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(54) Title of the Invention: TRAVELING DEVICE OF MOBILE FARMING MACHINE

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Specification

1. Title of the Invention

TRAVELING DEVICE OF MOBILE FARMING MACHINE

2. Claim

A traveling device, in a mobile farming machine comprising a pitching controller that controls maintenance of a longitudinally horizontal attitude of a vehicle body while changing a pitch angle of crawlers relative to the vehicle body, comprising:

a pitching correction controller that controls correction of a pitch of the crawlers so as to maintain the vehicle body in a longitudinally horizontal attitude by detecting a change in the pitch angle of the crawlers during traveling.

3. Detailed Description of the Invention

INDUSTRIAL FIELD OF APPLICATION

The present invention relates to a traveling device of a mobile farming machine, such as a combine or a seedling transplanter, having a pitching controller.

PRIOR ART AND PROBLEM TO BE SOLVED BY THE INVENTION

If a vehicle body pitches during traveling, a pitching controller performs control to maintain its longitudinally horizontal attitude by changing a pitch angle of crawlers relative to the vehicle body. If the vehicle body traverses a convex obstacle(s) during traveling, because the vehicle body exponentially becomes a downward tilted attitude after the vehicle body becomes an upward tilted attitude and traverses the obstacle(s), the vehicle situation cannot be followed with pitching controls of the vehicle body using a pitching controller in such case, and it causes a front part of the vehicle body to collide with soils or makes an operator uneasy or the like.

Then, the present invention solves such problems to attempt driving stability of the vehicle body and hazard prevention of the operator.

MEANS FOR SOLVING THE PROBLEM

The present invention relates to a construction machine having a pitching controller that controls maintenance of a longitudinally horizontal attitude of a vehicle body while changing a pitch angle of crawlers relative to the vehicle body, is equipped with a pitching correction controller that controls correction of a pitch of the crawlers so as to maintain the vehicle body in a longitudinally horizontal attitude by detecting a change in the pitch angle of the crawlers during traveling.

OPERATION OF THE INVENTION

When a vehicle body pitches during traveling, pitching control is performed by a pitching controller so as to maintain this vehicle body to be in a longitudinally horizontal attitude by changing a pitch angle of the crawlers relative to the vehicle body. During this pitching control, when a change in the pitch angle of the crawlers is detected by a sensor, a pitching correction controller controls correction of the pitch of the crawlers, and the vehicle body is maintained in a longitudinally horizontal attitude.

EFFECT OF THE INVENTION

During the pitching control, if a vehicle body traverses a ridge or the like, this vehicle body is exponentially changed from an upward tilted attitude to a downward tilted attitude, and if a change in a pitch angle of the crawlers is detected at this time, a pitching correction controller corrects the pitch angle of the crawlers and the vehicle body is controlled to be maintained in a longitudinally horizontal attitude. When a vehicle body traverses a ridge as mentioned above, an exponential forward tilt of the vehicle body cannot be followed with the pitching control, but the pitching correction controller can control the vehicle body to smoothly maintain in a longitudinally horizontal attitude without causing the vehicle body to become a forward tilted attitude and collide with soils or causing an operator to provide a sense of anxiety.

EMBODIMENT

Furthermore, in illustration examples, longitudinal vehicle body frames 5 are placed at left and right sides in a lower part of a vehicle body 2, and left and right traveling axis pipes 7 of a

the vehicle body 2 and transmit momentum to a pair of left and right crawlers 1 are mounted at front ends of these left and right vehicle body frames 5. Further, a support shaft 8 that supports these left and right vehicle body frames 5 is placed near rear sides of the left and right vehicle body frames 5, and left and right pitching arms 9 that are protruded toward a front part are placed in this support shaft 8 to be rotatable integrally, and a pitching cylinder 10 that oscillates these left and right pitching arms 9 is placed at one side of the vehicle body frames 5. Links 11 are placed at ends of these left and right pitching arms 9 to be turnable, respectively.

A pitching frame 12 that is configured as framework is placed inside these left and right vehicle body frames 5. Traveling frames 14 are placed at transversely outside and below both the left and right pitching frames 13 in a longitudinal direction. A plurality of track rollers 15 are placed outside these left and right traveling frames 14 by utilizing bearings to be rotatable, and, ring bodies 16 for tension that is mounted to be retractable from/into this traveling frames 14 are placed at rear ends.

The traveling device is configured by winding the crawlers 1 around these ring bodies 16 and plurality of track rollers 15, and drive sprockets 48 at the ends of left and right traveling axis pipes 7 in the traveling transmission case 6.

A sensor 37 that detects a change in a pitch angle of the crawlers 1 during traveling of the vehicle body 2 is established. For this sensor 37, movable track rollers 15a with a large diameter positioned in the center of the plurality of track rollers 15 are placed to be vertically oscillable relative to the traveling frames 14 via the arms 47, and, are established to elastically press downward, respectively. Then, the sensor 37 is configured to detect a change in the pitch angle of the crawlers 1 and to turn on a switch when the movable track rollers 15a are pivoted upward at the time of traversing a convex area on the soil surface or the like.

A vehicle speed sensor 39 that detects traveling route of the traveling transmission case 6 that transmits momentum to the crawlers 1.

Spindles 17 are placed in front of and behind the pitching frame 12 across the left and right pitching frames 13, respectively, and rolling arms 18 are placed at both left and right ends that protrude from the pitching frames 13 of these front and rear spindles 17, respectively. One ends of these rolling arms 18 are coupled to pins 19 of the traveling frames 14 to be pivotable, respectively, and the other ends couple the front and rear rolling arms 18 with coupling rods 20, respectively, and rolling cylinders 21 are placed between the end of the rear rolling arms 18 at the other side and the pitching frames 13, respectively. It is configured such that extension and retraction of these rolling cylinders 21 cause the front and rear rolling arms 18 using the front and rear spindles 17 as a rotation axis, and the traveling frames 14 move vertically relative to the pitching frame 12.

Both left and right sides of the spindle 17 in front of the pitching frame 12 are borne below the left and right vehicle body frames 5 to be rotatable, respectively, and ends of the links 11 of the left and right pitching arms 9 are mounted to pins 22 mounted at the rear sides on the left and right pitching frames 13 to be rotatable, respectively.

When the pitching arm 9 gyrates around the support shaft 8 due to extension of the pitching cylinder 10, it is configured such that the pitching frame 12 and the left and right traveling frames 14 are interlocked via the links 11 so as to integrally rotate downward using the front spindle 17 as a rotate axis.

When the rolling cylinders 21 are extended, the front and rear rolling arms 18 integrally pivot using the front and rear spindles 17 as their pivot axes, and it is configured such that the traveling frames 14 are interlocked so as to move downward while maintaining a parallel state relative to the pitching frames 13. Furthermore, the pivot axis of the front rolling arm 18 and that of the pitching frame 12 are the same.

A stroke sensor 23 that detects any strokes of

right stroke sensors 24 that detect any strokes of these rolling cylinders 21 are placed in the left and right rolling cylinders 21, respectively.

A roll sensor 25 that detects a roll of the vehicle body 2, and a pitch sensor 26 that detects a pitch are established. Further, a vehicle height raising/lowering lever that activates the left and right rolling cylinders 21 to adjust the vehicle height vertically by raising or lowering the left and right crawlers 1 is placed, and a manual tilting lever that activates the left and right rolling cylinders 21 or the pitching cylinder 10 to tilt the vehicle body 21 longitudinally or transversely is placed.

A reaper that reaps grains is placed at the front part of the vehicle body 2 to be vertically movable by an elevation cylinder 27, and an elevation lever that ascends or descends this reaper is placed.

Fig. 2 shows a hydraulic circuit, and an electromagnetic valve 29 is placed on an oil passage from a hydraulic pump 28 to the pitching cylinder 10, and, another electromagnetic valve 31 is placed on another oil passage to the left rolling cylinder 21L, and another electromagnetic valve 30 is placed on another oil passage to the right rolling cylinder 21R. An upward solenoid valve 32 and a downward solenoid valve 33 are also placed on the oil passage of the elevation cylinder 27 in the reaper. The symbol 34 represents an unload valve.

When detection information by a manual tilting switch 35 that will be turned on by a tilting operation of the manual tilting lever forward or backward or left or right, detection information by a vehicle height raising/lowering switch 36 that will be turned on by the upward/downward operation of the vehicle height raising/lowering lever; detection information by the sensor 37 that detects a change in a pitch angle of the pair of left and right crawlers 1, pitch information of the vehicle body 2 by a vehicle body horizontal switch 38 that starts horizontal control of the vehicle body 2 and the pitch sensor 26, roll information of the vehicle body 2 by the roll sensor 25, detection information of strokes of the pitching cylinders 10 by the stroke sensor 23, detection information of each stroke of left/right stroke sensor 24, detection information by the vehicle speed sensor 39 and the like are entered into a controller that is equipped with the rolling controller 3 and a pitching controller 4; in response to such information, it is configured to be controlled so as to enter the information to a left rising solenoid 40 and a left lowering solenoid 41 of the electromagnetic 30, a right raising solenoid 42 and a right lowering solenoid 43 of the electromagnetic 31, an upward raising solenoid 44 and a downward lowering solenoid 45 of the electromagnetic valve 29, and the unload valve 34 from the controller, respectively. The symbol 46 represents a pitching speed changing means.

When a pitch of the vehicle body 2 is detected by the pitch sensor 26, the upward raising solenoid 44 or the downward lowering solenoid 45 are activated by the pitching controller 4 of the controller to switch over the electromagnetic valve 29, and the pitching cylinder 10 is extended or retracted and the vehicle body 2 is pitching-controlled to be longitudinally horizontal. When a roll of the vehicle body 2 is detected by the roll sensor 25, the right raising solenoid 42 or the right lowering solenoid 43, or, the left raising solenoid 40 or the left lowering solenoid 41 is activated by the rolling controller 3 of the controller to switch over the electromagnetic valves 30 or 31, and the left and right rolling cylinder 21 are extended or retracted, and the vehicle body 2 is rolling-controlled to be transversely horizontal.

The controller is equipped with a pitching correction controller 4a. This pitching correction controller 4a is configured to control the correction of the pitch of the crawlers 1 so as to maintain the vehicle body 2 to be in a longitudinally horizontal attitude when the sensor 37 detects a change in a pitch angle of a pair of the left and right crawlers.

If the vehicle body 2 transversely tilts during traveling, this tilt is detected by the roll sensor 25, and the left rolling cylinder 21L and the right rolling cylinder 21R are extended or retracted based upon this detection information, and the rolling is controlled by the rolling controller 3 so as to

horizontal by raising or lowering the left and right crawlers 1 relative to the pitching frame 12. If the vehicle body 2 longitudinally tilts during traveling, this tilt is detected by the pitch sensor 26, and the pitching cylinder 10 is extended or retracted based upon this detection information, and the pitching frame 12 pivots relative to the vehicle body 2 and their rear sides of the left and right crawlers 1 are integrally pivoted up or down, and pitching is controlled by the pitching controller 4 so as to maintain the vehicle body 2 to be longitudinally horizontal.

During this pitching control, when a soil surface being traveled becomes a down-slope from an up-slope, for example, when a vehicle traverses a ridge, if the movable track roller 15a in the center traverses this ridge, it is pivoted upward and a switch is turned ON, and the sensor 37 detects a change in the pitch angle of the crawlers 1; the pitching correction controller 4a is activated to retract the pitching cylinder 10; the pitching frame 12 is pivoted upward around the spindle 17 at the front side relative to the vehicle body 2 and the left and right crawlers 1 are pivoted upward; and the vehicle body 2 is controlled for correction so as to be in a longitudinally horizontal attitude.

As mentioned above, when the vehicle traverses a ridge as mentioned above or loads are loaded to a truck by using a footboard(s), because the vehicle body 2 rapidly has a head forward attitude after becoming a horizontal attitude from an upward attitude, the pitching control is not sufficient to follow such situation; thus, an operator may feel a danger or a front part of the vehicle body 2 may collide with soils or the like, but because of the pitching correction controller 4a, the vehicle body 2 is smoothly controlled to be maintained in a longitudinally horizontal attitude. Further, because the speed of the change in this pitching attitude can be linked to the vehicle speed by the pitching speed changing means 46, the vehicle body 2 can be more smoothly controlled to be maintained in a longitudinally horizontal attitude.

4. Brief Description of Drawings

Drawings show one embodiment of the present invention, and Fig. 1 is a control circuit diagram, Fig. 2 is a hydraulic circuit diagram, Fig. 3 is a side view and Fig. 4 is a plan view.

In the drawings, the symbol 1 represents a crawler, 2 is a vehicle body, 4 is a pitching controller, 4a is pitching correction controller, 26 is a pitch sensor and 46 is a pitching speed changing means.

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