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(54) **ASPHALT FINISHER**

(57) An asphalt finisher 100 according to an embodiment of the present invention includes a rear wheel traveling pump 14R configured to supply hydraulic oil to rear wheel traveling motors 20L, 20R; a cylinder pump 14M configured to supply hydraulic oil to screed lift cylinders 25L, 25R; and an engine 14E configured to drive the rear wheel traveling pump 14R and the cylinder pump 14M. An auxiliary hydraulic source 60 capable of supplying hydraulic oil to the screed lift cylinders 25L, 25R is not used for driving the rear wheel traveling motors 20L, 20R.

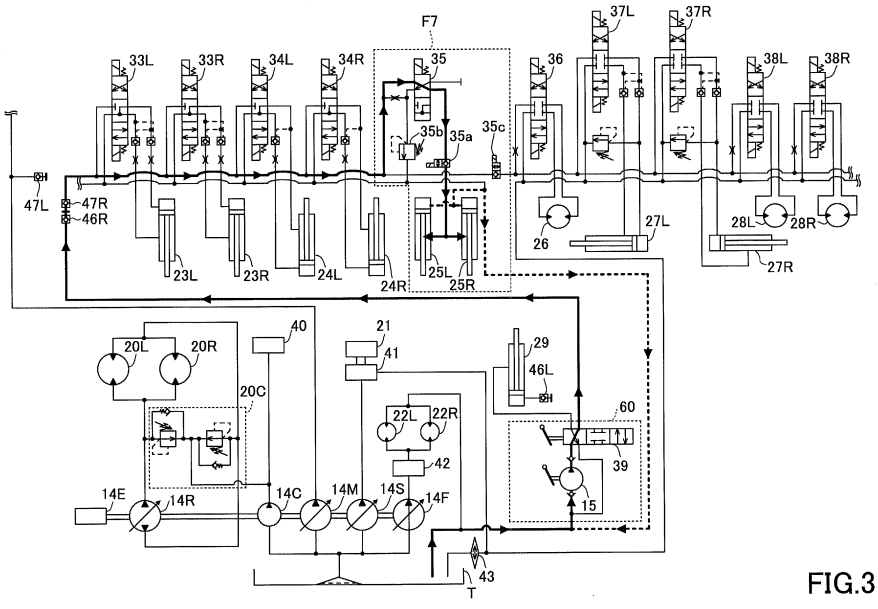

FIG.3

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an asphalt finisher including a hydraulic actuator.

2. Description of the Related Art

[0002] In the case where a hydraulic shovel, which mounts an engine, a hydraulic pump actuated by the engine, and a traveling motor actuated by the hydraulic pump, becomes incapable of running due to a hydraulic oil source related failure such as an engine failure or a hydraulic pump failure, a hydraulic source unit as an external unit which enables the hydraulic shovel to run temporarily is known (refer to Patent Document 1).

[0003] The hydraulic source unit mounts an external engine that is different from the engine mounted on the hydraulic shovel, and an external hydraulic pump that is different from the hydraulic pump of the hydraulic shovel and is actuated by the external engine. An operator connects the external hydraulic pump with a traveling motor of the hydraulic shovel via a hose, actuates the traveling motor by using the hydraulic oil discharged by the external pump, and causes the shovel to run.

[Citation List]

[Patent Literature]

[0004] [Patent Document 1] Japanese Patent No. 3145668

SUMMARY OF THE INVENTION

[TECHNICAL PROBLEM]

[0005] However, the above-described hydraulic source unit requires a large scale structure including an external engine capable of providing an output sufficient for causing the hydraulic shovel, which has become incapable of running due to a failure related to the hydraulic source, to run. Therefore, the hydraulic source unit has an excessive performance as an apparatus for driving hydraulic actuators other than the traveling motor in the asphalt finisher that has become incapable of running due to a failure related to the hydraulic source, and thus, it is difficult to introduce the hydraulic source unit because of the high cost, etc. As a result, there is a risk of creating, for example, a situation in which an asphalt finisher, which has become incapable of running and incapable of being towed in a state in which a screed is touched on a pavement surface due to a hydraulic source related failure, cannot be moved to a state capable of being towed. Further, there is a risk of creating a situation in which an asphalt finisher, which has become incapable of running and incapable of being transported by a trailer due to a hydraulic source related failure, cannot be moved to a state capable of being transported by a trailer. It should be noted that the state incapable of being transported by a trailer refers to, for example, a state in which the asphalt finisher has become incapable of running while the screed or a hopper has been expanded wider than a width of a tractor as a main body.

[0006] In view of the above, it is desired to provide an asphalt finisher with a simple mechanism that moves the asphalt finisher, which has become incapable of running due to a hydraulic source related failure, to a state capable of being towed or a state capable of being transported by a trailer.

[0007] An asphalt finisher according to an embodiment of the present invention includes a first hydraulic pump configured to supply hydraulic oil to a traveling motor; a second hydraulic pump configured to supply hydraulic oil to a hydraulic actuator; and a drive source configured to drive the first hydraulic pump and the second hydraulic pump. An auxiliary hydraulic source capable of supplying hydraulic oil to the hydraulic actuator is not used for driving the traveling motor.

[0008] According to the above means, it is possible to provide an asphalt finisher with a simple mechanism that moves the asphalt finisher, which has become incapable of running due to a hydraulic source related failure, to a state capable of being towed or a state capable of being transported by a trailer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1A is a schematic side view of an asphalt finisher according to an embodiment of the present invention.

Fig. 1B is a schematic top view of the asphalt finisher.

Fig. 2 is a hydraulic circuit diagram illustrating an example of a structure of a hydraulic system mounted on the asphalt finisher.

Fig. 3 is a hydraulic circuit diagram illustrating a state of the hydraulic system in a case where an operator causes a screed lift unit to operate by using an auxiliary hydraulic source.

Fig. 4 is a hydraulic circuit diagram illustrating a state of the hydraulic system in a case where the operator operates a screed expand/contract unit by using an auxiliary hydraulic source.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Fig. 1A and Fig. 1B are schematic drawings of an asphalt finisher 100 as an example of a road machine according to an embodiment. It should be noted that Fig. 1A is a left side view of the asphalt finisher 100 and Fig.

1B is a top view of the asphalt finisher 100.

[0011] The asphalt finisher 100 includes mainly a tractor 1, a hopper 2, a screed 3, and a controller 50. It should be noted that, in the present embodiment, it is assumed that a front direction refers to a direction of the hopper 2 viewed from the tractor 1 and a rear direction refers to a direction of the screed 3 viewed from the tractor 1.

[0012] The controller 50 is a control device for controlling the asphalt finisher 100. In the present embodiment, the controller 50 has an arithmetic processing including with a CPU and an internal memory. Further, various types of functions of the controller 50 are realized by causing the CPU to execute programs stored in the internal memory.

[0013] The tractor 1 is a mechanism for causing the asphalt finisher 100 to travel. In the present embodiment, the tractor 1 causes the asphalt finisher 100 to move by rotating rear wheels 5L, 5R by using rear wheel traveling motors 20L, 20R, and by rotating front wheels 6L, 6R by using front wheel traveling motors 22L, 22R. It should be noted that, in Fig. 1A and Fig. 1B, approximate positions of various types of hydraulic actuators are illustrated transparently, and the rear wheel 5R and the front wheel 6R are hidden and unseen. The rear wheel traveling motors 20L, 20R and the front wheel traveling motors 22L, 22R rotate by receiving hydraulic oil supply from a hydraulic oil source 14. Further, on top of the tractor 1, there is a cabin including a driving seat and a control panel. A canopy 10 is attached on top of the cabin. It should be noted that, for the sake of drawing clarity, illustration of the canopy 10 is omitted in Fig. 1B.

[0014] The hopper 2 is a mechanism for accepting a pavement material. In the present embodiment, the hopper 2 is capable of being opened and closed in a vehicle width direction via hopper cylinders 24L, 24R. Normally, the asphalt finisher 100 accepts the pavement material (e.g., asphalt composite material) from a carrier of a dump track (not shown) by causing the hopper 2 to be in a full open state. It should be noted that Fig. 1A and Fig. 1B illustrate that the hopper 2 is in a full open state. Further, when the asphalt composite material in the hopper 2 is decreased, the hopper 2 is closed and the asphalt composite material near the inner wall of the hopper 2 is collected in the center of the hopper 2, and thus, the asphalt composite material is ready to be conveyed and supplied to the screed 3 via a conveyor CV and a screw (not shown).

[0015] The screed 3 is a mechanism for pouring and leveling the asphalt composite material. In the present embodiment, the screed 3 includes mainly a left leveling arm (screed arm) 3AL, a right leveling arm 3AR, a left front screed 3LF, a right front screed 3RF, a left rear screed 3LR, and a right rear screed 3RR. Further, the screed 3 is a floating screed that is towed by the tractor 1, and is connected to the tractor 1 via the left leveling arm 3AL and the right leveling arm 3AR.

[0016] The screed 3 is moved up and down by using screed lift cylinders 25L, 25R, and is expanded/contracted in the vehicle width direction by using screed expand/contract cylinders 27L, 27R.

[0017] The screed lift cylinders 25L, 25R are hydraulic actuators for lifting the screed 3 from the ground (pavement surface) In the present embodiment, cylinders of the screed lift cylinders 25L, 25R are connected to the tractor 1 and rods of the screed lift cylinders 25L, 25R are connected to the screed 3. Further, in the case of lifting the screed 3 from the ground, the controller 50 causes the screen lift cylinders 25L, 26R to be contracted by causing the hydraulic oil discharged by the hydraulic source 14 to be capable of flowing into each of rod side oil chambers of the screed lift cylinders 25L, 25R. On the other hand, in the case of moving the lifted screed 3 down on the ground, the controller 50 causes the hydraulic oil in each of the rod side oil chambers of the screed lift cylinders 25L, 25R to be capable of flowing out. Further, the controller 50 causes the screed lift cylinders 25L, 25R to be expanded by causing the hydraulic oil in the rod side oil chambers to flow out due to the weight of the screed 3.

[0018] The screed expand/contract cylinders 27L, 27R are hydraulic actuators for expanding/contracting the screed 3 in the vehicle width direction. In the present embodiment, the screed expand/contract cylinder 27L causes the left rear screed 3LR to be expanded in a left direction with respect to the left front screed 3LF in the figure. Further, the screed expand/contract cylinder 27R causes the right rear screed 3RR to be expanded in a right direction with respect to the right front screed 3RF in the figure.

[0019] The leveling arms 3AL, 3AR are devices for connecting the screed 3 to the tractor 1. Specifically, one end of each of the leveling arms 3AL, 3AR is connected to the screed 3 and the other end is connected to the tractor 1 in a pivoting manner.

[0020] Leveling cylinders 23L, 23R are hydraulic actuators for moving up and down the leveling arms 3AL, 3AR in order to adjust construction thickness of an asphalt. In the present embodiment, cylinders of the leveling cylinders 23L, 23R are connected to the tractor 1, and rods of the leveling cylinders 23L, 23R are connected to the pivoting parts. Further, in the case of increasing the construction thickness, the controller 50 causes the leveling cylinders 23L, 23R to be contracted in order to raise the leveling arms 3AL, 3AR by causing the hydraulic oil discharged by the hydraulic source 14 to flow into each of the rod side oil chambers of the leveling cylinders 23L, 23R. On the other hand, in the case of decreasing the construction thickness, the controller 50 causes the leveling cylinders 23L, 23R to be expanded in order to lower the leveling arms 3AL, 3AR by causing the hydraulic oil in each of the rod side oil chambers of the leveling cylinders 23L, 23R to flow out.

[0021] Next, referring to Fig. 2, a hydraulic system mounted on the asphalt finisher 100 will be described. It should be noted that Fig. 2 is a hydraulic circuit diagram illustrating an example of a structure of a hydraulic sys-

tem mounted on the asphalt finisher 100.

[0022] The hydraulic system includes mainly a hydraulic source 14, a rear wheel drive unit F1, a conveyor/screw drive unit F2, a front wheel drive unit F3, a steering/compacting device drive unit F4, a leveling unit F5, a hopper drive unit F6, a screed lift unit F7, a crown device drive unit F8, a screed expand/contract unit F9, a step device drive unit F10, and a canopy drive unit F11.

[0023] The hydraulic source 14 is a functional element for supplying hydraulic oil for causing the drive units F1 to F10 to operate. In the present embodiment, the hydraulic source 14 includes mainly an engine 14E, a rear wheel traveling pump 14R, a charge pump 14C, a cylinder pump 14M, a conveyor/screw pump 14S, and a front wheel traveling pump 14F.

[0024] The engine 14E is a drive source for driving the hydraulic pumps 14R, 14C, 14M, 14S, 14F. The rear wheel traveling pump 14R is a variable displacement hydraulic pump that supplies the hydraulic oil for driving the rear wheel drive unit F1. In the present embodiment, the rear wheel traveling pump 14R is a swash plate type variable displacement bidirectional hydraulic pump used in a closed circuit.

[0025] The charge pump 14C is a fixed displacement hydraulic pump that supplies the hydraulic oil for controlling the rear wheel drive unit F1.

[0026] The cylinder pump 14M is a variable displacement hydraulic pump that supplies the hydraulic oil to the drive units F4 to F10. In the present embodiment, the cylinder pump 14M is a swash plate type variable displacement hydraulic pump, whose discharge amount is controlled in such a way that a discharge pressure becomes constant at a predetermined pressure.

[0027] The conveyor/screw pump 14S is a variable displacement hydraulic pump for supplying the hydraulic oil to the conveyor/screw drive unit F2. In the present embodiment, the conveyor/screw pump 14S is a swash plate type variable displacement hydraulic pump.

[0028] The front wheel traveling pump 14F is a variable displacement hydraulic pump that supplies the hydraulic oil for driving the front wheel drive unit F3. In the present embodiment, the front wheel traveling pump 14F is a swash plate type variable displacement hydraulic pump.

[0029] The rear wheel drive unit F1 is a functional element for driving the rear wheels 5L, 5R. In the present embodiment, the rear wheel drive unit F1 includes a left rear wheel traveling motor 20L, a right rear wheel traveling motor 20R, check valves 20La, 20Ra, relief valves 20Lb, 20Rb, and a decelerator switch valve 40.

[0030] The left rear wheel traveling motor 20L is a hydraulic motor for driving the left rear wheel 5L. Further, the right rear wheel traveling motor 20R is a hydraulic motor for driving the right rear wheel 5R. In the present embodiment, the left rear traveling motor 20L and the right rear wheel traveling motor 20R are non-stage transmission hydraulic motors, and form a closed circuit (HST circuit) together with the rear wheel traveling pump 14R.

[0031] The check valve 20La maintains a pressure of the hydraulic oil in a duct C1 that connects a first port of the rear wheel traveling pump 14R and each of second ports of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R at or greater than a predetermined pressure. Specifically, the check valve 20La causes the hydraulic oil discharged by the charge pump 14C to flow into the duct C1 in the case where a pressure of the hydraulic oil in the duct C1 becomes less than the discharge pressure of the charge pump 14C. It should be noted that, in the figure, the numbers in parentheses indicate port numbers. Similarly, the check valve 20Ra maintains a pressure of the hydraulic oil in a duct C2 that connects a second port of the rear wheel traveling pump 14R and each of first ports of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R at or greater than a predetermined pressure. Specifically, the check valve 20Ra causes the hydraulic oil discharged by the charge pump 14C to flow into the duct C2 in the case where a pressure of the hydraulic oil in the duct C2 becomes less than the discharge pressure of the charge pump 14C.

[0032] The relief valve 20Lb maintains a pressure of the hydraulic oil in the duct C1 less than a predetermined relief pressure. Specifically, the relief valve 20Lb causes the hydraulic oil in the duct C1 to flow out of the closed circuit in the case where a pressure of the hydraulic oil in the duct C1 becomes greater than the relief pressure. Similarly, the relief valve 20Rb maintains a pressure of the hydraulic oil in the duct C2 less than a predetermined relief pressure. Specifically, the relief valve 20Rb causes the hydraulic oil in the duct C2 to flow out of the closed circuit in the case where a pressure of the hydraulic oil in the duct C2 becomes greater than the relief pressure.

[0033] The decelerator switch valve 40 is a mechanism for switching respective reduction ratios of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R. In the present embodiment, in response to control instructions from the controller 50, the deceleration switch valve 40 switches respective reduction ratios of the left rear wheel traveling motor 20L and the right rear wheel traveling motor 20R by using the hydraulic oil discharged by the charge pump 14C.

[0034] The conveyor/screw drive unit F2 is a functional element for driving a conveyor and a screw. In the present embodiment, the conveyor/screw drive unit F2 includes mainly a conveyor/screw motor 21 and a conveyor/screw valve 41.

[0035] The conveyor/screw motor 21 is a variable displacement hydraulic motor that forms an open circuit, and includes a conveyor motor and a screw motor. Further, the conveyor/screw valve 41 includes a conveyor control valve and a screw control valve.

[0036] The conveyor control valve is switched in response to control instructions from the controller 50, and causes the hydraulic oil discharged by the conveyor/screw pump 14S to flow into a suction port of the conveyor motor, and causes the hydraulic oil flowing out of a discharge port of the conveyor motor to be discharged

into a hydraulic oil tank T. The screw control valve is switched in response to control instructions from the controller 50, causes the hydraulic oil discharged by the conveyor/screw pump 14S to flow into a suction port of the screw motor, and causes the hydraulic oil flowing out of a discharge port of the screw motor to be discharged into a hydraulic oil tank T. It should be noted that the hydraulic oil flowing out of a discharge port of the screw motor is discharged into the hydraulic oil tank T through an oil cooler 43.

[0037] The front wheel drive unit F3 is a functional element for driving the front wheels 6L, 6R. In the present embodiment, the front wheel drive unit F3 includes mainly front wheel traveling motors 22L, 22R and a front wheel traveling valve 42.

[0038] The front wheel traveling motors 22L, 22R are fixed displacement hydraulic motors that form an open circuit. Further, the front wheel traveling valve 42 is switched in response to control instructions from the controller 50, and causes the hydraulic oil discharged by the front wheel traveling pump 14F to flow into suction ports of the front wheel traveling motors 22L, 22R. The hydraulic oil flowing out of a discharge port of the front wheel traveling pump 14F is discharged into the hydraulic oil tank T without going through the front wheel traveling valve 42.

[0039] The steering/compacting device drive unit F4 is a functional element for driving a steering device (not shown) and a compacting device (not shown). The steering device is a hydraulic device for steering the front wheels 6L, 6R. In the present embodiment, in response to an operation of a steering ST (refer to Fig. 1A) by an operator, the steering device changes a steering angle of the front wheels 6L, 6R by using the hydraulic oil discharged by the cylinder pump 14M. Further, the compacting device is a hydraulic device for compacting the asphalt composite material. In the present embodiment, the compacting device includes a tamper and a vibrator, and causes the tamper and the vibrator to operate by using the hydraulic oil discharged by the cylinder pump 14M.

[0040] The leveling unit F5 is a functional element for adjusting the construction thickness of the asphalt. In the present embodiment, the leveling unit F5 includes mainly a leveling control valves 33L, 33R, leveling cylinders 23L, 23R, and pilot check valves 33La, 33Lb, 33Ra, 33Rb.

[0041] The leveling cylinders 23L, 23R are hydraulic cylinders for moving up and down the leveling arms 3AL, 3AR in order to adjust the construction thickness of the asphalt. The leveling cylinders 23L, 23R are contracted when increasing the construction thickness, and are expanded when decreasing the construction thickness.

[0042] The leveling control valves 33L, 33R switch their valve positions in response to a control signal from the controller 50. In the case of increasing the construction thickness, the leveling control valves 33L, 33R causes the hydraulic oil discharged by the cylinder pump 14M to flow into rod side hydraulic chambers of the leveling cylinders 23L, 23R, and causes the hydraulic oil flowing out of head side hydraulic chambers of the leveling cylinders 23L, 23R to be discharged into the hydraulic oil tank T. In this case, the leveling cylinders 23L, 23R are contracted, and the leveling arms 3AL, 3AR are moved up. On the other hand, in the case of decreasing the construction thickness, the leveling control valves 33L, 33R causes the hydraulic oil discharged by the cylinder pump 14M to flow into the head side hydraulic chambers of the leveling cylinders 23L, 23R, and causes the hydraulic oil flowing out of the rod side hydraulic chambers of the leveling cylinders 23L, 23R to be discharged into the hydraulic oil tank T. In this case, the leveling cylinders 23L, 23R are expanded, and the leveling arms 3AL, 3AR are moved down.

[0043] The pilot check valves 33La, 33Lb, 33Ra, 33Rb prevent the leveling cylinders 23L, 23R from being moved by an external force. For example, the pilot check valve 33La allows the hydraulic oil in the rod side hydraulic chamber of the leveling cylinder 23L to flow toward the hydraulic oil tank T only in the case where the hydraulic oil discharged by the cylinder pump 14M flows into the head side hydraulic chamber of the leveling cylinder 23L. Further, in the case other than the above, the pilot check valve 33La prohibits the hydraulic oil in the rod side hydraulic chamber of the leveling cylinder 23L from flowing toward the hydraulic oil tank T. The same goes for the pilot check valves 33Lb, 33Ra, 33Rb.

[0044] The hopper drive unit F6 is a functional element for opening and closing the hopper 2. In the present embodiment, the hopper drive unit F6 includes mainly a hopper control valves 34L, 34R, hopper cylinders 24L, 24R, and pilot check valves 34La, 34Ra.

[0045] The hopper cylinders 24L, 24R are hydraulic actuators for opening and closing the hopper 2. The hopper cylinders 24L, 24R are contracted when opening the hopper 2, and are expanded when closing the hopper 2.

[0046] The hopper control valves 34L, 34R switch their valve positions in response to a control signal from the controller 50. In the case of opening the hopper 2, the hopper control valves 34L, 34R causes the hydraulic oil discharged by the cylinder pump 14M to flow into rod side hydraulic chambers of the hopper cylinders 24L, 24R, and causes the hydraulic oil flowing out of head side hydraulic chambers of the hopper cylinders 24L, 24R to be discharged into the hydraulic oil tank T. In this case, the hopper cylinders 24L, 24R are contracted. On the other hand, in the case of closing the hopper 2, the hopper control valves 34L, 34R causes the hydraulic oil discharged by the cylinder pump 14M to flow into the head side hydraulic chambers of the hopper cylinders 24L, 24R, and causes the hydraulic oil flowing out of the rod side hydraulic chambers of the hopper cylinders 24L, 24R to be discharged into the hydraulic oil tank T. In this case, the hopper cylinders 24L, 24R are expanded.

[0047] The pilot check valves 34La, 34Ra prevent the hopper 2 from being opened by the contraction of the hopper cylinders 24L, 24R due to the weight of the hopper

2, or due to the weight of hopper 2 and the asphalt composite material in the hopper 2. For example, the pilot check valve 34La allows the hydraulic oil in the head side hydraulic chamber of the hopper cylinder 24L to flow toward the hydraulic oil tank T only in the case where the hydraulic oil discharged by the cylinder pump 14M flows into the rod side hydraulic chamber of the hopper cylinder 24L. Further, in the case other than the above, the pilot check valve 34La prohibits the hydraulic oil in the head side hydraulic chamber of the hopper cylinder 24L from flowing toward the hydraulic oil tank T. The same goes for the pilot check valves 34Ra.

[0048] It should be noted that, in the hopper drive unit F6, pilot check valves are not included between the rod side hydraulic chambers of the hopper cylinders 24L, 24R and the hopper control valves 34L, 34R. This is because there is little possibility that the hopper cylinders 24L, 24R are expanded unintentionally by an external force since the weight of the hopper 2 is large. It should be noted, however, that pilot check valves may be included between the rod side hydraulic chambers of the hopper cylinders 24L, 24R and the hopper control valves 34L, 34R.

[0049] The screed lift unit F7 is a functional element for lifting the screed 3. In the present embodiment, the screed lift unit F7 includes mainly a screed lift control valve 35, screed lift cylinders 25L, 25R, a switch valve 35a, a relief valve 35b, and a switch valve 35c.

[0050] The screed lift cylinders 25L, 25R are hydraulic actuators for lifting the screed 3. The screed lift cylinders 25L, 25R are contracted simultaneously when lifting the screed 3, and are expanded simultaneously when moving down the screed 3.

[0051] The screed lift control valve 35 switches its valve position in response to a control signal from the controller 50. In the case of lifting the screed 3, the screed lift control valve 35 causes the hydraulic oil discharged by the cylinder pump 14M to flow into rod side hydraulic chambers of the screed lift cylinders 25L, 25R. In this case, the switch valve 35a is switched to the first position including a check valve in response to the control signal from the controller 50. This is to prevent the hydraulic oil from flowing backward from the rod side hydraulic chambers of the screed lift cylinders 25L, 25R to the hydraulic oil tank T. It should be noted that the hydraulic oil flowing out of the head side hydraulic chambers of the screed lift cylinders 25L, 25R is discharged into the hydraulic oil tank T without going through the screed lift control valve 35. In this case, the screed lift cylinders 25L, 25R are contracted. On the other hand, in the case of moving down the screed 3 on the ground surface, the screed lift control valve 35 is not used (maintained in a state illustrated in Fig. 2). In this case, the switch valve 35a is switched to the second position not including a check valve in response to the control signal from the controller 50. This is to cause the hydraulic oil in the rod side hydraulic chambers of the screed lift cylinders 25L, 25R to flow toward the hydraulic oil tank T. The screed lift cylinders 25L, 25R are expanded due to the weight of the screed 3, and the hydraulic oil in the rod side hydraulic chambers of the screed lift cylinders 25L, 25R is discharged into the hydraulic oil tank T by going through the switch valve 35a and the relief valve 35b.

[0052] The switch valve 35a and the relief valve 35b realize upward and downward movement of the screed 3 in accordance with changes of lift force (force of the asphalt composite material for lifting the screed 3) that is generated when the asphalt finisher 100 paves the road while moving. Specifically, when the screed 3 moves up due to an increase of the lift force, the screed lift cylinders 25L, 25R are contracted. In this case, the hydraulic oil discharged by the cylinder pump 14M flows into the rod side hydraulic chambers of the screed lift cylinders 25L, 25R by going through a duct C3, the screed lift control valve 35, and the switch valve 35a. On the other hand, when the screed 3 moves down due to a decrease of the lift force, the screed lift cylinders 25L, 25R are expanded. In this case, the hydraulic oil flowing out of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R is discharged into the hydraulic oil tank T by going through the switch valve 35a, the screed lift control valve 35, and the relief valve 35b. It should be noted that, when the asphalt finisher 100 paves the road while moving, in response to a control signal from the controller 50, during when the drive units F8 to F10 are not used, the switch valve 35c is switched to the first position that includes a check valve. This is for not providing bad influence to the drive units F8 to F10 located downstream. Specifically, this is for preventing a crown device, a step device, etc., from moving unintentionally.

[0053] The crown device drive unit F8 is a functional element for driving the crown device. In the present embodiment, the crown device drive unit F8 includes mainly a crown device control valve 36 and a crown device motor 26.

[0054] The crown device is a mechanism for causing the length of a turnbuckle 26a (refer to Fig. 1B) attached between the left front screed 3LF and the right front screed 3RF to increase or decrease, and thus, causing the top contour shape of the screed 3 viewed from the back to be convex or concave. Specifically, in response to control instructions from the controller 50, the crown device causes the length of the turnbuckle 26a to increase or decrease by rotating the crown device motor 26 as a hydraulic actuator.

[0055] The convex degree of the top contour shape of the screed 3 increase as the length of the turnbuckle 26a increases compared with a reference length; the concave degree of the top contour shape of the screed 3 increases as the length of the turnbuckle 26a decreases compared with the reference length; and the top contour shape is linear in the case where the length of the turnbuckle 26a is equal to the reference length.

[0056] The crown device control valve 36 switches its valve position in response to a control signal from the controller 50. In the case of increasing the convex degree

of the top contour shape of the screed 3, the crown device control valve 36 causes the hydraulic oil discharged by the cylinder pump 14M to flow into one port of the crown device motor 26. Further, in the case of increasing the concave degree of the top contour shape of the screed 3, the crown device control valve 36 causes the hydraulic oil discharged by the cylinder pump 14M to flow into the other port of the crown device motor 26.

[0057] The screed expand/contract unit F9 is a functional element for expanding and contracting the rear screeds in the vehicle width direction. In the present embodiment, the screed expand/contract unit F9 includes mainly a screed expand/contract control valves 37L, 37R, screed expand/contract cylinders 27L, 27R, pilot check valves 37La, 37Lb, 37Ra, 37Rb, and relief valves 37Lc, 37Rc.

[0058] The screed expand/contract cylinder 27L is a hydraulic actuator for expanding/contracting the left rear screed 3LR in the vehicle width direction. The screed expand/contract cylinder 27L is contracted when narrowing the width, and is expanded when widening the width. Further, the screed expand/contract cylinder 27R is a hydraulic actuator for expanding/contracting the right rear screed 3RR in the vehicle width direction. The screed expand/contract cylinder 27R is contracted when narrowing the width, and is expanded when widening the width.

[0059] The screed expand/contract control valves 37L, 37R switch their valve positions in response to a control signal from the controller 50. In the case of narrowing the width, the screed expand/contract control valves 37L, 37R causes the hydraulic oil discharged by the cylinder pump 14M to flow into rod side hydraulic chambers of the screed expand/contract cylinders 27L, 27R, and causes the hydraulic oil flowing out of head side hydraulic chambers of the screed expand/contract cylinders 27L, 27R to be discharged into the hydraulic oil tank T. In this case, the screed expand/contract cylinders 27L, 27R are contracted, and the left rear screed 3LR and the right rear screed 3RR are retracted in the center. On the other hand, in the case of widening the width, the screed expand/contract control valves 37L, 37R causes the hydraulic oil discharged by the cylinder pump 14M to flow into the head side hydraulic chambers of the screed expand/contract cylinders 27L, 27R, and causes the hydraulic oil flowing out of the rod side hydraulic chambers of the screed expand/contract cylinders 27L, 27R to be discharged into the hydraulic oil tank T. In this case, the screed expand/contract cylinders 27L, 27R are expanded, and the left rear screed 3LR and the right rear screed 3RR are extruded left and right

[0060] The pilot check valves 37La, 37Lb, 37Ra, 37Rb prevent the screed expand/contract cylinders 27L, 27R from being moved unintentionally by an external force. For example, the pilot check valve 37La allows the hydraulic oil in the rod side hydraulic chamber of the screed expand/contract cylinder 27L to flow toward the hydraulic oil tank T only in the case where the hydraulic oil discharged by the cylinder pump 14M flows into the head side hydraulic chamber of the screed expand/contract cylinder 27L. Further, in the case other than the above, the pilot check valve 37La prohibits the hydraulic oil in the rod side hydraulic chamber of the screed expand/contract cylinder 27L from flowing toward the hydraulic oil tank T. The same goes for the pilot check valves 37Lb, 37Ra, 37Rb.

[0061] The relief valves 37Lc, 37Rc prevent members related to the rear screeds from being destroyed by an excessive external force acting in a direction for causing the rear screeds to be contracted. For example, in the case where a pressure of the hydraulic oil in the head side chamber of the screed expand/contract cylinder 27L increases excessively by receiving an excessive external force acting in a direction for causing the screed expand/contract cylinder 27L to be contracted, the relief valve 37Lc allows the hydraulic oil in the head side chamber to flow into the hydraulic oil tank T. As a result, the screed expand/contract cylinder 27L is contracted, and partially absorbs the external force, and thus, prevents the left rear screed 3LR from being damaged. The same goes for the relief valve 37Rc.

[0062] The step device drive unit F10 is a functional element for driving the step device. In the present embodiment, the step device drive unit F10 includes mainly a step device control valves 38L, 38R, and step device motors 28L, 28R.

[0063] The step device is a mechanism for moving the rear screeds up and down in order to eliminate a step formed between a surface paved by the front screeds and a surface paved by the rear screeds. Specifically, in response to control instructions from the controller 50, the step device rotates the step device motors 28L, 28R as hydraulic actuators, drives a rotational-movement/linear-movement conversion mechanism attached to the rear screeds, and moves the rear screeds up and down.

[0064] The step device control valve 38L switches its valve position in response to a control signal from the controller 50. In the case of moving up the left rear screed 3LR, the step device control valve 38L causes the hydraulic oil discharged by the cylinder pump 14M to flow into one port of the step device motor 28L. Further, in the case of moving down the left rear screed 3LR, the step device control valve 38L causes the hydraulic oil discharged by the cylinder pump 14M to flow into the other port of the step device motor 28L. The same goes for a case in which the step device control valve 38R moves the right rear screed 3RR up and down.

[0065] The canopy drive unit F11 is a functional element for unfolding the folded canopy 10. In the present embodiment, the canopy drive unit F11 includes mainly an auxiliary hydraulic source 60, a self-seal coupling mechanism 46, and a canopy cylinder 29.

[0066] The auxiliary hydraulic source 60 is a hydraulic source prepared separately from the hydraulic source 14. In the present embodiment, the auxiliary hydraulic source 60 includes mainly a manual hydraulic pump system 15 and an auxiliary hydraulic source control valve 39.

[0067] The manual hydraulic pump system 15 pumps and discharges the hydraulic oil in the hydraulic oil tank T in response to up and down movement of an attached lever moved by an operator.

[0068] The auxiliary hydraulic source control valve 39 switches its valve position in response to a manual operation of the operator. In the case of unfolding the canopy 10, the auxiliary hydraulic source control valves 39 causes the hydraulic oil discharged by the manual hydraulic pump system 15 to flow into a head side hydraulic chamber of the canopy cylinder 29, and causes the hydraulic oil flowing out of a rod side hydraulic chamber of the canopy cylinder 29 to be discharged into the hydraulic oil tank T. In this case, the canopy cylinder 29 is expanded, and the canopy 10 in a folded state is unfolded. On the other hand, in the case of folding the unfolded canopy 10, the auxiliary hydraulic source control valve 39 causes the hydraulic oil in the head side chamber of the canopy cylinder 29 to be capable of flowing out; the hydraulic oil in the head side hydraulic chamber flows out due to the weight of the canopy 10; and the canopy cylinder 20 is contracted. In this case, it is not necessary for an operator to manually operate the manual hydraulic pump system 15. This is because the canopy cylinder 29 is contracted naturally while drawing the hydraulic oil in the hydraulic oil tank T into the rod side hydraulic chamber of the canopy cylinder 29 due to the weight of the canopy 10.

[0069] The self-seal coupling mechanism 46 is a mechanism for connecting the head side hydraulic chamber of the canopy cylinder 29 with the auxiliary hydraulic source 60, and includes a pair of couplers 46L, 46R. The coupler 46L is attached to a duct extending from the head side hydraulic chamber of the canopy cylinder 29. The coupler 46R is attached to a duct extending from the discharging side of the auxiliary hydraulic source 60. Further, the self-seal coupling mechanism 46 causes the hydraulic oil to flow through the pair of the couplers 47L, 46R in the case where the pair of the couplers 46L, 46R are connected. Further, in the case where the pair of the couplers 46L, 46R are separated, each of the couplers 46L, 46R seals the duct automatically.

[0070] The self-seal coupling mechanism 47 is a mechanism for connecting the cylinder pump 14M with the drive units F5 to F10, and includes a pair of couplers 47L, 47R. The coupler 47L is attached to a duct extending from the discharging side of the cylinder pump 14M. The coupler 47R is attached to an upstream side duct of the leveling unit F5. Further, the self-seal coupling mechanism 47 causes the hydraulic oil to flow through the pair of the couplers 47L, 46R in the case where the pair of the couplers 46L, 46R are connected. Further, in the case where the pair of the couplers 47L, 47R are separated, each of the couplers 47L, 47R seals the duct automatically.

[0071] By using the above self-seal coupling mechanisms 46, 47, it is possible for an operator to connect the drive units F5 to F10 with, instead of the hydraulic source 14 (combination of the engine 14E and the cylinder pump 14M), the auxiliary hydraulic source 60. As a result, in the case where a failure related to the hydraulic source 14 occurs, it is possible for an operator to cause the drive units F5 to F10 to operate by using the auxiliary hydraulic source 60. Specifically, it is possible for an operator to separate each of the connections of the self-seal coupling mechanisms 46, 47, and to connect the auxiliary hydraulic source 60 with the drive units F5 to F10 by connecting the coupler 46R with the coupler 47R.

[0072] It should be noted that the auxiliary hydraulic source 60 is not used for driving the rear wheel traveling motors 20L, 20R. This is because driving the rear wheel traveling motors 20L, 20R requires a higher discharging pressure and a larger discharging amount compared with a case of driving other hydraulic actuators, and requires a larger scale structure. The same goes for the front wheel traveling motors 22L, 22R. Therefore, a duct extending from the discharging side of the auxiliary hydraulic source 60 is separated from a duct connected to the rear wheel traveling motors 20L, 20R, and the front wheel traveling motors 22L, 22R. The two ducts are in a state of no connection with each other. Further, the two ducts will not be connected with each other even via the self-seal coupling mechanisms. In other words, the self-seal coupling mechanisms 46, 47 are in a state of no connection with ducts connected to the rear wheel traveling motors 20L, 20R and the front wheel traveling motors 22L, 22R.

[0073] Here, referring to Fig. 3, a process will be described in which an operator causes the screed lift unit F7 to operate by using the auxiliary hydraulic source 60. It should be noted that Fig. 3 illustrates a state of the hydraulic system in a case where an operator causes the screed lift unit F7 to operate by using the auxiliary hydraulic source 60, and corresponds to Fig. 2. Further, Fig. 3 illustrates a state in which the coupler 46R has already been connected with the coupler 47R by an operator. It should be noted that solid line arrows in Fig. 3 depict a flow of the hydraulic oil flowing out of the hydraulic oil tank T into each of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R. Dotted line arrows in Fig. 3 depict a flow of the hydraulic oil flowing out of each of the head side hydraulic chambers of the screed lift cylinders 25L, 25R.

[0074] First, an operator manually operates the auxiliary hydraulic source 60 and the auxiliary hydraulic source control valve 39 to cause the hydraulic oil discharged by the manual hydraulic pump system 15 to be directed to the screed lift unit F7. The hydraulic oil discharged by the manual hydraulic pump system 15 goes through the auxiliary hydraulic source control valve 39, the coupler 46R, the coupler 47R, the screed lift control valve 35, and the switch valve 35a, and flows into each of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R. At this time, in the case where an electrical system can be used, the screed lift control valve 35 is switched to a state illustrated in Fig. 3 in response to control instructions from the controller 50 according to

an operational input by the operator via the control panel. In the case where the electrical system cannot be used, the screed lift control valve 35 is switched to a state illustrated in Fig. 3 according to a manual operation of the operator. It should be noted that an operator who operates the screed lift control valve 35 is typically different from an operator who manually operates the manual hydraulic pump system 15, but may be the same operator who operates the manual hydraulic pump system 15.

[0075] When the hydraulic oil flows into each of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R, the hydraulic oil flows out of each of the head side hydraulic chambers of the screed lift cylinders 25L, 25R toward the hydraulic oil tank T. As a result, each of the screed lift cylinders 25L, 25R is contracted, and the screed 3 is lifted.

[0076] When the screed 3 is lifted to a desired height, the operator operates the screed lift control valve 35 to block the hydraulic oil flow from the manual hydraulic pump system 15 to each of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R. As a result, the screed lift cylinders 25L, 25R are maintained in a contracted state, and the screed 3 is maintained in a lifted state.

[0077] Next, referring to Fig. 4, a process will be described in which an operator causes the screed expand/contract unit F9 to operate by using the auxiliary hydraulic source 60. It should be noted that Fig. 4 illustrates a state of the hydraulic system in a case where an operator causes the screed expand/contract unit F9 to operate by using the auxiliary hydraulic source 60, and corresponds to Fig. 2 and Fig. 3. Further, Fig. 4 illustrates a state in which the coupler 46R has already been connected with the coupler 47R by the operator. It should be noted that solid line arrows in Fig. 4 depict a flow of the hydraulic oil flowing out of the hydraulic oil tank T into each of the rod side hydraulic chambers of the screed expand/contract cylinders 27L, 27R. Dotted line arrows in Fig. 4 depict a flow of the hydraulic oil flowing out of each of the head side hydraulic chambers of the screed expand/contract cylinders 27L, 27R. Further, Fig. 4 illustrates the screed lift cylinders 25L, 25R that are contracted by manual operations.

[0078] First, the operator manually operates the auxiliary hydraulic source 60 and the auxiliary hydraulic source control valve 39 to cause the hydraulic oil discharged by the manual hydraulic pump system 15 to be directed to the screed expand/contract unit F9. The hydraulic oil discharged by the manual hydraulic pump system 15 goes through the auxiliary hydraulic source control valve 39, the coupler 46R, the coupler 47R, the screed expand/contract control valves 37L, 37R, and the pilot check valves 37La, 37Ra, and flows into each of the rod side hydraulic chambers of the screed expand/contract cylinders 27L, 27R. At this time, in the case where an electrical system can be used, the switch valve 35c and the screed expand/contract control valves 37L, 37R are switched to a state illustrated in Fig. 4 in response to control instructions from the controller 50 according to an operational input by the operator via the control panel. In the case where the electrical system cannot be used, the switch valve 35c and the screed expand/contract control valves 37L, 37R are switched to a state illustrated in Fig. 4 according to a manual operation of the operator. It should be noted that an operator who operates the switch valve 35c and the screed expand/contract control valves 37L, 37R is typically different from an operator who manually operates the manual hydraulic pump system 15, but may be the same operator who operates the manual hydraulic pump system 15.

[0079] With the above processes, it is possible for an operator to cause the screed lift unit F7, of the asphalt finisher 100 that has become unable to move in a state in which the screed 3 is touched on the pavement surface due to a failure related to the hydraulic source 14, to operate by using the auxiliary hydraulic source 60 to lift the screed 3 from the pavement surface. As described above, even in the case where the asphalt finisher 100 cannot be moved due to a failure related to the hydraulic source 14, it is possible for an operator to cause the asphalt finisher 100 in a state incapable of being towed to be in a state capable of being towed.

[0080] Further, it is possible for an operator to cause the screed expand/contract unit F9, of the asphalt finisher 100 that has become unable to move in a state in which at least one of the left rear screed 3LR and the right rear screed 3RR is expanded in the vehicle width direction due to a failure related to the hydraulic source 14, to operate by using the auxiliary hydraulic source 60 to retract the rear screeds. Further, it is possible for an operator to cause the hopper drive unit F6, of the asphalt finisher 100 that has become unable to move in a state in which the hopper 2 is opened due to a failure related to the hydraulic source 14, to operate by using the auxiliary hydraulic source 60 to close the hopper 2. As described above, even in the case where the asphalt finisher 100 cannot be moved due to a failure related to the hydraulic source 14, it is possible for an operator to cause the asphalt finisher 100 in a state incapable of being transported by a trailer to be in a state capable of being transported by a trailer.

[0081] As a result, it is possible for an operator to quickly cause the asphalt finisher 100 to be in a state capable of being towed or a state capable of being transported by a trailer, while avoiding the cumbersome work. The cumbersome work includes works of, for example, lifting the screed 3 with a crane after removing the piping or a hose of the hydraulic cylinder that the operator wants to operate, pushing the rear screeds toward the center by using another machine, or closing the hopper 2 by using another machine.

[0082] Normally, the pavement construction of a road such as an express highway and a national highway is carried out by closing the road, and the pavement construction of an airport runway is carried out at night when the runway is not used. Further, there is a limit to the time

the road can be closed and there is a limit to the time the runway is not used, and thus, the pavement construction must be finished within the time limits. Under these limits, in the case where the asphalt finisher 100 has become unable to move due to a failure related to the hydraulic source 14, it is required that at least the asphalt finisher 100 is moved out of the construction site within the time limits in order to recover the construction site. Even in the case where the asphalt finisher 100 has become unable to move due to a failure related to the hydraulic source 14, it is possible for the above-described hydraulic system to quickly and easily cause the asphalt finisher 100 to be in a state capable of being towed, and thus, the above requirements can be satisfied.

[0083] It should be noted that, in the above embodiment, after causing the screed lift cylinders 25L, 25R to be contracted by using the auxiliary hydraulic source 60, the operator causes the screed expand/contract cylinders 27L, 27R to be contracted, or causes the hopper cylinders 24L, 24R to be expanded. This is to cause the asphalt finisher 100 to be in a state capable of being towed as soon as possible. However, the operator may carry out the contraction of the screed lift cylinders 25L, 25R, the contraction of the screed expand/contract cylinders 27L, 27R, and the expanding of the hopper cylinders 24L, 24R in different order, or may carry out simultaneously.

[0084] Further, in the above embodiment, the operator causes the screed expand/contract cylinders 27L, 27R to be contracted simultaneously. However, the operator may cause the screed expand/contract cylinders 27L, 27R to be contracted one by one in order. The same goes for the hopper cylinders 24L, 24R.

[0085] Further, in the above embodiment, the operator connects the coupler 46R attached to a duct extending from the discharging side of the auxiliary hydraulic source 60 with the coupler 47R attached to a duct of the upstream side of the leveling unit F5 in order to cause each of the drive units F5 to F10 to operate. However, the auxiliary hydraulic source 60 may be connected to right before the upstream side of the rode side hydraulic chambers of the screed lift cylinders 25L, 25R in order to only cause the screed lift cylinders 25L, 25R to be contracted. Specifically, a connection mechanism that is similar to the self-seal coupling mechanism 47 may be located right before the upstream side of the rod side hydraulic chambers of the screed lift cylinders 25L, 25R. In this case, in order to make the auxiliary hydraulic source 60 capable of causing the screed expand/contract cylinders 27L, 27R to be contracted, a connection mechanism as described above may be additionally arranged right before the upstream side of the rod side hydraulic chambers of the screed expand/contract cylinders 27L, 27R. Further, in order to make the auxiliary hydraulic source 60 capable of causing the hopper cylinders 24L, 24R to be expanded, a connection mechanism as described above may be additionally arranged right before the upstream side of the head side hydraulic chambers of the hopper cylinders 24L, 24R. Further, a connection mechanism as described above may be additionally arranged right before the upstream side of other hydraulic cylinders.

[0086] Further, in the above embodiment, the auxiliary hydraulic source 60 is connected to the hydraulic system to be able to cause each of the drive units F5 to F10 to operate. However, the auxiliary hydraulic source 60 may be connected to the hydraulic system to be able to cause only the screed lift unit F7 to operate. This is because it is possible to cause the asphalt finisher 100 to be at least in a state capable of being towed if the screed lift unit F7 can be caused to operate. Further, the auxiliary hydraulic source 60 may be connected to the hydraulic system to be able to cause only the hopper drive unit F6, the screed lift unit F7, and the screed expand/contract unit F9. This is because it is possible to cause the asphalt finisher 100 to be at least in a state capable of being towed and capable of being transported by a trailer if the hopper drive unit F6, the screed lift unit F7, and the screed expand/contract unit F9 can be caused to operate.

[0087] Further, in the above embodiment, the auxiliary hydraulic source 60 is attached to the asphalt finisher 100 in a fixed manner. However, the auxiliary hydraulic source 60 may be attached to the asphalt finisher 100 in a detachable and re-attachable manner. In this case, another self-seal coupling mechanism may be arranged between the suction side of the auxiliary hydraulic source 60 and the hydraulic oil tank T. With the above arrangement, even in the case where the auxiliary hydraulic source 60 is not included in the asphalt finisher 100 as standard equipment, it is possible for an operator to attach an auxiliary hydraulic source 60 located at another location to the asphalt finisher 100 as necessary.

[0088] Further, in the above embodiment, the auxiliary hydraulic source 60 includes the manual hydraulic pump system 15. However, the auxiliary hydraulic source 60 may include an electric hydraulic pump system or an accumulator.

[0089] Further, the auxiliary hydraulic source 60 may be a portable type. In this case, preferably, the auxiliary hydraulic source 60 has such a size and weight that can be carried by one operator alone.

[0090] Further, in the above embodiment, the suction side of the auxiliary hydraulic source 60 is connected to the hydraulic oil tank T in an undetachable manner. Further, the discharge side of the auxiliary hydraulic source 60 is either connected to the discharge side of the cylinder pump 14M via the self-seal coupling mechanism 47 or connected to the expansion side hydraulic chamber (head side hydraulic chamber) of the canopy cylinder 29 via the self-seal coupling mechanism 46 in a detachable and re-attachable manner. In other words, the auxiliary hydraulic source 60 is attached mainly in order to cause the canopy cylinder 29 to be expanded. In addition to the above, the auxiliary hydraulic source 60 is attached in order to, in an emergency, cause the hopper cylinders 24L, 24R to be expanded, to cause the screed lift cylinders 25L, 25R to be contracted, or to cause the screed

expand/contract cylinders 27L, 27R to be contracted. However, the main use of the auxiliary hydraulic source 60 may be other than causing the canopy cylinder 29 to be expanded. Further, the auxiliary hydraulic source 60 may be attached in order to be used only in an emergency.

[0091] Further, the hydraulic system may include two or more auxiliary hydraulic sources. In this case, the discharge side of the first auxiliary hydraulic source may be connected to the discharge side of the cylinder pump 14M via the self-seal coupling mechanism 47 in a detachable manner and the discharge side of the second auxiliary hydraulic source may be connected to the expansion side hydraulic chamber (head side hydraulic chamber) of the canopy cylinder 29 via the self-seal coupling mechanism 46 in a detachable manner. Further, at least one of the self-seal coupling mechanism 46 and the self-seal coupling mechanism 47 may be omitted. In other words, the discharge side of at least one of the first auxiliary hydraulic source and the second auxiliary hydraulic source may be connected in an undetachable manner. It should be noted that, in the case where the self-seal coupling mechanism 47 is omitted, a stop valve may be arranged between a point, to which the discharge side of the first auxiliary hydraulic source is connected, and the discharge side of the cylinder pump 14M. This is to prevent the hydraulic oil discharged by the first auxiliary hydraulic source from leaking out of the cylinder pump 14M in an emergency use.

[0092] As described above, preferable embodiments of the present invention have been explained in detail. However, the present invention shall not be limited to the above embodiments. Variety of modifications and substitutions can be applied to the above embodiments without deviating from the scope of the present invention.

[0093] For example, in the above embodiment, the present invention has been applied to an asphalt finisher. However, the present invention may be applied to other road machineries, such as a concrete finisher or a motor grader, which may become incapable of being towed, or incapable of being transported by a trailer due to a failure related to the hydraulic source.

[0094] Further, the present application is based on and claims the benefit of priority of Japanese Priority Application No. 2014-208605 filed on October 10, 2014, the entire contents of which are incorporated herein by reference.

[DESCRIPTION OF THE REFERENCE NUMERALS]

[0095]

1: tractor,
2: hopper,
3: screed,
3AL: left leveling arm,
3AR: right leveling arm,
3LF: left front screed,
3RF: right front screed,
3LR: left rear screed,
3RR: right rear screed,
5L, 5R: rear wheels,
6L, 6R: front wheels,
10: canopy,
14: hydraulic source,
14C: charge pump,
14E: engine,
14F: front wheel traveling pump,
14M: cylinder pump,
14R: rear wheel traveling pump,
14S: conveyor/screw pump,
15: manual hydraulic pump system,
20L, 20R: rear wheel traveling motor,
20La, 20Ra: check valves,
20Lb, 20Rb: relief valves,
21: conveyor/screw motor,
22L, 22R: front wheel traveling motor,
23L, 23R: leveling cylinders,
24L, 24R: hopper cylinders,
25L, 25R: screed lift cylinders,
26: crown device motor,
26a: turnbuckle,
27L, 27R: screed expand/contract cylinders,
28L, 28R: step device motor,
29: canopy cylinder,
33L, 33R: leveling control valves,
33La, 33Ra, 33Lb, 33Rb: pilot check valves,
34L, 34R: hopper control valves,
34La, 34Ra: pilot check valves,
35: screed lift control valve,
35a: switch valve,
35b: relief valve,
35c: switch valve,
36: crown device control valve,
37L, 37R: screed expand/contract control valves,
37La, 37Ra, 37Lb, 37Rb: pilot check valves,
37Lc, 37Rc: relief valves,
38L, 38R: step device control valves,
39: auxiliary hydraulic source control valve,
40: deceleration switch valve,
41: conveyor/screw valve,
42: front wheel traveling valve,
43: oil cooler,
46: self-seal coupling mechanism,
46L, 46R: couplers,
47: self-seal coupling mechanism,
47L, 47R: couplers,
50: controller,
60: auxiliary hydraulic source,
F1: rear wheel drive unit,
F2: conveyor/screw drive unit,
F3: front wheel drive unit,
F4: steering/compacting device drive unit,
F5: leveling unit,
F6: hopper drive unit,
F7: screed lift unit,

F8: crown device drive unit,
F9: screed expand/contract unit,
F10: step device drive unit,
F11: canopy drive unit,
ST: steering,
T: hydraulic oil tank

Claims

1. An asphalt finisher comprising:

a first hydraulic pump configured to supply hydraulic oil to a traveling motor;
a second hydraulic pump configured to supply hydraulic oil to a hydraulic actuator; and
a drive source configured to drive the first hydraulic pump and the second hydraulic pump, wherein
an auxiliary hydraulic source capable of supplying hydraulic oil to the hydraulic actuator is not used for driving the traveling motor.

2. The asphalt finisher according to claim 1, wherein a duct of a discharge side of the auxiliary hydraulic source is separated from a duct connected to the traveling motor.

3. The asphalt finisher according to claim 1, further comprising:

the auxiliary hydraulic source.

4. The asphalt finisher according to claim 1, further comprising:

a connection mechanism connectable to the auxiliary hydraulic source.

5. The asphalt finisher according to claim 1, wherein the hydraulic actuator includes a screed lift cylinder, and
the auxiliary hydraulic source is capable of supplying the hydraulic oil to at least the screed lift cylinder.

6. The asphalt finisher according to claim 1, wherein the auxiliary hydraulic source is attachable to and detachable from the asphalt finisher.

7. The asphalt finisher according to claim 1, wherein the auxiliary hydraulic source is a manual hydraulic pump system, an electric hydraulic pump system, or an accumulator.

8. The asphalt finisher according to claim 1, wherein the auxiliary hydraulic source is a portable type.

9. The asphalt finisher according to claim 1, wherein a discharge side of the auxiliary hydraulic source is connectable to a discharge side of the second hydraulic pump via a first self-seal coupling mechanism, and is connectable to an expansion side hydraulic chamber of a canopy cylinder via a second self-seal coupling mechanism.

10. The asphalt finisher according to claim 2, further comprising:

a self-seal coupling mechanism,
wherein the self-seal coupling mechanism and a duct connected to the traveling motor are in a state of no connection.

FIG.1A

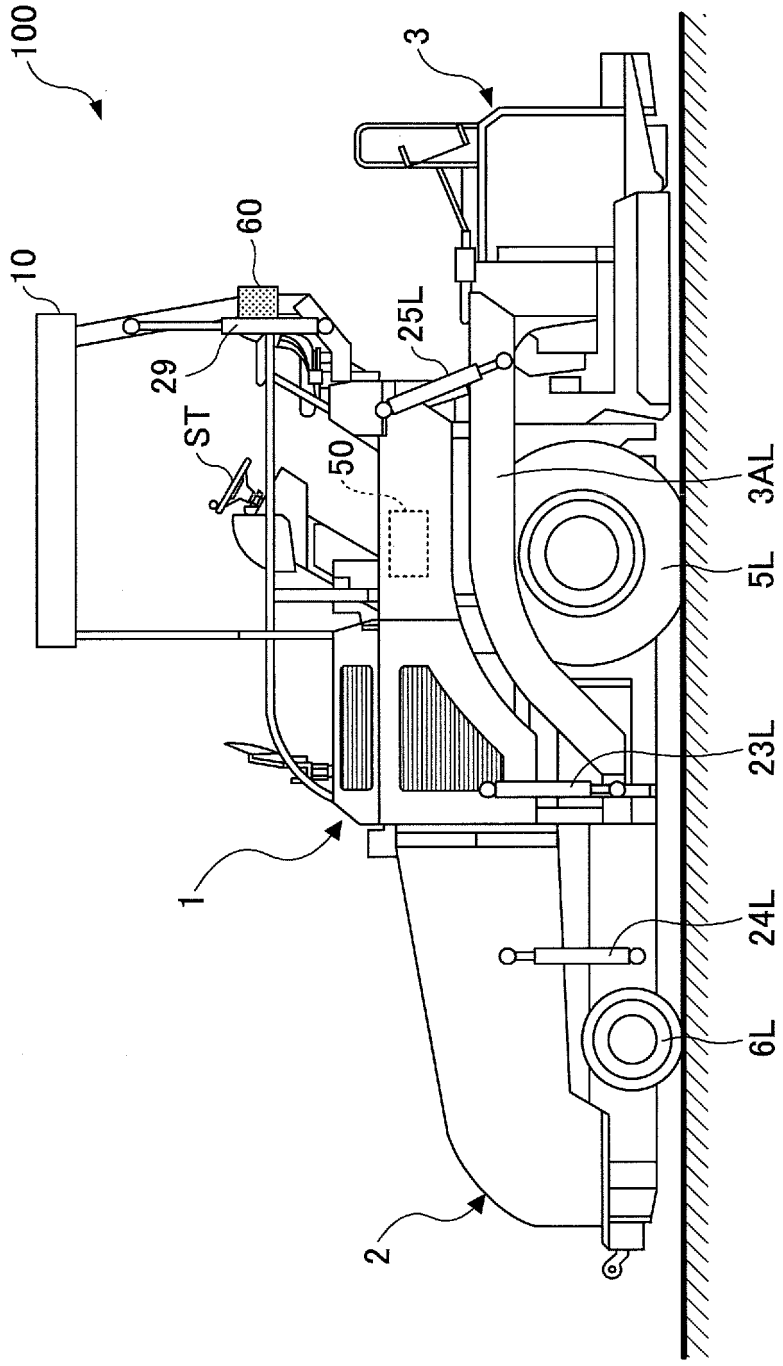
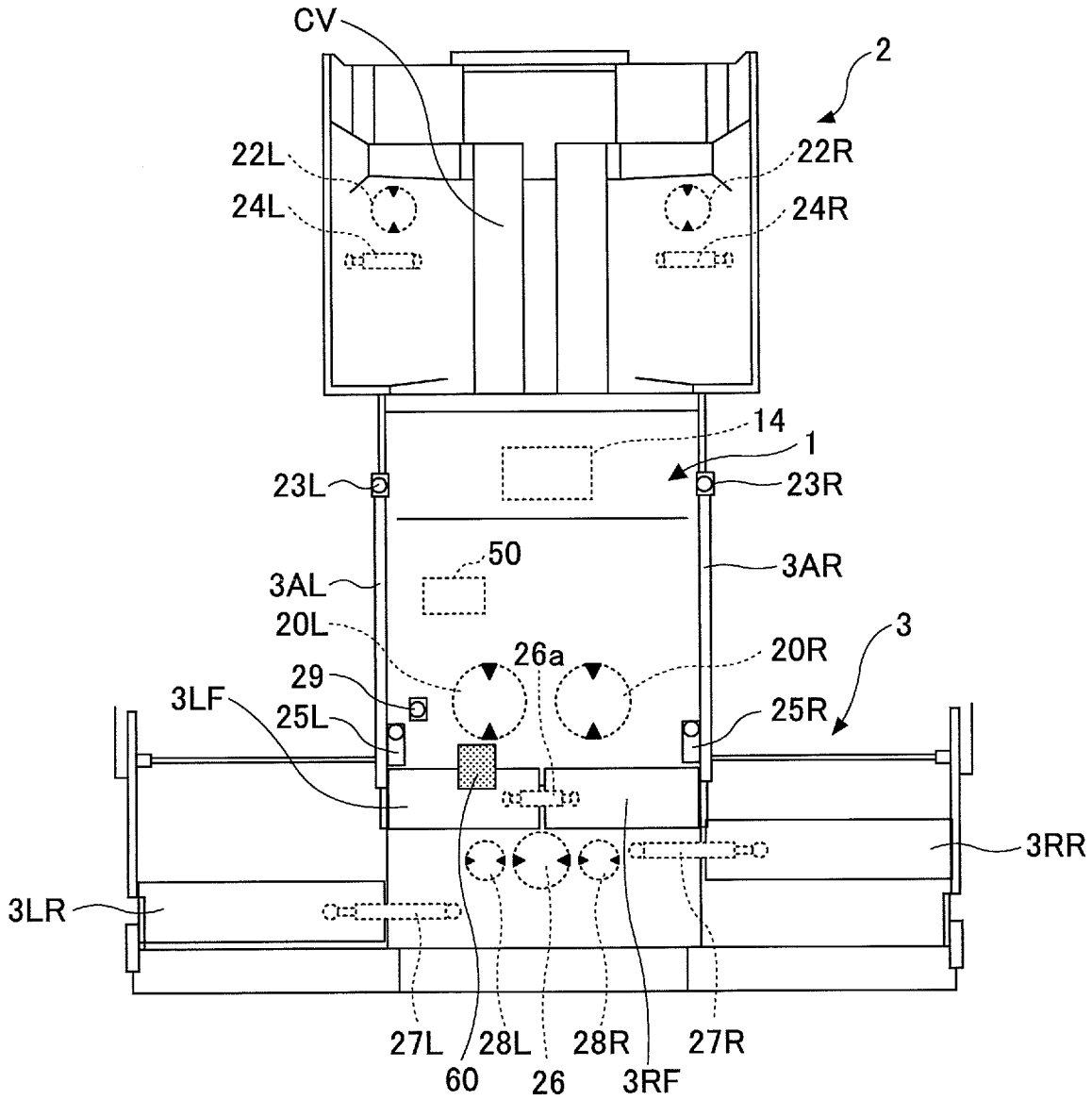


FIG.1B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24R
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50
3AL
3AR
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26a
20R
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25L
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3RR
3LR
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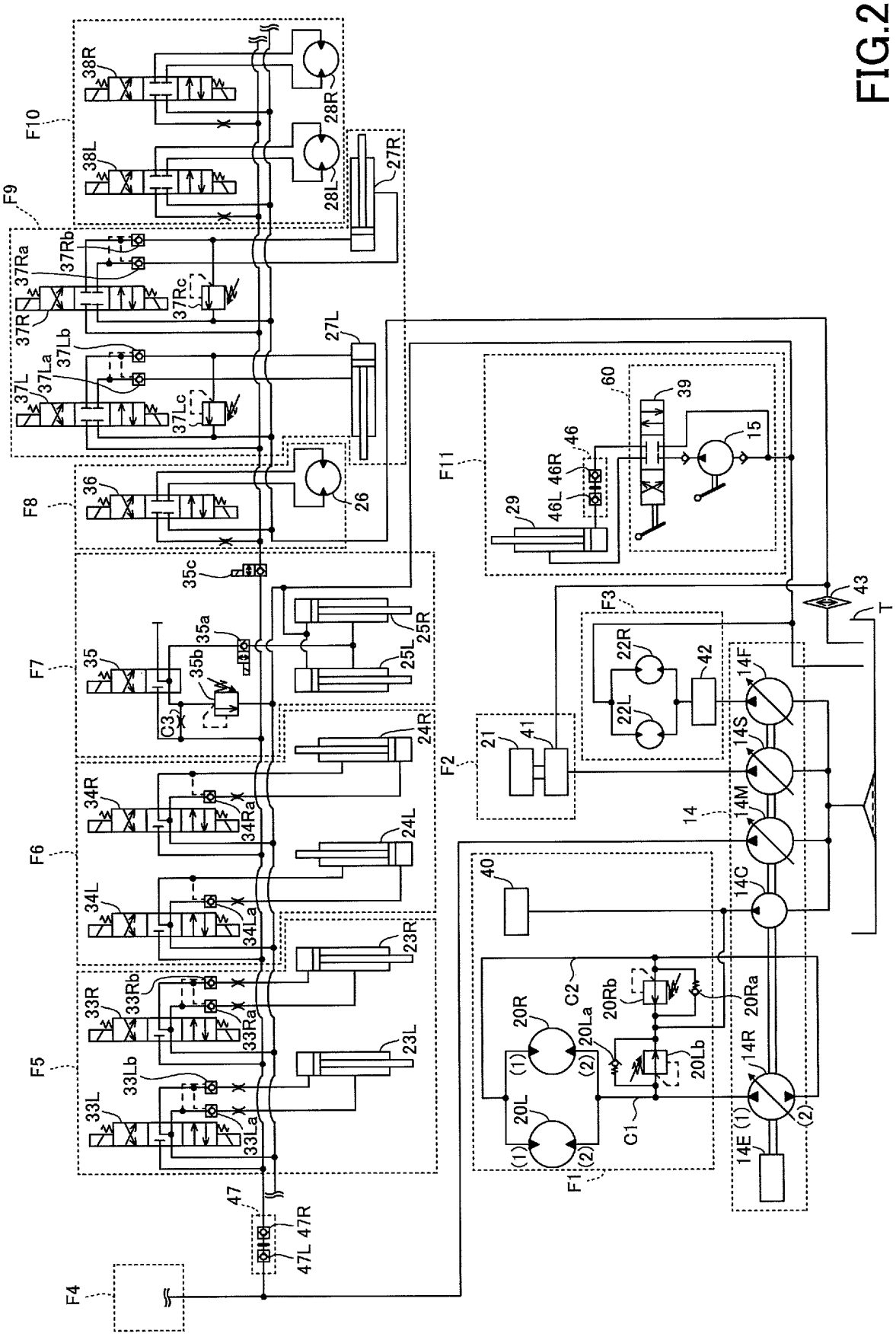
28L
28R
27R
60
26
3RF

FIG.2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F7
F6
F5
F4
F11
F3
F2
F1
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38L
28R
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37Rb
37Ra
37R
37Rc
37L
37La
37Lb
37Lc
27L
36
26
35c
35
35a
35b
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25R
25L
24R
24L
23R
23L
34R
34Ra
34L
34La
33R
33Rb
33Ra
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33L
33La
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15
46
46R
46L
29
43
T
22R
22L
42
21
41
14F
14S
14M
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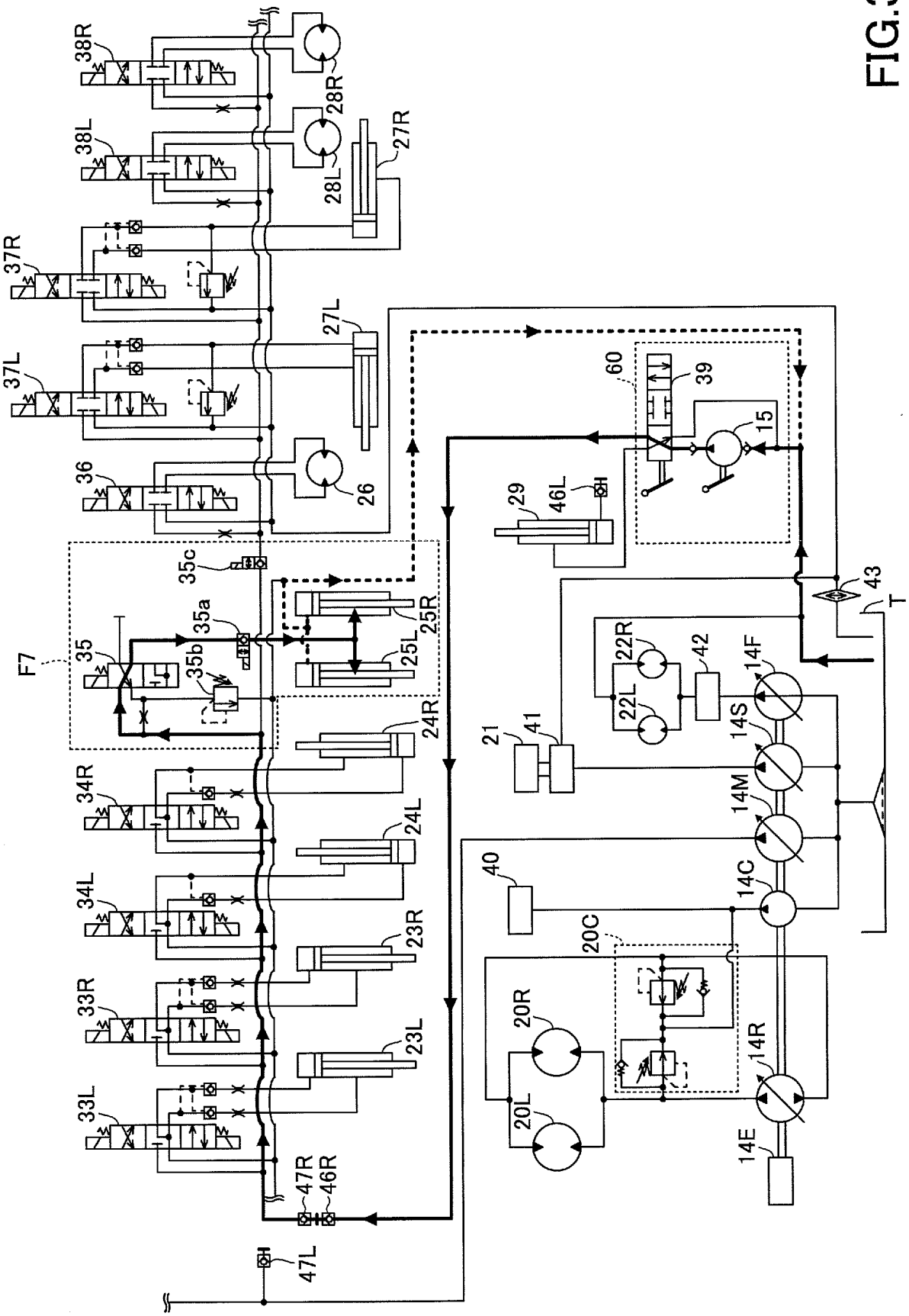
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37R
37L
36
28R
28L
27R
27L
26
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35a
35b
35
F7
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24R
24L
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23L
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33L
47R
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47L
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39
15
29
46L
43
T
22R
22L
42
14F
14S
14M
14C
14R
14E
21
41
40
20C
20R
20L

FIG.3

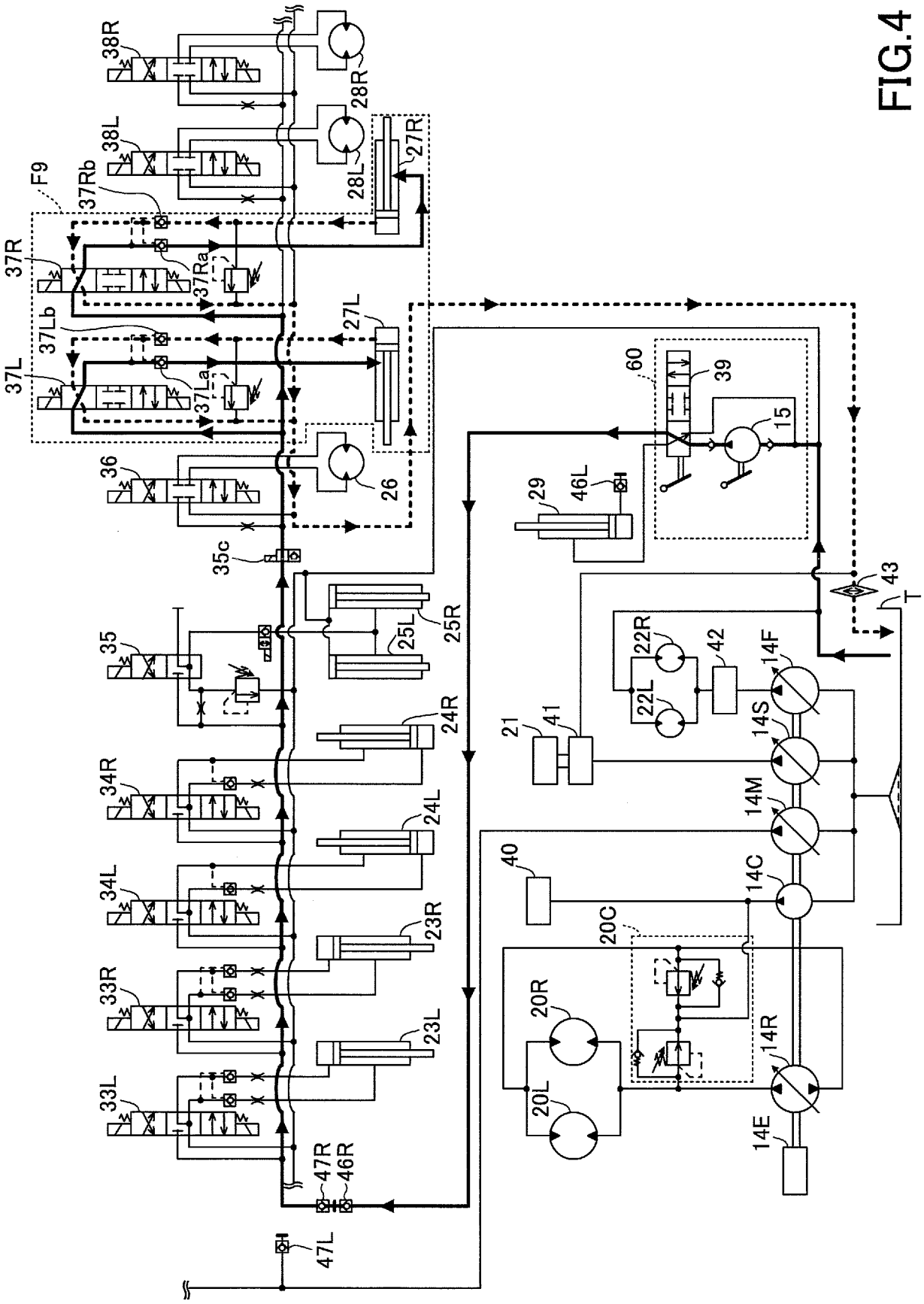
38R
28R
38L
28L
27R
F9
37Rb
37R
37Ra
37Lb
37L
37La
27L
26
36
35c
35
25L
25R
24R
34R
24L
34L
23R
33R
23L
33L
47R
46R
47L
60
39
15
29
46L
43
T
22R
22L
42
14F
21
41
14S
14M
40
14C
20C
20R
20L
14R
14E

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/078529

A. CLASSIFICATION OF SUBJECT MATTER
E01C19/48(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E01C19/00-19/52, E02F9/24, F15B20/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2012-31890 A (Sumitomo Construction Machinery Co., Ltd.), 16 February 2012 (16.02.2012), paragraphs [0017], [0019] to [0021], [0023]; fig. 1 to 2 (Family: none)	1-6,8 1-10
Y	JP 8-120710 A (Shin Caterpillar Mitsubishi Ltd.), 14 May 1996 (14.05.1996), paragraphs [0010], [0033], [0045], [0058] to [0063] (Family: none)	1-10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 December 2015 (09.12.15)	22 December 2015 (22.12.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/078529

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2012-67454 A (Nippon Sharyo, Ltd.), 05 April 2012 (05.04.2012), paragraph [0018] (Family: none)	9-10

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3145668 B **[0004]**
- JP 2014208605 A **[0094]**