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DESCRIPTION

Field of the Invention

[0001] The subject disclosure relates to transport arrangements for agricultural machines, and, more particularly, relates to an arrangement for the machine, such as an agricultural mower, to enable the machine to be transported in less than its operating width.

Description of the Related Art

[0002] Agricultural mowers and mower/conditioners, hereinafter referred to simply as mowers, are well known and include self-propelled and pull-behind types. A problem with pull-behind mowers involves the transporting of the machines between fields, since the width of the machine may exceed practical or regulatory limits. Machine movement may be necessary over farm lanes, through gates or on highways where the machine width will not allow passage in the operating orientation.

[0003] A typically solution is to place the mower-conditioner header mechanism on a separate trailer such that the lateral width of the mechanism is generally aligned with the length of the trailer (lateral transport) and then tow the trailer with the tractor. One such example is the Discbine™ Transporter (by common assignee) which is specifically configured for loading, unloading, and laterally transporting a Model 1441/1442 disc mower conditioner while attached to the operating power unit (tractor). Such special trailers add significant cost, requires significant skill to load and unload, and must be used to transport the machine between locations or separately transported.

[0004] FR-A-2 332 690 discloses a support frame for an agricultural implement. This support frame has two freely swiveling wheels at the back and a front retractable wheel. During field operation, one of the freely swiveling wheels is lifted such that it no longer is in contact with the ground, while the other swiveling wheel is rotated such that it points in the working direction. The front retractable wheel is also placed into contact with the ground, such that the front wheel and one of the back wheels are in contact with the ground. When the implement needs to be transported on the road, the front wheel will be pivoted upwardly into a transport position, while the two swiveling wheels in the back are pivoted in the direction of the forward movement. Therefore, one of the wheels is pivoted from a transport position to a position where it is in contact with the ground, while the other swiveling wheel is pivoted such that it is now in the correct traveling position.

[0005] It would be advantageous to provide a reconfigurable transport arrangement for supporting a pull-behind mower header to be laterally transported while attached to a tractor without requiring an additional implement or special trailer. Further advantages would be

realized by a lateral transport system that is quickly and easily operated thereby reducing the time necessary to reconfigure the implement between operating and lateral transport configurations. Still further advantages would be realized by a lateral transport system that can be produced with less cost than the separate trailer lateral transport option it replaces.

Summary

[0006] The following presents a simplified summary in order to provide a basic understanding of some aspects of the disclosed examples. This summary is not an extensive overview and is intended to neither identify key or critical elements nor delineate the scope of such aspects. Its purpose is to present some concepts in a simplified form as a prelude to the more detailed description that is presented later.

[0007] The subject disclosure provides a reconfigurable transport arrangement for supporting a mower allowing lateral transportation of the mower while attached to a tractor without requiring an additional implement or special trailer.

[0008] The disclosure in one form is directed to a transport arrangement for an agricultural machine having a chassis, a trail frame being part of the chassis and a field suspension system. The transport arrangement coupled to the trail frame of the chassis includes a first suspension element being pivotal about a first axis, and a second suspension element being pivotal about a second axis. The first axis being perpendicular to the trail frame and the second axis being parallel to the trail frame. The second suspension element additionally being pivotal about the first axis.

[0009] The disclosure in another form is directed to an agricultural mower including a chassis, a pivotal tongue coupled to the chassis and a transport arrangement coupled to the chassis. The transport arrangement has a first suspension element pivotal about a first axis and a second suspension element pivotal about a second axis. The second suspension element additionally being pivotal about the first axis.

[0010] An advantage of the subject disclosure is that the lateral transport mode is accomplished without a separate implement or trailer.

[0011] Another advantage is that the transport mode is achieved using hydraulic controls available on the tractor.

[0012] Yet another advantage is that the transport system is stowed on the back portion of the mower.

[0013] Yet another advantage is that the legs of the transport system are of differing lengths to enhance stability of the mower in the transport mode.

[0014] A further advantage is that the transport suspension is above the discharge zone of the mower and does not interfere with the flow of the crop material.

[0015] A still further advantage is that the transport arrangement doesn't negatively effect the balance of the mower.

[0016] To the accomplishment of the foregoing and related ends, one or more examples comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative aspects and are indicative of but a few of the various ways in which the principles of the various aspects may be employed. Other advantages and novel features will become apparent from the following detailed description when considered in conjunction with the drawings and the disclosed examples are intended to include all such aspects and their equivalents.

Brief description of the drawings

[0017] The above-mentioned and other features and advantages of this disclosure, and the manner of attaining them, will become more apparent and the disclosure will be better understood by reference to the following description of an embodiment of the disclosure taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of an agricultural machine in the form of a mower including an embodiment of a transport arrangement of the present application in the stowed position;

Fig. 2 is a top view of the mower with the transport arrangement shown in Fig. 1;

Fig. 3 is a perspective view of the mower shown in Figs. 1 and 2, with the tongue shifted to a field use position;

Fig. 4 is another perspective view of the mower of Figs. 1-3, illustrating the transport arrangement of the present application being deployed;

Fig. 5 is yet another perspective view of the mower of Figs. 1-4, illustrating the transport arrangement of the present application being further deployed lifting the chassis of the mower;

Fig. 6 is yet another perspective view of the mower of Figs. 1-5, illustrating the tongue of the mower being pivoted to a transport position;

Fig. 7 is a front view of the mower of Figs. 1-6, illustrating the transport arrangement of the present application being deployed for transporting the mower, from the perspective of the operator in a tractor; and

Fig. 8 is a side view of the mower of Figs. 1-7, illustrating the transport arrangement of the present application being fully deployed having lifted the chassis of the mower.

[0018] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates an embodiment of the subject disclosure, and such exemplification is not to be construed as limiting the scope of the subject disclosure in any manner.

Detailed description

[0019] Referring now to the drawings, and more particularly to Fig. 1, there is shown a perspective view of an agricultural machine in the form of a mower 10, which can be attached to a tractor (not shown). Mower 10 generally includes a chassis 12, which carries a number of other components such as crop engaging blades 14, and drive components 16. A tongue 18 is pivotally connected to chassis 12, an end of which can be connected to the tractor. A field suspension system 20 supports mower 10 while mower 10 is in a field mode. Mower 10 additionally includes a transport arrangement 22, which, when deployed, provides the support for the transport of mower 10. Crop engaging blades 14 can be disc cutter blades 14 or a sickle bar, or another crop cutting device.

[0020] Now, additionally referring to Figs. 2-8, transport arrangement 22 includes suspension elements 24 and 26, which respectively have wheels 28 and 30 connected to corresponding ends of suspension elements 24 and 26. Suspension elements 24 and 26 are rotatable about an axis 32, when suspension element 26 is in the position shown in Figs. 4-8. Additionally, suspension element 26 is rotatable about an axis 34 as it transitions from a stowed position illustrated in Figs. 1-3 to the position shown in Fig. 4. Axis 32 is generally perpendicular to axis 34.

[0021] When suspension element 26 is in the stowed position it is generally above, or at least vertically elevated above, suspension element 24. Additionally, suspension element 26 is somewhat shorter than suspension element 24, as can be particularly seen in Fig. 2, where it can also be seen that suspension element 26 is positioned such that wheel 30 is behind wheel 28 when transport arrangement 22 is in a stowed position.

[0022] A sequence of movements of the elements of mower 10 will now be discussed with references to the various figures. Figs. 1 and 2 illustrate transport arrangement 22 in a stowed position and tongue 18 is angularly positioned in a substantially forward direction 36. This is a configuration in which mower 10 can be used, but generally mower 10 will be used with tongue 18 located to either side, such as that shown in Fig. 3. Fig. 3 illustrates a predetermined position for tongue 18 to be located to allow the needed clearance for suspension element 26 to rotate about axis 34, as shown fully deployed, in Fig. 4. Initially the field wheels associated with field suspension system 20 are fully extended to lift chassis 12.

[0023] Once transport arrangement 22 is positioned as shown in Fig. 4, then both suspension elements 24 and 26 rotate about axis 32 causing wheels 28 and 30 to contact the ground

thereby lifting chassis 12 so that field suspension system 20 is lifted off of the ground. Field suspension system 20 can be coordinated to also lift its wheels while or after wheels 28 and 30 contact the ground. The wheels of field suspension system 20 are raised to provide ground clearance by the retraction of the lift cylinders associated with field suspension system 20 (as can be seen in Figs. 7 and 8). A result of this step is that transport arrangement 22 is fully deployed as seen in Fig. 5 and is in the transport position.

[0024] The next step is that tongue 18 is now swung to a transport position as shown in Fig. 6. This step has to wait on the full deployment of transport arrangement 22 to prevent mower 10 from tipping to one side. Figs. 7 and 8 show mower 10 in the transport mode respectively from the operator viewpoint and the right hand side of mower 10.

[0025] The steps needed to configure mower 10 for field use are the reverse of those just discussed in order to transition from the transport position to the stowed position of transport arrangement 22. The position of tongue 18 in the transport mode is at a small angle to the tracking of mower 10, as seen in Fig. 7, so as to position the hitch in the desired location for connection with the tractor.

[0026] Transport arrangement 22 is coupled to chassis 12 and more particularly to trail frame 38, which is part of chassis 12. The coupling of transport arrangement 22 is offset to the side of the centerline of mower 10. The folding mechanism of transport arrangement 22 is provided to allow at least portions of transport arrangement 22 to be stowed above and to the rear of the trail frame 38 during field operations. Upon placing the center pivot disc mower conditioner 10 (CPDMC) in the full field left position, the mechanism of transport arrangement 22 rotates about a pivot axis 34 that is parallel to or substantially parallel to the trail frame 38 (or the axis of the field wheels). This action can deploy the left hand (as in transport position) wheel to a position ahead of the header (ahead as in the field position) while still located above the trail frame 38. When this rotation has been completed, a secondary rotation takes place about axis 32; this action is a pivoting action which is above and perpendicular to the trail frame 38 and the field wheel axis. This action rotates wheels 28 and 30 from their position above trail frame 38 to a position below trail frame 38 and in contact with the ground.

[0027] When this action is complete, the trail frame/header is then rotated to a position essentially in-line with tongue 18, thus allowing a narrow transport for public roads. The steps to transition from field operation to lateral transport operation are thus: 1. Fully lift chassis 12 to the non-mowing position by extending the field wheels of field suspension system 20; 2. Rotate chassis 12 to the full field left position; 3. Extend the primary lateral transport cylinder to rotate suspension element 26 along with wheel 30 from a position above and behind the trail frame 38 to a position above and ahead of the trail frame 38; 4. Extend the secondary lateral transport cylinder to rotate suspension elements 24 and 26 with wheels 28 and 30 down below the trail frame 38, with wheel 28 being behind the header/trail frame 38 and wheel 30 being in front of the header/trail frame 38; 5. Initiate the system to complete the rotation of chassis 12 to the full lateral transport position and raise the field wheels. The steps to transition from lateral transport to field operation are then to reverse the actions starting with step 5 and work

backward to step 1.

[0028] The subject disclosure includes the action of rotating the left hand transport wheel 30 from a position above and behind the trail frame 38 to a position ahead of the trail frame 38 and the header about an axis generally parallel to the trail frame 38 and the field wheel axis. There is also the subsequent action (or precedent action depending on which way the transition is proceeding) of rotating the transport wheel from a position above the header/trail frame 38 to a position below the header/trail frame 38, where the left hand transport wheel 30 is ahead of the header with the right hand transport wheel 28 to the rear of the header (in field position) and about an axis 32 perpendicular to the trail frame 38 field wheel axis. The system stows the transport wheels 28 and 30 above and behind the trail frame 38 while having the ability to rotate the transport wheel 30 to a position ahead of the header. Any system can be used to actuate the lateral transport rotations, with hydraulic cylinders being assumed, but the actions can be accomplished with any arrangement of cylinders, actuators, linear motors, rotational motors, to name a few.

[0029] Advantages of the subject disclosure include the providing of integrated lateral transport while allowing full rotation of the header for all field conditions with the transport wheels stowed above and behind the trail frame 38. The stowed position keeps the transport wheels completely out of the incoming crop stream, as well as completely out of the crop stream exiting from the conditioner. Further, this system allows for the CPDMC to be balanced during both field and lateral transport operation.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- [ER2332690A](#) [0004]

PATENTKRAV

1. Landbrugsmaskine (10), der omfatter:
 - et chassis (12);
 - 5 en trækramme (38), der er en del af chassiset (12);
 - et markophængningssystem (20) til at bære chassiset (12) og
 - en transportanordning (22), der er koblet til chassisets (12) trækramme (38) til udfoldning
 - til at støtte landbrugsmaskinen (10) i en vejtransporttilstand, hvilken transportanordning (22)
 - indbefatter:
 - 10 et første ophængningselement (24), der kan dreje omkring en første akse (32);
 - hvilken første akse (32) er vinkelret på trækrammen (38); og
 - et andet ophængningselement (26), der kan dreje omkring en anden akse (34);
 - kendetegnet ved, at:**
 - den anden akse (34) er parallel med trækrammen (38); og
 - 15 det andet ophængningselement (26) endvidere kan dreje omkring den første akse (32).
2. Landbrugsmaskine (10) ifølge krav 1, hvor transportanordningen (22) er i en sammenfoldet position, når landbrugsmaskinen (10) er udformet til markarbejde, og transportanordningen (22) er i en transportposition, når landbrugsmaskinen (10) er udformet til
- 20 vejtransport.
3. Landbrugsmaskine (10) ifølge krav 2, hvor, når transportanordningen (22) er i den sammenfoldede position, det første ophængningselement (24) er i umiddelbar nærhed af det andet ophængningselement (26) i umiddelbar nærhed af én side af landbrugsmaskinen (10).
- 25
4. Landbrugsmaskine (10) ifølge krav 3, hvor den ene side af landbrugsmaskinen (10) er en bagside af landbrugsmaskinen (10).
5. Landbrugsmaskine (10) ifølge krav 3 eller 4, hvor det andet ophængningselement (26)
- 30 generelt er over det første ophængningselement (24), når transportanordningen (22) er i den sammenfoldede position.
6. Landbrugsmaskine (10) ifølge krav 2-5, hvor, når transportanordningen (22) overgår fra den sammenfoldede position til transportpositionen, det andet ophængningselement (26) først
- 35 roterer omkring den anden akse (34), derefter roterer både det første ophængningselement (24)

og det andet ophængningselement (26) omkring den første akse (32).

7. Landbrugsmaskine (10) ifølge krav 1-6, hvor chassiset (12) og markophængningssystemet (20) i det væsentlige bæres af transportanordningen (22), når den er i transportpositionen.

8. Landbrugsmaskine (10) ifølge krav 1-7, hvor det første ophængningselement (24) er længere end det andet ophængningselement (26).

9. Landbrugsmaskine (10) ifølge krav 2-8, hvor landbrugsmaskinen (10) er en slåmaskine med en drejetunge (18), hvilken drejetunge (18) drejes til en forudbestemt position, når transportanordningen (22) overgår fra den sammenfoldede position til transportpositionen og fra transportpositionen til den sammenfoldede position.

DRAWINGS

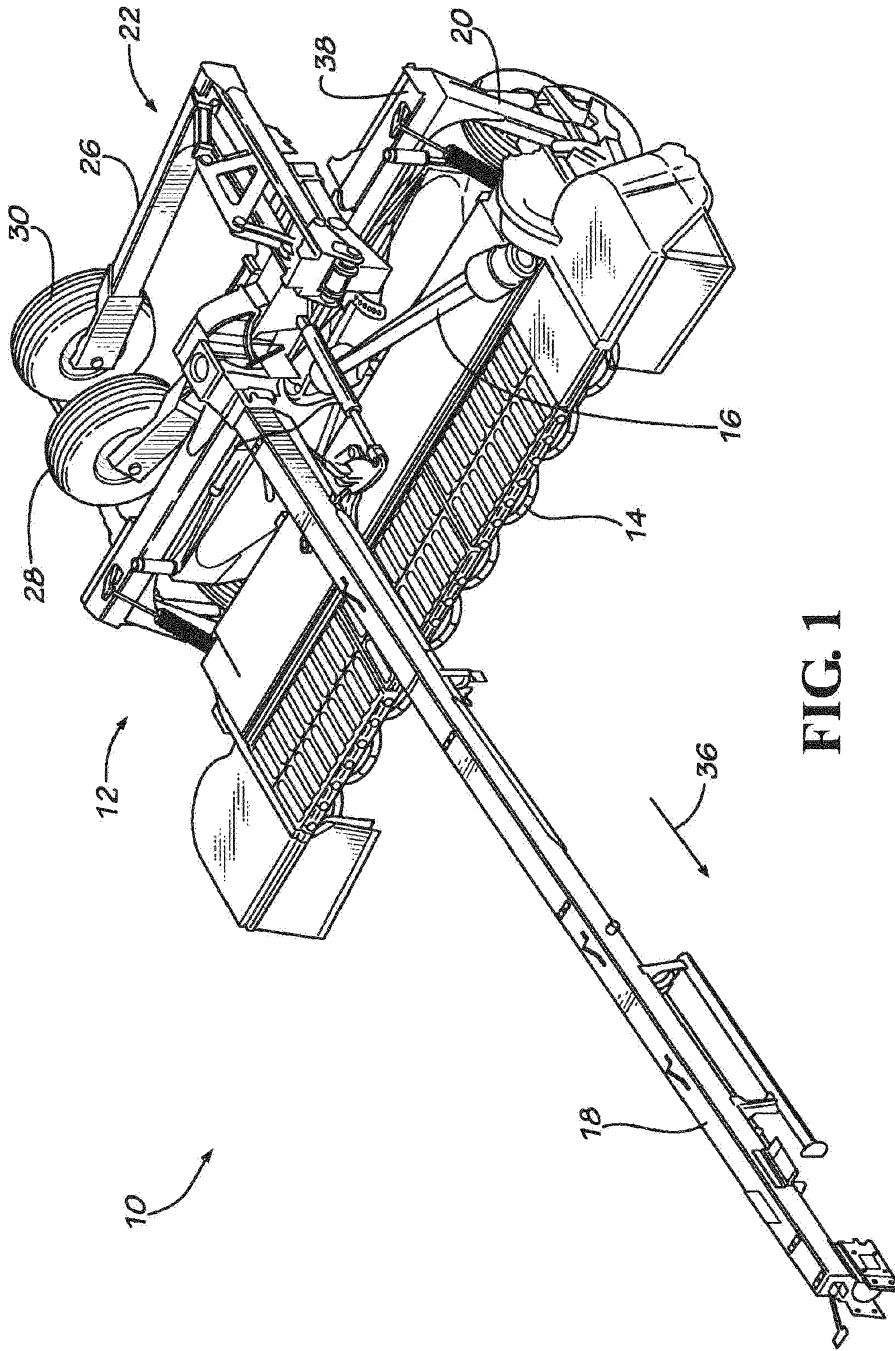


FIG. 1

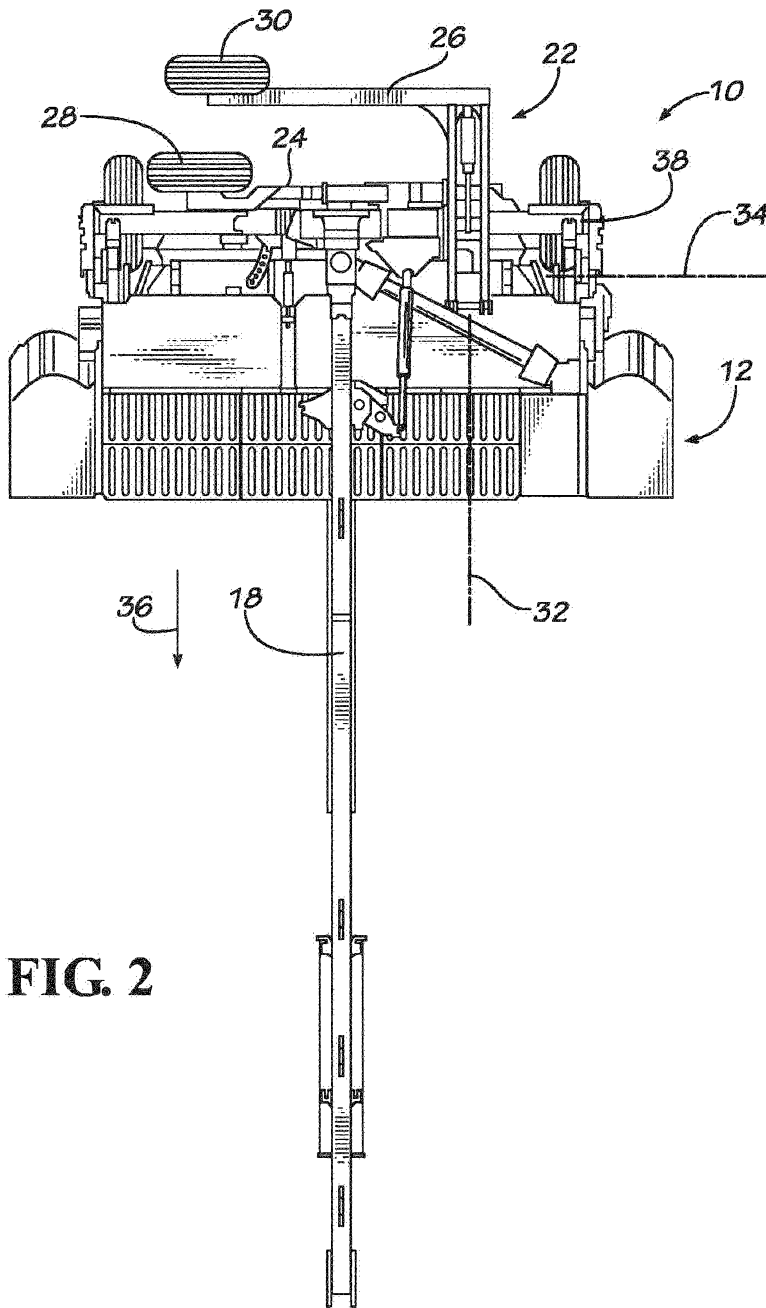


FIG. 2

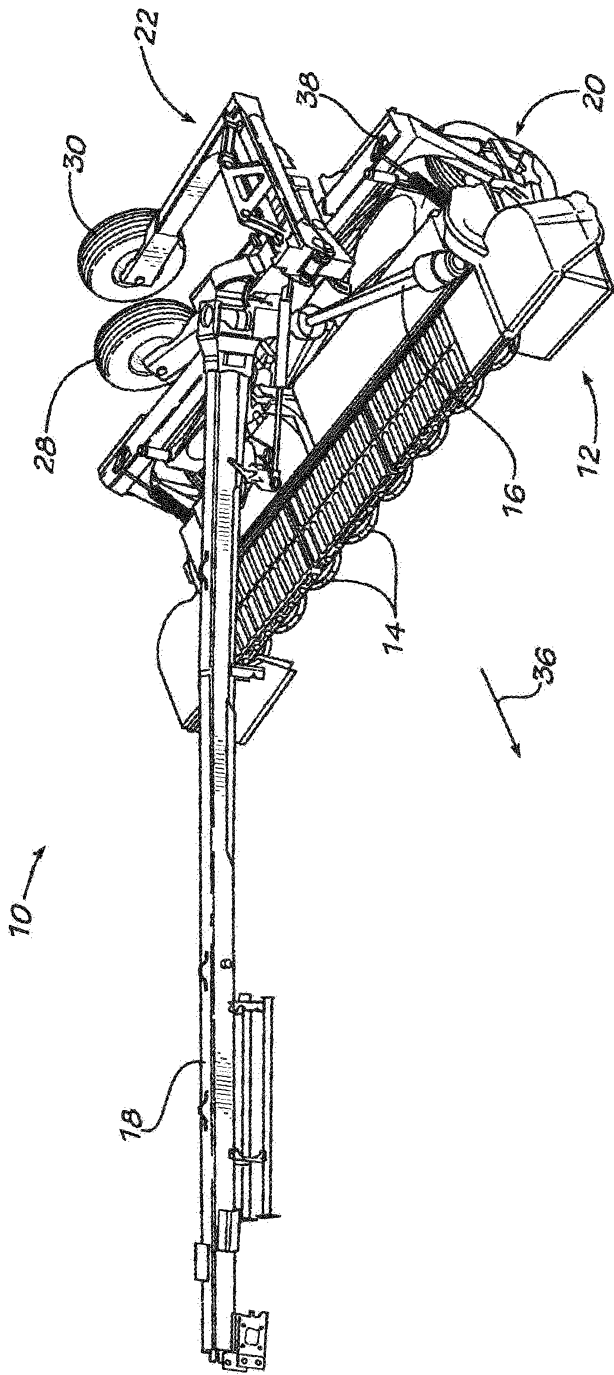


FIG. 3

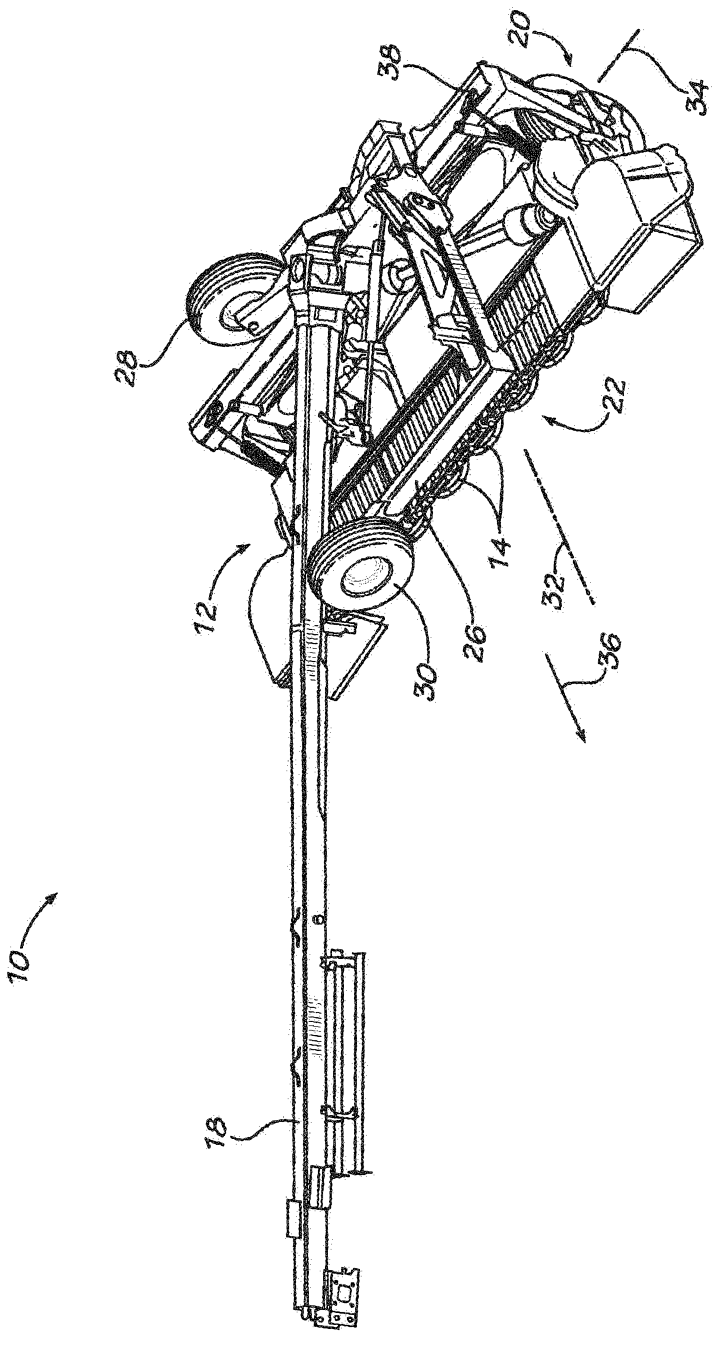


FIG. 4

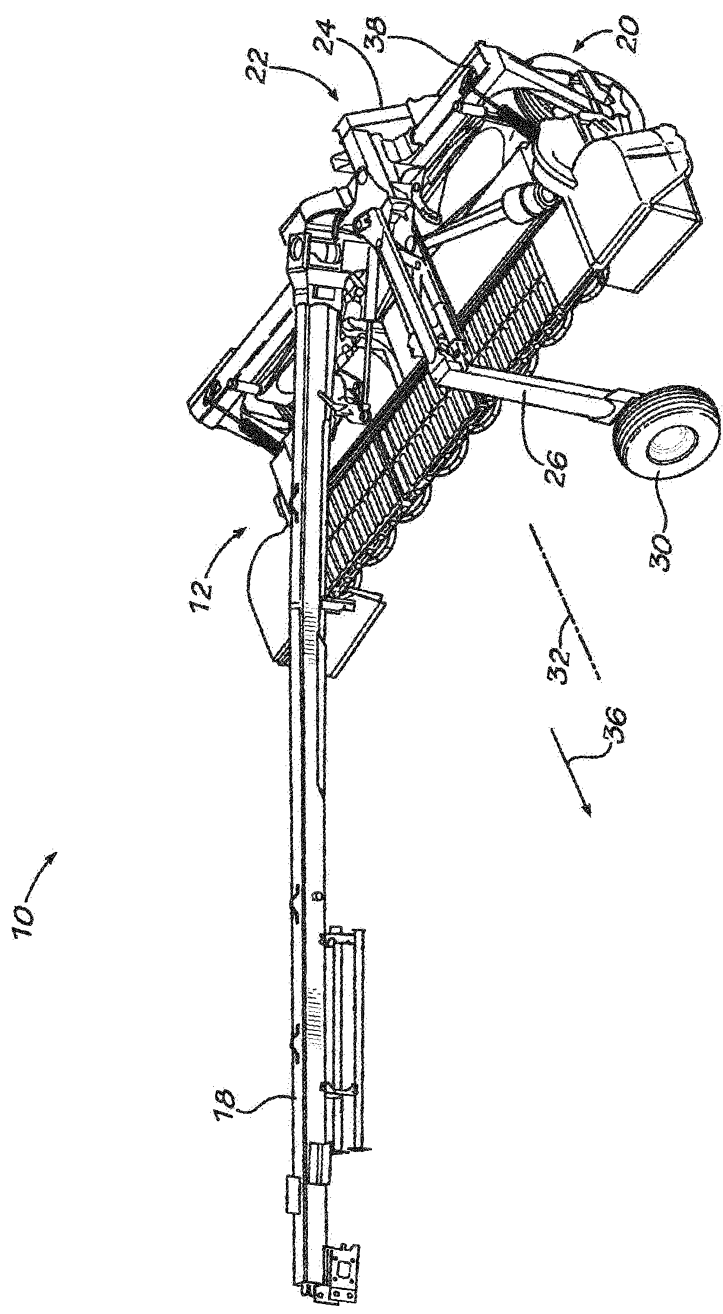


FIG. 5

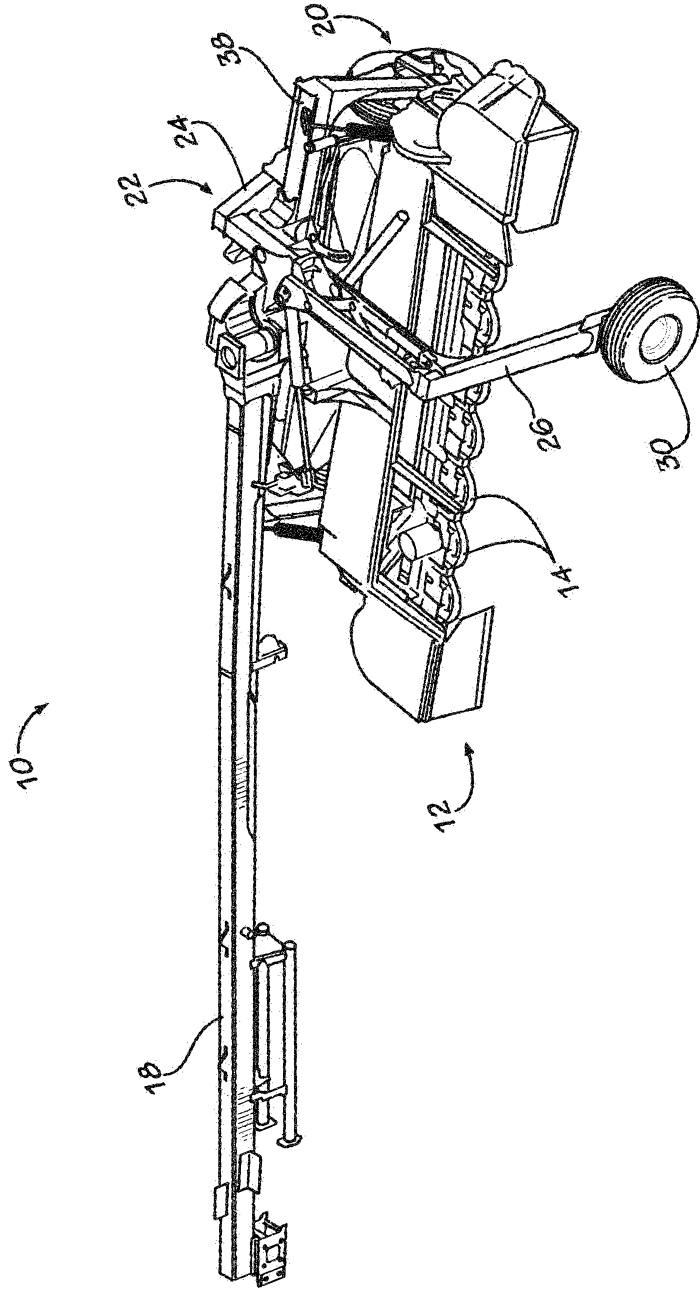


FIG. 6

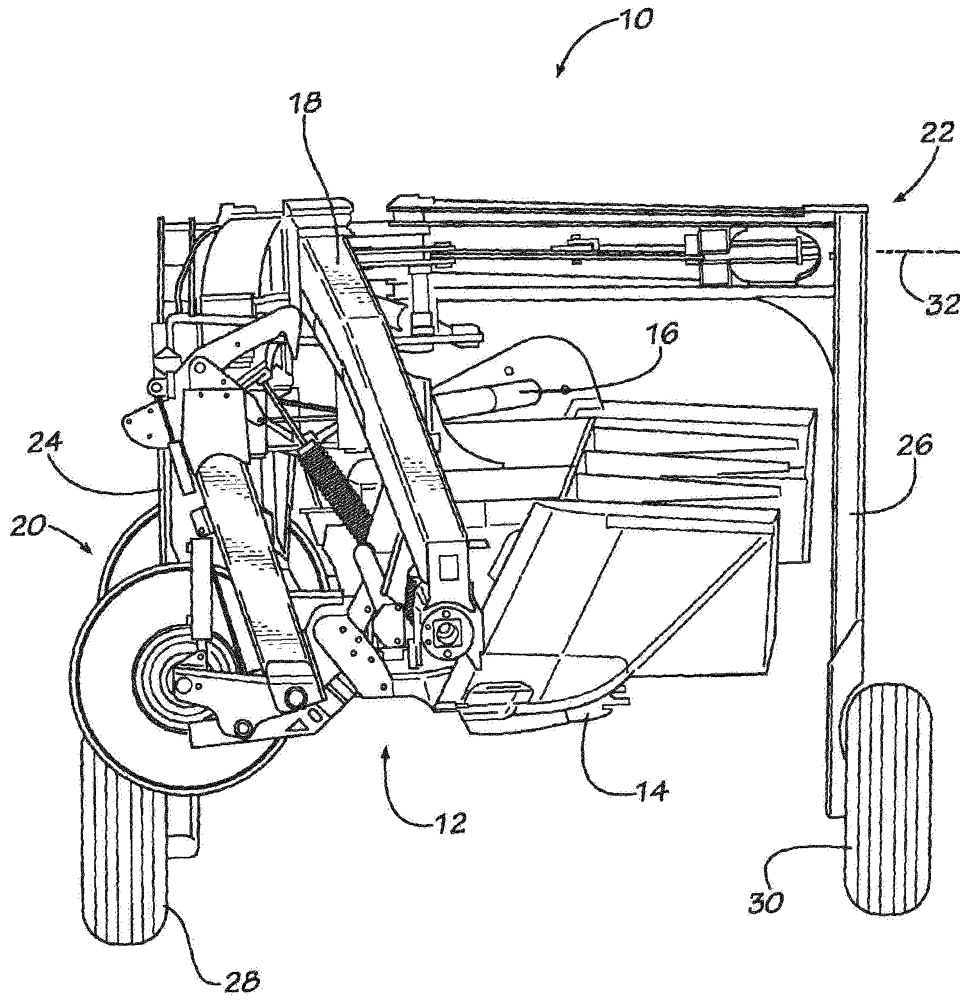


FIG. 7

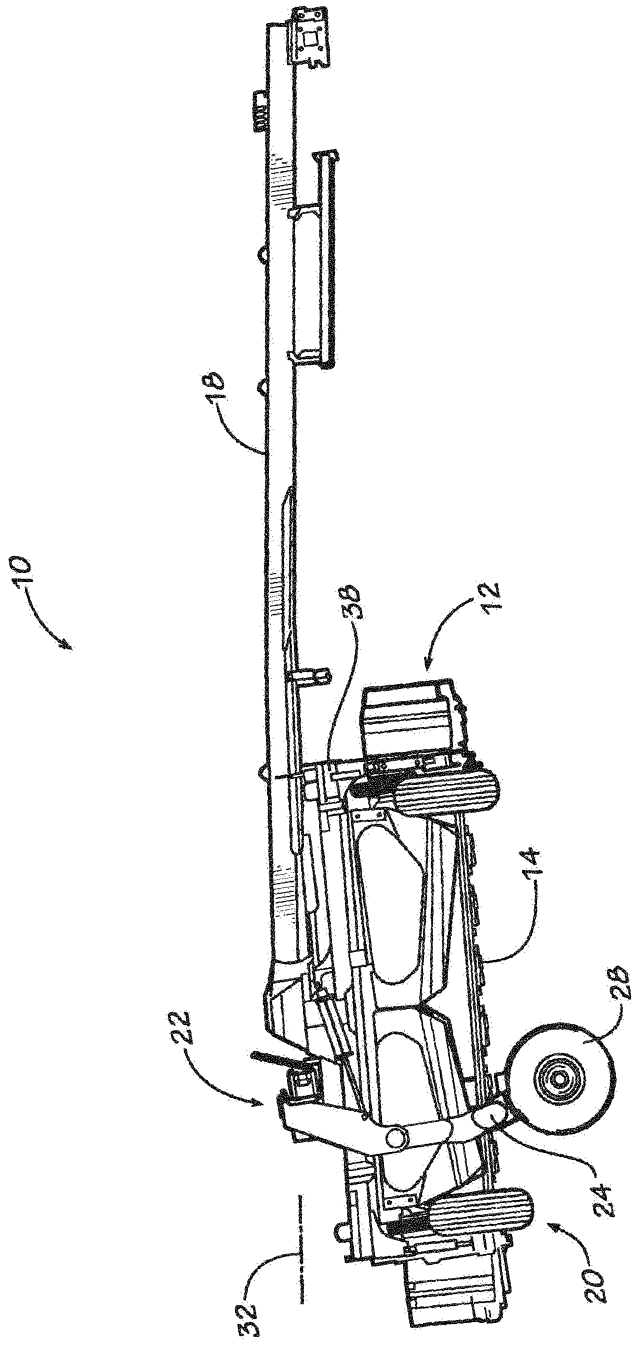


FIG. 8