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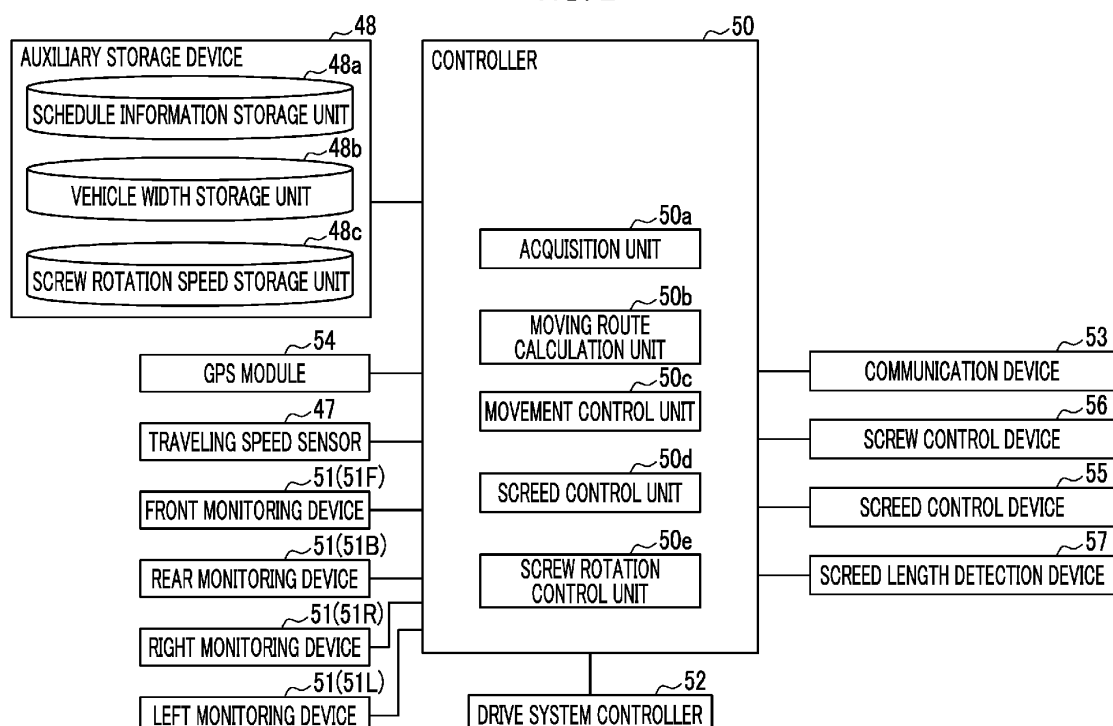
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(54) **ASPHALT FINISHER**

(57) Construction quality of a road surface is improved. An asphalt finisher (100) includes a tractor (1), a hopper (2) that is provided on a front side of the tractor (1), a conveyor (CV) that transports a paving material in the hopper (2) to a rear side of the tractor (1), a screw (SC) that spreads the paving material, which is transported by the conveyor (CV) and which is sprinkled on a road surface in a vehicle width direction, and a screed device

(3) that levels the paving material spread by the screw (SC) on a rear side of the screw (SC) and that is capable of expanding and contracting in the vehicle width direction, in which a rotation speed of the screw (SC) is configured to be changed while the asphalt finisher (100) is moved by the tractor (1) based on information related to a moving direction of the asphalt finisher (100).

FIG. 2



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an asphalt finisher.

Description of Related Art

[0002] In the related art, an asphalt finisher including a tractor, a hopper that is provided on a front side of the tractor and that receives a paving material, a conveyor that feeds the paving material in the hopper to a rear side of the tractor, a screw that spreads the paving material fed by the conveyor on the rear side of the tractor, and a screed that levels the paving material spread by the screw on a rear side of the screw is known.

[0003] When the asphalt finisher performs construction, a configuration of the asphalt finisher is controlled depending on the situation of a road surface where the paving material is leveled. For example, Japanese Unexamined Patent Publication No. 2021-127560 proposes a technique of adjusting the rotation speed of the screw in accordance with expansion and contraction of the screed of the asphalt finisher.

SUMMARY OF THE INVENTION

[0004] In the asphalt finisher, a paving material holding amount of the screed can be adjusted by adjusting the rotation speed of the screw in accordance with expansion and contraction of the screed. Accordingly, an appropriate amount of paving material can be leveled on the road surface.

[0005] However, there is a situation other than the expansion and contraction of the screed where a change in the rotation speed of the screw is necessary in order to adjust the paving material holding amount of the screed. For example, when the asphalt finisher has changed a traveling direction along a road, the area of a paved road surface changes compared to a case where the asphalt finisher moves straight.

[0006] In view of the description above, construction quality of the road surface is improved by sprinkling an appropriate amount of paving material in accordance with the road surface due to the change in the rotation speed of the screw depending on the situation of the asphalt finisher.

[0007] According to an aspect of the present invention, there is provided an asphalt finisher including a tractor, a hopper that is provided on a front side of the tractor, a conveyor that transports a paving material in the hopper to a rear side of the tractor, a screw that spreads the paving material, which is transported by the conveyor and which is sprinkled on a road surface, in a vehicle width direction, and a screed device that levels the paving

material spread by the screw on a rear side of the screw and that is capable of expanding and contracting in the vehicle width direction, in which a rotation speed of the screw is configured to be changed while the asphalt finisher is moved by the tractor based on information related to a moving direction of the asphalt finisher.

[0008] According to the aspect of the present invention, construction quality of the road surface is improved by realizing appropriate leveling in accordance with the road surface due to the change in the rotation speed of the screw.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Figs. 1A and 1B are views showing an asphalt finisher which is an example of a road machine according to an embodiment.

Fig. 2 is a block diagram showing a configuration example of a controller and devices connected to the controller according to the embodiment.

Fig. 3 is a view showing a table in which the current situation of the asphalt finisher and a rotation speed of a screw corresponding to the situation are associated with each other in a screw rotation speed storage unit according to the embodiment.

Fig. 4 is a hydraulic circuit diagram showing a configuration example of a hydraulic system mounted on the asphalt finisher according to the embodiment.

Fig. 5 is a view showing configurations of the screw and a screed in the asphalt finisher according to the embodiment.

Fig. 6 is a view for describing the length of the screed from a rear surface of the asphalt finisher according to the embodiment.

Fig. 7 is a view showing a target moving route based on schedule information of the asphalt finisher according to the embodiment.

Fig. 8 is a flowchart showing control of the asphalt finisher performed by the controller according to the embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. In each of the drawings, the same or corresponding configurations will be assigned with the same reference symbols, and description thereof will be omitted.

[0011] Figs. 1A and 1B are schematic views of an asphalt finisher 100 according to the embodiment of the present invention. Specifically, Fig. 1A is a left side view of the asphalt finisher 100, and Fig. 1B is a top view of the asphalt finisher 100.

[0012] The asphalt finisher 100 is mainly configured by a tractor 1, a hopper 2, and a screed 3. In the example shown in Figs. 1A and 1B, the asphalt finisher 100 is

disposed such that a vehicle length direction thereof corresponds to an X-axis direction and a vehicle width direction thereof corresponds to a Y-axis direction. In addition, a Z-axis is disposed to be perpendicular to each of an X-axis and a Y-axis. Specifically, a front side in the vehicle length direction corresponds to a +X side, a rear side in the vehicle length direction corresponds to a -X side, a left side in the vehicle width direction corresponds to a +Y side, a right side in the vehicle width direction corresponds to a -Y side, an upper side in a vertical direction corresponds to a +Z side, and a lower side in the vertical direction corresponds to a -Z side.

[0013] The tractor 1 is a mechanism for causing the asphalt finisher 100 to travel. In the example shown in Figs. 1A and 1B, the tractor 1 moves the asphalt finisher 100 by rotating a rear wheel 5 using a rear wheel traveling motor 20 (see Fig. 4) and rotating a front wheel 6 using a front wheel traveling motor 22 (see Fig. 4). Both of the rear wheel traveling motor 20 and the front wheel traveling motor 22 are hydraulic motors that rotate by receiving supply of a hydraulic oil from a hydraulic pump. However, the tractor 1 may include a crawler instead of the wheels.

[0014] The asphalt finisher 100 according to the present embodiment changes a traveling direction by controlling a steering angle of the front wheel 6. In a case where the asphalt finisher 100 includes the crawler instead of the wheels, the traveling direction is changed by making rotation speeds different between a starting wheel in a crawler on the right side and a starting wheel in a crawler on the left side.

[0015] The hopper 2 is a mechanism for receiving a paving material. The paving material is, for example, an asphalt mixture or the like. In the example shown in Figs. 1A and 1B, the hopper 2 is provided on the front side (+X side) of the tractor 1 and is configured to be opened and closed in the Y-axis direction (vehicle width direction) by a hopper cylinder 24. The asphalt finisher 100 usually brings the hopper 2 into a fully open state so that a paving material is received from a loading platform of a dump truck. In addition, the asphalt finisher 100 continues to travel while pushing the dump truck forward via a push roller 2b even when receiving the paving material from the loading platform of the dump truck. Figs. 1A and 1B show the asphalt finisher 100 when the hopper 2 is in a fully open state. An operator of the asphalt finisher 100 closes the hopper 2 when the paving material in the hopper 2 decreases and collects the paving material near an inner wall of the hopper 2 at a central portion of the hopper 2. This is because a conveyor CV which is at the bottom of the central portion of the hopper 2 can transport the paving material to the rear side of the tractor 1. The paving material transported to the rear side (-X side) of the tractor 1 is spread in the vehicle width direction on the rear side of the tractor 1 and the front side of the screed 3 by a screw SC.

[0016] The conveyor CV is driven by a hydraulic motor that rotates by receiving supply of a hydraulic oil from a

hydraulic pump. In the example shown in Figs. 1A and 1B, the conveyor CV is configured to send a paving material in the hopper 2 to the rear side of the tractor 1 via a transport passage CP. The transport passage CP is a substantially rectangular parallelepiped space formed inside the tractor 1 and has a substantially rectangular inlet OP that opens into the hopper 2 in a front surface of the tractor 1. Specifically, the conveyor CV includes a left conveyor and a right conveyor.

[0017] The screw SC is driven by a hydraulic motor that rotates by receiving supply of a hydraulic oil from a hydraulic pump. Specifically, the screw SC includes a left screw SCL provided on the left side of the asphalt finisher 100 and a right screw SCR provided on the right side of the asphalt finisher 100. The left conveyor is configured to send a paving material toward the left screw SCL. The right conveyor is configured to send the paving material toward the right screw SCR. The left screw SCL and the right screw SCR are disposed within the width of the tractor 1.

[0018] The screed 3 is a mechanism for leveling a paving material. In the example shown in Figs. 1A and 1B, the screed 3 mainly includes a main screed 30 and a telescopic screed 31. The main screed 30 includes a left main screed and a right main screed. The telescopic screed 31 includes a left telescopic screed 31L and a right telescopic screed 31R. The main screed 30, the left telescopic screed 31L, and the right telescopic screed 31R are disposed to be shifted away from each other on the front and rear sides so as not to overlap each other in the vehicle length direction. Specifically, the left telescopic screed 31L is disposed on the rear side of the main screed 30, and the right telescopic screed 31R is disposed on the rear side of the left telescopic screed 31L. The screed 3 is a floating screed pulled by the tractor 1 and is connected to the tractor 1 via a leveling arm 3A. The screed 3 is moved up and down together with the leveling arm 3A in response to expansion and contraction of a screed lift cylinder 25. The leveling arm 3A includes a left leveling arm 3AL and a right leveling arm 3AR.

[0019] The telescopic screed 31 is configured to expand and contract in the vehicle width direction by a screed expanding and contracting cylinder 27. The screed expanding and contracting cylinder 27 is supported by a support portion fixed to a rear surface of a casing of the main screed 30 and is configured to expand and contract the telescopic screed 31 in the vehicle width direction (Y-axis direction). Specifically, the screed expanding and contracting cylinder 27 includes a left screed expanding and contracting cylinder 27L (an example of a left screed device) and a right screed expanding and contracting cylinder 27R (an example of a right screed device). The left screed expanding and contracting cylinder 27L can expand and contract the left telescopic screed 31L to the left side in the vehicle width direction with respect to the main screed 30. The right screed expanding and contracting cylinder 27R can expand and contract the right telescopic screed 31R to the right side

in the vehicle width direction with respect to the main screed 30.

[0020] The leveling arm 3A is configured to connect the screed 3 to the tractor 1. Specifically, one end of the leveling arm 3A is connected to the screed 3 and the other end thereof is pivotably connected to the tractor 1.

[0021] A leveling cylinder 23 is a hydraulic cylinder that moves a front end portion of the leveling arm 3A up and down in order to adjust a leveling thickness (pavement thickness) of a paving material. In the example shown in Figs. 1A and 1B, a cylinder portion of the leveling cylinder 23 is connected to the tractor 1, and a rod portion thereof is connected to the front end portion of the leveling arm 3A. The front end portion of the leveling arm 3A is slidably supported by the tractor 1. In a case of increasing the pavement thickness, a controller 50 causes a hydraulic oil discharged by the hydraulic pump to flow into a rod-side oil chamber of the leveling cylinder 23 and contracts the leveling cylinder 23 to raise the front end portion of the leveling arm 3A. On the other hand, in a case of reducing the leveling thickness, the controller 50 causes the hydraulic oil in the rod-side oil chamber of the leveling cylinder 23 to flow out and expands the leveling cylinder 23 to lower the front end portion of the leveling arm 3A.

[0022] The screed lift cylinder 25 is a hydraulic cylinder for lifting the screed 3. In the example shown in Figs. 1A and 1B, a cylinder portion of the screed lift cylinder 25 is connected to the tractor 1, and a rod portion thereof is connected to a rear end portion of the leveling arm 3A. In a case of lifting the screed 3, the controller 50 causes a hydraulic oil discharged by the hydraulic pump to flow into a rod-side oil chamber of the screed lift cylinder 25. As a result, the screed lift cylinder 25 contracts, the rear end portion of the leveling arm 3A is lifted, and the screed 3 is lifted. On the other hand, in a case of lowering the lifted screed 3, the controller 50 enables the hydraulic oil in the rod-side oil chamber of the screed lift cylinder 25 to flow out. As a result, the screed lift cylinder 25 is expanded by the weight of the screed 3, the rear end portion of the leveling arm 3A is lowered, and the screed 3 is lowered.

[0023] A side plate 40 is attached to a distal end of the telescopic screed 31. The side plate 40 includes a left side plate 40L and a right side plate 40R. Specifically, the left side plate 40L is attached to a distal end (left end) of the left telescopic screed 31L, and the right side plate 40R is attached to a distal end (right end) of the right telescopic screed 31R.

[0024] As shown in Fig. 1B, an end portion of the side plate 40 on a front side (X-axis positive direction side) in the traveling direction extends to an extension line of the screw SC in a longitudinal direction (rotation axis direction).

[0025] The side plate 40 is also attached to a distal end of a telescopic mold board 41. The telescopic mold board 41 is a member for adjusting the amount of paving material staying in front of the telescopic screed 31, out of a paving material spread by the screw SC, and is con-

figured to expand and contract in the vehicle width direction together with the telescopic screed 31.

[0026] Specifically, the telescopic mold board 41 is a plate-shaped member extending in the vehicle width direction and includes a left telescopic mold board 41L and a right telescopic mold board 41R. In addition, the left side plate 40L (an example of a plate portion) is attached to a distal end (left end) of the left telescopic mold board 41L, and the right side plate 40R (an example of the plate portion) is attached to a distal end (right end) of the right telescopic mold board 41R.

[0027] The telescopic mold board 41 is configured to adjust a height in a Z-axis direction regardless of the telescopic screed 31 and the side plate 40. By moving the telescopic mold board 41 up and down to adjust the size of a gap between a lower end of the telescopic mold board 41 and a roadbed, the asphalt finisher 100 can adjust the amount of paving material passing through the gap. For this reason, by moving the telescopic mold board 41 up and down, the asphalt finisher 100 can adjust the amount (height) of paving material staying on the rear side (-X side) of the telescopic mold board 41 and the front side (+X side) of the telescopic screed 31 and can adjust the amount of paving material taken into the lower side of the telescopic screed 31.

[0028] A screed step 42 is a member configuring a scaffold when a worker works behind the screed 3. Specifically, the screed step 42 includes a left screed step 42L, a central screed step 42C, and a right screed step 42R.

[0029] A retaining plate 43 is a plate-shaped member for preventing a paving material sent out in the vehicle width direction by the screw SC from being scattered in front of the screw SC in order to appropriately send out the paving material in the vehicle width direction by the screw SC. In the example shown in Figs. 1A and 1B, the retaining plate 43 includes a left retaining plate 43L and a right retaining plate 43R.

[0030] The controller 50 is a control device that controls the asphalt finisher 100. In the example shown in Figs. 1A and 1B, the controller 50 is a computer including a CPU, a volatile storage device, and a non-volatile storage device and is mounted on the tractor 1. Various types of functions of the controller 50 are realized, for example, as the CPU executes a program stored in the non-volatile storage device. In addition, the various types of functions realized by the controller 50 include, for example, a function of controlling a discharge amount of the hydraulic pump that supplies a hydraulic oil for driving a hydraulic actuator and a function of controlling a flow of the hydraulic oil between the hydraulic actuator and the hydraulic pump. The hydraulic actuator includes a hydraulic cylinder and a hydraulic motor.

[0031] A communication device 53 is configured to control communication between the asphalt finisher 100 and a device outside the asphalt finisher 100. The communication device 53 according to the present embodiment is provided in front of a driver's seat 1S and controls

communication via a mobile phone communication network, a short-range wireless communication network, a satellite communication network, or the like.

[0032] A GPS module 54 is an example of a global navigation satellite system (GNSS) module and receives position information indicating a two-dimensional positioning result through the global positioning system (GPS). The position information is information representing the position of the asphalt finisher 100 in latitude and longitude. Although the GPS is used as a position information acquisition method in the present embodiment, the position information acquisition method is not limited, and other known methods may be used.

[0033] A space recognition device 51 is attached to the tractor 1. The space recognition device 51 acquires information related to a space around the asphalt finisher 100 and is configured to output the acquired information to the controller 50. The space recognition device 51 according to the present embodiment includes a front monitoring device 51F, a rear monitoring device 51B, a right monitoring device 51R, and a left monitoring device 51L.

[0034] The front monitoring device 51F is configured to monitor the front of the asphalt finisher 100. In the present embodiment, the front monitoring device 51F is a LIDAR, of which a monitoring range RF is a space in front of the tractor 1, and is attached to a front end central portion of an upper surface of the tractor 1. The front monitoring device 51F may be attached to other parts of the asphalt finisher 100.

[0035] The rear monitoring device 51B is configured to monitor the rear of the asphalt finisher 100. In the present embodiment, the rear monitoring device 51B is a LIDAR, of which a monitoring range RB is a space behind the screed 3, and is attached to a guide rail 1G that functions as a handrail for the operator of the asphalt finisher 100. The rear monitoring device 51B may be attached to a lower portion of the driver's seat 1S or may be attached to other parts of the asphalt finisher 100.

[0036] The right monitoring device 51R is configured to monitor the right side of the asphalt finisher 100. The left monitoring device 51L is configured to monitor the left side of the asphalt finisher 100. The right monitoring device 51R and the left monitoring device 51L according to the present embodiment are set to include, as a monitoring range, an end portion of a road surface (a portion serving as a boundary between the road surface and a road shoulder) and the side plate 40 provided at the distal end of the telescopic screed 31. The right monitoring device 51R and the left monitoring device 51L are, for example, LIDARs, and are attached to the guide rail 1G that functions as the handrail for the operator of the asphalt finisher 100. The right monitoring device 51R and the left monitoring device 51L may be attached to any positions on the side of the asphalt finisher 100 under a condition of including the monitoring range described above.

[0037] The LIDAR measures, for example, a distance between a million or more points within the monitoring

range and the LIDAR. However, at least one of the front monitoring device 51F and the rear monitoring device 51B may be a monocular camera, a stereo camera, a millimeter wave radar, a laser radar, a laser scanner, a distance image camera, a laser range finder, or the like. The same applies to the side monitoring device. An example in which the LIDAR is used as an example of the space recognition device 51 has been described in the embodiment. However, the present embodiment does not limit the space recognition device 51 to the LIDAR. That is, a space recognition device that can recognize a space based on the asphalt finisher 100 may be used.

[0038] The monitoring range RF of the front monitoring device 51F includes a roadbed. The same applies to the monitoring range of the side monitoring device. In the present embodiment, the monitoring range RF has a width larger than the width of a roadbed BS.

[0039] The monitoring range RB of the rear monitoring device 51B includes a newly constructed pavement body. In the present embodiment, the monitoring range RB has a width larger than the width of the newly constructed pavement body.

[0040] Measurement information detected by the space recognition device 51 according to the present embodiment is transmitted to the controller 50. The controller 50 according to the present embodiment automatically steers the asphalt finisher 100 based on the received measurement information. In addition, the controller 50 may perform notification, such as warning, for a driver based on the received measurement information.

[0041] Next, the controller 50 mounted on the asphalt finisher 100 will be described with reference to Fig. 2. Fig. 2 is a block diagram showing a configuration example of the controller 50 and devices connected to the controller 50.

[0042] As shown in Fig. 2, the controller 50 is connected to a traveling speed sensor 47, an auxiliary storage device 48, the GPS module 54, the front monitoring device 51F, the rear monitoring device 51B, a drive system controller 52, the communication device 53, a screed control device 55, a screw control device 56, and a screed length detection device 57.

[0043] The traveling speed sensor 47 is configured to detect a traveling speed of the asphalt finisher 100. In the example shown in Fig. 2, the traveling speed sensor 47 is an encoder that detects an angular speed of a rotation axis of the rear wheel traveling motor 20 which drives the rear wheel 5. Specifically, the traveling speed sensor 47 includes a left traveling speed sensor and a right traveling speed sensor. The left traveling speed sensor is an encoder that detects an angular speed of a rotation axis of a left rear wheel traveling motor 20L which drives a left rear wheel. The right traveling speed sensor is an encoder that detects an angular speed of a rotation axis of a right rear wheel traveling motor 20R which drives a right rear wheel. The traveling speed sensor 47 may be configured by a proximity switch or the like that detects a slit formed in a rotating plate.

[0044] The auxiliary storage device 48 is configured to store various types of information. In the example shown in Fig. 2, the auxiliary storage device 48 is a non-volatile storage device mounted on the tractor 1 and stores various types of information. For example, the auxiliary storage device 48 includes a schedule information storage unit 48a, a vehicle width storage unit 48b, and a screw rotation speed storage unit 48c.

[0045] The schedule information storage unit 48a stores schedule information for constructing a road surface which is a pavement target of the asphalt finisher 100. The schedule information according to the present embodiment includes, for example, a center line of a route through which the asphalt finisher 100 moves and a target line indicating an end portion (a portion that is a boundary between the road surface and a road shoulder) of the road surface to be paved. The asphalt finisher 100 according to the present embodiment automatically controls pavement of a road based on the schedule information.

[0046] The vehicle width storage unit 48b stores information of a length from a structural (in other words, from a left side surface to a right side surface of the asphalt finisher 100 in the vehicle width direction) center position to a side surface of the asphalt finisher 100 in the vehicle width direction of the asphalt finisher 100.

[0047] Therefore, the controller 50 can calculate a distance from the center position of the asphalt finisher 100 in the vehicle width direction to the side plate 40 in accordance with the length of the telescopic screed 31 in the vehicle width direction.

[0048] The screw rotation speed storage unit 48c stores information of the rotation speed of the screw SC in accordance with the current situation of the asphalt finisher 100.

[0049] Fig. 3 is a view showing a table in which the current situation of the asphalt finisher 100 and the rotation speed of the screw SC corresponding to the situation are associated with each other in the screw rotation speed storage unit 48c according to the present embodiment. In the example shown in Fig. 3, as the current situation of the asphalt finisher 100, a speed and a steering angle of the asphalt finisher 100 and a length from the center position of the asphalt finisher 100 in the vehicle width direction to a distal end portion of the telescopic screed 31 are associated with the rotation speed of the screw SC. The table may be common to the left screw SCL and the right screw SCR. For example, in a case of the right screw SCR, when curving to the right, a positive value of the steering angle is referred to, and when curving to the left, a record of a negative value of the steering angle is referred to. In a case of the left screw SCL, when curving to the right, a negative value of the steering angle is referred to, and when curving to the left, a record of a positive value of the steering angle is referred to. In addition, the table may be held for each of the left screw SCL and the right screw SCR.

[0050] In the table according to the present embodi-

ment, at least the steering angle of the asphalt finisher 100 associated with the rotation speed of the screw SC may be included as the current situation of the asphalt finisher 100. Accordingly, the rotation speed of the screw SC can be changed in accordance with the steering angle of the asphalt finisher 100.

[0051] Referring back to Fig. 2, the GPS module 54 is an example of a global navigation satellite system (GNSS) module and receives position information indicating a two-dimensional positioning result through the global positioning system (GPS). The position information is information representing the position of the asphalt finisher 100 in latitude and longitude. Although the GPS is used as a position information acquisition method in the present embodiment, the position information acquisition method is not limited, and other known methods may be used.

[0052] The screed length detection device 57 (an example of a detection unit) detects a length by which each of the left telescopic screed 31L and the right telescopic screed 31R expands and contracts in the vehicle width direction. The screed length detection device 57 may use any sensor insofar as the length by which the telescopic screed 31 expands and contracts in the vehicle width direction can be detected. The screed length detection device 57 may be a laser sensor or the like for detecting the length or may be the GNSS module provided at the side plate 40. For example, from a distance between position information detected by the GNSS module and position information of the GNSS module provided at a main body of the asphalt finisher 100, the telescopic screed 31 may calculate a length that expands and contracts in the vehicle width direction. As another example, instead of the screed length detection device 57, the controller 50 may identify the length of the telescopic screed 31 in the vehicle width direction based on measurement information of each of the right monitoring device 51R and the left monitoring device 51L.

[0053] The communication device 53 performs wireless communication with devices in the surroundings of the asphalt finisher 100, a server that manages a work site, or the like. In the present embodiment, for example, any one or more of Wi-Fi (registered trademark), wireless LAN, Bluetooth (registered trademark), and the like may be used as wireless communication standards of the communication device 53.

[0054] The drive system controller 52 controls the tractor 1 in accordance with a control command. For example, the drive system controller 52 performs speed control and steering angle control of the tractor 1.

[0055] The screed control device 55 is configured to control an expansion and contraction amount of the telescopic screed 31. In the example shown in Fig. 2, the screed control device 55 controls the flow rate of a hydraulic oil flowing into the screed expanding and contracting cylinder 27. The screed control device 55 includes a screed expansion and contraction control valve 37 shown in Fig. 4 and switches between communication

and cutoff of a pipeline that connects the inside of a rod-side oil chamber of the screed expanding and contracting cylinder 27 and the hydraulic pump to each other in accordance with a control command from the controller 50.

[0056] Then, the screed control device 55 performs, in accordance with a control command from the controller 50, control of shrinking the left telescopic screed 31L by contracting the left screed expanding and contracting cylinder 27L and control of extending the left telescopic screed 31L by expanding the left screed expanding and contracting cylinder 27L.

[0057] In addition, the screed control device 55 performs, in accordance with a control command from the controller 50, control of shrinking the right telescopic screed 31R by contracting the right screed expanding and contracting cylinder 27R and control of extending the right telescopic screed 31R by expanding the right screed expanding and contracting cylinder 27R.

[0058] In this manner, the screed control device 55 controls each of the lengths of the right telescopic screed 31R and the left telescopic screed 31L in accordance with the control command from the controller 50.

[0059] The screw control device 56 is configured to control the rotation speed of the screw SC. In the example shown in Fig. 2, the screw control device 56 is an electromagnetic valve that controls the flow rate of a hydraulic oil flowing into the hydraulic motor driving the screw SC. Specifically, the screw control device 56 increases and decreases a flow path area of a pipeline that connects the hydraulic motor driving the screw SC and the hydraulic pump to each other in accordance with the control command from the controller 50. More specifically, the screw control device 56 increases the flow rate of the hydraulic oil flowing into the hydraulic motor driving the screw SC and increases the rotation speed of the screw SC by increasing the flow path area. Alternatively, the screw control device 56 decreases the flow rate of the hydraulic oil flowing into the hydraulic motor driving the screw SC and decreases the rotation speed of the screw SC by reducing the flow path area. The screw control device 56 according to the present embodiment can change the rotation speed of each of the left screw SCL and the right screw SCR.

[0060] The controller 50 acquires information from the GPS module 54, the front monitoring device 51F, the rear monitoring device 51B, the right monitoring device 51R, the left monitoring device 51L, the traveling speed sensor 47, the screed length detection device 57, and the auxiliary storage device 48, after executing various types of calculation, and outputs a control command to the screed control device 55, the screw control device 56, and the drive system controller 52 in accordance with the calculation results. Functional blocks included in the controller 50 according to the present embodiment will be described later.

<Description of Hydraulic System>

[0061] Next, a hydraulic system mounted on the asphalt finisher 100 will be described with reference to Fig. 4. Fig. 4 is a hydraulic circuit diagram showing a configuration example of the hydraulic system mounted on the asphalt finisher 100.

[0062] The hydraulic system mainly includes a hydraulic source 14, a rear wheel drive unit F1, a conveyor and screw drive unit F2, a front wheel drive unit F3, a steering and compacting device drive unit F4, a leveling unit F5, a hopper drive unit F6, a screed lift unit F7, and a screed expansion and contraction unit F8.

[0063] The hydraulic source 14 is configured to supply a hydraulic oil for operating various types of drive units. In the present embodiment, the hydraulic source 14 mainly includes an engine 14E, a rear wheel traveling pump 14R, a charge pump 14C, a cylinder pump 14M, a conveyor and screw pump 14S, and a front wheel traveling pump 14F.

[0064] The engine 14E is a drive source that drives the rear wheel traveling pump 14R, the charge pump 14C, the cylinder pump 14M, the conveyor and screw pump 14S, and the front wheel traveling pump 14F.

[0065] The rear wheel traveling pump 14R is a variable capacity type hydraulic pump that supplies a driving hydraulic oil to the rear wheel drive unit F1. In the present embodiment, the rear wheel traveling pump 14R is a swash plate variable capacity type bidirectional hydraulic pump used in a closed circuit.

[0066] The charge pump 14C is a fixed capacity type hydraulic pump that supplies a controlling hydraulic oil to the rear wheel drive unit F1.

[0067] The cylinder pump 14M is a variable capacity type hydraulic pump that can supply a hydraulic oil to each of the steering and compacting device drive unit F4, the leveling unit F5, the hopper drive unit F6, the screed lift unit F7, and the screed expansion and contraction unit F8. In the present embodiment, the cylinder pump 14M is a swash plate variable capacity type hydraulic pump, and a discharge amount thereof is controlled such that a discharge pressure becomes constant at a predetermined pressure.

[0068] The conveyor and screw pump 14S is a variable capacity type hydraulic pump that supplies a hydraulic oil to the conveyor and screw drive unit F2. In the present embodiment, the conveyor and screw pump 14S is a swash plate variable capacity type hydraulic pump.

[0069] The front wheel traveling pump 14F is a variable capacity type hydraulic pump that supplies a hydraulic oil to the front wheel drive unit F3. In the present embodiment, the front wheel traveling pump 14F is a swash plate variable capacity type hydraulic pump.

[0070] The rear wheel drive unit F1 is configured to drive the rear wheel 5. In the present embodiment, the rear wheel drive unit F1 includes the left rear wheel traveling motor 20L, the right rear wheel traveling motor 20R, check valves 20La and 20Ra, relief valves 20Lb

and 20Rb, and a speed reducer switching valve V0.

[0071] The left rear wheel traveling motor 20L is a hydraulic motor that drives a rear wheel on the left side. In addition, the right rear wheel traveling motor 20R is a hydraulic motor that drives a rear wheel on the right side. In the present embodiment, the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R are stepless speed change type hydraulic motors and configure a closed circuit (HST circuit) together with the rear wheel traveling pump 14R.

[0072] The check valve 20La maintains the pressure of a hydraulic oil in a pipeline C1 that connects a first port of the rear wheel traveling pump 14R and a second port of each of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R to each other at a predetermined pressure or higher. Specifically, in a case where the pressure of the hydraulic oil in the pipeline C1 falls below the discharge pressure of the charge pump 14C, the check valve 20La causes the hydraulic oil discharged by the charge pump 14C to flow into the pipeline C1. Numbers in parentheses in the drawings represent port numbers. Similarly, the check valve 20Ra maintains the pressure of a hydraulic oil in a pipeline C2 that connects a second port of the rear wheel traveling pump 14R and a first port of each of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R to each other at a predetermined pressure or higher. Specifically, in a case where the pressure of the hydraulic oil in the pipeline C2 falls below the discharge pressure of the charge pump 14C, the check valve 20Ra causes the hydraulic oil discharged by the charge pump 14C to flow into the pipeline C2.

[0073] The relief valve 20Lb maintains the pressure of a hydraulic oil in the pipeline C1 at a predetermined relief pressure or lower. Specifically, the relief valve 20Lb causes the hydraulic oil in the pipeline C1 to flow out of the closed circuit in a case where the pressure of the hydraulic oil in the pipeline C1 exceeds the relief pressure. Similarly, the relief valve 20Rb maintains the pressure of a hydraulic oil in the pipeline C2 at a predetermined relief pressure or lower. Specifically, the relief valve 20Rb causes the hydraulic oil in the pipeline C2 to flow out of the closed circuit in a case where the pressure of the hydraulic oil in the pipeline C2 exceeds the relief pressure.

[0074] The speed reducer switching valve V0 is a mechanism that switches between respective reduction ratios of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R. In the present embodiment, the speed reducer switching valve V0 switches between the respective reduction ratios of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R using a hydraulic oil discharged by the charge pump 14C, in accordance with a control command from the controller 50.

[0075] The conveyor and screw drive unit F2 is configured to drive the conveyor CV and the screw SC. In the present embodiment, the conveyor and screw drive unit

F2 mainly includes a conveyor motor 21C, a screw motor 21S, a conveyor control valve V1C, and a screw control valve V1S.

[0076] Both of the conveyor motor 21C and the screw motor 21S are variable capacity type hydraulic motors that form an open circuit. The conveyor motor 21C includes a left conveyor motor 21CL and a right conveyor motor 21CR. The screw motor 21S includes a left screw motor 21SL and a right screw motor 21SR. The conveyor control valve V1C includes a left conveyor control valve V1CL and a right conveyor control valve V1CR. The screw control valve V1S includes a left screw control valve V1SL and a right screw control valve V1SR.

[0077] The left conveyor control valve V1CL operates in accordance with a control command from the controller 50, causes a hydraulic oil discharged by the conveyor and screw pump 14S to flow into a suction port of the left conveyor motor 21CL, and causes a hydraulic oil flowing out from a discharge port of the left conveyor motor 21CL to be discharged to a hydraulic oil tank T. The right conveyor control valve V1CR operates in accordance with a control command from the controller 50, causes a hydraulic oil discharged by the conveyor and screw pump 14S to flow into a suction port of the right conveyor motor 21CR, and causes a hydraulic oil flowing out from a discharge port of the right conveyor motor 21CR to be discharged to the hydraulic oil tank T. Similarly, the left screw control valve V1SL operates in accordance with a control command from the controller 50, causes a hydraulic oil discharged by the conveyor and screw pump 14S to flow into a suction port of the left screw motor 21SL, and causes a hydraulic oil flowing out from a discharge port of the left screw motor 21SL to be discharged to the hydraulic oil tank T. The right screw control valve V1SR operates in accordance with a control command from the controller 50, causes a hydraulic oil discharged by the conveyor and screw pump 14S to flow into a suction port of the right screw motor 21SR, and causes a hydraulic oil flowing out from a discharge port of the right screw motor 21SR to be discharged to the hydraulic oil tank T. The hydraulic oil flowing out from the discharge port of each of the left conveyor motor 21CL, the right conveyor motor 21CR, the left screw motor 21SL, and the right screw motor 21SR is discharged to the hydraulic oil tank T through an oil cooler OC.

[0078] The front wheel drive unit F3 is configured to drive the front wheel 6. In the present embodiment, the front wheel drive unit F3 mainly includes the front wheel traveling motor 22 and a front wheel traveling valve V2.

[0079] The front wheel traveling motor 22 is a fixed capacity type hydraulic motor that forms an open circuit. The front wheel traveling valve V2 operates in accordance with a control command from the controller 50 and causes a hydraulic oil discharged by the front wheel traveling pump 14F to flow into a suction port of the front wheel traveling motor 22. In the example shown in Fig. 4, the front wheel traveling motor 22 includes a left front wheel traveling motor 22L and a right front wheel traveling

motor 22R. The front wheel traveling pump 14F supplies a hydraulic oil to each of the left front wheel traveling motor 22L and the right front wheel traveling motor 22R in parallel.

[0080] The steering and compacting device drive unit F4 is configured to drive a steering device and a compacting device (neither of which is shown). The steering device is a hydraulic device for steering the front wheel 6. In the present embodiment, the steering device changes, for example, the steering angle of the front wheel 6 using a hydraulic oil discharged by the cylinder pump 14M in response to an operation of a steering wheel by the operator. In addition, the compacting device is a hydraulic device for compacting a paving material. In the present embodiment, the compacting device includes a tamper and a vibrator and operates the tamper and the vibrator using the hydraulic oil discharged by the cylinder pump 14M.

[0081] The leveling unit F5 is configured to adjust a pavement thickness. In the present embodiment, the leveling unit F5 mainly includes the leveling cylinder 23, a leveling control valve 33, and a pilot check valve 33P.

[0082] The leveling cylinder 23 is a hydraulic cylinder that moves the leveling arm 3A up and down in order to adjust a pavement thickness. The leveling cylinder 23 is configured to contract when increasing the pavement thickness and to expand when reducing the pavement thickness. In the example shown in Fig. 4, the leveling cylinder 23 includes a left leveling cylinder 23L and a right leveling cylinder 23R.

[0083] The leveling control valve 33 is configured to operate in accordance with a control signal from the controller 50. In the example shown in Fig. 4, the leveling control valve 33 includes a left leveling control valve 33L and a right leveling control valve 33R. In a case of increasing a pavement thickness, the left leveling control valve 33L causes a hydraulic oil discharged by the cylinder pump 14M to flow into a rod-side oil chamber of the left leveling cylinder 23L and causes a hydraulic oil flowing out from a head-side oil chamber of the left leveling cylinder 23L to be discharged to the hydraulic oil tank T. In this case, the left leveling cylinder 23L contracts, and the left leveling arm 3AL rises. The same applies to the right leveling control valve 33R that contracts the right leveling cylinder 23R. On the other hand, in a case of reducing the pavement thickness, the left leveling control valve 33L causes a hydraulic oil discharged by the cylinder pump 14M to flow into the head-side oil chamber of the left leveling cylinder 23L and causes the hydraulic oil flowing out from the rod-side oil chamber of the left leveling cylinder 23L to be discharged to the hydraulic oil tank T. In this case, the left leveling cylinder 23L expands, and the left leveling arm 3AL lowers. The same applies to the right leveling control valve 33R that expands the right leveling cylinder 23R.

[0084] The pilot check valve 33P is configured to prevent the leveling cylinder 23 from moving due to an external force. In the example shown in Fig. 4, the pilot

check valve 33P includes pilot check valves 33PaL, 33PbL, 33PaR, and 33PbR. For example, only in a case where the left leveling control valve 33L operates in response to an operation by the operator and a hydraulic oil discharged by the cylinder pump 14M flows into the head-side oil chamber of the left leveling cylinder 23L, the pilot check valve 33PaL allows the hydraulic oil of the rod-side oil chamber of the left leveling cylinder 23L to flow toward the hydraulic oil tank T. In addition, in other cases, the pilot check valve 33PaL prohibits the hydraulic oil of the rod-side oil chamber of the left leveling cylinder 23L from flowing toward the hydraulic oil tank T. The same applies to the pilot check valves 33PbL, 33PaR, and 33PbR.

[0085] The hopper drive unit F6 is configured to open and close the hopper 2. In the present embodiment, the hopper drive unit F6 mainly includes the hopper cylinder 24, a hopper control valve 34, and a pilot check valve 34P.

[0086] The hopper cylinder 24 is a hydraulic actuator that opens and closes the hopper 2, contracts when opening the hopper 2, and expands when closing the hopper 2. In the example shown in Fig. 4, the hopper cylinder 24 includes a left hopper cylinder 24L and a right hopper cylinder 24R.

[0087] The hopper control valve 34 is configured to operate in accordance with a control signal from the controller 50. In the example shown in Fig. 4, the hopper control valve 34 includes a left hopper control valve 34L and a right hopper control valve 34R. In a case of opening the hopper 2, the left hopper control valve 34L causes a hydraulic oil discharged by the cylinder pump 14M to flow into a rod-side oil chamber of the left hopper cylinder 24L and causes a hydraulic oil flowing out from a head-side oil chamber of the left hopper cylinder 24L to be discharged to the hydraulic oil tank T. In this case, the left hopper cylinder 24L contracts. In addition, the right hopper control valve 34R causes a hydraulic oil discharged by the cylinder pump 14M to flow into a rod-side oil chamber of the right hopper cylinder 24R and causes a hydraulic oil flowing out from a head-side oil chamber of the right hopper cylinder 24R to be discharged to the hydraulic oil tank T. In this case, the right hopper cylinder 24R contracts. On the other hand, in a case of closing the hopper 2, the left hopper control valve 34L causes a hydraulic oil discharged by the cylinder pump 14M to flow into the head-side oil chamber of the left hopper cylinder 24L and causes a hydraulic oil flowing out from the rod-side oil chamber of the left hopper cylinder 24L to be discharged to the hydraulic oil tank T. In this case, the left hopper cylinder 24L expands. In addition, the right hopper control valve 34R causes a hydraulic oil discharged by the cylinder pump 14M to flow into the head-side oil chamber of the right hopper cylinder 24R and causes a hydraulic oil flowing out from the rod-side oil chamber of the right hopper cylinder 24R to be discharged to the hydraulic oil tank T. In this case, the right hopper cylinder 24R expands.

[0088] The pilot check valve 34P is configured to pre-

vent the hopper cylinder 24 from contracting and the hopper 2 from opening due to the weight of the hopper 2 or the weight of the hopper 2 and a paving material in the hopper 2. In the example shown in Fig. 4, the pilot check valve 34P includes a pilot check valve 34PL and a pilot check valve 34PR. For example, only in a case where the left hopper control valve 34L operates in response to an operation by the operator and a hydraulic oil discharged by the cylinder pump 14M flows into the rod-side oil chamber of the left hopper cylinder 24L, the pilot check valve 34PL allows the hydraulic oil of the head-side oil chamber of the left hopper cylinder 24L to flow toward the hydraulic oil tank T. In addition, in other cases, the pilot check valve 34PL prohibits the hydraulic oil of the head-side oil chamber of the left hopper cylinder 24L from flowing toward the hydraulic oil tank T. The same applies to the pilot check valve 34PR.

[0089] In the hopper drive unit F6, a pilot check valve is not provided between a rod-side oil chamber of the hopper cylinder 24 and the hopper control valve 34. This is because a probability in which the hopper cylinder 24 unintentionally expands due to an external force is low since the weight of the hopper 2 is great. However, the pilot check valve may be provided between the rod-side oil chamber of the hopper cylinder 24 and the hopper control valve 34.

[0090] The screed lift unit F7 is configured to lift the screed 3. In the present embodiment, the screed lift unit F7 mainly includes the screed lift cylinder 25, a screed lift control valve 35, a switching valve 35a, a relief valve 35b, and a switching valve 35c.

[0091] The screed lift cylinder 25 is a hydraulic actuator that lifts the screed 3, contracts when lifting the screed 3, and expands when lowering the screed 3. In the example shown in Fig. 4, the screed lift cylinder 25 includes a left screed lift cylinder 25L and a right screed lift cylinder 25R.

[0092] The screed lift control valve 35 is configured to operate in accordance with a control signal from the controller 50. In a case of lifting the screed 3, the screed lift control valve 35 causes a hydraulic oil discharged by the cylinder pump 14M to flow into the rod-side oil chamber of the screed lift cylinder 25. In this case, the switching valve 35a switches to a first position including a check valve in accordance with a control signal from the controller 50. This is because a hydraulic oil is prevented from flowing backward from the rod-side oil chamber of the screed lift cylinder 25 toward the hydraulic oil tank T. The hydraulic oil flowing out from a head-side oil chamber of the screed lift cylinder 25 is discharged to the hydraulic oil tank T without passing through the screed lift control valve 35. In this case, the screed lift cylinder 25 contracts. On the other hand, in a case of lowering the screed 3 to the ground, the screed lift control valve 35 is not used (maintained in the state shown in Fig. 4). In this case, the switching valve 35a switches to a second position where the check valve is not included in accordance with a control signal from the controller 50. This is because a

hydraulic oil of the rod-side oil chamber of the screed lift cylinder 25 flows out toward the hydraulic oil tank T. For this reason, the screed lift cylinder 25 expands due to the weight of the screed 3, and the hydraulic oil of the rod-side oil chamber of the screed lift cylinder 25 is discharged to the hydraulic oil tank T through the switching valve 35a and the relief valve 35b.

[0093] The switching valve 35a and the relief valve 35b realize an up-and-down movement of the screed 3 accompanying a change in a lifting force (a force with which a paving material lifts the screed 3) generated when paving a road while moving the asphalt finisher 100. Specifically, when the screed 3 rises due to an increase in the lifting force, the screed lift cylinder 25 contracts. In this case, a hydraulic oil discharged by the cylinder pump 14M flows into the rod-side oil chamber of the screed lift cylinder 25 through a pipeline C3, the screed lift control valve 35, and the switching valve 35a. On the other hand, when the screed 3 is lowered due to a decrease in the lifting force, the screed lift cylinder 25 expands. In this case, a hydraulic oil flowing out from the rod-side oil chamber of the screed lift cylinder 25 is discharged to the hydraulic oil tank T through the switching valve 35a, the screed lift control valve 35, and the relief valve 35b. When paving a road while moving the asphalt finisher 100, that is, while the hydraulic device, such as the screed expansion and contraction unit F8 on a downstream side, is not used, the switching valve 35c switches to the first position including the check valve in accordance with a control signal from the controller 50. This is because the hydraulic device such as the screed expansion and contraction unit F8 on the downstream side is not to be adversely affected. Specifically, this is because the telescopic screed 31, a crown device, a step device, or the like is prevented from unintentionally moving.

[0094] The screed expansion and contraction unit F8 is configured to expand and contract the telescopic screed 31 in the vehicle width direction. In the present embodiment, the screed expansion and contraction unit F8 mainly includes the screed expanding and contracting cylinder 27, the screed expansion and contraction control valve 37, a pilot check valve 37P, and a relief valve 37V. In the example shown in Fig. 4, the screed expansion and contraction control valve 37 includes a left screed expansion and contraction control valve 37L and a right screed expansion and contraction control valve 37R. The pilot check valve 37P includes pilot check valves 37PaL, 37PaR, 37PbL, and 37PbR. The relief valve 37V includes a left relief valve 37VL and a right relief valve 37VR.

[0095] The left screed expansion and contraction control valve 37L is configured to operate in accordance with a control signal from the controller 50. In a case of retracting the left telescopic screed 31L, the left screed expansion and contraction control valve 37L causes a hydraulic oil discharged by the cylinder pump 14M to flow into a rod-side oil chamber of the left screed expanding and contracting cylinder 27L and causes the hydraulic oil flowing out from a head-side oil chamber of the left

screed expanding and contracting cylinder 27L to be discharged to the hydraulic oil tank T. In this case, the left screed expanding and contracting cylinder 27L contracts, and the left telescopic screed 31L is retracted. The same applies to a case where the right telescopic screed 31R is retracted. On the other hand, in a case of pushing out the left telescopic screed 31L, the left screed expansion and contraction control valve 37L causes a hydraulic oil discharged by the cylinder pump 14M to flow into the head-side oil chamber of the left screed expanding and contracting cylinder 27L and causes the hydraulic oil flowing out from the rod-side oil chamber of the left screed expanding and contracting cylinder 27L to be discharged to the hydraulic oil tank T. In this case, the left screed expanding and contracting cylinder 27L expands, and the left telescopic screed 31L is pushed out.

[0096] The pilot check valve 37P is configured to prevent the screed expanding and contracting cylinder 27 from unintentionally moving due to an external force. For example, only in a case where the left screed expansion and contraction control valve 37L operates in response to an operation by the operator and a hydraulic oil discharged by the cylinder pump 14M flows into the head-side oil chamber of the left screed expanding and contracting cylinder 27L, the pilot check valve 37PaL allows the hydraulic oil of the rod-side oil chamber of the left screed expanding and contracting cylinder 27L to flow toward the hydraulic oil tank T. In addition, in other cases, the pilot check valve 37PaL prohibits the hydraulic oil of the rod-side oil chamber of the left screed expanding and contracting cylinder 27L from flowing toward the hydraulic oil tank T. The same applies to the pilot check valves 37PbL, 37PaR, and 37PbR.

[0097] The relief valve 37V is configured to prevent a member related to the telescopic screed 31 from being destroyed by an excessive external force acting on a direction in which the telescopic screed 31 is retracted. For example, in a case where the pressure of a hydraulic oil in the head-side oil chamber of the left screed expanding and contracting cylinder 27L has been excessively risen by receiving an excessive external force acting on a direction in which the left screed expanding and contracting cylinder 27L is contracted, the left relief valve 37VL allows the hydraulic oil in the head-side oil chamber to flow out to the hydraulic oil tank T. As a result, as the left screed expanding and contracting cylinder 27L contracts and some of the external force is absorbed, the left telescopic screed 31L is prevented from being damaged. The same applies to the right relief valve 37VR.

<Functional Block of Controller>

[0098] Referring back to Fig. 2, each functional block in the controller 50 of the asphalt finisher 100 will be described. Each functional block in the controller 50 is conceptual and does not necessarily have to be physically configured as shown. All or some of the respective functional blocks can be configured by being functionally or

physically distributed and integrated in any unit. All or any part of the respective processing functions performed in the respective functional blocks are realized by a program executed by the CPU. Alternatively, each functional block may be realized as hardware by wired logic. A program executed by such a controller 50 according to the present embodiment is not limited to a method of storing in a non-volatile auxiliary storage device, may be stored in a distributable storage unit medium, and may be transmitted and received via a communication line.

[0099] In accordance with detection results from the GPS module 54, the front monitoring device 51F, the rear monitoring device 51B, and the traveling speed sensor 47, the controller 50 according to the present embodiment performs self-localization and performs automatic movement control in order to pave, with asphalt, a road surface indicated by schedule information stored in the auxiliary storage device 48.

[0100] In that case, the controller 50 transmits, to the screed control device 55, a control command for extending or shrinking the telescopic screed 31 based on measurement information from the right monitoring device 51R, the left monitoring device 51L, and the screed length detection device 57 such that a paving material does not project from the road surface, which is a pavement target.

[0101] The asphalt finisher 100 according to the present embodiment levels a paving material on a road surface, which is a pavement target. The amount of paving material sprinkled on the road surface by the asphalt finisher 100 changes depending on the situation of the road surface. The adjustment of the amount of paving material sprinkled on the road surface is realized by changing the rotation speed of the screw SC.

[0102] In the related art, it is necessary for the asphalt finisher to sprinkle a paving material by an amount suitable for the area of a road. However, the road, which is a pavement target, is curved in many cases. The situation of a road surface differs between a curved road and a straight road. For example, in a case of the curved road, the area of the road surface differs between the right side and the left side of the asphalt finisher. In such a case, in the asphalt finisher of the related art, adjustment of the amount of paving material sprinkled on the road surface depending on a change in the situation of the road surface is not considered.

[0103] On the contrary, the asphalt finisher 100 according to the present embodiment adjusts the amount of sprinkled paving material depending on a change in the situation of the road surface by adjusting the rotation speed of the screw SC. Hereinafter, a configuration for realizing the control will be described.

[0104] More specifically, the controller 50 has an acquisition unit 50a, a moving route calculation unit 50b, a movement control unit 50c, a screed control unit 50d, and a screw rotation control unit 50e as functional blocks configured by software, hardware, or a combination thereof.

[0105] The acquisition unit 50a acquires various types of information. For example, the acquisition unit 50a acquires measurement information from various types of sensors. For example, the acquisition unit 50a acquires measurement information detected by the front monitoring device 51F, the rear monitoring device 51B, the right monitoring device 51R, and the left monitoring device 51L. In addition, the acquisition unit 50a acquires measurement information (for example, including the speed of the asphalt finisher 100) detected by the traveling speed sensor 47. In addition, the acquisition unit 50a acquires measurement information (a length by which each of the left telescopic screed 31L and the right telescopic screed 31R expands and contracts in the vehicle width direction) from the screed length detection device 57. Further, the acquisition unit 50a acquires position information from the GPS module 54. Further, the acquisition unit 50a acquires information from the auxiliary storage device 48 as necessary. In addition, the acquisition unit 50a may acquire steering angle information from the tractor 1.

[0106] The moving route calculation unit 50b calculates a target moving route of the asphalt finisher 100 based on schedule information read from the schedule information storage unit 48a. The target moving route is information indicating a route through which a structural (in other words, from the left side surface to the right side surface of the asphalt finisher 100 in the vehicle width direction) center position of the asphalt finisher 100 in the vehicle width direction moves, for example, in order for the asphalt finisher 100 to construct a road surface. The target moving route is not limited to a calculation method in the controller 50 and may be received from an external device via the communication device 53. Further, the target moving route is not limited to the route described above, may be a route where the asphalt finisher 100 can move, and, for example, may be a trajectory of a left front wheel of the tractor 1.

[0107] The movement control unit 50c outputs a control command based on measurement information and position information acquired by the acquisition unit 50a to the drive system controller 52 to move along the calculated target moving route. Accordingly, automatic movement control of the asphalt finisher 100 is performed.

[0108] The screed control unit 50d outputs a control command for expanding and contracting the telescopic screed 31 to the screed control device 55 based on measurement information from the right monitoring device 51R, the left monitoring device 51L, and the screed length detection device 57 (an example of a detection result) to correspond to the width of a road surface on which a paving material is sprinkled. Accordingly, since the length of the screed 3 in the vehicle width direction can be made to match the width of a road, which is a construction target, the paving material can be appropriately leveled on the road surface, which is a pavement target.

[0109] Fig. 5 is a view showing configurations of the screw SC and the screed 3 in the asphalt finisher 100

according to the present embodiment. Fig. 5 is an example in which the asphalt finisher 100 travels in a traveling direction 4001. In addition, the screw SC provided in the asphalt finisher 100 rotates in a direction 4002 in accordance with a control signal from the controller 50. Accordingly, a paving material is pushed out in a direction 4003.

[0110] In the example shown in Fig. 5, an end portion (a portion that is a boundary between a road surface and a road shoulder) of the road surface to be paved is set as a target line OL (left target line OLL) of the side plate 40 of the asphalt finisher 100.

[0111] In a case where there is a change in the road surface or a change in the steering angle of the asphalt finisher 100 when the asphalt finisher 100 travels in the traveling direction 4001, the target line OL which is the boundary between the road surface and the road shoulder shifts in a rightward direction or a leftward direction with the center position of the asphalt finisher 100 in the vehicle width direction as reference.

[0112] The acquisition unit 50a of the controller 50 according to the present embodiment detects a shift (change) of the target line OL (for example, the left target line OLL) based on measurement information from the right monitoring device 51R and the left monitoring device 51L. Then, the screed control unit 50d transmits a control command for extending or shrinking the telescopic screed 31 based on the detection result to the screed control device 55 such that the side plate 40 follows the target line (for example, the left target line OLL).

[0113] Accordingly, the side plate 40 can move in a rightward direction 4011 or a leftward direction 4012 to follow the target line OL.

[0114] Referring back to Fig. 2, the screw rotation control unit 50e outputs a control command for rotating the screw SC to the screw control device 56 to correspond to the current situation of the asphalt finisher 100. Specifically, the screw rotation control unit 50e identifies the rotation speed of the screw SC with reference to the screw rotation speed storage unit 48c with measurement information acquired by the acquisition unit 50a and a control command value of a steering angle as a search key. Then, the screw rotation control unit 50e outputs the control command for rotating the screw SC at the rotation speed to the screw control device 56. Accordingly, an appropriate amount of paving material can be sprinkled on a road surface where the asphalt finisher 100 travels.

[0115] The rotation speed of the screw SC according to the present embodiment is determined, for example, depending on a change in a road surface where the asphalt finisher 100 travels.

[0116] As described above, in a case where expansion and contraction of the left telescopic screed 31L and expansion and contraction of the right telescopic screed 31R are performed by the screed control unit 50d, the asphalt finisher 100 changes an area where a paving material is leveled. In this case, the screw rotation control unit 50e changes the rotation speed of the screw SC such that the amount of paving material corresponding to the

changed area is sprinkled on a road surface.

[0117] Fig. 6 is a view for describing the length of the screed 3 from a rear surface of the asphalt finisher 100 according to the present embodiment. In the present embodiment, the vehicle width storage unit 48b stores a length 5001 from the center position of the asphalt finisher 100 in the vehicle width direction to the left side surface and a length 5002 from the center position in the vehicle width direction to the right side surface.

[0118] In addition, the screed length detection device 57 detects a length 5011 from the left side surface to a distal end portion of the left telescopic screed 31L and a length 5012 from the right side surface to a distal end portion of the right telescopic screed 31R.

[0119] Accordingly, the acquisition unit 50a of the controller 50 can acquire a left pavement target length 5051 from the center position (an example of a center) in the vehicle width direction to the distal end portion of the left telescopic screed 31L and a right pavement target length 5052 from the center position (the example of the center) in the vehicle width direction to the distal end portion of the right telescopic screed 31R based on a detection result from the screed length detection device 57 (an example of the detection unit) and the lengths 5001 and 5002 stored in the vehicle width storage unit 48b.

[0120] After then, the acquisition unit 50a calculates a ratio between the left pavement target length 5051 and the right pavement target length 5052.

[0121] In addition, the screw rotation control unit 50e according to the present embodiment changes each of right and left rotation speeds of the screw SC in accordance with a ratio between right and left lengths of a pavement target. For example, in a case where the ratio between the lengths is 1:1.5, the number of rotations is changed such that the amount of sprinkled paving material becomes 1:1.5. In the present embodiment, the change in the rotation speed is identified with reference to the screw rotation speed storage unit 48c.

<Description of Moving Route of Asphalt Finisher>

[0122] Further, the amount of paving material sprinkled on a road surface changes also in a case where the traveling direction of the asphalt finisher 100 has changed. Thus, the amount of paving material sprinkled on the road surface will be described based on the moving route of the asphalt finisher 100.

[0123] Fig. 7 is a view showing a target moving route based on schedule information of the asphalt finisher 100 according to the present embodiment. Fig. 7 shows an example in which the asphalt finisher 100 moves on a road 6001 in a traveling direction 6011.

[0124] In order to move along a road, which is a pavement target, the movement control unit 50c of the asphalt finisher 100 performs movement control of the tractor 1 such that the center position of the asphalt finisher 100 in the vehicle width direction matches a route CL of the road, which is the pavement target.

[0125] Further, the screed control unit 50d outputs, to the screed control device 55, a control command for expanding and contracting the left telescopic screed 31L such that the left side plate 40L matches the target line OLL on the left side. Similarly, the screed control unit 50d outputs, to the screed control device 55, a control command for expanding and contracting the right telescopic screed 31R such that the right side plate 40R matches a target line OLR on the right side. Accordingly, even in a case where the center position of the asphalt finisher 100 in the vehicle width direction is slightly shifted from the center of a road, which is a pavement target, the paving material can be appropriately leveled on a road surface, which is a pavement target.

[0126] In the example shown in Fig. 7, in a case where the center position of the asphalt finisher 100 in the vehicle width direction is at the center of the road when the asphalt finisher 100 moves in accordance with the route CL, the center position is at a left pavement target length L1 from the center position in the vehicle width direction to an end portion of the road in the leftward direction and at a right pavement target length L1 from the center position in the vehicle width direction to an end portion of the road in the rightward direction. In addition, based on the left pavement target length L1 and the right pavement target length L1, a ratio between the pavement target on the left side and the right side becomes L1:L1.

[0127] Then, the screw rotation control unit 50e calculates the rotation speeds of the left screw motor 21SL and the right screw motor 21SR based on the movement speed of the asphalt finisher 100 and a ratio between the lengths of the pavement target on the left side and the right side and outputs a control command in accordance with the rotation speeds.

[0128] In the asphalt finisher 100, the movement control unit 50c performs automatic control such that the asphalt finisher 100 moves along the road 6001. For this reason, the movement control unit 50c performs steering angle control of the tractor 1 in accordance with a change in the road 6001 in the rightward and leftward directions.

[0129] Fig. 7 shows an example in which the movement control unit 50c has performed control of a steering angle to curve in the leftward direction in accordance with the road 6001. In the example shown in Fig. 7, an example in which the asphalt finisher 100 turns in the leftward direction with a turning center 6021 as reference is adopted.

[0130] As shown in Fig. 7, in a case where the road 6001 is curved, the center position of the asphalt finisher 100 in the vehicle width direction is shifted from the center of the road 6001 at a timing when the movement control unit 50c changes the steering angle of the tractor 1. In the example shown in Fig. 7, due to the shift, the center position is at a left pavement target length L3 from the center position in the vehicle width direction to an end portion of the road in the leftward direction and at a right pavement target length L2 from the center position in the vehicle width direction to an end portion of the road in

the rightward direction.

[0131] In addition, in a case where the asphalt finisher 100 turns in the leftward direction, a radius having the turning center 6021 as reference is different between a region of a pavement target on the right side of the center position of the asphalt finisher 100 in the vehicle width direction and a region of the pavement target on the left side of the center position in the vehicle width direction. In other words, in addition to a difference between the left pavement target length L3 and the right pavement target length L2, based on the radius, a difference between a right area 6031 of the pavement target on the right side of the center position of the asphalt finisher 100 in the vehicle width direction and a left area 6032 of the pavement target on the left side of the center position of the asphalt finisher 100 in the vehicle width direction is generated.

[0132] It is necessary to determine the amount of paving material sprinkled in accordance with the area of each of the right area 6031 and the left area 6032. Thus, the screw rotation control unit 50e identifies the rotation speeds of the left screw motor 21SL and the right screw motor 21SR with reference to the screw rotation speed storage unit 48c and outputs a control command in accordance with the rotation speed such that the amount of paving material corresponding to the area of each of the right area 6031 and the left area 6032 is sprinkled.

[0133] As shown in Fig. 3, the screw rotation speed storage unit 48c associates the speed and the steering angle of the asphalt finisher 100 and a length from the center position of the asphalt finisher 100 in the vehicle width direction to the distal end portion of the telescopic screed 31 with a rotation speed. The association relationship will be described. First, the right area 6031 and the left area 6032 at a predetermined angle θ having the turning center 6021 as reference can be identified by the steering angle of the tractor 1 and the length from the center position of the asphalt finisher 100 in the vehicle width direction to the distal end portion of the telescopic screed 31. A time for the asphalt finisher 100 to travel a distance CLA (see Fig. 7) can also be identified from the speed of the asphalt finisher 100. For this reason, the rotation speeds of the left screw motor 21SL and the right screw motor 21SR are set in the screw rotation speed storage unit 48c such that the amount of paving material necessary for each of the right area 6031 and the left area 6032 is sprinkled for a time required for traveling the distance CLA. Accordingly, for example, in a case of turning in the leftward direction, the screw rotation control unit 50e outputs a control command such that the rotation speed is raised with respect to the left screw motor 21SL and the rotation speed is reduced with respect to the right screw motor 21SR, compared to before the turning. The steering angle of the tractor 1 may be a command value of movement control by the movement control unit 50c or may be measurement information acquired from the tractor 1 by the acquisition unit 50a.

[0134] Accordingly, the screw rotation control unit 50e

can identify the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR in accordance with the current situation of the asphalt finisher 100 with reference to the screw rotation speed storage unit 48c. Then, as the screw rotation control unit 50e outputs a control command for rotating at the identified rotation speed, the left screw motor 21SL and the right screw motor 21SR can sprinkle an appropriate amount of paving material with respect to a road surface where the asphalt finisher 100 travels.

[0135] That is, in a case where the movement control unit 50c changes the steering angle of the tractor 1 while the asphalt finisher 100 according to the present embodiment is moved by the tractor 1, the screw rotation control unit 50e performs control to change the rotation speed of the screw SC.

[0136] Specifically, in a case where the movement control unit 50c has changed the steering angle of the tractor 1 while the asphalt finisher 100 is moved by the tractor 1, the screw rotation control unit 50e performs control such that a rotation speed differs between the right screw SCR and the left screw SCL in accordance with the right area 6031 of a pavement target and the left area 6032 of a pavement target on the left side.

[0137] An example in which the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR is identified with reference to the screw rotation speed storage unit 48c has been described in the present embodiment. However, the present embodiment does not limit a method of identifying the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR to an example of referring to the table. For example, the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR may be identified through a calculation formula. For example, a formula for calculating the rotation speed by substituting the speed and the steering angle of the asphalt finisher 100 and a length from the center position of the asphalt finisher 100 in the vehicle width direction to the distal end portion of the telescopic screed 31 as parameters, or the like is considered as the calculation formula. The method is not limited to the formula for calculating the rotation speed using all of the speed and the steering angle of the asphalt finisher 100 and the length from the center position of the asphalt finisher 100 in the vehicle width direction to the distal end portion of the telescopic screed 31, and the rotation speed can be calculated using any one or more of the parameters. Any method may be used as a method of calculating the rotation speed, regardless of a known method.

<Description of Control Procedures in Automatic Movement Control by Asphalt Finisher>

[0138] Fig. 8 is a flowchart showing control of the asphalt finisher 100 by the controller 50 according to the present embodiment.

[0139] First, before performing automatic control, the

acquisition unit 50a of the controller 50 acquires schedule information from the schedule information storage unit 48a of the auxiliary storage device 48 (S7001).

[0140] The moving route calculation unit 50b calculates a target moving route of the asphalt finisher 100 in accordance with the schedule information (S7002).

[0141] Then, the movement control unit 50c starts movement control to move along the calculated target moving route (S7003).

[0142] The acquisition unit 50a acquires measurement information from each of the front monitoring device 51F, the rear monitoring device 51B, the traveling speed sensor 47, and the screed length detection device 57 while acquiring position information from the GPS module 54 (S7004).

[0143] Based on the position information and the measurement information of each of the front monitoring device 51F, the rear monitoring device 51B, and the traveling speed sensor 47, the movement control unit 50c performs movement control to move along the target moving route (S7005).

[0144] The screw rotation control unit 50e determines whether or not the movement control unit 50c has performed steering angle control along the target moving route (S7006). In a case where it is determined that the steering angle control is not performed (S7006: NO), processing proceeds to S7008.

[0145] In a case where the screw rotation control unit 50e determines that the movement control unit 50c has performed steering angle control along the target moving route (S7006: YES), the screw rotation control unit 50e changes the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR based on the steering angle changed by the movement control unit 50c with reference to the screw rotation speed storage unit 48c (S7007).

[0146] Further, the screed control unit 50d determines whether or not the side plate 40 is shifted from the target line based on the measurement information of the right monitoring device 51R and the left monitoring device 51L acquired by the acquisition unit 50a and the detection result from the screed length detection device 57 (S7008). In a case where it is determined that the side plate 40 is not shifted from the target line (S7008: NO), processing proceeds to S7011.

[0147] On the other hand, in a case where it is determined that the side plate 40 is shifted from the target line (S7008: YES), the screed control unit 50d outputs, to the screed control device 55, a control command for expanding and contracting the telescopic screed 31 in order to make the side plate 40 match the target line (S7009).

[0148] Further, the screw rotation control unit 50e changes the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR in accordance with a ratio between the left pavement target length 5051 and the right pavement target length 5052 of the screed 3 after controlling the screed control device 55, with reference to the screw rotation speed storage unit 48c

(S7010).

[0149] After then, the movement control unit 50c determines whether or not movement along the target moving route is completed (S7011). In a case where it is determined that movement along the target moving route is not completed (S7011), processing is again performed from S7004.

[0150] On the other hand, in a case where the movement control unit 50c determines that movement along the target moving route is completed (S7011: YES), processing is completed.

[0151] A case where the steering angle of the tractor 1 is changed when changing the traveling direction of the asphalt finisher 100 has been described in the present embodiment. That is, in a case where the steering angle of the tractor 1 is changed, the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR is changed. However, information for changing the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR is not limited to information indicating a change in the steering angle of the tractor 1. For example, the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR may be changed based on the target moving route calculated by the moving route calculation unit 50b. For example, the screw rotation control unit 50e may change the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR at a timing when the asphalt finisher 100 changes the traveling direction in the target moving route.

[0152] The controller 50 according to the present embodiment can change the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR in a case where the asphalt finisher 100 moves and in a case where the steering angle is changed in accordance with the traveling direction. Further, when expansion and contraction control of the telescopic screed 31 is performed in accordance with the width of a road in a case where the asphalt finisher 100 moves, the controller 50 can change the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR. Accordingly, the amount of paving material corresponding to the area of the road, which is a pavement target, can be sprinkled. Therefore, since the controller 50 can suppress insufficiency of the paving material on the road or the generation of excess of the paving material by sprinkling a suitable amount of paving material on the road, paving construction quality can be improved.

(Modification Example 1)

[0153] An example in which the movement control unit 50c of the asphalt finisher 100 performs automatic movement control to follow a target moving route has been described in the embodiment described above. However, the embodiment described above is not limited to a method of performing automatic movement control to follow the target moving route. Thus, a case where the operator operates the asphalt finisher 100 will be described in the

present modification example.

[0154] The movement control unit 50c according to the present modification example outputs a control command for moving the asphalt finisher 100 to the drive system controller 52 in response to an operation of the steering device by the operator. Accordingly, movement control of the asphalt finisher 100 is performed.

[0155] The acquisition unit 50a according to the present modification example detects an end portion (a portion that is a boundary between a road surface and a road shoulder) of the road surface to be paved based on measurement information from the right monitoring device 51R and the left monitoring device 51L and sets the end portion of the road surface as the target line OL of the side plate 40. Subsequent processing is the same as in the embodiment described above.

[0156] That is, the screed control unit 50d according to the present modification example outputs, to the screed control device 55, a control command for expanding and contracting the telescopic screed 31 such that the side plate 40 matches the target line OL.

[0157] In addition, as in the embodiment described above, the screw rotation control unit 50e according to the present modification example identifies the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR based on a ratio between the length of a pavement target on the left side of the center position of the asphalt finisher 100 in the vehicle width direction and the length of a pavement target on the right side of the center position in the vehicle width direction and outputs a control command in accordance with the identified rotation speed.

[0158] Further, as in the embodiment described above, the screw rotation control unit 50e according to the present modification example identifies the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR in accordance with steering angle control performed by the operator and outputs a control command in accordance with the identified rotation speed.

[0159] As the controller 50 performs the control described above, the same effects as in the embodiment described above can be obtained in the present modification example.

(Modification Example 2)

[0160] An example in which movement control of the asphalt finisher 100 is performed in response to an operation by the operator, but the screed control unit 50d expands and contracts the telescopic screed 31 based on measurement information has been described in modification example 1. However, expansion and contraction of the telescopic screed 31 is not limited to automatic control by the controller 50. A case where the worker performs the expansion and contraction will be described in the present modification example.

[0161] In the present modification example, an input

unit 58L shown in Fig. 6 receives, from the worker, an operation for expanding and contracting the left telescopic screed 31L to the left side in the vehicle width direction with respect to the main screed 30. Similarly, an input unit 58R receives, from the worker, an operation for expanding and contracting the right telescopic screed 31R to the right side in the vehicle width direction with respect to the main screed 30. The input unit 58L and the input unit 58R output information of the received operations to the controller 50.

[0162] In addition, the screw rotation control unit 50e according to the present modification example identifies the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR based on a ratio between the length of a pavement target on the left side of the center position of the asphalt finisher 100 in the vehicle width direction and the length of a pavement target on the right side of the center position in the vehicle width direction after expansion and contraction of the telescopic screed 31 is performed and outputs a control command in accordance with the identified rotation speed. Accordingly, the same effects as in the embodiment described above can be obtained.

(Modification Example 3)

[0163] A case where the steering angle of the tractor 1 is changed when changing the traveling direction of the asphalt finisher 100 has been described in the embodiment described above. However, the embodiment described above is not limited to a method of changing the steering angle of the tractor 1 when changing the traveling direction of the asphalt finisher 100.

[0164] For example, an example in which the tractor 1 of the asphalt finisher 100 includes the front wheel 6 and the rear wheel 5 has been described in the embodiment described above. However, the embodiment described above is not limited to the example in which the tractor 1 includes the front wheel 6 and the rear wheel 5, and the tractor 1 may include a crawler (an example of a moving body). Thus, an example in which the tractor 1 is provided with a right crawler and a left crawler will be described in the modification example.

[0165] In this case, instead of changing the steering angle of the front wheel 6, the movement control unit 50c changes the traveling direction of the asphalt finisher 100 by changing rotation speeds of a starting wheel of the crawler on the right side (an example of an undercarriage on the right side) and a starting wheel of the crawler on the left side (an example of an undercarriage on the left side). In other words, the traveling direction of the asphalt finisher 100 is changed by a difference between the rotation speeds of the starting wheel of the crawler on the right side (an example of the undercarriage on the right side) and the starting wheel of the crawler on the left side (an example of the undercarriage on the left side).

[0166] That is, the screw rotation control unit 50e according to the present modification example changes the

rotation speed of each of the left screw motor 21SL and the right screw motor 21SR to correspond to the traveling direction of the asphalt finisher 100 based on information indicating that the rotation speeds of the crawler on the right side (an example of the undercarriage on the right side) and the crawler on the left side (an example of the undercarriage on the left side) are changed. In order to realize the change in the rotation speed, for example, the rotation speed of the starting wheel of one crawler, the rotation speed of the starting wheel of the other crawler, a length from the center position of the asphalt finisher 100 in the vehicle width direction to one distal end portion of the telescopic screed 31, and the rotation speed of the screw SC may be associated with each other in the screw rotation speed storage unit.

[0167] As described above, the screw rotation control unit 50e may change the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR based on information indicating the rotation speeds of the crawler on the right side (an example of the undercarriage on the right side) and the crawler on the left side (an example of the undercarriage on the left side), with reference to the screw rotation speed storage unit.

[0168] An example in which any one or more pieces of information indicating a steering angle, a target moving route for performing movement control, and the rotation speeds of the crawler on the right side and the crawler on the left side (for example, may be a difference between the rotation speeds of the crawler on the right side and the crawler on the left side) are used as information related to a moving direction of the asphalt finisher for changing the rotation speed of each of the left screw motor 21SL and the right screw motor 21SR has been described in the embodiment and the modification examples described above. The information related to the moving direction of the asphalt finisher 100 is not limited to the information described above. For example, the angle of steering (wheel) for switching the moving directions of the tractor 1, the length of a steering cylinder controlled when switching the moving directions of the tractor 1 in response to a steering operation (not shown), or the moving direction of the tractor 1 may be used. Further, a steering angle used as the information related to the moving direction of the asphalt finisher 100 may be a command value or an actual steering angle.

<Action>

[0169] As the controller 50 of the asphalt finisher 100 according to the embodiment and the modification examples described above has the configuration described above, the amount of paving material corresponding to a road which is a pavement target can be sprinkled by changing the rotation speed of the screw SC in accordance with the traveling direction of the asphalt finisher 100. Accordingly, since insufficiency of the paving material on the road or the generation of excess of the paving material can be suppressed, construction quality of a

paved road surface can be improved.

[0170] Further, since the controller 50 of the asphalt finisher 100 according to the embodiment and the modification examples changes the rotation speed of the screw SC based on the information related to the traveling direction of the asphalt finisher 100, a worker who rides on the asphalt finisher 100 and adjusts the rotation speed of the screw SC becomes unnecessary. For this reason, costs for construction by the asphalt finisher 100 can be reduced.

[0171] Further, since the asphalt finisher 100 can sprinkle the amount of paving material corresponding to the area of a road, which is a pavement target, the amount of wasted paving material can be reduced.

[0172] Further, the controller 50 of the asphalt finisher 100 controls the length of each of the right telescopic screed 31R and the left telescopic screed 31L in addition to adjustment of the rotation speed of the screw SC and changes the rotation speed of the screw SC in accordance with a ratio between the lengths of the right telescopic screed 31R and the left telescopic screed 31L. Therefore, the amount of paving material projecting outside a road which is a pavement target is reduced. Accordingly, since the number of workers who perform a post-process on the road after the asphalt finisher 100 has passed can be reduced, costs for construction by the asphalt finisher 100 can be reduced.

[0173] Further, since the controller 50 of the asphalt finisher 100 makes a rotation speed different between the left screw motor 21SL and the right screw motor 21SR in a case where the moving direction of the asphalt finisher 100 (for example, the steering angle of the tractor 1) has changed while the asphalt finisher 100 is moved by the tractor 1, even in a case where the area of the road, which is a pavement target, differs between the right side and the left side of the asphalt finisher 100 due to the change in the moving direction, the amount of paving material corresponding to the area can be sprinkled. Accordingly, construction quality of the paved road can be improved.

[0174] Although the embodiment has been described in detail hereinbefore, the present disclosure is not limited to such a specific embodiment, various modifications and changes are possible within the scope of the concept described in the scope of the claims.

[0175] Although the embodiment of the asphalt finisher has been described hereinbefore, the present invention is not limited to the embodiment or the like. Various types of changes, modifications, substitutions, additions, deletions, and combinations thereof are possible within the scope of the claims. It is evident that these belong to the technical scope of the present invention.

Brief Description of the Reference Symbols

[0176]

100 asphalt finisher

SCL left screw
 SCR right screw
 27L left screed expanding and contracting cylinder
 27R right screed expanding and contracting cylinder
 30 main screed 5
 31L left telescopic screed
 31R right telescopic screed
 47 traveling speed sensor
 48 auxiliary storage device
 48a schedule information storage unit 10
 48b vehicle width storage unit
 50 controller
 50a acquisition unit
 50b moving route calculation unit
 50c movement control unit 15
 50d screed control unit
 50e screw rotation control unit
 51F front monitoring device
 51B rear monitoring device
 51R right monitoring device 20
 51L left monitoring device
 52 drive system controller
 53 communication device
 54 GPS module
 55 screed control device 25
 56 screw control device
 57 screed length detection device

Claims

1. An asphalt finisher (100) comprising:

a tractor (1);
 a hopper (2) that is provided on a front side of the tractor (1); 35
 a conveyor (CV) that transports a paving material in the hopper (2) to a rear side of the tractor (1);
 a screw (SC) that spreads the paving material, which is transported by the conveyor (CV) and which is sprinkled on a road surface, in a vehicle width direction; and 40
 a screed device (3) that levels the paving material spread by the screw (SC) on a rear side of the screw (SC) and that is capable of expanding and contracting in the vehicle width direction, wherein a rotation speed of the screw (SC) is configured to be changed while the asphalt finisher (100) is moved by the tractor (1) based on information related to a moving direction of the asphalt finisher (100). 50

2. The asphalt finisher (100) according to claim 1,

wherein the screw (SC) includes a right screw (SCR) that is provided on a right side of a center position of the asphalt finisher (100) in the vehi-

cle width direction and a left screw (SCL) that is provided on a left side of the center position of the asphalt finisher (100), and the right screw (SCR) and the left screw (SCL) are configured to have different rotation speeds based on the information in a case where a change related to a moving direction of the tractor (1) has been performed while the asphalt finisher (100) is moved by the tractor (1).

3. The asphalt finisher (100) according to claim 1, wherein the information is any one or more of a steering angle of the tractor (1), an angle of steering for switching moving directions of the tractor (1), a length of a steering cylinder that is controlled when switching the moving directions of the tractor (1), a target moving route that is set in advance in order for the asphalt finisher (100) to construct a road surface, speeds of an undercarriage on a right side and an undercarriage on a left side of the tractor (1), and the moving direction of the tractor (1).

4. The asphalt finisher (100) according to any one of claims 1 to 3,

wherein the screed device (3) includes a right screed device (27R) that is provided on a right side of the asphalt finisher (100) and a left screed device (27L) that is provided on a left side of the asphalt finisher (100), a length of each of the right screed device (27R) and the left screed device (27L) is controlled, and a rotation speed of the screw (SC) is configured to be changed in accordance with a ratio between a length of a pavement target on a right side of a center of the asphalt finisher (100) and a length of a pavement target on a left side of the center of the asphalt finisher (100).

5. The asphalt finisher (100) according to claim 4, further comprising:

a detection unit (57) that detects the length of each of the right screed device (27R) and the left screed device (27L), wherein the length of each of the right screed device (27R) and the left screed device (27L) is configured to be controlled based on a detection result from the detection unit (57).

FIG. 1A

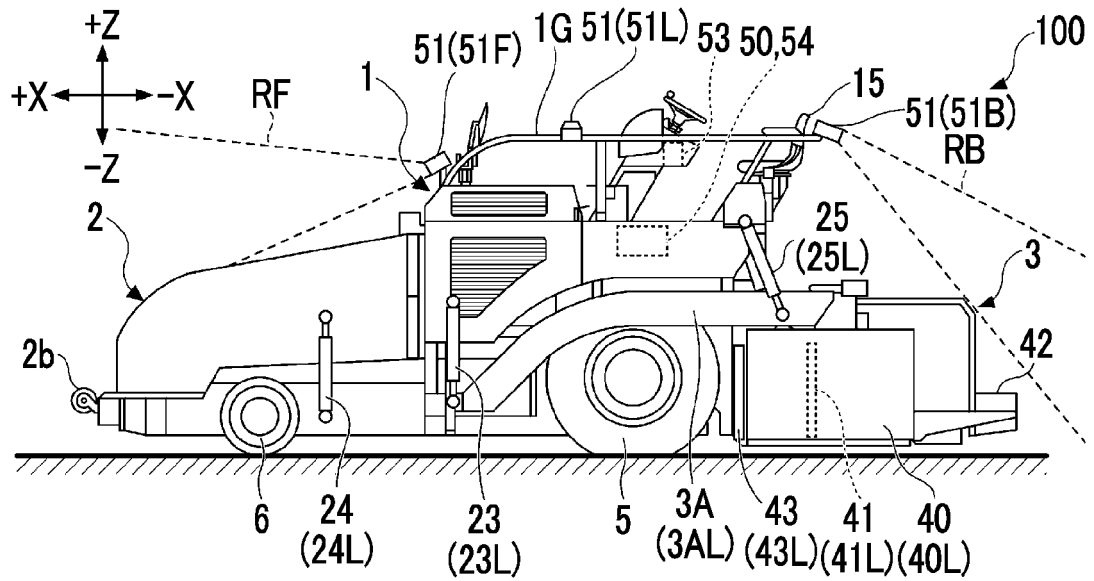


FIG. 1B

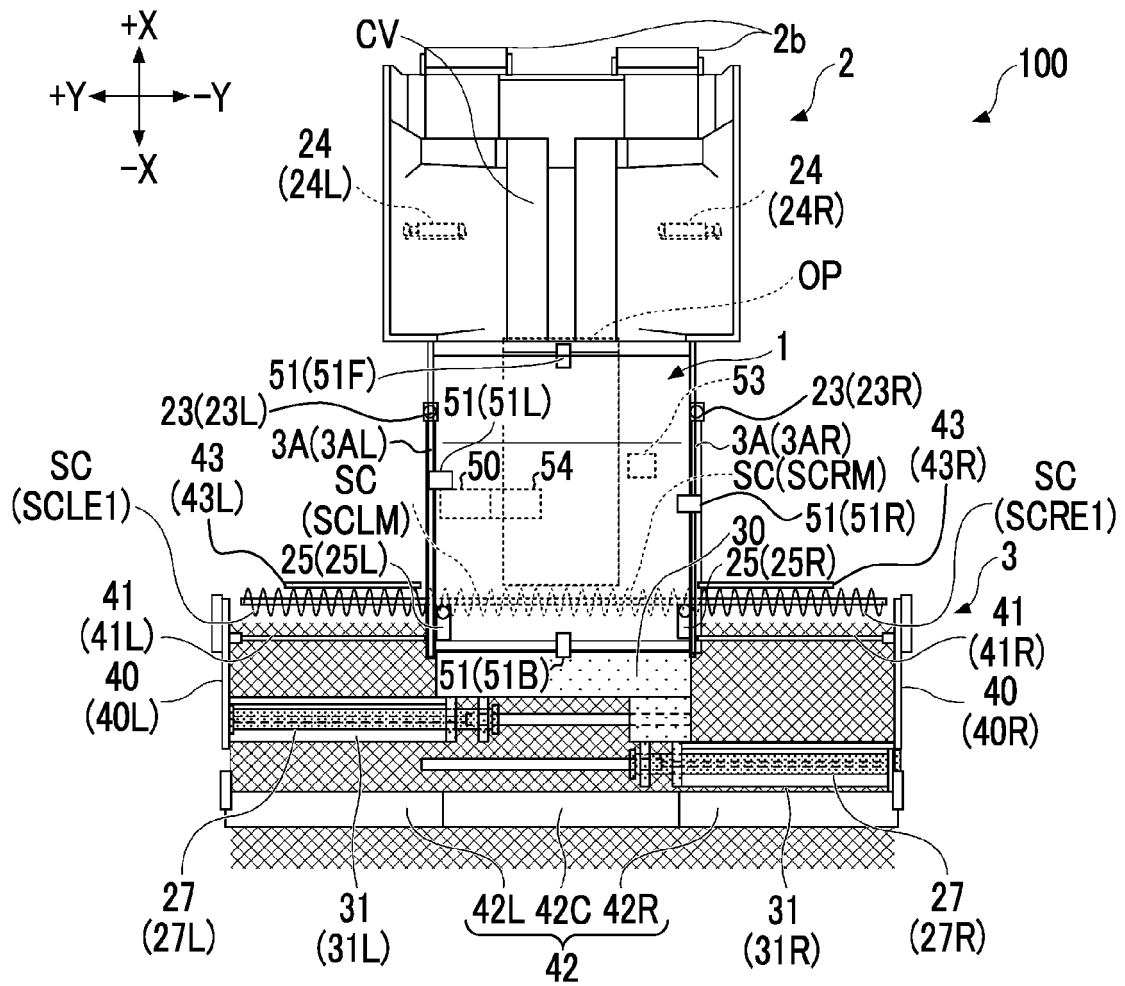


FIG. 2

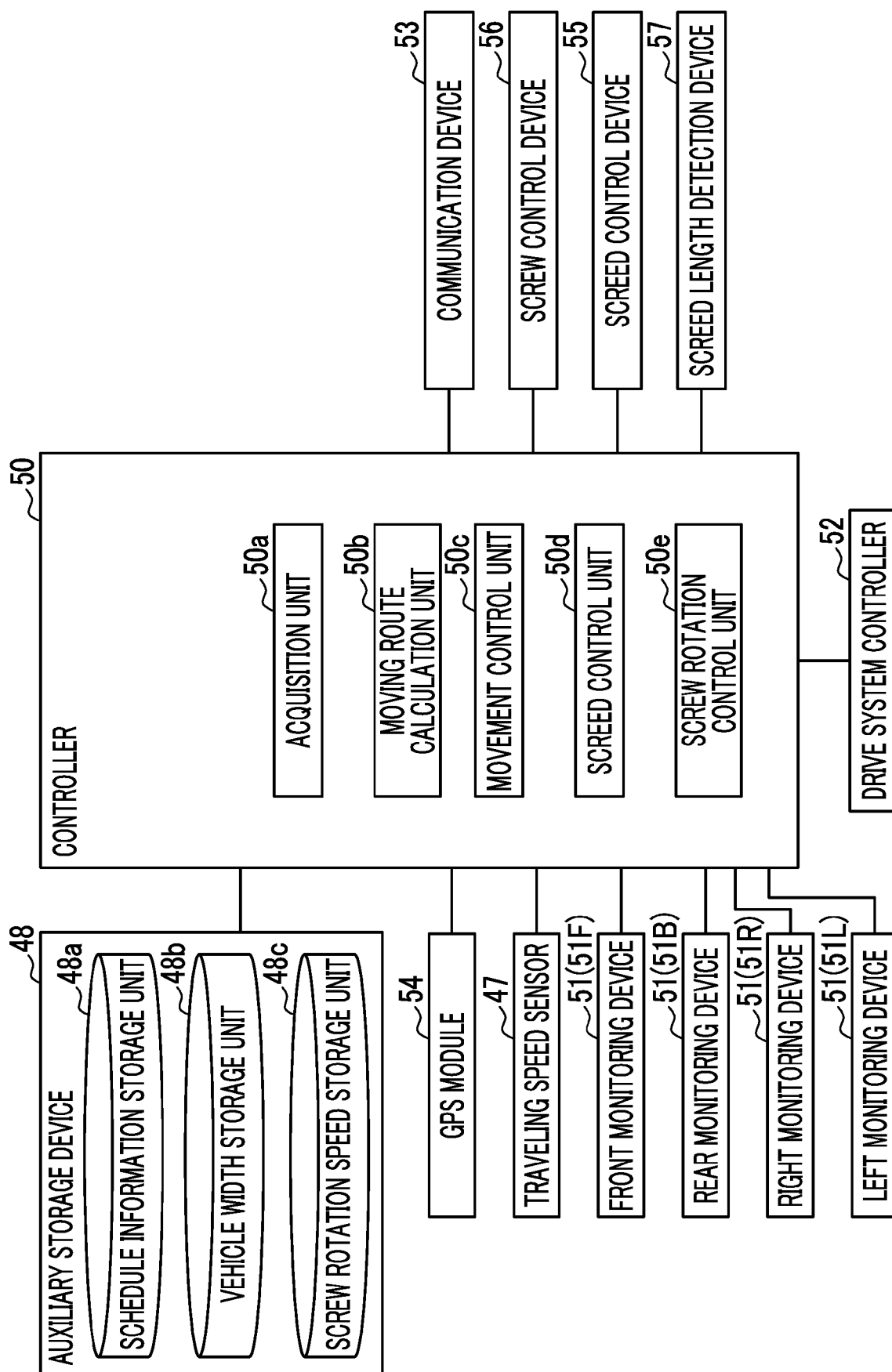


FIG. 3

CURRENT SITUATION OF ASPHALT FINISHER			ROTATION SPEED
SPEED	STEERING ANGLE	LENGTH	
x x	— O x	△△	□□
:	:	:	:

FIG. 4

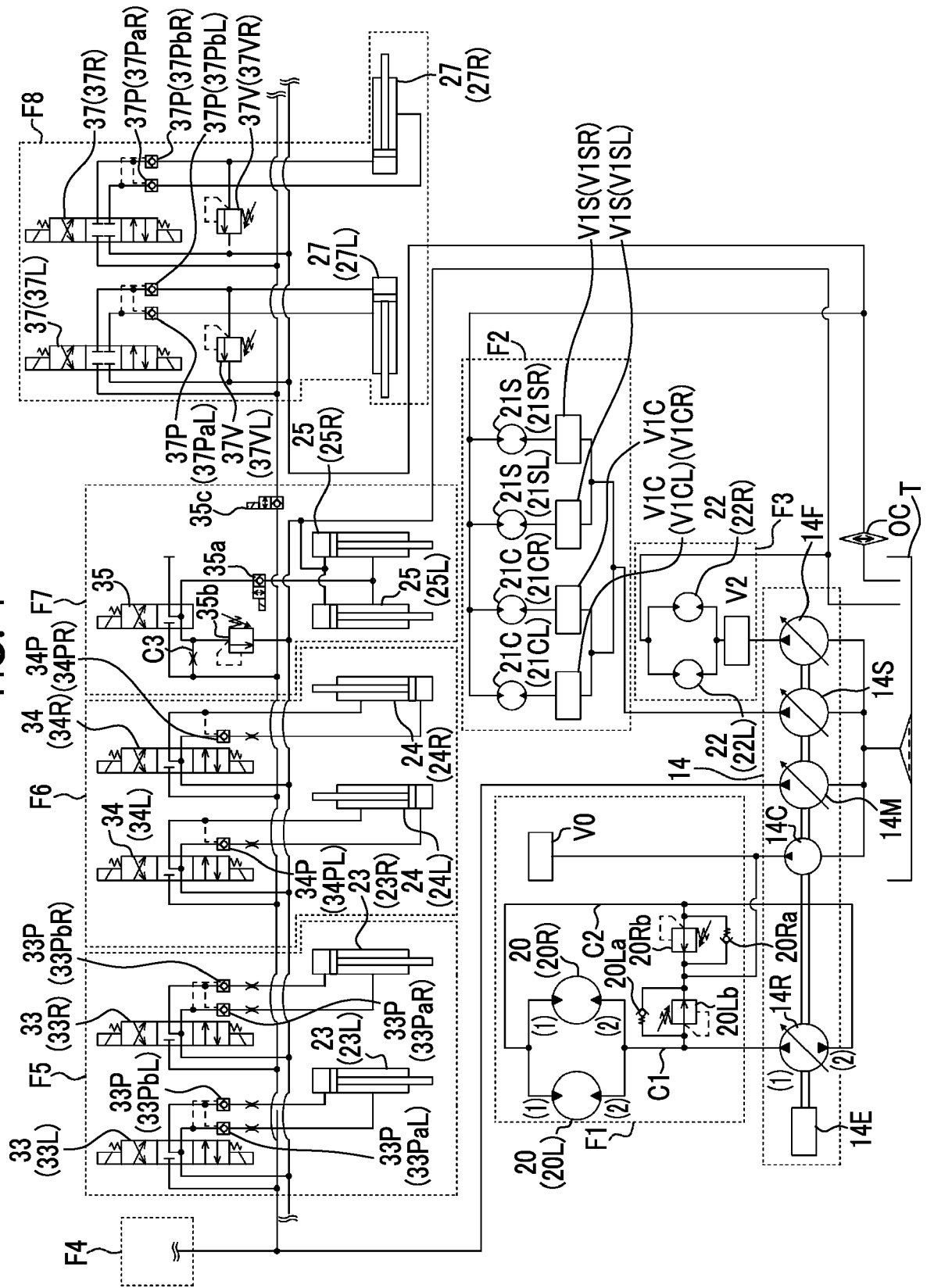


FIG. 5

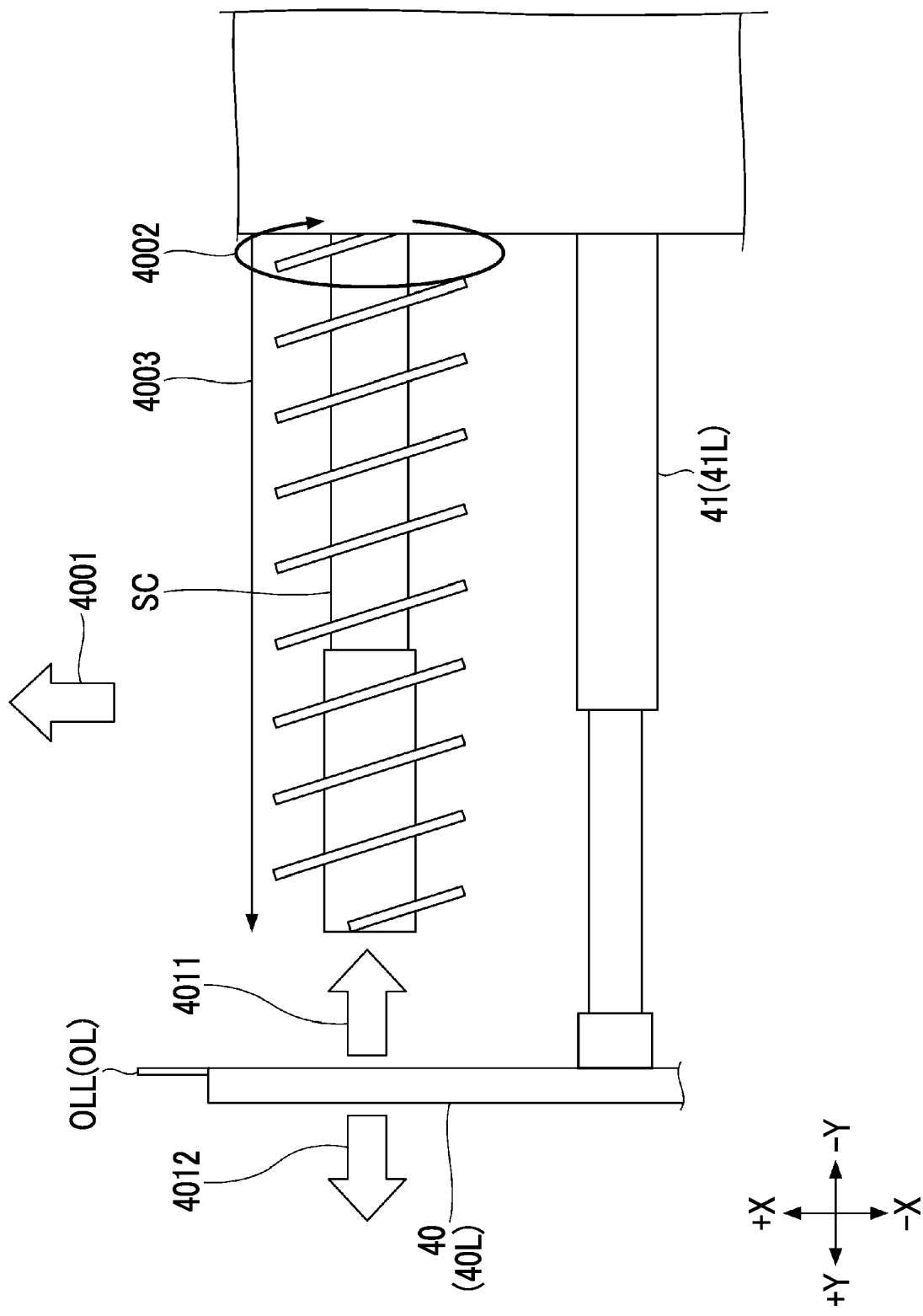


FIG. 6

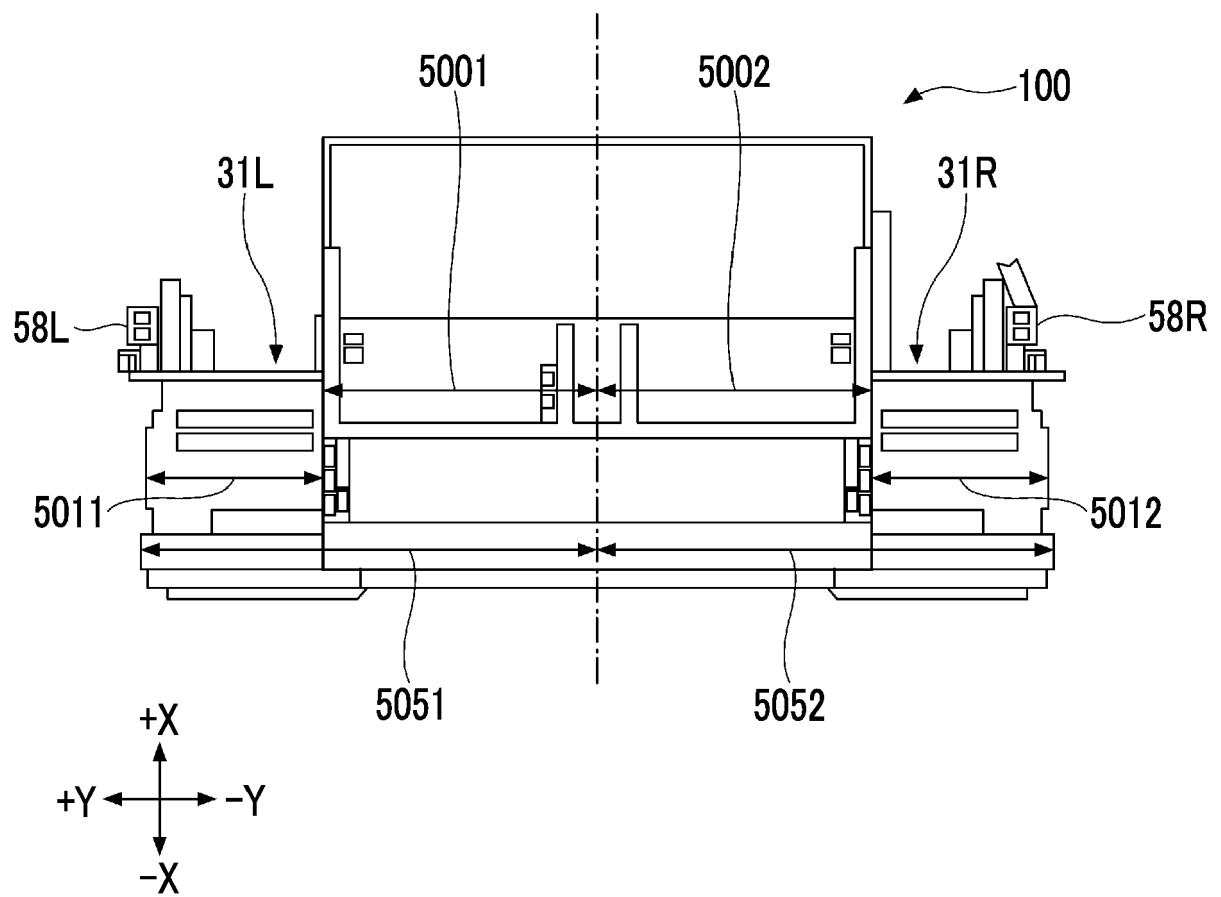


FIG. 7

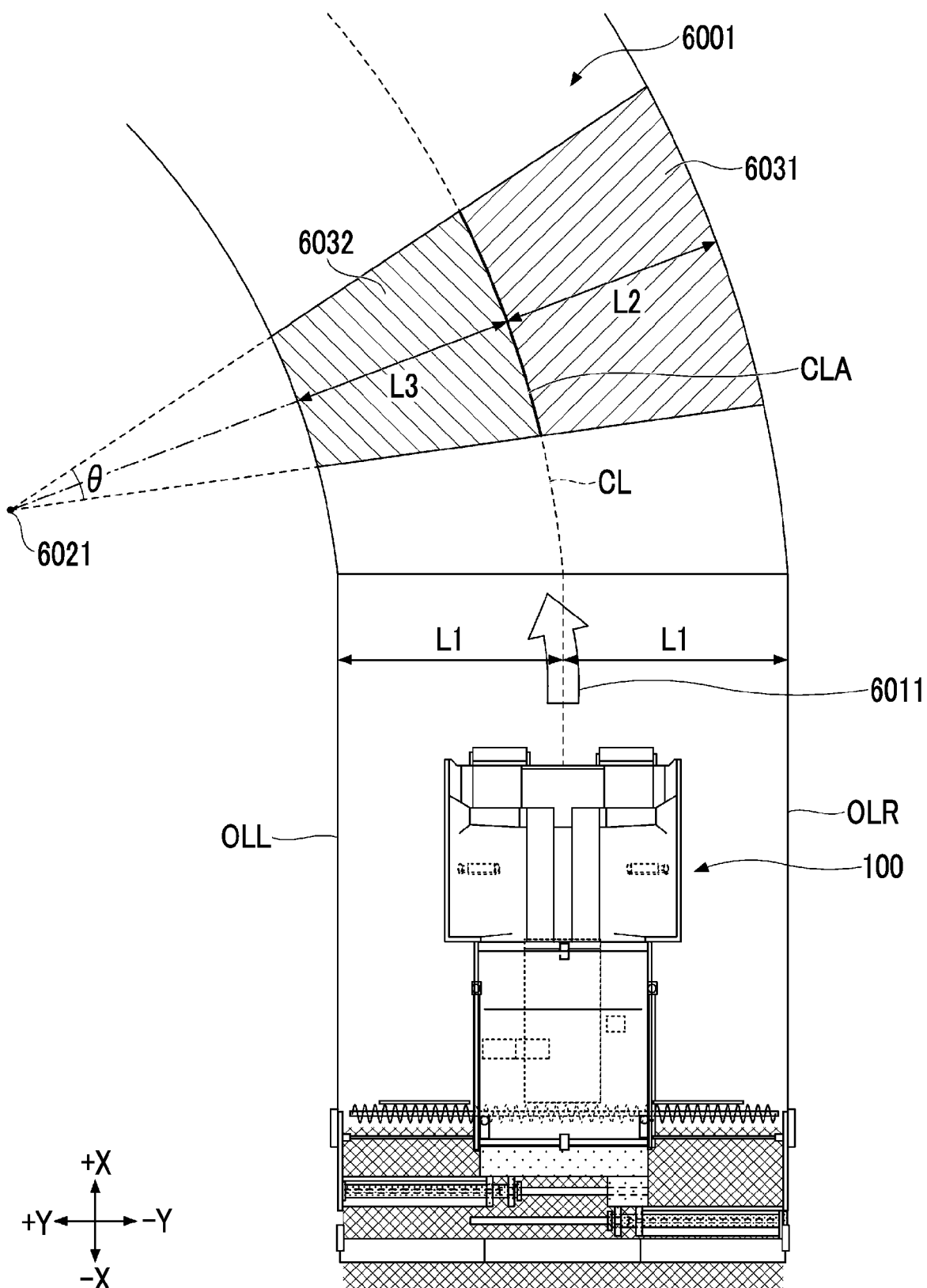
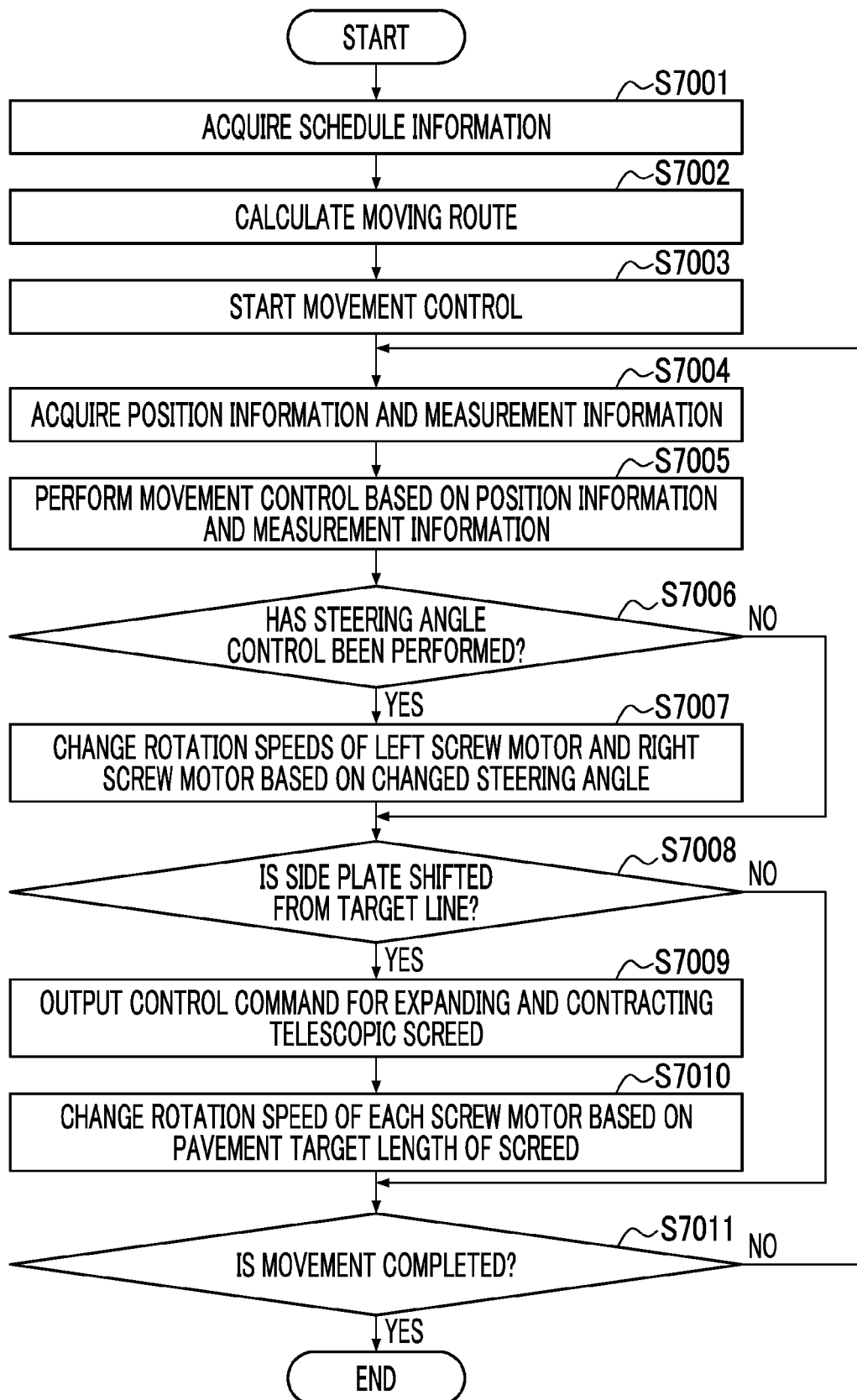


FIG. 8





EUROPEAN SEARCH REPORT

Application Number

EP 23 17 9303

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	US 2023/295885 A1 (SIMMER JACOB A [US] ET AL) 21 September 2023 (2023-09-21) * the whole document *	1-5	INV. E01C19/48
X	JP 2014 129694 A (SUMITOMO CONSTR MACHINERY MFG) 10 July 2014 (2014-07-10) * paragraphs [0010] - [0013], [0017], [0026] - [0034]; figures 1-4 *	1-3	
A		4,5	
X	US 2014/099165 A1 (SMIEJA JAMESON MICHAEL [US]) 10 April 2014 (2014-04-10) * paragraphs [0001], [0008] - [0014], [0037]; figures 1,2,5 *	1-3	
A		4,5	
X	WO 2021/193332 A1 (SUMITOMO CONSTRUCTION MACHINERY CO LTD [JP]) 30 September 2021 (2021-09-30) * paragraph [0102]; figures 4A,4B *	1-3	
A		4,5	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 January 2024	Examiner Kremsler, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 17 9303

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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