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(54) **CONSTRUCTION MACHINE**

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(73) Proprietor: **Hitachi Construction Machinery Tierra Co., Ltd.**
Shiga 528-0061, (JP)

(72) Inventors:
- **YAMAMOTO, Daisuke**
Koka-shi, Shiga 528-0061 (JP)
- **NAKATANI, Kenichiro**
Koka-shi, Shiga 528-0061 (JP)

(74) Representative: **Manitz Finsterwald Patent- und Rechtsanwaltspartnerschaft mbB**
Martin-Greif-Strasse 1
80336 München (DE)

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a construction machine such as a hydraulic excavator, and more particularly, to a construction machine with a blade used in ground leveling work.

BACKGROUND ART

[0002] A hydraulic excavator is generally configured, as a typical construction machine, to include a self-propelled lower traveling structure and an upper revolving structure mounted rotatably on the lower traveling structure through a revolving apparatus. A working mechanism is provided on a front side of the upper revolving structure. A blade (earth removal plate) extending in the left-and-right direction is provided on a front side of a truck frame that constitutes the lower traveling structure, and the blade is used to perform earth and sand removing work and ground leveling work for developed land, roads and so on.

[0003] Herein, when ground leveling work is performed using a bulldozer, an earthwork system is known to detect with laser beams, GPS and other devices the position of a blade mounted on the bulldozer to control the operation of the blade, depending on the ground to be leveled. The earthwork system includes a laser transmitter transmitting reference beams composed of laser beams and a laser receiver mounted on the blade of the bulldozer through a mast and detecting the laser beams. Accordingly, the laser receiver detects the height position of the blade based upon the height of the laser beams to allow ground leveling work to be performed with the blade, depending on the ground to be leveled (see Patent Document 1) .

[0004] Another ground leveling system is known to control the operation of a blade according to three-dimensional data of the ground to be leveled even in hydraulic excavators with such a blade. The ground leveling system includes a position detector such as a prism mounted on the blade of a hydraulic excavator through a mast and a controller controlling the operation of the blade. The height position of the blade is continuously detected by transmitting and receiving laser beams between a total station installed in a working site and the position detector. As a result, the controller controls the operation of the blade based upon the position thereof and three-dimensional data of the ground to be leveled to allow ground leveling work suitable for the ground to be leveled to be performed.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005] Patent Document 1: Patent Publication No. 5064505 A construction machine in accordance with the preamble of claim 1 is known from JP 2020 012255 A.

SUMMARY OF THE INVENTION

[0006] A blade of a hydraulic excavator, which extends in the left-and-right direction, is normally provided with a position detector such as a prism on either a left end portion or a right end portion of the blade through a mast. Herein, the mounting position of the mast relative to the blade is determined in view of the following conditions. That is, there are no obstacles between a total station and the position detector. The range of the total station to track the position detector is wider, with the total station installed at a place so as not to prevent traveling of a working vehicle or receive any vibrational or other effects. Therefore, the mast is installed upright on either a left end portion or a right end portion of the blade to satisfy the above-described conditions, and the position detector is mounted on an upper end of the mast.

[0007] Meanwhile, obstacles such as rocks that can hamper ground leveling work may be buried in the ground prior to the start of the ground leveling work using a blade of a hydraulic excavator. In this case, such obstacles must be unburied from the ground to be leveled for removal by revolving an upper revolving structure and operating a bucket of a working mechanism at the same time. Therefore, when the mast is installed upright on the left end portion or the right end portion of the blade, the upper revolving structure must carefully be revolved so as not to allow the working mechanism to interfere with the mast. Thus, the operational efficiency for removing obstacles using the working mechanism is unfortunately reduced.

[0008] Moreover, the position at which the working mechanism interferes with the mast varies depending on whether the mast is installed upright on the left end portion or the right end portion of the blade. Thus, the operation of carefully revolving the upper revolving structure so as not to allow the working mechanism to interfere with the mast is complicated, and this drawback unfortunately further reduces the operational efficiency for removing obstacles using the working mechanism.

[0009] It is an object of one embodiment of the present invention to provide a construction machine capable of preventing a working mechanism from interfering with a mast by revolving operation of an upper revolving structure regardless of the mounting position of the mast relative to a blade.

[0010] One embodiment of the present invention provides a construction machine including: a self-propelled lower traveling structure; an upper revolving structure provided with a working mechanism and mounted rotatably on the lower traveling structure; a blade mounted rotatably on the lower traveling structure and extending in the left-and-right direction; a mast mounted on the blade and extending in the vertical direction; a blade position detector provided on an upper end side of the mast to detect the position of the blade, wherein the construction machine including: a mast position detecting device detecting the mounting position of the mast relative to the blade and a rotation limiting device limiting the revolving range for allowing the upper revolving structure to revolve, depending on the mounting position of the mast detected by the mast position detecting device.

[0011] One embodiment of the present invention can prevent a working mechanism from interfering with a mast by revolving operation of an upper revolving structure regardless of the mounting position of the mast relative to a blade.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a left side view of a hydraulic excavator according to a first embodiment of the present invention.
Fig. 2 is a perspective view of a blade, a mast, a left proximity sensor and so on seen from a left rear side.
Fig. 3 is a plan view of a hydraulic excavator without a mast and a prism seen from above.
Fig. 4 is a plan view of a hydraulic excavator showing a left side revolution limiting range of an upper revolving structure.
Fig. 5 is a plan view of the hydraulic excavator showing a right side revolution limiting range of the upper revolving structure.
Fig. 6 is a hydraulic circuit diagram including a rotation limiting device, a control lever device, a revolving motor and so on according to the first embodiment.
Fig. 7 is a hydraulic circuit diagram according to a second embodiment, which is similar to Fig. 6.

MODE FOR CARRYING OUT THE INVENTION

[0013] Hereinafter, embodiments of the present invention will be in detail explained referring to the accompanying drawings by taking a case of being applied to a hydraulic excavator as an example. Figs. 1 to 6 show a first embodiment. In this embodiment, the running direction of a hydraulic excavator is defined as front-and-rear direction, and the direction perpendicular to the running direction of the hydraulic excavator is defined as left-and-right direction.

[0014] A hydraulic excavator 1 is generally configured, as a typical construction machine, to include a crawler type lower traveling structure 2 that is self-propelled in a front-and-rear direction and an upper revolving structure 4 mounted rotatably on the lower traveling structure 2 via a revolving apparatus 3. A swing type working mechanism 5 excavating earth and sand and performing other works is provided on a front side of the upper revolving structure 4.

[0015] The lower traveling structure 2 includes a truck frame 2A that is to be a base, and the truck frame 2A has left and right side frames 2B provided as a pair in the left-and-right direction and extending in the front-and-rear direction. An idler wheel 2C is provided on one side in the front-and-rear direction of the left and right side frames 2B, and a drive wheel 2D is provided on another side in the front-and-rear direction. A crawler belt 2E is wound around the idler wheel 2C and the drive wheel 2D, and the drive wheel 2D drives the crawler belt 2E to allow the lower traveling structure 2 to travel. Also, a later-described earth and sand removing device 18 is provided on the truck frame 2A of the lower traveling structure 2.

[0016] The upper revolving structure 4 is mounted rotatably on the truck frame 2A of the lower traveling structure 2 via the revolving apparatus 3. The upper revolving structure 4 is configured to include a later-described revolving frame 6, a counterweight 7, an operator's seat 8, an engine 12, a canopy 16, and an exterior cover 17.

[0017] The working mechanism 5 is configured to include a swing post 5A, a boom 5B, an arm 5C, a bucket 5D, a boom cylinder 5E, an arm cylinder 5F, and a bucket cylinder 5G. The swing post 5A is mounted on a front end of the revolving frame 6 in the left-and-right direction to be capable of swinging. The boom 5B is mounted on the swing post 5A to be capable of tilting up and down. The arm 5C is mounted rotatably at a tip end of the boom 5B, and the bucket 5D is mounted rotatably at a tip end of the arm 5C. In addition, a swing cylinder 5H swinging the swing post 5A in the left-and-right direction is provided between the revolving frame 6 and the swing post 5A (see Fig. 3).

[0018] A revolving frame 6 constitutes a base of the upper revolving structure 4. The revolving frame 6 is mounted rotatably on the truck frame 2A via the revolving apparatus 3. A support bracket 6A projecting forward is provided at a front end of the revolving frame 6. The swing post 5A of the working mechanism 5 is supported on the support bracket 6A in the left-and-right direction to be capable of swinging. The counterweight 7 is provided on a rear side of the revolving frame 6, and a weight balance is taken with the working mechanism 5 by the counterweight 7.

[0019] Herein, the rear surface 7A of the counterweight 7 is formed in such a manner as to be accommodated within the vehicle width dimension of the lower traveling structure 2 in the left-and-right direction (the interval between left and right crawler belts 2E) when the upper revolving structure 4 is revolved. As a result, the hydraulic excavator 1 achieves a rear small turn of the upper revolving structure 4 to prevent interference of the upper revolving structure 4 in rotation with nearby obstacles.

[0020] An operator's seat 8 is located on a front side of the counterweight 7 and mounted on the revolving frame 6. The operator's seat 8 is provided for an operator operating the hydraulic excavator 1 to be seated. A control lever device 9 operating the revolving apparatus 3, the working mechanism 5 and the like is disposed on left and right sides of the operator's seat 8. A gate lock lever 10 is provided on a lower side of the left control lever device 9. The gate lock lever 10 switches between "enabling" and "disabling" the operation of the control lever device 9. A blade control lever operating the earth and sand removing device 18 (not shown) is disposed on the right side of the right side control lever device 9. A multi-monitor 11 is provided on a front side of the right side control lever device 9. The multi-monitor 11 displays to an operator information such as the state of operation of the hydraulic excavator 1, setup, and alarms, for example.

[0021] An engine 12 is provided on a lower side of the operator's seat 8 as a prime mover. The engine 12 is located on the front side of the counterweight 7 and mounted on the revolving frame 6 to drive a hydraulic pump 13. The hydraulic pump 13 supplies pressurized oil to hydraulic actuators such as cylinders 5E, 5F, 5G, 5H of the working mechanism 5, a traveling motor of the lower traveling structure 2 (not shown), and a later-described revolving motor 31. The prime mover used may be an electric motor, or a hybrid type prime mover composed of an engine and an electric motor combined.

[0022] A floor member 14 is provided on a front side of the operator's seat 8. The floor member 14 is composed of a flat plate body, which forms a foothold for the operator seated in the operator's seat 8. A pair of left and right traveling lever/pedal devices 15 are provided on the floor member 14. Traveling operation of the lower traveling structure 2 is controlled by manual operation or stepping-on operation of the left and right traveling lever/pedal devices 15.

[0023] A canopy 16 covers the operator's seat 8 from above. The canopy 16 is configured as a two-column canopy to include left and right columns 16A and a roof 16B. The left and right columns 16A are installed upright on an upper surface of the counterweight 7 with intervals in the left-and-right direction. The roof 16B is provided on an upper end side of the left and right columns 16A. This embodiment shows an example of a canopy type hydraulic excavator 1 with a canopy 16, but such an excavator may include a cab in place of a canopy 16.

[0024] An exterior cover 17 is provided on the revolving frame 6 so as to surround the operator's seat 8. The exterior cover 17 covers a heat exchanger, a hydraulic oil tank, a fuel tank and the like (each not shown) mounted on the revolving frame 6. The exterior cover 17 is configured to include a right rear cover 17A, a right front cover 17B, a left rear cover 17C, and a skirt cover 17D. The right rear cover 17A covers the engine 12, the heat exchanger and the like from the right side and the upper side. The right front cover 17B covers the hydraulic oil tank, the fuel tank and the like from the right side and the upper side. The left rear cover 17C covers the engine 12, the hydraulic pump 13 and the like from the left side, and the skirt cover 17D covers an area between a bottom plate of the revolving frame 6 and the floor member 14.

[0025] Subsequently, an earth and sand removing device 18 provided on the lower traveling structure 2 will be described.

[0026] The earth and sand removing device 18 is provided on the truck frame 2A of the lower traveling structure 2. The earth and sand removing device 18 is configured to include a V-shaped lifting arm 19, a blade 20, a lifting cylinder 21, an angle cylinder 22, and a tilt cylinder 23. A base end side of the lifting arm 19 is mounted rotatably on the truck frame 2A, and a tip end side thereof is capable of swinging in the vertical direction.

[0027] The blade 20 is mounted rotatably on the truck frame 2A of the lower traveling structure 2 through the lifting arm 19, and extends in the left-and-right direction. The blade 20 is composed of a rectangular plate-shaped member extending in the left-and-right direction, and has a larger length dimension than the interval of the left and right crawler belts 2E of the lower traveling structure 2. A central portion of a rear surface 20A of the blade 20 is mounted at a tip end of the lifting arm 19 through a universal pin 20B.

[0028] The lifting cylinder 21 is provided between the lifting arm 19 and the truck frame 2A, and extends in the front-and-rear direction. The angle cylinder 22 is provided between a left part of the lifting arm 19 and the rear surface 20A of the blade 20, and extends in the front-and-rear direction. The tilt cylinder 23 is provided between the lifting arm 19 and the blade 20, and extends in the left-and-right direction along the rear surface 20A of the blade 20.

[0029] The angle cylinder 22 swings in the front-and-rear direction both ends of the blade 20 provided in the left-and-right direction (length direction), with the universal pin 20B positioned centrally. As a result, earth and sand pushed out by the blade 20 can be discharged all together leftward or rightward from the lower traveling structure 2. The tilt cylinder 23 swings in the vertical direction both ends of the blade 20 provided in the left-and-right direction, with the universal pin 20B positioned centrally. As a result, the ground to be leveled by the blade 20 can be sloped. The lifting cylinder 21 and the tilt cylinder 23 control the height position and posture of the control blade 20 by controlling supply and discharge of pressurized oil with a control valve for the blade 20 (not shown).

[0030] A left mast platform 20D composed of a rectangular plate body is fixed on the left end portion 20C of the blade 20. A right mast platform 20F having the same shape as the left mast platform 20D is fixed on a right end portion 20E of the blade 20. A mounting flange 24A of a later-described mast 24 is mounted detachably on the left mast platform 20D and the right mast platform 20F.

[0031] The mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20. The mast 24 is formed as a linear cylindrical body made of a pipe material, for example. A rectangular and flat mounting flange 24A is fixed on a lower end of the mast 24. The mounting flange 24A is mounted detachably on the left mast platform 20D or the right mast platform 20F of the blade 20, using bolts or other tightening tools. As a result, the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20, and extends vertically upward. A prism 25 is mounted on an upper end 24B of the mast 24.

[0032] The prism 25, as a blade position detector, is provided on the upper end 24B of the mast 24 to detect the position of the blade 20. The prism 25 is an object (target) to be tracked by an auto-tracking total station (not shown) when ground leveling work is performed using the earth and sand removing device 18. The total station continuously measures the position and height of the blade 20 by tracking the prism 25, and outputs the measured data to a controller for performing ground leveling work (not shown) as positional information of the blade 20 wirelessly.

[0033] The controller for performing ground leveling work controls a control valve for the blade 20 (not shown) based upon the positional information of the blade 20 outputted from the total station. When ground leveling work is performed using the earth and sand removing device 18, the operation of the lifting cylinder 21, the tilt cylinder 23 and the like that constitute the earth and sand removing device 18 is controlled according to three-dimensional data of the ground to be leveled.

[0034] Herein, the mounting position of the mast 24 relative to the blade 20 is determined in view of the following conditions. That is, there are no obstacles between the total station and the prism 25. The range of the total station to track the prism 25 is wider, with the total station installed at a place so as not to prevent traveling of a working vehicle or receive any vibrational or other effects. Thus, the mast 24 is installed upright on either the left end portion 20C or the right end portion 20E of the blade 20 to satisfy the above-described conditions. Then, the prism 25 is mounted on the upper end 24B of the mast 24.

[0035] A monitor device 26 is provided on a rear side of the right front cover 17B that constitutes the exterior cover 17, for example. The monitor device 26 is mounted on the revolving frame 6, using a bracket or the like, and disposed rightward from the operator's seat 8. The monitor device 26 displays data such as three-dimensional data of the ground to be leveled and measured positional information of the blade 20 when ground leveling work is performed using the earth and sand removing device 18.

[0036] Subsequently, a left proximity sensor 27 and a right proximity sensor 28 used in this embodiment will be described as a mast position detecting device detecting whether the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20.

[0037] The left proximity sensor 27 is provided adjacent to the left mast platform 20D on the blade 20. The left proximity sensor 27 detects the mounting flange 24A when the mounting flange 24A of the mast 24 is mounted on the left mast platform 20D. Then, the left proximity sensor 27 outputs to a later-described controller 40 a signal indicating that the mast 24 is mounted on the left end portion 20C of the blade 20.

[0038] The right proximity sensor 28 is provided adjacent to the right mast platform 20F on the blade 20. The right proximity sensor 28 constitutes the mast position detecting device together with the left proximity sensor 27. The right proximity sensor 28 detects the mounting flange 24A when the mounting flange 24A of the mast 24 is mounted on the right mast platform 20F. Then, the right proximity sensor 28 outputs to the controller 40 a signal indicating that the mast 24 is mounted on the right end portion 20E of the blade 20. As a result, a signal is outputted from either the left proximity sensor 27 or the right proximity sensor 28 to the controller 40, depending on whether the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20.

[0039] Subsequently, a rotation limiting device 29 limiting the revolving range for allowing the upper revolving structure 4 to revolve, depending on the mounting position of the mast 24 relative to the blade 20, will be described with reference to Fig. 6.

[0040] The rotation limiting device 29 limits the revolving range of the upper revolving structure 4, depending on the mounting position of the mast 24, with the mast 24 mounted on the blade 20. The rotation limiting device 29 is configured to include a later-described directional control valve 33, a left revolution stoppage valve 38, a right revolution stoppage valve 39, and a controller 40.

[0041] The hydraulic pump 13 and the tank 30 constitute a hydraulic power source, and the hydraulic power source and the revolving motor 31 are connected through a main line 32. The directional control valve 33 is located between the hydraulic power source and the revolving motor 31 and provided in the main line 32. The directional control valve 33 allows the revolving motor 31 to switch between left revolution and right revolution, depending on pilot pressure supplied relative to the left hydraulic pilot portion 33A and the right hydraulic pilot portion 33B. Supply of the pilot pressure to the left hydraulic pilot portion 33A allows the revolving motor 31 to rotate in the left revolving direction (direction of left revolution for the upper revolving structure 4). Supply of the pilot pressure to the right hydraulic pilot portion 33B allows the revolving motor 31 to rotate in the right revolving direction (direction of right revolution for the upper revolving structure 4).

[0042] A pilot hydraulic power source 34 is configured by the pilot pump 35 and the tank 30. The control lever device 9 is configured by a pressure reducing valve type pilot valve having a control lever 9A. The control lever device 9 and the left hydraulic pilot portion 33A of the directional control valve 33 are connected via a pilot line 36 for left revolution. The control lever device 9 and the right hydraulic pilot portion 33B of the directional control valve 33 are connected via a pilot line 37 for right revolution. Pilot pressure from the pilot pump 35 is supplied to the left hydraulic pilot portion 33A or the right hydraulic pilot portion 33B of the directional control valve 33, depending on the operational direction and operating amount of the control lever 9A provided on the control lever device 9. Supply of pilot pressure relative to the left hydraulic pilot portion 33A and the right hydraulic pilot portion 33B is stopped when the control lever 9A of the control lever device 9 is at a neutral position. As a result, the directional control valve 33 returns to the neutral position to stop rotation of the revolving motor 31.

[0043] A left revolution stoppage valve 38 is provided in the pilot line 36 for left revolution. The left revolution stoppage valve 38 is configured by a 3-port and 2-position electromagnetic valve having a solenoid operated pilot portion 38A. The solenoid operated pilot portion 38A is connected to an output side of the controller 40. The left revolution stoppage valve 38 allows the pilot line 36 to be communicated by retaining a communication position (a) when no control signal is supplied from the controller 40 to the solenoid operated pilot portion 38A.

[0044] Pilot pressure is supplied to the left hydraulic pilot portion 33A of the directional control valve 33 through the pilot line 36 when the control lever 9A of the control lever device 9 is operated in an arrow L direction. As a result, the revolving motor 31 rotates in the left revolving direction, which allows the upper revolving structure 4 to perform left revolution, depending on the operating amount relative to the control lever 9A. Meanwhile, supply of a control signal from the controller 40 to the solenoid operated pilot portion 38A of the left revolution stoppage valve 38 allows the left revolution stoppage valve 38 to switch to a blockade position (b) and shut off the pilot line 36. As a result, the revolving motor 31 stops rotation, which will stop left revolving operation of the upper revolving structure 4.

[0045] A right revolution stoppage valve 39 is provided in the pilot line 37 for right revolution. The right revolution stoppage valve 39 is configured by a 3-port and 2-position electromagnetic valve having a solenoid operated pilot portion 39A. The solenoid operated pilot portion 39A is connected to the output side of the controller 40. The right revolution stoppage valve 39 allows the pilot line 37 to be communicated by retaining a communication position (c) when no control signal is supplied from the controller 40 to the solenoid operated pilot portion 39A.

[0046] Pilot pressure is supplied to the right hydraulic pilot portion 33B of the directional control valve 33 through the pilot line 37 when the control lever 9A of the control lever device 9 is operated in an arrow R direction. As a result, the revolving motor 31 rotates in the right revolving direction, which allows the upper revolving structure 4 to perform right revolution, depending on the operating amount relative to the control lever 9A. Meanwhile, supply of a control signal from the controller 40 to the solenoid operated pilot portion 39A of the right revolution stoppage valve 39 allows the right revolution stoppage valve 39 to switch to a blockade position (d) and shut off the pilot line 37. As a result, the revolving motor 31 stops rotation, which will stop right revolving operation of the upper revolving structure 4.

[0047] The controller 40 is mounted on the upper revolving structure 4. An angle sensor 41, a left proximity sensor 27, a right proximity sensor 28, a left revolution pressure sensor 42, a right revolution pressure sensor 43 and other parts are connected to an input side of the controller 40. The solenoid operated pilot portion 38A of the left revolution stoppage valve 38, the solenoid operated pilot portion 39A of the right revolution stoppage valve 39 and other parts are connected to the input side of the controller 40. The angle sensor 41 is provided on the revolving apparatus 3, for example. The angle sensor 41 detects the revolving angle (revolving position) of the upper revolving structure 4 relative to the lower traveling structure 2, and outputs to the controller 40 a signal corresponding to the revolving angle. The left proximity sensor 27 outputs to the controller 40 a signal indicating that the mast 24 is mounted on the left end portion 20C of the blade 20. The right proximity sensor 28 outputs to the controller 40 a signal indicating that the mast 24 is mounted on the right end portion 20E of the blade 20. The left revolution pressure sensor 42 is provided in the pilot line 36 for left revolution, for example. The left revolution pressure sensor 42 detects pilot pressure supplied to the left hydraulic pilot portion 33A of the directional control valve 33, and outputs to the controller 40 a signal corresponding to the pilot pressure. The right revolution pressure sensor 43 is provided in the pilot line 37 for right revolution, for example. The right revolution pressure sensor 43 detects pilot pressure supplied to the right hydraulic pilot portion 33B of the directional control valve 33, and outputs to the controller 40 a signal corresponding to the pilot pressure.

[0048] The controller 40 sets a later-described left side revolution limiting range α when the controller determines that the mast 24 is mounted on the left end portion 20C of the blade 20 according to a signal from the left proximity sensor 27. Then, the controller 40 stops the revolving motor 31 when the revolving angle of the upper revolving structure 4 detected by the angle sensor 41 reaches the left side revolution limiting range ex. Specifically, the controller 40 determines whether the revolving direction of the upper revolving structure 4 is left revolution or right revolution according to signals from the left revolution pressure sensor 42 and the right revolution pressure sensor 43. The controller 40 stops the revolving motor 31 in cases where the revolving direction of the upper revolving structure 4 approaches the mast 24 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range ex. Meanwhile, the controller 40 continues revolving operation of the upper revolving structure 4 in cases where the revolving direction of the upper revolving structure 4 is spaced apart from the mast 24 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range ex.

[0049] The controller 40 sets a later-described right side revolution limiting range β when the controller determines that the mast 24 is mounted on the right end portion 20E of the blade 20 according to a signal from the right proximity sensor 28. Then, the controller 40 stops the revolving motor 31 when the revolving angle of the upper revolving structure 4 detected by the angle sensor 41 reaches the right side revolution limiting range β. Specifically, the controller 40 stops the revolving motor 31 in cases where the revolving direction of the upper revolving structure 4 approaches the mast 24 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β. Meanwhile, the controller 40 continues revolving operation of the upper revolving structure 4 in cases where the revolving direction of the upper revolving structure 4 is spaced apart from the mast 24 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β.

[0050] Herein, the left side revolution limiting range α set by the controller 40 regarding the mast 24 that is mounted on the left end portion 20C of the blade 20 will be described. In this embodiment, a virtual line passing through a revolving center A of the upper revolving structure 4 and extending in the front-and-rear direction is defined as B-B. A case where a boom 5B of a working mechanism 5 extends parallel to the virtual line B-B (the state in Figs. 1 and 3) and then the upper revolving structure 4 revolves is illustrated.

[0051] As shown in Fig. 4, a virtual line passing through the revolving center A of the upper revolving structure 4 and a center C of the mast 24 mounted on the left end portion 20C of the blade 20 is defined as a left reference line D-D. The left reference line D-D is inclined at an angle θ relative to the virtual line B-B in the left revolving direction. The left reference line D-D is positioned when the working mechanism 5 interferes with the mast 24 while the upper revolving structure 4 performs revolving operation. Therefore, the angle totaling constant margin angles (margin ranges) α1 to rotate the upper revolving structure 4 in the left revolving direction and the right revolving direction with reference to the left reference line D-D is the left side revolution limiting range ex. The controller 40 sets the left side revolution limiting range α when the mast 24 is mounted on the left end portion 20C of the blade 20. Then, the controller 40 allows the left revolution stoppage valve 38 or the right revolution stoppage valve 39 to stop the revolving motor 31 during left revolution or right revolution of the upper revolving structure 4 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range ex.

[0052] Herein, the right side revolution limiting range β set by the controller 40 regarding the mast 24 that is mounted on the right end portion 20E of the blade 20 will be described.

[0053] As shown in Fig. 5, a virtual line passing through the revolving center A of the upper revolving structure 4 and a center E of the mast 24 mounted on the right end portion 20E of the blade 20 is defined as a right reference line F-F. The right reference line F-F is inclined at an angle θ relative to the virtual line B-B in the right revolving direction. The right reference line F-F is positioned when the working mechanism 5 interferes with the mast 24 while the upper revolving structure 4 performs revolving operation. Therefore, the angle totaling constant margin angles (margin ranges) β1 to rotate the upper revolving structure 4 in the left revolving direction and the right revolving direction with reference to the right reference line F-F is the right side revolution limiting range β. The controller 40 sets the right side revolution limiting range β when the mast 24 is mounted on the right end portion 20E of the blade 20. Then, the controller 40 allows the left revolution stoppage valve 38 or the right revolution stoppage valve 39 to stop the revolving motor 31 during left revolution or right revolution of the upper revolving structure 4 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β.

[0054] The hydraulic excavator 1 of this embodiment is configured as stated above, and a case where ground leveling work is performed using the earth and sand removing device 18 of the hydraulic excavator 1 will be described.

[0055] The mast 24 is mounted on the left end portion 20C or the right end portion 20E of the blade 20, depending on the position of the total station installed in a working site (not shown) when ground leveling work is performed. That is, the mast 24 is installed upright at either the left end portion 20C or the right end portion 20E of the blade 20 in cases where there are no obstacles between the total station and the prism 25 and there is a wider range for the total station to be able to track the prism 25. The prism 25 transmitting and receiving laser beams with the total station is mounted on the upper end 24B of the mast 24.

[0056] When ground leveling work is performed using the hydraulic excavator 1, obstacles such as rocks buried on the ground must be excavated and removed as preoperation using the bucket 5D of the working mechanism 5. Thus, the working mechanism 5 can interfere with the mast 24 by revolving the upper revolving structure 4, with the mast 24 mounted on the blade 20. Therefore, an operator must carefully revolve the upper revolving structure 4 so as not to allow the working mechanism 5 to interfere with the mast 24, thereby lowering the operational efficiency for removing obstacles using the working mechanism 5.

[0057] On the other hand, a signal is outputted from the left proximity sensor 27 to the controller 40 when the mast 24 is mounted on the left end portion 20C of the blade 20, for example. As a result, the controller 40 determines that the mast 24 is mounted on the left end portion 20C of the blade 20. Then, the controller 40 sets the left side revolution limiting range α shown in Fig. 4 in order to avoid interference between the working mechanism 5 and the mast 24.

[0058] In this state, the upper revolving structure 4 performs left revolution in the arrow L direction in Fig. 3 when the control lever 9A of the control lever device 9 is operated in the left revolving direction (the arrow L direction in Fig. 6) . Likewise, the upper revolving structure 4 performs right revolution in the arrow R direction in Fig. 3 when the control lever 9A of the control lever device 9 is operated in the right revolving direction (the arrow R direction in Fig. 6).

[0059] Pilot pressure is provided to the left hydraulic pilot portion 33A of the directional control valve 33 when the control lever 9A is operated in the left revolving direction, with the mast 24 mounted on the left end portion 20C of the blade 20. As a result, pressurized oil from the hydraulic pump 13 allows for rotation of the revolving motor 31 in the left revolving direction and left revolution of the upper revolving structure 4. At this time, the left revolution pressure sensor 42 and the right revolution pressure sensor 43 output to the controller 40 signals corresponding to the pressures in the pilot lines 36 , 37. As a result, the controller 40 determines that the upper revolving structure 4 performs left revolution. Meanwhile, the angle sensor 41 detects the revolving angle (revolving position) of the upper revolving structure 4 to output to the controller 40 a signal indicative of the revolving angle. The controller 40 determines that left revolution of the upper revolving structure 4 allows the working mechanism 5 to approach the mast 24 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range α shown in Fig. 4, and outputs a control signal to the solenoid operated pilot portion 38A of the left revolution stoppage valve 38. As a result, the left revolution stoppage valve 38 is switched to the blockade position (b) to shut off the pilot line 36. Therefore, the revolving motor 31 stops rotation and left revolving operation of the upper revolving structure 4 stops, thereby allowing the working mechanism 5 to avoid interference with the mast 24. In this state, pilot pressure is provided to the right hydraulic pilot portion 33B of the directional control valve 33 when the control lever 9A is operated in the right revolving direction. Therefore, the revolving motor 31 rotates in the right revolving direction and the upper revolving structure 4 performs right revolving operation to allow the working mechanism 5 to separate from the mast 24.

[0060] Meanwhile, pilot pressure is provided to the right hydraulic pilot portion 33B of the directional control valve 33 when the control lever 9A is operated in the right revolving direction, with the mast 24 mounted on the left end portion 20C of the blade 20. As a result, pressurized oil from the hydraulic pump 13 allows for rotation of the revolving motor 31 in the right revolving direction and right revolution of the upper revolving structure 4. At this time, the controller 40 determines that the upper revolving structure 4 performs right revolution based on signals from the left revolution pressure sensor 42 or the right revolution pressure sensor 43. In addition, the angle sensor 41 detects the revolving angle of the upper revolving structure 4 to output to the controller 40 a signal indicative of the revolving angle. The controller 40 determines that right revolution of the upper revolving structure 4 allows the working mechanism 5 to approach the mast 24 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range α shown in Fig. 4, and outputs a control signal to the solenoid operated pilot portion 39A of the right revolution stoppage valve 39. As a result, the right revolution stoppage valve 39 is switched to the blockade position (d) to shut off the pilot line 37. Therefore, the revolving motor 31 stops rotation and right revolving operation of the upper revolving structure 4 stops, thereby allowing the working mechanism 5 to avoid interference with the mast 24. In this state, pilot pressure is provided to the left hydraulic pilot portion 33A of the directional control valve 33 when the control lever 9A is operated in the left revolving direction. Therefore, the revolving motor 31 rotates in the left revolving direction and the upper revolving structure 4 performs left revolving operation to allow the working mechanism 5 to separate from the mast 24.

[0061] As described above, the controller 40 sets the left side revolution limiting range α when the mast 24 is mounted on the left end portion 20C of the blade 20. As a result, revolving operation of the upper revolving structure 4 stops when the revolving angle of the upper revolving structure 4 detected by the angle sensor 41 reaches the left side revolution limiting range α regardless of whether the upper revolving structure 4 performs left revolution or right revolution. Therefore, the operator need not revolve the upper revolving structure 4 carefully so as not to allow the working mechanism 5 to interfere with the mast 24. Consequently, the operational efficiency for removing obstacles using the working mechanism 5 can be enhanced.

[0062] Subsequently, a signal is outputted from the right proximity sensor 28 to the controller 40 when the mast 24 is mounted on the right end portion 20E of the blade 20, for example. As a result, the controller 40 determines that the mast 24 is mounted on the right end portion 20E of the blade 20, and sets the right side revolution limiting range β shown in Fig. 5 to avoid interference between the working mechanism 5 and the mast 24.

[0063] Pilot pressure is provided to the right hydraulic pilot portion 33B of the directional control valve 33 when the control lever 9A of the control lever device 9 is operated in the right revolving direction, with the mast 24 mounted on the right end portion 20E of the blade 20. As a result, pressurized oil from the hydraulic pump 13 allows for rotation of the revolving motor 31 in the right revolving direction and right revolution of the upper revolving structure 4. At this time, the controller 40 determines that the upper revolving structure 4 performs right revolution based on signals from the left revolution pressure sensor 42 or the right revolution pressure sensor 43. Meanwhile, the angle sensor 41 detects the revolving angle of the upper revolving structure 4 to output to the controller 40 a signal indicative of the revolving angle. The controller 40 determines that right revolution of the upper revolving structure 4 allows the working mechanism 5 to approach the mast 24 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β shown in Fig. 5, and outputs a control signal to the solenoid operated pilot portion 39A of the right revolution stoppage valve 39. As a result, the right revolution stoppage valve 39 is switched to the blockade position (d) to shut off the pilot line 37. Therefore, the revolving motor 31 stops rotation and right revolving operation of the upper revolving structure 4 stops, thereby allowing the working mechanism 5 to avoid interference with the mast 24. In this state, pilot pressure is provided to the left hydraulic pilot portion 33A of the directional control valve 33 when the control lever 9A is operated in the left revolving direction. Therefore, the revolving motor 31 rotates in the left revolving direction and the upper revolving structure 4 performs left revolving operation to allow the working mechanism 5 to separate from the mast 24.

[0064] Meanwhile, pilot pressure is provided to the left hydraulic pilot portion 33A of the directional control valve 33 when the control lever 9A is operated in the left revolving direction, with the mast 24 mounted on the right end portion 20E of the blade 20. As a result, pressurized oil from the hydraulic pump 13 allows for rotation of the revolving motor 31 in the left revolving direction and left revolution of the upper revolving structure 4. At this time, the controller 40 determines that the upper revolving structure 4 performs left revolution based on signals from the left revolution pressure sensor 42 and the right revolution pressure sensor 43. In addition, the angle sensor 41 detects the revolving angle of the upper revolving structure 4 to output to the controller 40 a signal indicative of the revolving angle. The controller 40 determines that left revolution of the upper revolving structure 4 allows the working mechanism 5 to approach the mast 24 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β shown in Fig. 5, and outputs a control signal to the solenoid operated pilot portion 38A of the left revolution stoppage valve 38. As a result, the left revolution stoppage valve 38 is switched to the blockade position (b) to shut off the pilot line 36. Therefore, the revolving motor 31 stops rotation and left revolving operation of the upper revolving structure 4 stops, thereby allowing the working mechanism 5 to avoid interference with the mast 24. In this state, pilot pressure is provided to the right hydraulic pilot portion 33B of the directional control valve 33 when the control lever 9A is operated in the right revolving direction. Therefore, the revolving motor 31 rotates in the right revolving direction and the upper revolving structure 4 performs right revolving operation to allow the working mechanism 5 to separate from the mast 24.

[0065] As described above, the controller 40 sets the right side revolution limiting range β when the mast 24 is mounted on the right end portion 20E of the blade 20. As a result, revolving operation of the upper revolving structure 4 stops when the revolving angle of the upper revolving structure 4 detected by the angle sensor 41 reaches the right side revolution limiting range β regardless of whether the upper revolving structure 4 performs right revolution or left revolution. Therefore, the operator need not revolve the upper revolving structure 4 carefully so as not to allow the working mechanism 5 to interfere with the mast 24. Consequently, the hydraulic excavator 1 of this embodiment can prevent the working mechanism 5 from interfering with the mast 24 by revolving operation of the upper revolving structure 4, regardless of the mounting position of the mast 24 relative to the blade 20. Therefore, the operational efficiency for removing obstacles using the working mechanism 5 can be enhanced as a pre-operation of ground leveling work using the blade 20.

[0066] Moreover, the revolving operation of the upper revolving structure 4 is limited by the left side revolution limiting range α when the mast 24 is mounted on the left end portion 20C of the blade 20, or otherwise it is not limited. In addition, the revolving operation of the upper revolving structure 4 is limited by the right side revolution limiting range β when the mast 24 is mounted on the right end portion 20E of the blade 20, or otherwise it is not limited. Consequently, a large range of the upper revolving structure 4 to revolve can be ensured, and the operational efficiency for removing obstacles using the working mechanism 5 can be enhanced as a pre-operation of ground leveling work using the blade 20, for example.

[0067] Accordingly, ground leveling work is performed using the earth and sand removing device 18 (blade 20) after removing obstacles such as rocks buried in the ground using the bucket 5D of the working mechanism 5, while avoiding interference between the mast 24 and the working mechanism 5.

[0068] The ground is leveled by allowing the hydraulic excavator 1 to travel with a lower end of the blade 20 in contact with the ground when the ground leveling work is performed using the earth and sand removing device 18. At this time, a total station (not shown) tracks the prism 25 mounted on the blade 20 through the mast 24. As a result, the total station continuously measures the position and height of the blade 20, and outputs the measured data to a controller for performing ground leveling work (not shown) as positional information of the blade 20.

[0069] The controller for performing ground leveling work controls a control valve (not shown) for the blade 20 based upon outputs and the like from the total station. As a result, the operation of the earth and sand removing device 18 (lifting cylinder 21, tilt cylinder 23) is controlled according to three-dimensional data of the ground to be leveled. Consequently, the posture of the blade 20 (height, tilt angle or the like) varies according to the three-dimensional data of the ground to be leveled to perform ground leveling work suitable for the ground to be leveled.

[0070] Therefore, the hydraulic excavator 1 of this embodiment includes a self-propelled lower traveling structure 2, an upper revolving structure 4 provided with a working mechanism 5 and mounted rotatably on the lower traveling structure 2, a blade 20 mounted rotatably on the lower traveling structure 2 and extending in the left-and-right direction, a mast 24 mounted on the blade 20 and extending in the vertical direction, and a prism 25 provided on an upper end side of the mast 24 to detect the position of the blade 20. Also, the hydraulic excavator 1 is provided with a left proximity sensor 27 and a right proximity sensor 28 detecting the mounting position of the mast 24 relative to the blade 20, and a rotation limiting device 29 limiting the revolving range for allowing the upper revolving structure 4 to revolve, depending on the mounting position of the mast 24 detected by the left proximity sensor 27 and the right proximity sensor 28.

[0071] This configuration allows the left proximity sensor 27 and the right proximity sensor 28 to detect the mounting position of the mast 24 relative to the blade 20 and the revolving range of the upper revolving structure 4 to be limited, depending on the mounting position of the mast 24. Consequently, the hydraulic excavator 1 of this embodiment can prevent the working mechanism 5 from interfering with the mast 24 by revolving operation of the upper revolving structure 4, regardless of the mounting position of the mast 24 relative to the blade 20.

[0072] In this embodiment, the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20, the rotation limiting device 29 sets the left side revolution limiting range α in the left revolving direction and the right revolving direction with reference to a position at which the working mechanism 5 interferes with the mast 24 (left reference line D-D) when the left proximity sensor 27 and the right proximity sensor 28 detect the left end portion 20C of the blade 20 as the mounting position of the mast 24, and stops revolving operation of the upper revolving structure 4 when the revolving angle of the upper revolving structure 4 reaches the left side revolution limiting range ex. Also, the rotation limiting device 29 sets the right side revolution limiting range β in the left revolving direction and the right revolving direction with reference to a position at which the working mechanism 5 interferes with the mast 24 (right reference line F-F) when the left proximity sensor 27 and the right proximity sensor 28 detect the right end portion 20E of the blade 20 as the mounting position of the mast 24, and stops revolving operation of the upper revolving structure 4 when the revolving angle of the upper revolving structure 4 reaches the right side revolution limiting range β.

[0073] According to this configuration, the revolving operation of the upper revolving structure 4 is limited by the left side revolution limiting range α when the mast 24 is mounted on the left end portion 20C of the blade 20, or otherwise it is not limited. In addition, the revolving operation of the upper revolving structure 4 is limited by the right side revolution limiting range β when the mast 24 is mounted on the right end portion 20E of the blade 20, or otherwise it is not limited. Therefore, a large range of the upper revolving structure 4 to revolve can be ensured, and the operational efficiency for removing obstacles using the working mechanism 5 can be enhanced as a pre-operation of ground leveling work using the blade 20, for example.

[0074] The hydraulic excavator 1 of this embodiment is configured to include a control lever device 9 instructing the revolving direction of the upper revolving structure 4 to be left revolution or right revolution, allowing the rotation limiting device 29 to control the revolving direction of the upper revolving structure 4 in the left revolution or the right revolution, depending on a pilot signal from the control lever device 9, and stop revolving operation of the upper revolving structure 4 by shutting off a pilot signal from the control lever device 9 when the revolving range of the upper revolving structure 4 is limited. According to this configuration, revolving operation of the upper revolving structure 4 is stopped using a pilot signal from the control lever device 9 to limit the revolving range of the upper revolving structure 4.

[0075] In this embodiment, the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20, the left mast platform 20D is provided on the left end portion 20C of the blade 20, and the right mast platform 20F is provided on the right end portion 20E of the blade 20. The mounting flange 24A mounted detachably on the left mast platform 20D and the right mast platform 20F is provided on a lower end of the mast 24, and the mast position detecting device is configured by the left proximity sensor 27 and the right proximity sensor 28 each provided on the left and right end portions of the blade 20 and detecting the mounting of the mounting flange 24A of the mast 24. According to this configuration, the left proximity sensor 27 can detect the mounting of the mast 24 on the left end portion 20C of the blade 20. Also, the right proximity sensor 28 can detect the mounting of the mast 24 on the right end portion 20E of the blade 20.

[0076] Subsequently, Fig. 7 shows a second embodiment of the present invention. The second embodiment is characterized by the configuration of the mast position detecting device with an operating tool using a monitor device. In the second embodiment, the component elements that are identical to those of the foregoing first embodiment will be simply denoted by the same reference numerals to avoid repetitions of similar explanations.

[0077] In Fig. 7, the angle sensor 41, the left revolution pressure sensor 42, the right revolution pressure sensor 43, and the monitor device 44 are connected to the input side of the controller 40. The monitor device 44 is connected to the controller 40 in place of the left proximity sensor 27 and the right proximity sensor 28 according to the first embodiment. The monitor device 44 constitutes an operating tool to be operated by an operator, for example, depending on whether the mast 24 is mounted on either the left end portion 20C or the right end portion 20E of the blade 20.

[0078] Herein, the monitor device 44, like the monitor device 26 according to the first embodiment, is disposed rightward from the operator's seat 8 to display three-dimensional data of the ground to be leveled, measured positional information of the blade 20 and other data when ground leveling work is performed using the earth and sand removing device 18. The monitor device 44 displays 2 switches 44A, 44B, for example. Then, a signal indicating that the mast 24 is mounted on the left end portion 20C of the blade 20 is outputted to the controller 40 when the switch 44A is operated. Meanwhile, a signal indicating that the mast 24 is mounted on the right end portion 20E of the blade 20 is outputted to the controller 40 when the switch 44B is operated.

[0079] The controller 40 determines that the mast 24 is mounted on the left end portion 20C of the blade 20 and sets the left side revolution limiting range α shown in Fig. 4 when the switch 44A of the monitor device 44 is operated. Meanwhile, the controller 40 determines that the mast 24 is mounted on the right end portion 20E of the blade 20 and sets the right side revolution limiting range β shown in Fig. 5 when the switch 44B of the monitor device 44 is operated. As a result, like the first embodiment, the hydraulic excavator 1 of this embodiment can prevent the working mechanism 5 from interfering with the mast 24 by revolving operation of the upper revolving structure 4, regardless of the mounting position of the mast 24 relative to the blade 20.

[0080] In the embodiments, the left revolution stoppage valve 38 and the right revolution stoppage valve 39 are configured by a solenoid operated pilot electromagnetic valve. However, the present invention is not restricted to that, and a hydraulic pilot type control valve may be employed.

[0081] In addition, the embodiments shows an example of a case where a crawler type hydraulic excavator 1 with a crawler belt 2E is employed. However, the present invention is not limited to that, and may also be employed in, for example, wheel type hydraulic excavators.

DESCRIPTION OF REFERENCE NUMERALS

[0082]

1: Hydraulic excavator
2: Lower traveling structure
4: Upper revolving structure
5: Working mechanism
9: Control lever device
20: Blade
20C: Left end portion
20D: Left mast platform
20E: Right end portion
20F: Right mast platform
24: Mast
24A: Mounting flange
25: Prism (Blade position detector)
27: Left proximity sensor (Mast position detecting device)
28: Right proximity sensor (Mast position detecting device)
29: Rotation limiting device
44: Monitor device (Mast position detecting device)

Claims

1. A construction machine comprising:

a self-propelled lower traveling structure (2);
an upper revolving structure (4) provided with a working mechanism (5) and mounted rotatably on the lower traveling structure (2);
a blade (20) mounted rotatably on the lower traveling structure (2) and extending in the left-and-right direction;
a mast (24) mounted on the blade (20) and extending in the vertical direction; and
a blade position detector (25) provided on an upper end side of the mast (24) to detect the position of the blade (20), **characterized in that**:
the construction machine further comprises:

a mast position detecting device (27, 28) detecting the mounting position of the mast (24) relative to the blade (20), and
a rotation limiting device (29) limiting the revolving range for allowing the upper revolving structure (4) to revolve, depending on the mounting position of the mast (24) detected by the mast position detecting device (27, 28).

2. The construction machine according to claim 1, wherein

the mast (24) is mounted on either a left end portion (20C) or a right end portion (20E) of the blade (20),
the rotation limiting device (29) sets a left side revolution limiting range (α) in the left revolving direction and the right revolving direction with reference to a position at which the working mechanism (5) interferes with the mast (24) when the mast position detecting device (27) detects the left end portion (20C) of the blade (20) as the mounting position of the mast (24), and stops revolving operation of the upper revolving structure (4) when the revolving position of the upper revolving structure (4) reaches the left side revolution limiting range (α), and
the rotation limiting device (29) sets a right side revolution limiting range (β) in the left revolving direction and the right revolving direction with reference to a position at which the working mechanism (5) interferes with the mast (24) when the mast position detecting device (28) detects the right end portion (20E) of the blade (20) as the mounting position of the mast (24), and stops revolving operation of the upper revolving

structure (4) when the revolving position of the upper revolving structure (4) reaches the right side revolution limiting range (β).

3. The construction machine according to claim 1, comprising

a control lever device (9) instructing the revolving direction of the upper revolving structure (4) to be a left revolution or a right revolution, and the rotation limiting device (29) controls the revolving direction of the upper revolving structure (4) in the left revolution or the right revolution, depending on a pilot signal from the control lever device (9), and stops revolving operation of the upper revolving structure (4) by shutting off a pilot signal from the control lever device (9) when the revolving range of the upper revolving structure (4) is limited.

4. The construction machine according to claim 1, wherein

the mast (24) is mounted on either a left end portion (20C) or a right end portion (20E) of the blade (20),
the left end portion (20C) and the right end portion (20E) of the blade (20) are each provided with a mast platform (20D, 20F) to which the mast (24) is mounted,
a mounting flange (24A) to be mounted detachably on the mast platform (20D, 20F) is provided on a lower end of the mast (24), and
the mast position detecting device (27, 28) is configured by sensors, each mounted on the left and right end portions of the blade (20) and detecting the mounting of the mounting flange (24A) of the mast (24).

5. The construction machine according to claim 1, wherein

the mast (24) is mounted on either a left end portion (20C) or a right end portion (20E) of the blade (20), and
the mast position detecting device (27, 28) is configured by an operating tool (44) that is operated, depending on whether the mast (24) is mounted on either the left end portion (20C) or the right end portion (20E) of the blade (20).

Patentansprüche

1. Baumaschine, umfassend:

einen selbstangetriebenen unteren Fahraufbau (2);
einen oberen Drehaufbau (4), der mit einem Arbeitsmechanismus (5) versehen und drehbar auf dem unteren Fahraufbau (2) montiert ist;
eine Schaufel (20), die drehbar an dem unteren Fahraufbau (2) montiert ist und sich in der Links-Rechts-Richtung erstreckt;
einen Mast (24), der an der Schaufel (20) montiert ist und sich in vertikaler Richtung erstreckt; und
einen Schaufelpositionsdetektor (25), der an einer oberen Endseite des Mastes (24) vorgesehen ist, um die Position der Schaufel (20) zu erfassen,
dadurch gekennzeichnet, dass:
die Baumaschine ferner umfasst:

eine Mastpositionserfassungsvorrichtung (27, 28), die die Montageposition des Mastes (24) relativ zur Schaufel (20) erfasst, und
eine Drehbegrenzungsvorrichtung (29), die den Drehbereich, um eine Drehung des oberen Drehaufbaus (4) zuzulassen, in Abhängigkeit der Montageposition des Mastes (24) begrenzt, die durch die Mastpositionserfassungsvorrichtung (27, 28) erfasst ist.

2. Baumaschine nach Anspruch 1, wobei

der Mast (24) entweder an einem linken Endabschnitt (20C) oder einem rechten Endabschnitt (20E) der Schaufel (20) montiert ist,
die Drehbegrenzungsvorrichtung (29) einen linksseitigen Drehbegrenzungsbereich (α) in der linken Drehrichtung und der rechten Drehrichtung in Bezug auf eine Position einstellt, an der der Arbeitsmechanismus (5) mit dem Mast (24) kollidiert, wenn die Mastpositionserfassungsvorrichtung (27) den linken Endabschnitt (20C) der Schaufel (20) als die Montageposition des Mastes (24) erfasst, und einen Drehbetrieb des oberen Drehaufbaus (4) stoppt, wenn die Drehposition des oberen Drehaufbaus (4) den linksseitigen Drehbegrenzungsbereich (α) erreicht, und
die Drehbegrenzungsvorrichtung (29) einen rechtsseitigen Drehbegrenzungsbereich (β) in der linken Drehrichtung und der rechten Drehrichtung in Bezug auf eine Position einstellt, bei der der Arbeitsmechanismus (5) mit dem Mast (24) kollidiert, wenn die Mastpositionserfassungsvorrichtung (28) den rechten Endabschnitt (20E) der Schaufel (20) als die Montageposition des Mastes (24) erfasst, und einen Drehbetrieb des oberen Drehaufbaus (4) stoppt, wenn die Drehposition des oberen Drehaufbaus (4) den rechtsseitigen Drehbegrenzungsbereich (β) erreicht.

3. Baumaschine nach Anspruch 1, umfassend

eine Steuerhebeleinrichtung (9), die die Drehrichtung des oberen Drehaufbaus (4) auf eine Linksdrehung oder eine Rechtsdrehung festlegt, und
die Drehbegrenzungsvorrichtung (29) die Drehrichtung des oberen Drehaufbaus (4) in der Linksdrehung oder der Rechtsdrehung abhängig von einem Vorsteuersignal von der Steuerhebeleinrichtung (9) steuert, und den Drehbetrieb des oberen Drehaufbaus (4) durch Abschalten eines Steuersignals von der Steuerhebeleinrichtung (9) stoppt, wenn der Drehbereich des oberen Drehaufbaus (4) begrenzt ist.

4. Baumaschine nach Anspruch 1, wobei

der Mast (24) entweder an einem linken Endabschnitt (20C) oder einem rechten Endabschnitt (20E) der Schaufel (20) montiert ist,
der linke Endabschnitt (20C) und der rechte Endabschnitt (20E) der Schaufel (20) jeweils mit einer Mastplattform (20D, 20F) versehen sind, an der der Mast (24) befestigt ist,
an einem unteren Ende des Mastes (24) ein Befestigungsflansch (24A) vorgesehen ist, der abnehmbar an der Mastplattform (20D, 20F) zu befestigen ist, und
die Mastpositionserfassungsvorrichtung (27, 28) durch Sensoren konfiguriert ist, die jeweils an den linken und rechten Endabschnitten der Schaufel (20) montiert sind und die Montage des Montageflansches (24A) des Mastes (24) erfassen.

5. Baumaschine nach Anspruch 1, wobei

der Mast (24) entweder an einem linken Endabschnitt (20C) oder einem rechten Endabschnitt (20E) der Schaufel (20) montiert ist, und
die Mastpositionserfassungsvorrichtung (27, 28) durch ein Betätigungswerkzeug (44) konfiguriert ist, das in Abhängigkeit davon betätigt wird, ob der Mast (24) entweder am linken Endabschnitt (20C) oder am rechten Endabschnitt (20E) der Schaufel (20) montiert ist.

Revendications

1. Machine de chantier comprenant :

une structure de déplacement inférieure autopropulsée (2) ;
une structure pivotante supérieure (4) dotée d'un mécanisme de travail (5) et montée en rotation sur la structure de déplacement inférieure (2) ;
une lame (20) montée en rotation sur la structure de déplacement inférieure (2) et s'étendant dans la direction gauche/droite ;
un mât (24) monté sur la lame (20) et s'étendant dans la direction verticale ; et
un détecteur de position de l'âme (25) prévu sur un côté d'extrémité supérieure du mât (24) pour détecter la position de la lame (20),
caractérisée en ce que :
la machine de chantier comprend en outre :

un dispositif de détection de position de mât (27, 28) détectant la position de montage du mât (24) relativement à la lame (20), et
un dispositif de limitation de rotation (29) limitant la plage de pivotement pour permettre à la structure pivotante supérieure (4) de pivoter, en dépendance de la position de montage du mât (24) détectée par le dispositif de détection de position de mât (27, 28).

2. Machine de chantier selon la revendication 1, dans laquelle

le mât (24) est monté soit sur une portion d'extrémité de gauche (20C), soit sur une portion d'extrémité de droite (20E) de la lame (20),
le dispositif de limitation de rotation (29) fixe une plage de limitation de pivotement du côté gauche (α) dans la direction de pivotement vers la gauche et la direction de pivotement vers la droite en se référant à une position à laquelle le mécanisme de travail (5) interfère avec le mât (24) quand le dispositif de détection de position de mât (27) détecte la portion d'extrémité de gauche (20C) de la lame (20) comme étant la position de montage du mât (24), et arrête l'opération de pivotement de la structure pivotante supérieure (4) quand la position de pivotement de la structure pivotante supérieure (4) atteint la plage de limitation de rotation du côté gauche (a), et
le dispositif de limitation de rotation (29) fixe une plage de limitation de pivotement du côté droit (β) dans la direction de pivotement vers la gauche et la direction de pivotement vers la droite en se référant à une position à laquelle le mécanisme de travail (5) interfère avec le mât (24) quand le dispositif de détection de position de mât (27) détecte la portion d'extrémité de droite (20C) de la lame (20) comme étant la position de montage du mât (24), et arrête l'opération de pivotement de la structure pivotante supérieure (4) quand la position de pivotement de la structure pivotante supérieure (4) atteint la plage de limitation de rotation du côté droit (β).

3. Machine de chantier selon la revendication 1, comprenant

un dispositif à levier de commande (9) donnant une instruction selon laquelle la direction de pivotement de la structure pivotante supérieure (4) est un pivotement vers la gauche ou un pivotement vers la droite, et
le dispositif de limitation de rotation (29) commande la direction de pivotement de la structure pivotante supérieure (4) dans le pivotement vers la gauche ou le pivotement vers la droite, en dépendance d'un signal pilote provenant du dispositif à levier de commande (9), et arrête l'opération de pivotement de la structure pivotante supérieure (4) en interrompant un signal pilote provenant du dispositif à levier de commande (9) quand la plage de pivotement de la structure pivotante supérieure (4) est limitée.

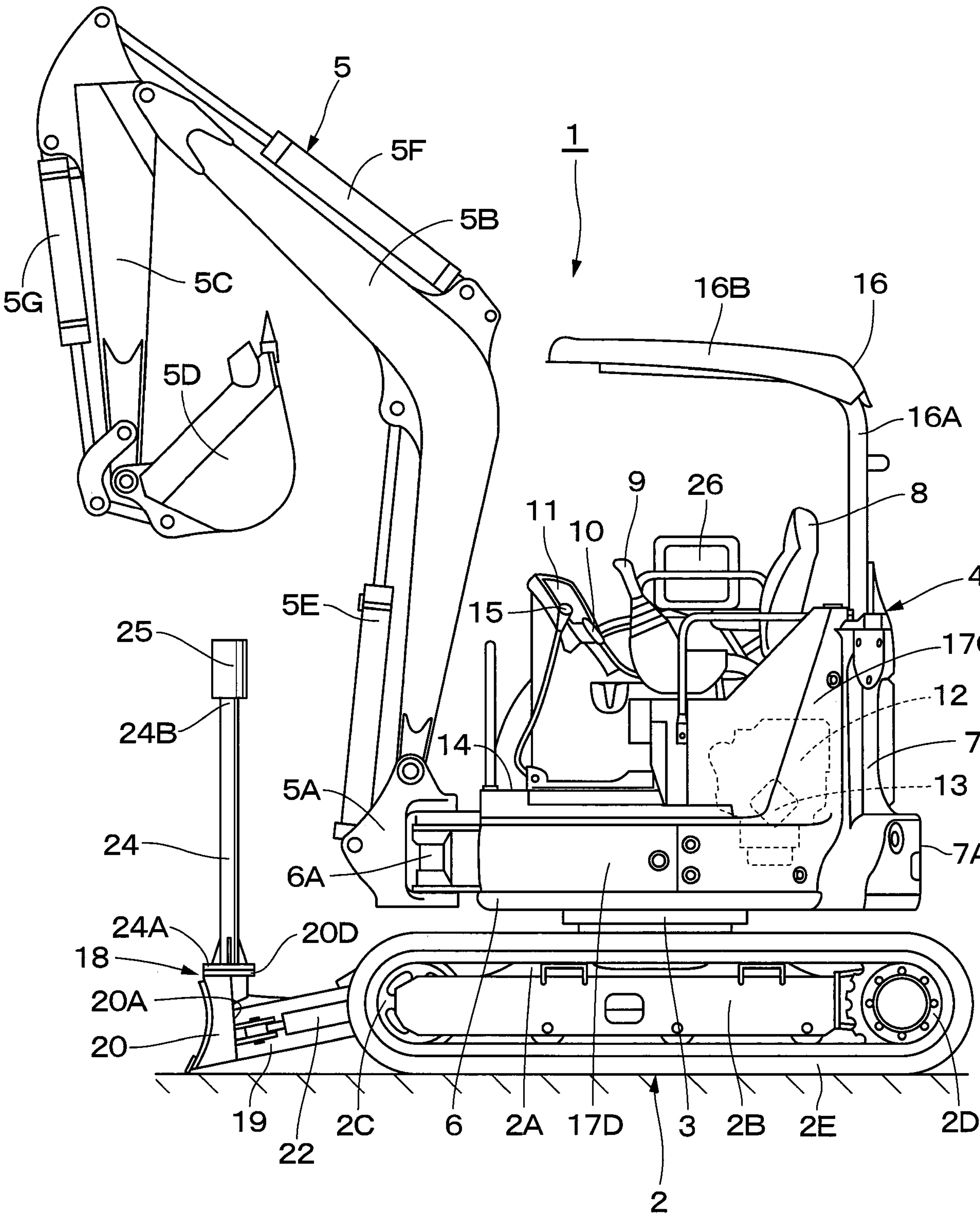
4. Machine de chantier selon la revendication 1, dans laquelle

le mât (24) est monté soit sur une portion d'extrémité de gauche (20C) soit sur une portion d'extrémité de droite (20E) de la lame (20),
la portion d'extrémité de gauche (20C) et la portion d'extrémité de droite (20E) de la lame (20) sont dotées chacune d'une plateforme de mât (20D, 20F) sur laquelle le mât (20) est monté,
une bride de montage (24A) à monter de manière détachable sur la plateforme de mât (20D, 20F) est prévue sur une extrémité inférieure du mât (24), et
le dispositif de détection de position de mât (27, 28) est configuré par des capteurs, montés chacun sur les portions d'extrémité de gauche et droite de la lame (20) et détectant le montage de la bride de montage (24A) du mât (24).

5. Machine de chantier selon la revendication 1, dans laquelle

le mât (24) est monté soit sur une portion d'extrémité de gauche (20C) soit sur une portion d'extrémité de droite (20E) de la lame (20), et
le dispositif de détection de position de mât (27, 28) est configuré par un outil d'actionnement (44) qui est actionné en dépendance du fait de savoir si le mât (24) est monté soit sur la portion d'extrémité de gauche (20C) soit sur la portion d'extrémité de droite (20E) de la lame (20).

Fig.1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17C
25
12
24B
14
7
5A
13
24
6A
7A
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6
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17D
3
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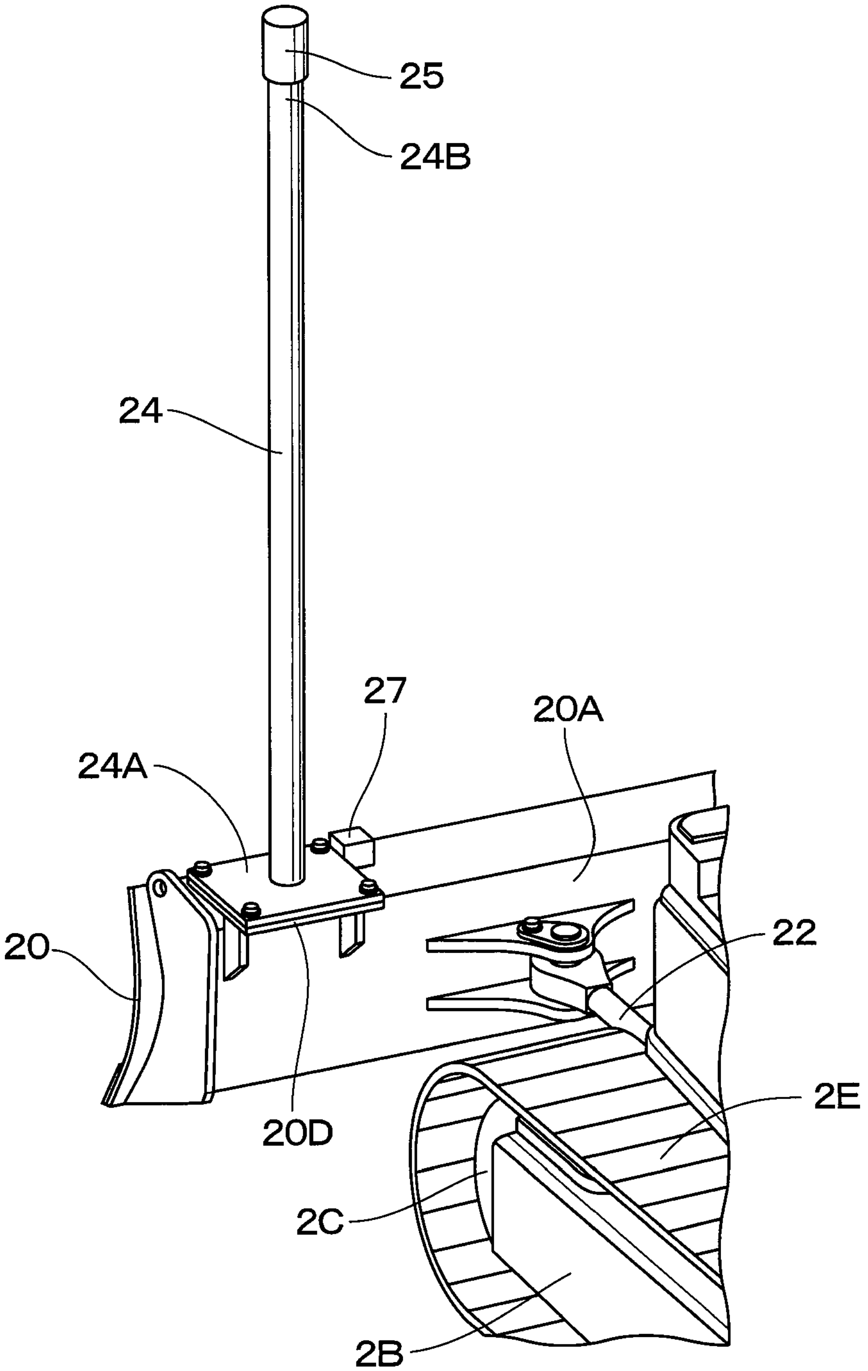
2E
2D
22
2

Fig.2



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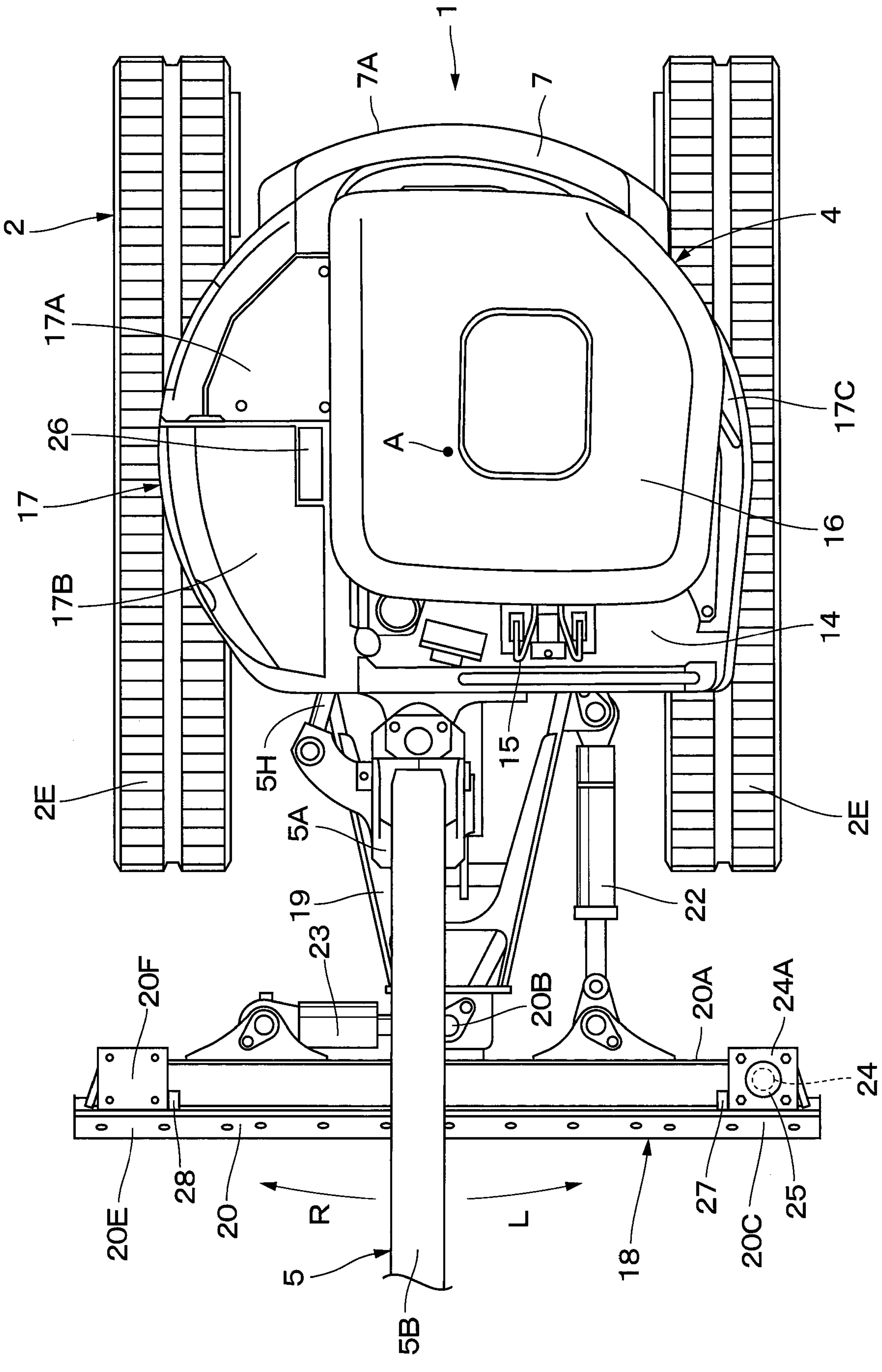
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22
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20B
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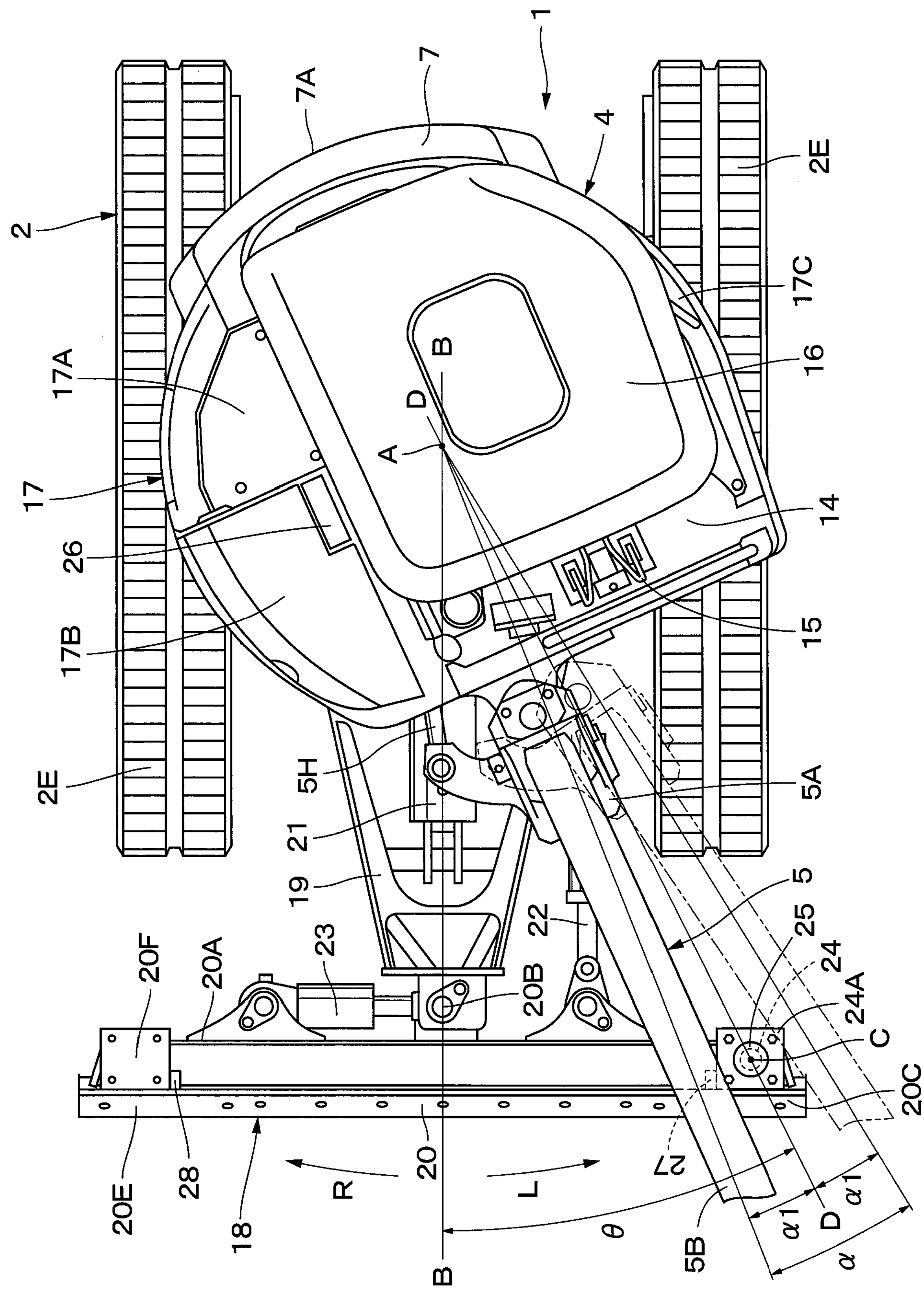
24
28
27
20E
20
R
L
18
20C
25
5
5B

Fig.4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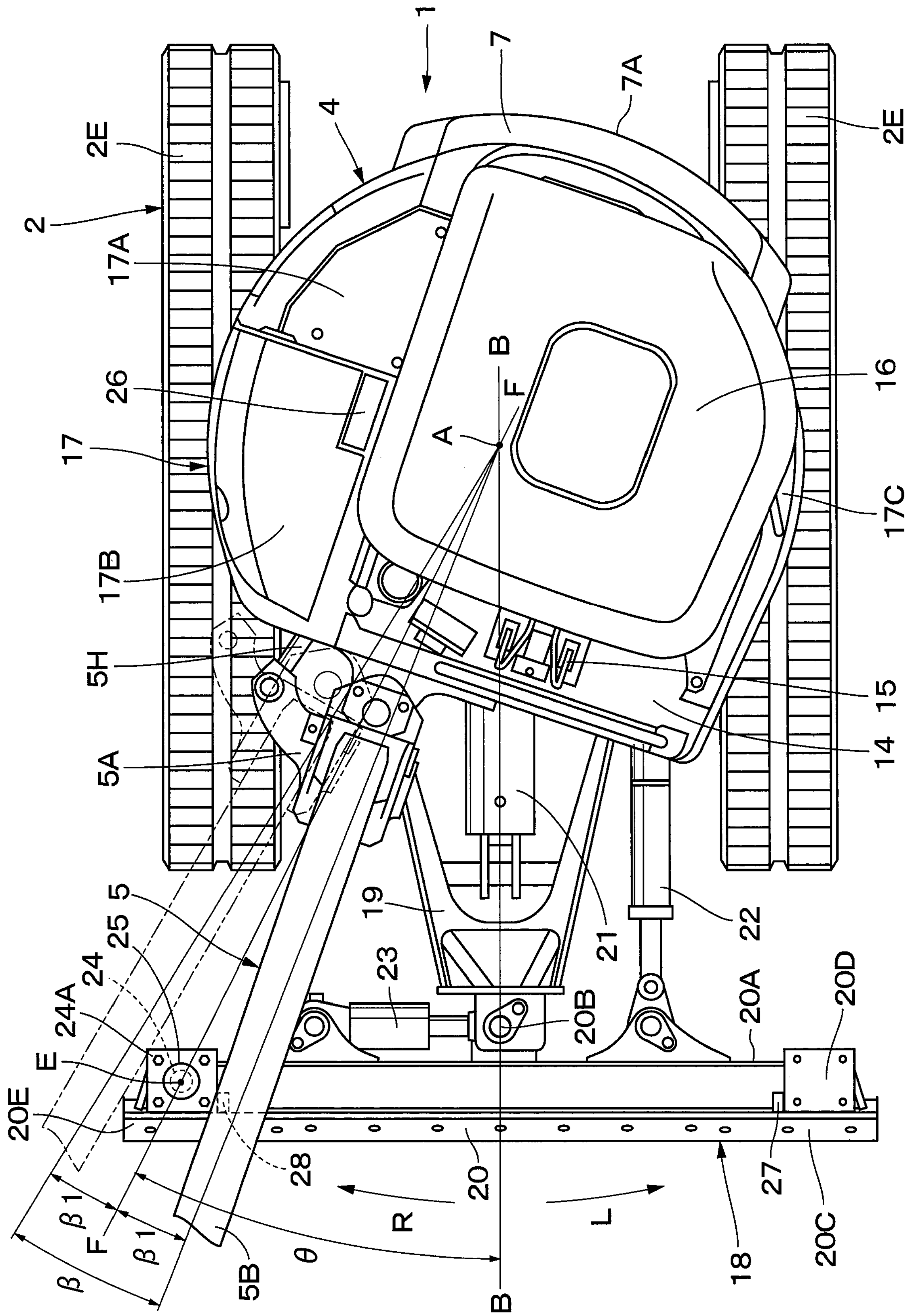
19
20
20A
20B
20C
20E
20F
21
22
23
24
24A
25
26
27
28
A
B
C
D
R
L
θ
α
α1

Fig.5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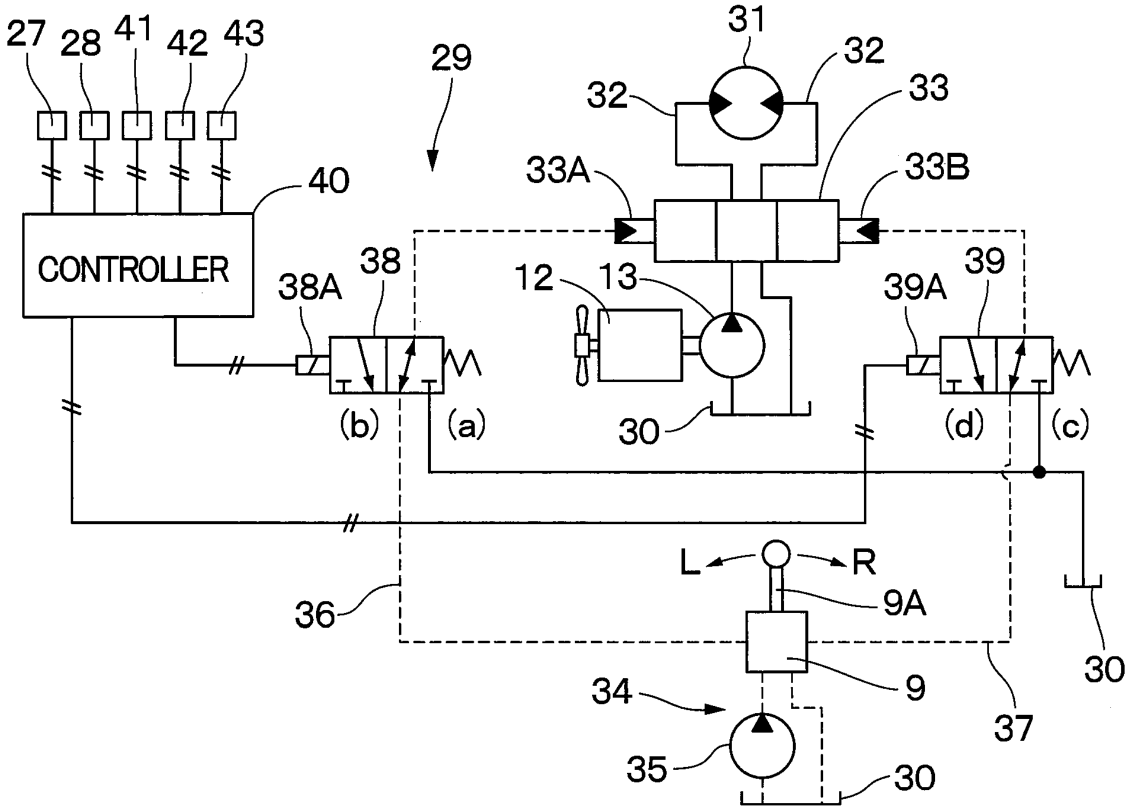
14
5A
21
5
25
24
24A
19
22
23
20B
20A
20D
E
20E
β1
β1
F
β
28
20
R
L
27
20C
18
5B
θ
B

Fig.6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(a)
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(d)
(c)
L
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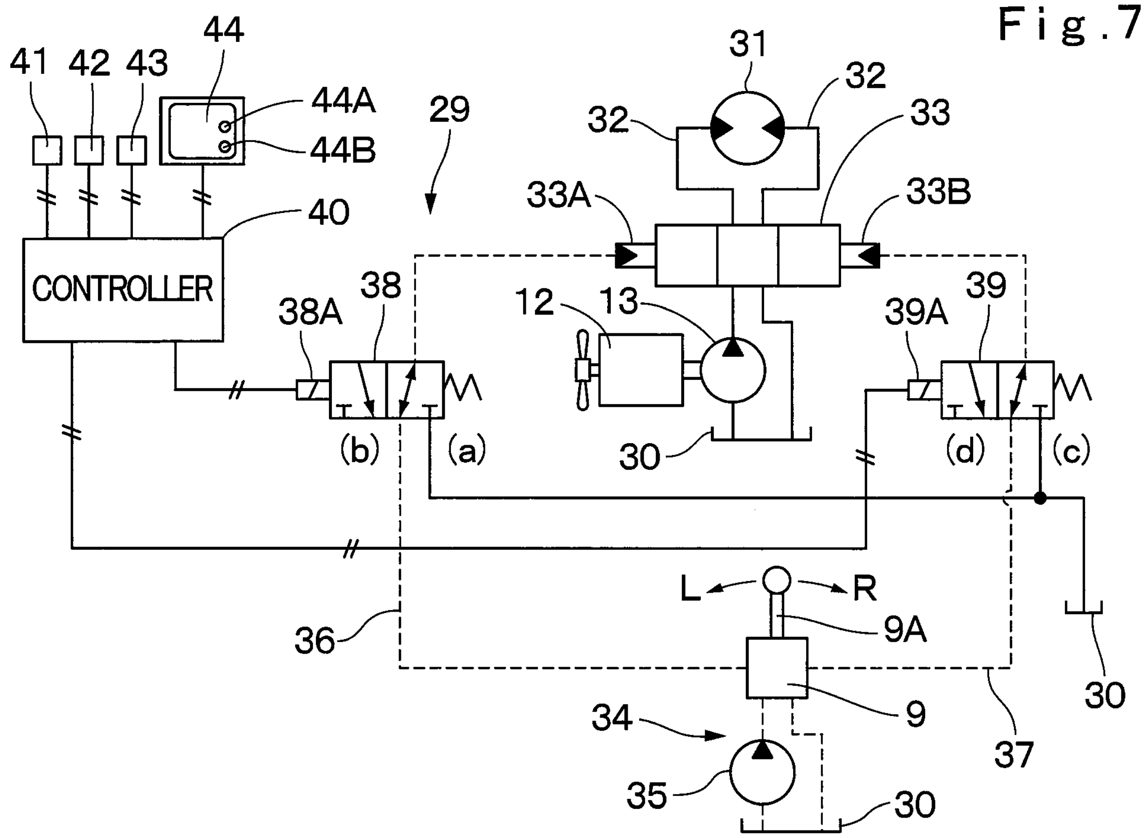
9A
36
9
30
34
37
35
30

Fig.7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39A
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(b)
(a)
30
(d)
(c)
L
R
9A
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9
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37
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30

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 2020012255 A **[0005]**