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EARTH WORKING APPARATUS**CROSS-REFERENCE TO RELATED APPLICATIONS**

The present application claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Application Ser. No. 61/824,097, filed May 16, 2013, and titled "DIRT PULVERIZING FINE GRADER" and U.S. Provisional Application Ser. No. 61/937,128, filed Feb. 7, 2014, and titled "EARTH GRADER." U.S. Provisional Application Ser. Nos. 61/824,097 and 61/937,128 are herein incorporated by reference in their entireties.

BACKGROUND

Earth working involves the physical treatment of the earth and includes operations such as beating, compacting, crushing, cultivating, cutting, digging, furrowing, harrowing, leveling, mixing, plowing, pulverizing, rolling, scraping, scratching, smoothing, tilling, and so forth. For example, the earth is worked by an earth working tool driven by a vehicle (e.g., a tractor), and in other cases using hand tools (e.g., a hoe).

SUMMARY

Aspects of the disclosure relate to earth working apparatus. An earth working apparatus (e.g., an earth grader or a sod cutter) includes a working implement (e.g., a dirt pulverizing roller or a blade) having a first end and a second end. The earth working apparatus also includes a first support (e.g., a tube) supporting the working implement, where the first support also has a first end and a second end. The earth working apparatus further includes a first arm (e.g., a first roller hanger or a first blade hanger) connecting the first end of the working implement to the first end of the first support, and a second arm (e.g., a second roller hanger or a second blade hanger) connecting the second end of the working implement to the second end of the first support. A second support (e.g., a tongue) is pivotally coupled with the first support by a torsion coupler. In some embodiments, the first arm and the second arm are also pivotally coupled with the first support by one or more torsion couplers. In some embodiments, the second support is connected to a third support (e.g., a connecting support for connecting the earth working apparatus to a skid steer vehicle or a tractor). The second support is configured to articulate with respect to the third support between a generally horizontal working orientation and a transport orientation (e.g., where the second support is angled away from the working orientation).

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

DRAWINGS

The Detailed Description is described with reference to the accompanying figures. The use of the same reference numbers in different instances in the description and the figures can indicate similar or identical items.

FIG. 1 is an isometric view illustrating an earth working apparatus configured to attach a vehicle, such as a skid steer vehicle, where the earth working apparatus includes a con-

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necting support configured to connect to the vehicle, a tongue extending from the connecting support, and a spike tube pivotally coupled with the tongue by a torsion coupler, and where spikes, a roller, and gauge wheels are attached to the spike tube in accordance with an example embodiment of the present disclosure.

FIG. 2 is a partial isometric view of the earth working apparatus illustrated in FIG. 1, where a portion of the tongue is removed to further illustrate the torsion coupler.

FIG. 3A is a side elevation view illustrating an earth working apparatus, such as the earth working apparatus illustrated in FIG. 1, where the earth working apparatus is attached to a skid steer vehicle in a working orientation in accordance with example embodiments of the present disclosure.

FIG. 3B is a side elevation view of the earth working apparatus illustrated in FIG. 3A, where the earth working apparatus is in a transport orientation in accordance with example embodiments of the present disclosure.

FIG. 3C is a side elevation view of the earth working apparatus illustrated in FIG. 3A, where the earth working apparatus is in the working orientation in accordance with example embodiments of the present disclosure.

FIG. 4 is an isometric view illustrating a connecting support for an earth working apparatus, such as the earth working apparatus illustrated in FIG. 1, in accordance with an example embodiment of the present disclosure.

FIG. 5 is an isometric view illustrating an earth working apparatus configured to attach a vehicle, such as a tractor, where the earth working apparatus includes a three-point attachment configured to connect to the tractor, a tongue extending from the three-point attachment, and a spike tube pivotally coupled with the tongue by a torsion coupler, and where spikes, a roller, and gauge wheels are attached to the spike tube in accordance with an example embodiment of the present disclosure.

FIG. 6 is another isometric view of the earth working apparatus illustrated in FIG. 5.

FIG. 7 is a partial cross-sectional side elevation view illustrating a torsion coupler for an earth working apparatus, such as the earth working apparatus illustrated in FIGS. 1 and 5, in accordance with an example embodiment of the present disclosure.

FIG. 8 is an isometric view illustrating a gauge wheel for an earth working apparatus, such as the earth working apparatus illustrated in FIGS. 1 and 5, in accordance with an example embodiment of the present disclosure.

FIG. 9 is a perspective view illustrating a spike tube for an earth working apparatus, such as the earth working apparatus illustrated in FIGS. 1 and 5, in accordance with an example embodiment of the present disclosure.

FIG. 10 is a partial exploded isometric view illustrating a spike tube for an earth working apparatus, such as the earth working apparatus illustrated in FIGS. 1 and 5, where spikes are configured to be attached to the spike tube in accordance with an example embodiment of the present disclosure.

FIG. 11 is another partial exploded isometric view illustrating a spike tube for an earth working apparatus, such as the earth working apparatus illustrated in FIGS. 1 and 5, where spikes are configured to be attached to the spike tube in accordance with an example embodiment of the present disclosure.

FIG. 12 is an isometric view illustrating an earth working apparatus configured to attach a vehicle, such as a skid steer vehicle, where the earth working apparatus includes a connecting support configured to connect to the vehicle, a tongue extending from the connecting support, and a spike tube pivotally coupled with the tongue by a torsion coupler, where