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Track configuration for a farm implement

Abstract

A track assembly for a farm implement includes a camber arm mounted in a camber arm housing, a first mounting bracket coupled to the upper connection point on the front end and pivotably coupled to the lower pivot point on the front end, and a second mounting bracket coupled to the upper connection point on the back end and pivotably coupled to the lower pivot point on the back end. The track assembly further includes first and second set arms having idler wheel sets mounted on one end and bogie wheel sets mounted on another end. The first set arm is pivotably coupled to the first mounting bracket, and the second set arm is pivotably coupled to the second mounting bracket, such that the idler wheel sets and bogie wheel sets are movable in opposing vertical directions.

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Background/Summary

FIELD OF THE DISCLOSURE

(1) This disclosure relates generally to farm implements, and more particular, to a track configuration for a farm implement such that the track assembly is able to better conform to the terrain when the farm implement is towed behind a tractor or otherwise moved.

BACKGROUND

(2) Mobile farm implements may generally include wheels or track assemblies to support the frame and allow a tow vehicle such as a tractor to move the farm implement. Mobile farm implements such as grain carts, seed tenders, and sprayers are used in fields in which the terrain may be uneven. If the track assemblies are not able to follow the contours of the terrain, it may cause stress on the track assemblies or the implement, which may cause failure or increased wear. In the case of towable farm implements, the farm implements are also required to closely follow the path of a tow vehicle to avoid moving off the path and damaging crops. Therefore, it is desirable to have track assemblies for a farm implement that can adapt to the unevenness of the terrain and closely follow the path of the tow vehicle.

(3) One solution is provided by U.S. Pat. No. 9,457,854, the content of which is hereby incorporated in its entirety.

SUMMARY

(4) High loading or uneven weight across the track assembly wheels can cause higher stresses in the track components. Accordingly, there is a need to provide an improved track configuration for a farm implement such that the track assembly is able to better conform to the terrain when the farm implement is towed behind a tractor or otherwise moved and that can address issues of high loading or uneven weight across the track assembly when conforming to the terrain.

(5) According to a first aspect, embodiments of a farm implement are provided. In some embodiments, the farm implement may include left and right track assemblies for assisting in moving the farm implement along a ground surface in a line of travel, wherein each track assembly comprises: a camber arm mounted in a camber arm housing, such that the camber arm permits the camber arm housing to pivot about a first axis perpendicular to the line of travel and a second axis parallel to the line of travel; wherein the camber arm housing has a front end and a back end, and further has upper connection points on both the front end and back end and lower pivot points on both the front end and back end; a first mounting bracket coupled to the upper connection point on

the front end and pivotably coupled to the lower pivot point on the front end; a second mounting bracket coupled to the upper connection point on the back end and pivotably coupled to the lower pivot point on the back end; a first set arm having a first idler wheel set mounted on one end and a first bogie wheel set mounted on another end, wherein the first set arm is pivotably coupled to the first mounting bracket such that the first idler wheel set and first bogie wheel set are movable in opposing vertical directions; a second set arm having a second idler wheel set mounted on one end and a second bogie wheel set mounted on another end, wherein the second set arm is pivotably coupled to the second mounting bracket, such that the second idler wheel set and second bogie wheel set are movable in opposing vertical directions.

(6) In some embodiments, the farm implement further includes a first suspension member connected to the upper connection point on the front end and between the first mounting bracket and the front end. In some embodiments, the farm implement further includes a second suspension member connected to the upper connection point on the back end and between the second mounting bracket and the back end. In some embodiments, the first and second mounting brackets are triangle-shaped members. In some embodiments, one or both of the first and second suspension members comprise one or more of: a hydraulic cylinder having a hydraulic accumulator, a spring, a gas strut, and a shock. In some embodiments, the second mounting bracket is pivotably coupled to the camber arm housing.

(7) In some embodiments, the first idler wheel set is pivotable about a third axis perpendicular to the line of travel and the first bogie wheel set is pivotable about a fourth axis perpendicular to the line of travel, such that the first idler wheel set and the first bogie wheel set are independently pivotable relative to each other. In some embodiments, the second idler wheel set is pivotable about a fifth axis perpendicular to the line of travel and the second bogie wheel set is pivotable about a sixth axis perpendicular to the line of travel, such that the second idler wheel set and the second bogie wheel set are independently pivotable relative to each other.

(8) In some embodiments, the first set arm is pivotable about a seventh axis perpendicular to the line of travel allowing the first bogie wheel set and the first idler wheel set to move generally vertically. In some embodiments, the second set arm is pivotable about an eighth axis perpendicular to the line of travel allowing the second bogie wheel set and the second idler wheel set to move generally vertically. In some embodiments, the first axis perpendicular to the line of travel is movable generally vertically when the farm implement transitions from an unloaded configuration to a loaded configuration.

(9) Other features and characteristics of the subject matter of this disclosure, as well as the methods of operation, functions of related elements of structure and the combination of parts, and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The accompanying drawings, which are incorporated herein and form part of the specification, illustrate various embodiments of the subject matter of this disclosure. In the drawings, like reference numbers indicate identical or functionally similar elements.

(2) FIG. **1** is an isometric view of a track assembly on a grain cart according to an embodiment.

(3) FIG. **2** is a side view of a track assembly on a grain cart according to an embodiment.

(4) FIG. **3** is a front view of a track assembly on a grain cart according to an embodiment.

(5) FIG. **4** is a side view of a track assembly according to an embodiment.

(6) FIG. **5** is a side view of a track assembly according to an embodiment.

(7) FIG. **6** is a side view of a track assembly according to an embodiment.
(8) FIG. **7** is a side view of a track assembly according to an embodiment.
(9) FIG. **8** is a side view of a track assembly according to an embodiment.
(10) FIG. **8**A is a sectional view of FIG. **8** along line A-A.
(11) FIG. **9** is an isometric view of a track assembly according to an embodiment.
(12) FIG. **10** is an isometric view of a track assembly according to an embodiment.
(13) FIG. **11** is a perspective exploded view of a trunnion assembly according to an embodiment.

DETAILED DESCRIPTION

(14) While aspects of the subject matter of the present disclosure may be embodied in a variety of forms, the following description and accompanying drawings are merely intended to disclose some of these forms as specific examples of the subject matter. Accordingly, the subject matter of this disclosure is not intended to be limited to the forms or embodiments so described and illustrated.
(15) Unless defined otherwise, all terms of art, notations and other technical terms or terminology used herein have the same meaning as is commonly understood by persons of ordinary skill in the art to which this disclosure belongs. All patents, applications, published applications and other publications referred to herein are incorporated by reference in their entirety. If a definition set forth in this section is contrary to or otherwise inconsistent with a definition set forth in the patents, applications, published applications, and other publications that are herein incorporated by reference, the definition set forth in this section prevails over the definition that is incorporated herein by reference.
(16) Unless otherwise indicated or the context suggests otherwise, as used herein, “a” or “an” means “at least one” or “one or more.”
(17) This description may use relative spatial and/or orientation terms in describing the position and/or orientation of a component, apparatus, location, feature, or a portion thereof. Unless specifically stated, or otherwise dictated by the context of the description, such terms, including, without limitation, top, bottom, above, below, under, on top of, upper, lower, left of, right of, in front of, behind, next to, adjacent, between, horizontal, vertical, diagonal, longitudinal, transverse, radial, axial, etc., are used for convenience in referring to such component, apparatus, location, feature, or a portion thereof in the drawings and are not intended to be limiting.
(18) Furthermore, unless otherwise stated, any specific dimensions mentioned in this description are merely representative of an exemplary implementation of a device embodying aspects of the disclosure and are not intended to be limiting.
(19) As used herein, the term “adjacent” refers to being near or adjoining. Adjacent objects can be spaced apart from one another or can be in actual or direct contact with one another. In some instances, adjacent objects can be coupled to one another or can be formed integrally with one another.
(20) As used herein, the terms “substantially” and “substantial” refer to a considerable degree or extent. When used in conjunction with, for example, an event, circumstance, characteristic, or property, the terms can refer to instances in which the event, circumstance, characteristic, or property occurs precisely as well as instances in which the event, circumstance, characteristic, or property occurs to a close approximation, such as accounting for typical tolerance levels or variability of the embodiments described herein.
(21) Although the terms horizontal and vertical are used here with respect to augers, such augers may not be completely horizontal or completely vertical. For example, the vertical auger may be angled so as to increase a side reach and/or forward reach of the auger relative to the hopper. Likewise, the horizontal auger may have a slope to it, and may also move with the hopper as the grain cart travels over uneven terrain. The terms denote the general direction in which grain is moved, e.g. horizontal movement to displace grain to a lift auger or vertical movement to lift grain to a discharge height.
(22) FIGS. **1-3** depict an exemplary grain cart **100** with a track assembly **114** according to an

embodiment of the present disclosure. Like part numbers refer to the same or similar parts in the figures. As shown, the grain cart **100** includes a grain holding container or hopper **118** mounted on a frame **115** with track assemblies **114** on either side of the frame **115** for moving the grain cart **100** and a hitch **116** for coupling the grain cart **100** to a vehicle (such as a tractor). The hopper **118** includes a front wall or side **120**, laterally opposed side walls **122** and **124**, and a rear wall or side, which together define a grain holding space with a bottom, and which may have an open top. In some embodiments, as shown in FIG. **1**, the opposed side walls **122** and **124** of the hopper **118** are angled toward each other to form a trough that extends along a bottom of the hopper **118** to promote grain flow toward the bottom of the hopper **118**. In some embodiments the walls may be curved, or sloped differently than shown, in order to promote grain flow toward the bottom of the hopper **118**.

(23) Grain cart **100** may include one or more auger assemblies, e.g. for unloading grain from the hopper **118**, such as auger assembly **110**. Auger assembly **110** may be a dual auger assembly, which includes a horizontal auger assembly disposed toward a bottom of or below the hopper **118** and extending substantially along the trough of the hopper **118** so as to receive grain flow falling or flowing toward the bottom of the hopper **118**, and a substantially vertical auger assembly for discharging grain. In some embodiments, a horizontal auger assembly may extend along a substantial portion of the length of the hopper **118**, up to and including the entire length of the hopper **118**. The horizontal auger assembly may be configured to convey agricultural material (such as grain) collected at the bottom of the hopper **118** toward a discharge opening disposed at the front wall **120** of the hopper **118**. In some embodiments, grain cart **100** may have more or fewer augers than shown. Alternatively, auger assembly **110** may be a single auger assembly, which includes a substantially vertical auger assembly that is fed by gravity.

(24) Each track assembly **114** is pivotally coupled to frame **115**. As shown in FIG. **2**, a track assembly **114** may pivot about a horizontal pivot axis perpendicular to the direction of travel, for example, by up to a degrees. The track assembly **114** is depicted in FIG. **2** with dashed lines to show the extent of pivoting about the horizontal pivot axis perpendicular to the direction of travel. As shown in FIG. **3**, a track assembly **114** may also pivot about a horizontal pivot axis parallel to the direction of travel, for example, by up to R degrees. The extent of pivoting about the horizontal pivot axis parallel to the direction of travel is depicted in FIG. **3** with dashed lines. Although FIGS. **2** and **3** depict the pivoting of one track assembly **114**, in embodiments both track assemblies **114**, one on each side of the frame **115**, pivot as depicted for one of the track assemblies **114**.

(25) FIG. **4** illustrates a side view of track assembly **114** according to an embodiment of the present disclosure. FIG. **4** depicts the track assembly **114** on flat ground, as it would appear on an empty (unloaded) grain cart. Track assembly **114** includes a track **401**, idler wheel assembly **402**, bogie wheel assembly **404**, a trunnion assembly **406**, suspension arms **408**, suspension members **410**, suspension member cover **411**, and rocker arms **412**. Idler wheel assembly **402** is located in the front and in the rear of the track assembly **114**, and each of the front and rear idler wheel assemblies **402** includes two idler wheels on opposite sides of the corresponding rocker arm **412** that are mounted on an axle assembly for the idler wheels. Bogie wheel assembly **404** is located in the front and rear of the track assembly **114**, and each of the front and rear bogie wheel assemblies **404** include four bogie wheels, two bogie wheels on opposite faces of the corresponding rocker arm **412** that are mounted on a first axle assembly for the bogie wheels and two bogie wheels on opposite faces of the corresponding rocker arm **412** that are mounted on a second axle assembly for the bogie wheels. Track **401** may be an endless (or continuous) track belt looping around the track assembly **114**.

(26) Trunnion assembly **406** allows the track assembly to pivot about a horizontal axis perpendicular to the direction of travel (such as track assembly pivot axis **1016** shown in FIG. **10**) and about a horizontal axis parallel to the direction of travel (such as trunnion assembly camber axis **1010** shown in FIG. **10**). Trunnion assembly **406** includes a trunnion connecting these pivot

axes. Suspension member cover **411** helps to reduce debris buildup on the trunnion assembly **406** and suspension members **410**, as well as to position the axle assembly for the upper track belt idle wheel **413**. The upper track belt idle wheel **413** helps to prevent the track belt **401** from bouncing up and down and contacting the trunnion assembly **406** when or if the track belt **401** bounces downward.

(27) Front and rear suspension arms **408**, front and rear suspension members **410**, and front and rear rocker arms **412** are located on either side of the trunnion assembly **406**. The respective suspension arms **408** connect the trunnion assembly **406** with the respective rocker arms **412**. The respective rocker arms **412** connect the respective idler wheel assemblies **402** to the respective pair of bogie wheel assemblies **404**. Front and rear suspension members **410** are connected between the respective suspension arm **408** and the trunnion assembly **406** (at upper connection points **450**). Suspension members **410** may include hydraulic cylinders with accumulators, springs, gas shocks, and other members capable of providing suspension. Suspension members **410** may be oriented, for example, generally in the direction of travel. In some embodiments, one or both of suspension members **410** may be replaced with a fixed connection, or otherwise modified, so that the respective suspension arm **408** does not pivot with respect to the trunnion assembly **406**.

(28) As shown in FIG. **4**, trunnion assembly **406** is generally in the center of the track assembly **114** along the direction of travel. The trunnion assembly **406** includes four connection points, with suspension members **410** being connected at top front and rear connection points and suspension arms **408** being connected at bottom front and rear connection points. Suspension arms **408** include three connection points, the suspension member **410** and trunnion assembly **406** already mentioned are connected at two of the connection points, and the rocker arm **412** is connected at the third connection point. As shown, the three connection points of the suspension arms **408** form a triangle, and in embodiments, suspension arms **408** may be roughly triangular in shape. Rocker arms **412** include three connection points, with idler wheel assembly **402** connected to a connection point at one end of rocker arm **412**, bogie wheel assembly **404** connected to a connection point at another end of rocker arm **412**, and the suspension arm **408** connected to a connection point in between the other two connection points. As shown, rocker arms **412** may be arced or curved in shape. Variations on this design are possible. For example, one of the rocker arms **412** may be pivotably connected to the camber arm housing instead of suspension arm **408**.

(29) The connection of the suspension arms **408** to the rocker arms **412**, on which the bogie and idler wheel assemblies are connected, allows rocker arm **412** to pivot (such as about rocker arm pivot axis **1014** shown in FIG. **10** that is a horizontal axis perpendicular to the direction of travel), allowing the bogie and idler wheel assemblies to move generally vertically. This vertical movement, as well as the pivoting trunnion assembly **406** and the suspension members **410**, improves wheel and track belt ground contact, also known as track assembly ground contouring, as well as reduces the load spikes transmitted into the farm implement, the track assembly, and/or the track assembly components.

(30) The connection of the suspension arm **408** to the suspension member **410** allows for pivoting, such as about suspension member pivot axis **1008** shown in FIG. **10**, which is a horizontal axis perpendicular to the direction of travel. The connection of the suspension arm **408** to the trunnion assembly **406** allow for pivoting, such as about suspension arm pivot axis **1012** shown in FIG. **10**, which is a horizontal axis perpendicular to the direction of travel.

(31) FIG. **5** illustrates a side view of track assembly **114** according to an embodiment of the present disclosure. Whereas FIG. **4** depicts the track assembly **114** on flat ground, as it would appear on an empty (unloaded) grain cart, FIG. **5** depicts the track assembly **114** on flat ground as it would appear on a loaded grain cart. As illustrated, the load compresses or shortens the overall length of suspension members **410**, causing the suspension arms **408** to pivot upward and moving the vertical height of the main track pivot axis **1016** (shown in FIG. **10**) closer to the ground. In an embodiment, the main track pivot axis **1016** may move by as much as 2 inches (e.g., from 29

inches when empty to 27 inches when the cart is fully loaded). In other embodiments, the main track pivot axis **1016** may move more or less when under load.

(32) FIG. **6** illustrates a side view of track assembly **114** according to an embodiment of the present disclosure. FIG. **6** depicts the track assembly **114** on as it would contour when going over terrain that is higher in the middle of the track assembly **114** than the idler wheel assemblies **402**. The dashed line indicates the lowest point of the terrain. The rocker arms **412** pivot about the suspension arm pivot connection **1012** (shown in FIG. **10**), bringing the pair of bogie wheel tandem assemblies **404** closer to the trunnion assembly **406** while the idler wheel assemblies **402** move downward and the idler wheel assemblies **402** move downward relative to the main track pivot axis **1016**. The bogie wheel tandem assembly **404** vertically oscillates about the rocker arm connection via an axis perpendicular to the direction of travel, such as bogie wheel tandem assembly pivot axis **1018** shown in FIG. **10**.

(33) FIG. **7** illustrates a side view of track assembly **114** according to an embodiment of the present disclosure. FIG. **7** depicts the track assembly **114** on as it would contour when going over terrain that is lower in the middle of the track assembly **114** than the idler wheel assemblies **402**. The dashed line indicates the lowest point of the terrain. The rocker arm **412** pivots about the suspension arm pivot connection **1012** (shown in FIG. **10**), moving the pair of bogie wheel tandem assemblies **404** away from the trunnion assembly **406** and the idler wheel assemblies **402** move upward relative to the main track pivot axis **1016** (shown in FIG. **10**).

(34) FIG. **8** illustrates a side view of track assembly **114** according to an embodiment of the present disclosure. As shown, track **401** has been removed for illustrative purposes. FIG. **8**A is a cross-section along line A-A shown in FIG. **8**. Two of the four bogie wheel assemblies **404** are oscillated side to side from level position on axes parallel to the direction of travel located between the bogie wheels. The section view in FIG. **8**A further shows the bogie wheel axle assembly oscillated, and further shows the bogie wheel axle assembly pivot axis **802** which is a horizontal axis parallel to the direction of travel. In embodiments, all of the bogie wheel assemblies **404** can oscillate in this manner. Likewise, in other embodiments, some or all of the bogie wheel assemblies **404** may be fixed such that they do not tilt or oscillate side to side. In embodiments, there may be a combination of fixed and oscillating bogie wheel assemblies **404**. Also, in embodiments there may be more or fewer bogie wheel assemblies **404** per track assembly **114**.

(35) FIG. **9** illustrates an isometric view of track assembly **114** according to an embodiment of the present disclosure. FIG. **10** illustrates an isometric view of track assembly **114** according to an embodiment of the present disclosure. As shown, the track **401** has been removed for illustrative purposes in FIG. **10**. The tensioner member **1002** and tensioner arm **1004** (which provides force for belt tension) are visible in this view. The tensioner arm **1004** pivots about an axis perpendicular to the direction of travel connected to the alignment arm **1006**. The alignment arm **1006** is connected to one of the rocker arms **412** via a vertical pivot. Hardware on the opposite end is used to pivot and hold the position of the alignment arm **1006** to shift the belt and achieve good belt alignment.

(36) Brake arm mounting position **1020** is a mounting point for a brake system, such as, for example, the brake system disclosed in U.S. application Ser. No. 16/601,966, the entire contents of which are herein incorporated by reference.

(37) FIG. **11** illustrates a perspective exploded view of trunnion assembly **406** according to an embodiment of the present disclosure. Trunnion assembly **406** includes trunnions **1102** and pivoting member **1104** and camber arm housing **1106**.

(38) While the subject matter of this disclosure has been described and shown in considerable detail with reference to certain illustrative embodiments, including various combinations and sub-combinations of features, those skilled in the art will readily appreciate other embodiments and variations and modifications thereof as encompassed within the scope of the present disclosure. Moreover, the descriptions of such embodiments, combinations, and sub-combinations is not intended to convey that the claimed subject matter requires features or combinations of features

other than those expressly recited in the claims. Accordingly, the scope of this disclosure is intended to include all modifications and variations encompassed within the spirit and scope of the following appended claims.

Claims

1. A farm implement comprising: left and right track assemblies for assisting in moving the farm implement along a ground surface in a line of travel, wherein each track assembly comprises: a camber arm mounted in a camber arm housing, such that the camber arm permits the camber arm housing to pivot about a first axis perpendicular to the line of travel and a second axis parallel to the line of travel; wherein the camber arm housing has a front end and a back end, and further has upper connection points on both the front end and back end and lower pivot points on both the front end and back end; a first mounting bracket coupled to the upper connection point on the front end; a second mounting bracket coupled to the upper connection point on the back end; a first set arm having a first idler wheel set mounted on one end and a first bogie wheel set mounted on another end, wherein the first set arm is pivotably coupled to the first mounting bracket such that the first idler wheel set and first bogie wheel set are movable in opposing vertical directions; a second set arm having a second idler wheel set mounted on one end and a second bogie wheel set mounted on another end, wherein the second set arm is pivotably coupled to the second mounting bracket, such that the second idler wheel set and second bogie wheel set are movable in opposing vertical directions; wherein one or more of: the first mounting bracket is pivotably coupled to the lower pivot point on the front end and the second mounting bracket is pivotably coupled to the lower pivot point on the back end.
2. The farm implement of claim 1, further comprising a first suspension member connected to the upper connection point on the front end and between the first mounting bracket and the front end.
3. The farm implement of claim 1, further comprising a second suspension member connected to the upper connection point on the back end and between the second mounting bracket and the back end, and wherein both of: the first mounting bracket is pivotably coupled to the lower pivot point on the front end and the second mounting bracket is pivotably coupled to the lower pivot point on the back end.
4. The farm implement of claim 2, wherein the second mounting bracket is pivotably coupled to the camber arm housing.
5. The farm implement of claim 1, wherein the first and second mounting brackets are triangle-shaped members.
6. The farm implement of claim 3, wherein the first and second suspension members comprise one or more of: a hydraulic cylinder having a hydraulic accumulator, a spring, a gas strut, and a shock.
7. The farm implement of claim 1, wherein the first set arm is pivotable about a seventh axis perpendicular to the line of travel allowing the first bogie wheel set and the first idler wheel set to move generally vertically.
8. The farm implement of claim 1, wherein the second set arm is pivotable about an eighth axis perpendicular to the line of travel allowing the second bogie wheel set and the second idler wheel set to move generally vertically.
9. The farm implement of claim 1, wherein the first axis perpendicular to the line of travel is movable generally vertically when the farm implement transitions from an unloaded configuration to a loaded configuration.