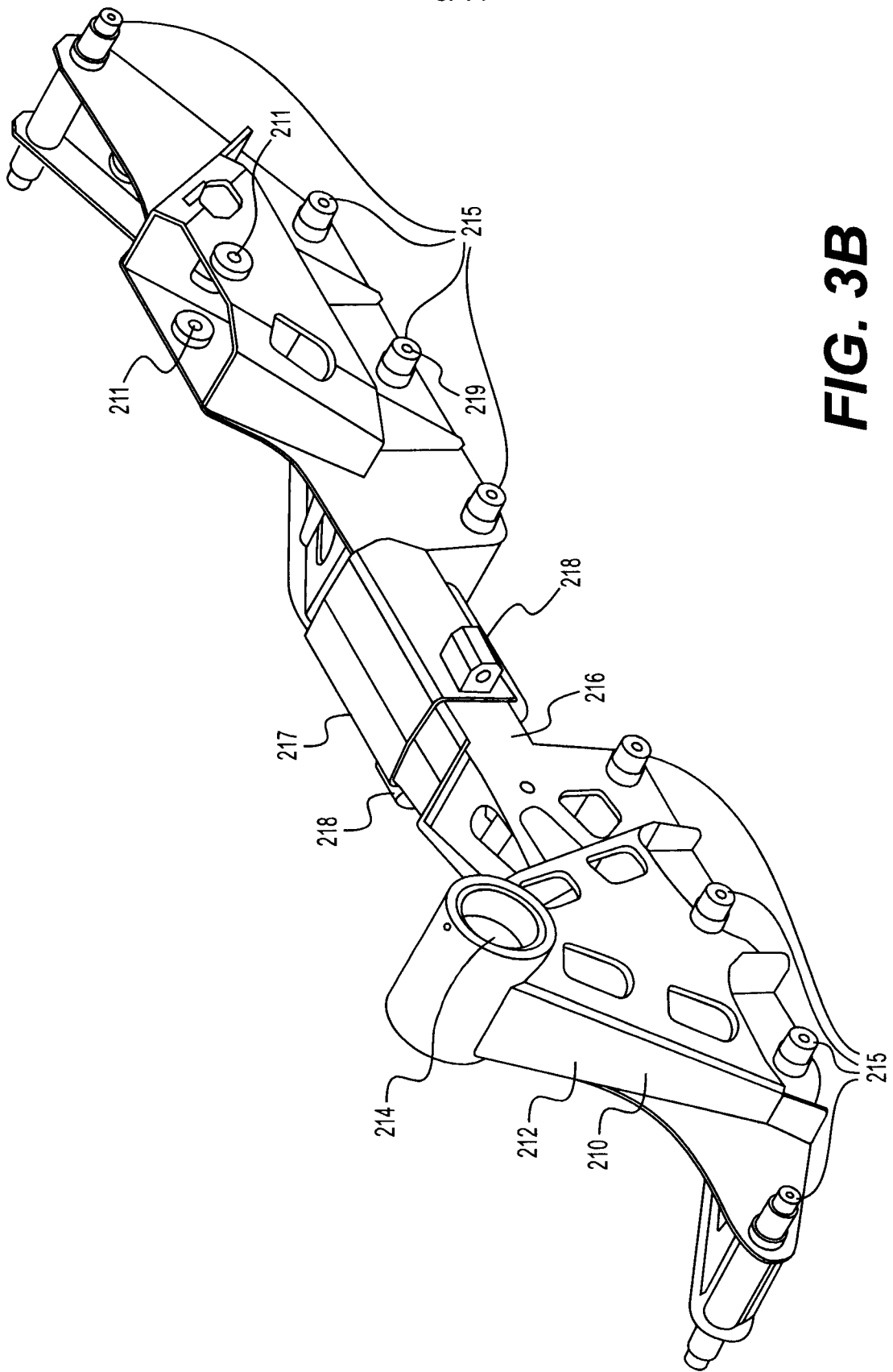
**FIG. 1C**



**FIG. 2**

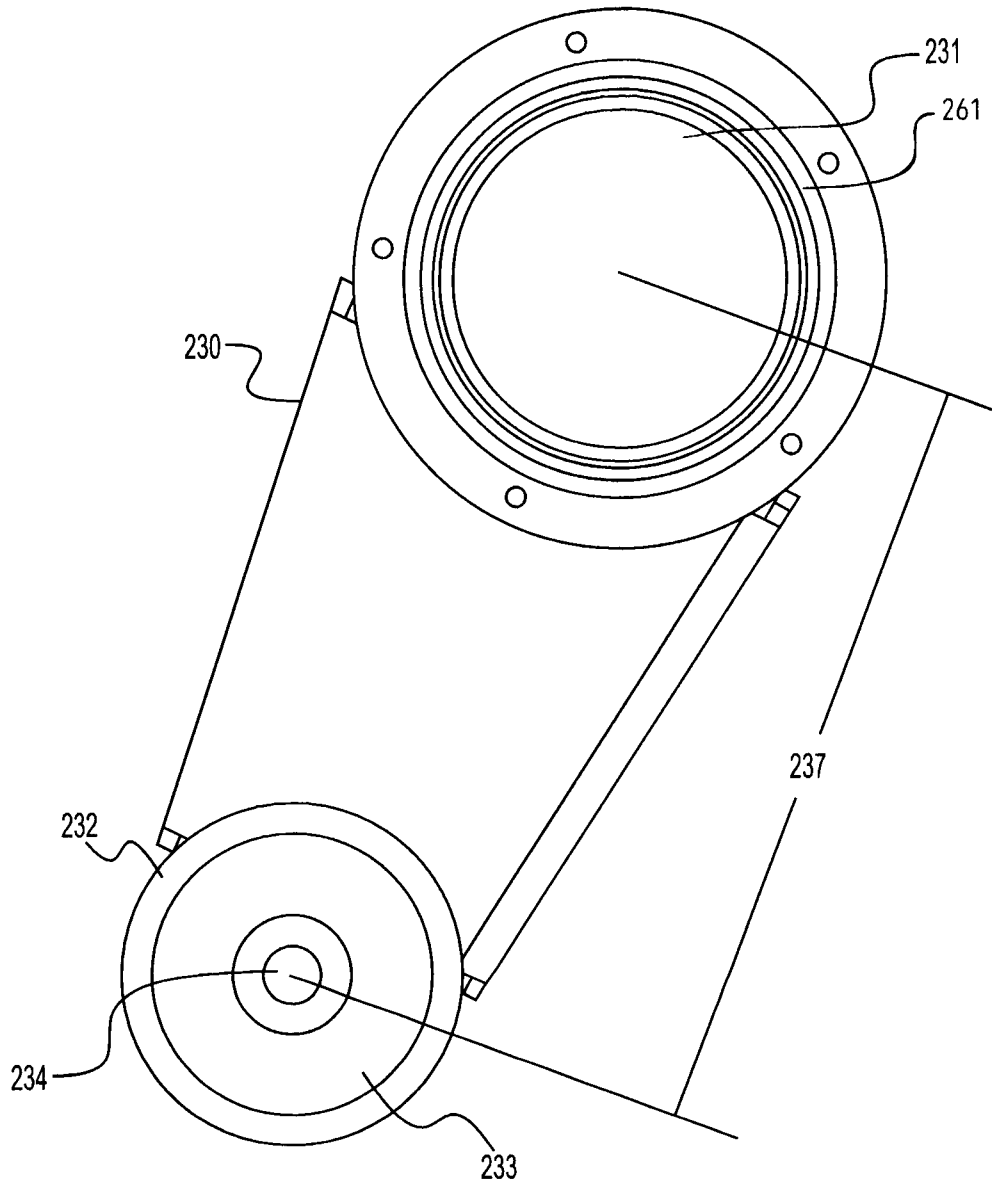


**FIG. 3A**

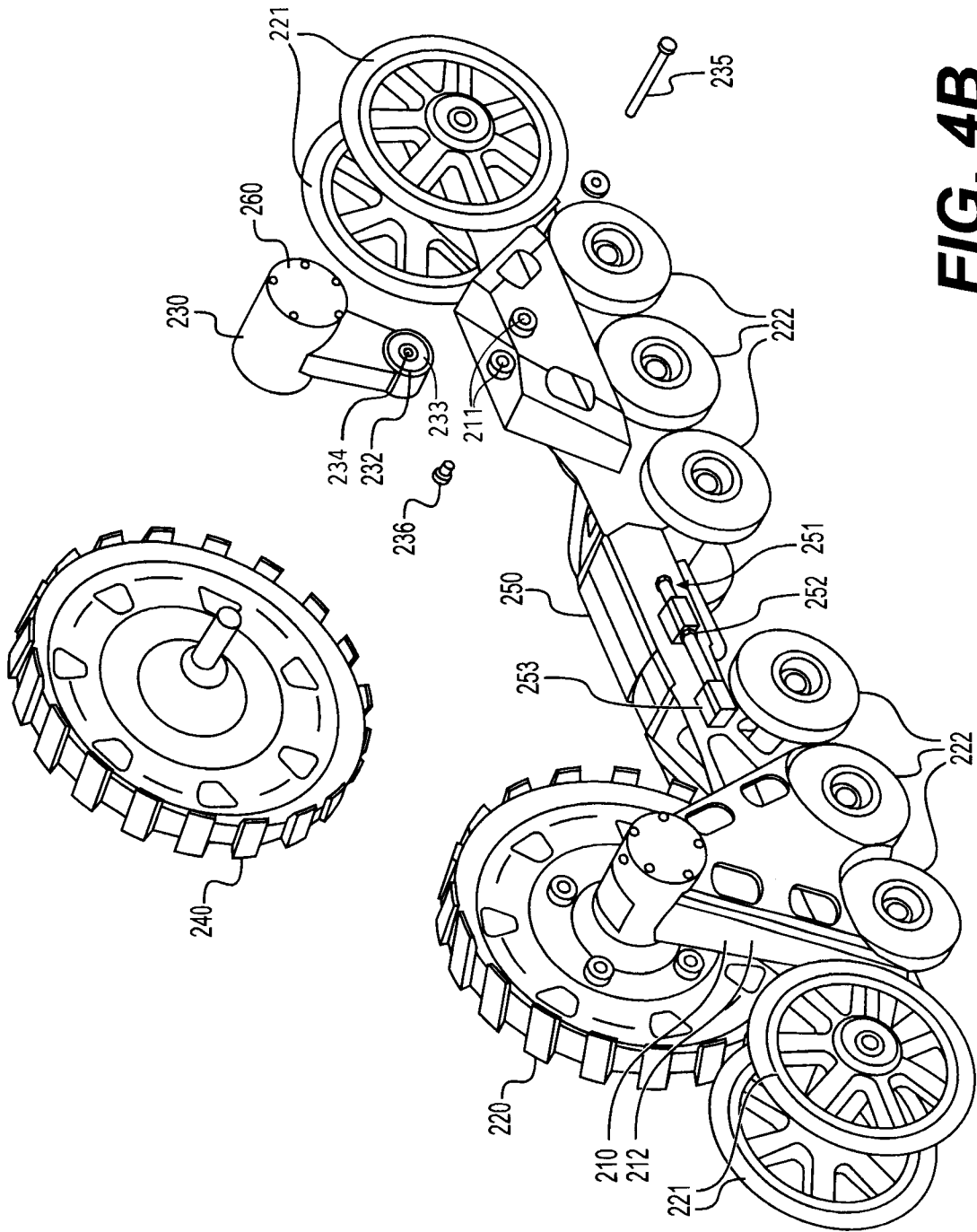


**FIG. 3B**

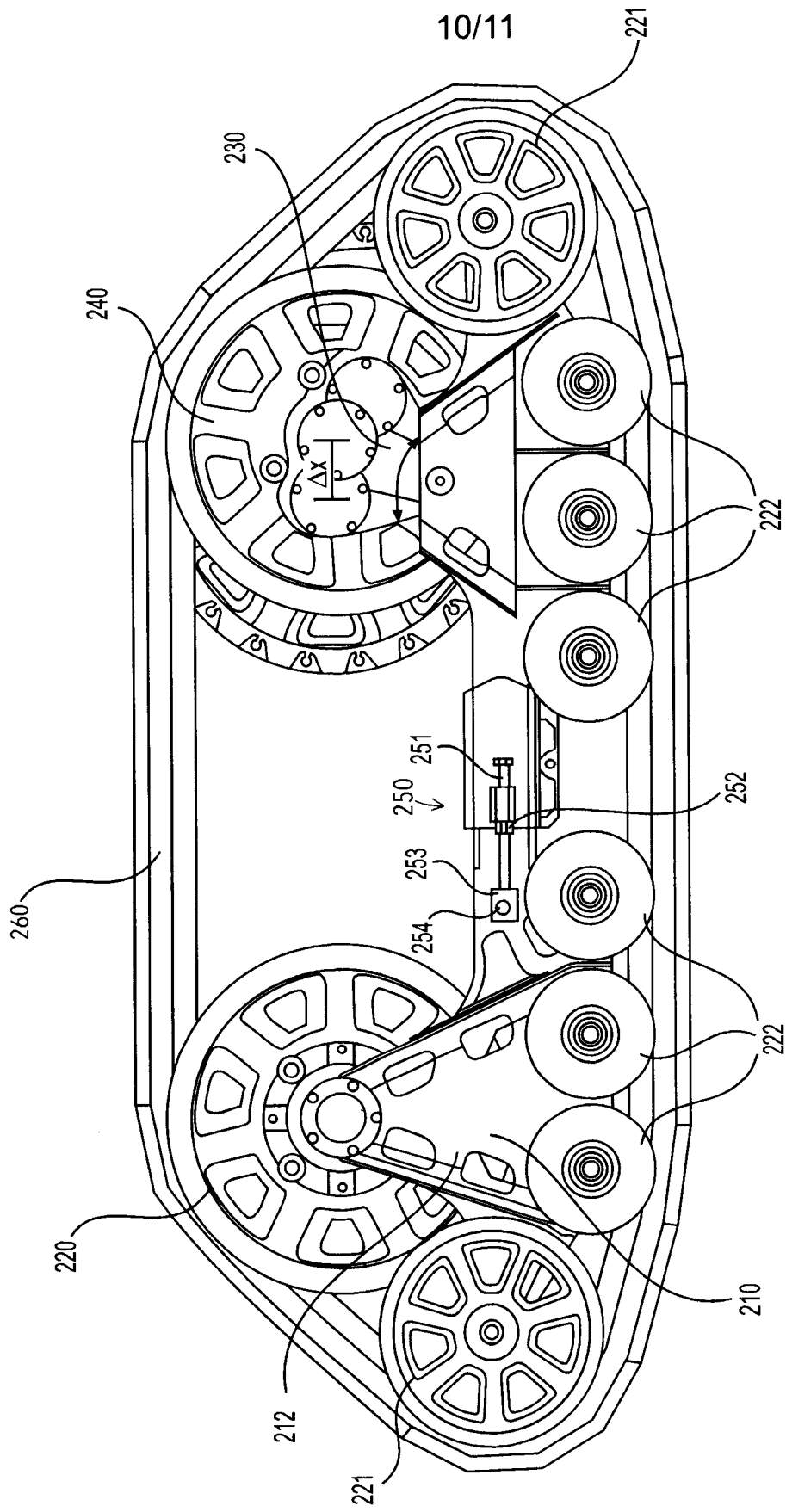




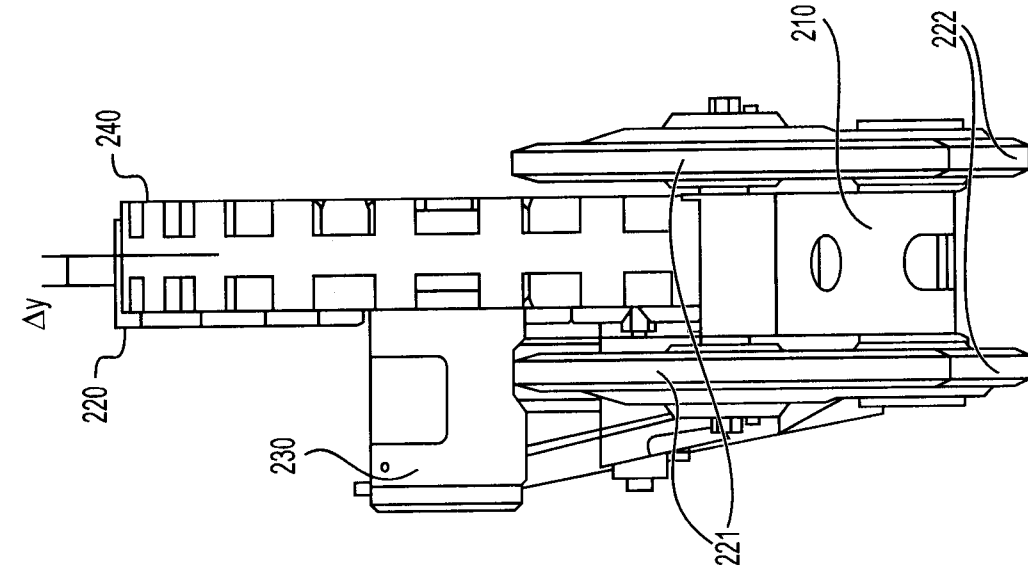
**FIG. 4A**



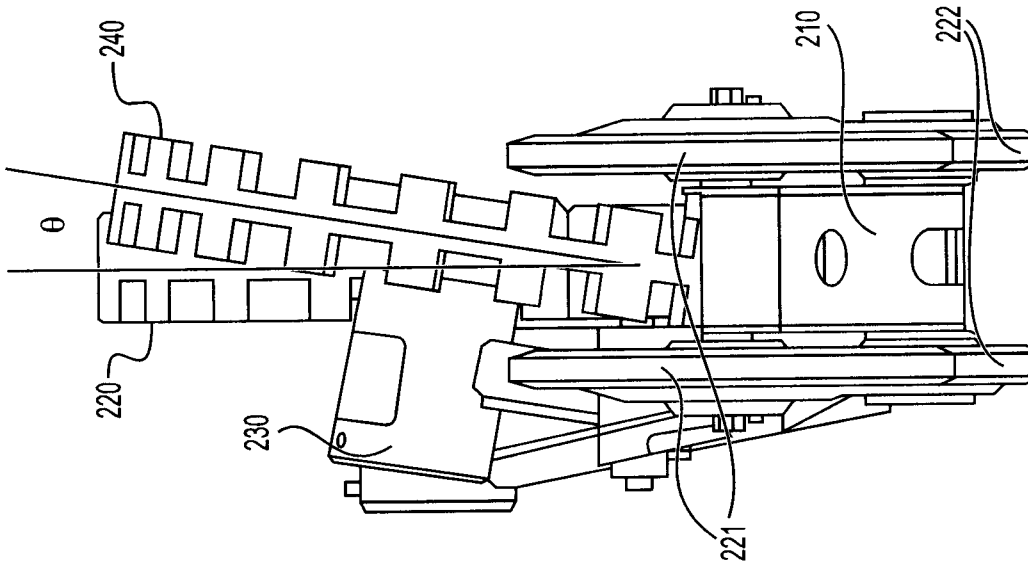
**FIG. 4B**



**FIG. 5**



**FIG. 6B**



**FIG. 6A**

