(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 048 505 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.07.2016 Bulletin 2016/30

(21) Application number: **14845704.7**

(22) Date of filing: **18.09.2014**

(51) Int Cl.:
G05G 1/01 *(2008.04)* ***E02F 9/16*** *(2006.01)*
E02F 9/20 *(2006.01)* ***G05G 9/047*** *(2006.01)*
B25J 13/02 *(2006.01)*

(86) International application number:
PCT/JP2014/074726

(87) International publication number:
WO 2015/041300 (26.03.2015 Gazette 2015/12)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **18.09.2013 JP 2013193500**

(71) Applicant: **Hitachi Construction Machinery Co., Ltd.**
Bunkyo-ku
Tokyo 112-8563 (JP)

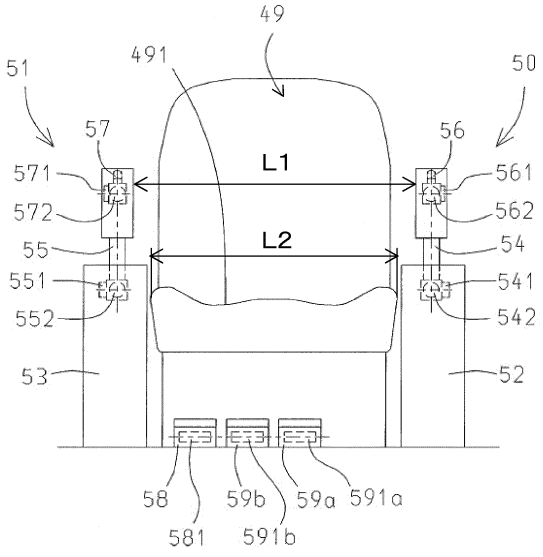
(72) Inventors:
- **ISHII Akinori**
  Tsuchiura-shi,
  Ibaraki 300-0013 (JP)
- **HANAKAWA Kazuyoshi**
  Tsuchiura-shi,
  Ibaraki 300-0013 (JP)
- **TOMITA Kunitsugu**
  Tsuchiura-shi,
  Ibaraki 300-0013 (JP)

(74) Representative: **Beetz & Partner mbB**
Patentanwälte
Steinsdorfstraße 10
80538 München (DE)

(54) DEVICE FOR OPERATING WORKING MACHINE

(57) In an operating device for a double arm type hydraulic excavator 1 comprising a left operating device 50 provided on the left side of a cab seat 49 and a right operating device 51 provided on the right side of the cab seat 49, the left operating device 50 includes a left control lever 54 and a left control switch 56 provided on the left control lever 54, while the right operating device 51 includes a right control lever 55 and a right control switch 57 provided on the right control lever 55. The shortest distance between the left control lever 54 and the right control lever 55 is greater than the width of the cab seat 49. The operation of a right front work implement B is performed by using the left control lever 54 and the right control lever 55. The operation of a left front work implement A is performed by using the left control switch 56 and the right control switch 57. With this configuration, the operation of the double arm type hydraulic excavator can be performed in a manner similar to that in conventional technology and the operator can sit down on the cab seat without a hitch while avoiding breakage caused by a contact with the control lever.

FIG.4



EP 3 048 505 A1

Description

Technical Field

[0001] The present invention relates to a double arm type work machinery comprising two front work implements of the multijoint type and being used for demolition works of objects such as structures and wastes, civil engineering works, and so forth.

Background Art

[0002] Work machineries comprising a lower track structure having a travel structure, an upper swing structure attached to the lower track structure to be freely swingable, and a front work implement of the multijoint type attached to the upper swing structure to be freely pivotable up and down are well known as those used for structure demolition works, waste demolition works, civil engineering construction works, and so forth. Hydraulic excavators are an example of such work machineries. The hydraulic excavator, in which the front work implement including a boom and an arm is linked to the upper swing structure to be freely pivotable up and down and a bucket is attached to the tip end of the arm to be freely pivotable up and down, is used to perform works such as excavation, loading and ground leveling. The hydraulic excavator is configured so that other types of works such as structure demolition works and waste demolition works can also be performed by attaching a breaker, crusher, grapple or the like to the arm instead of the bucket.

[0003] However, these hydraulic excavators of the standard type, having only one front work implement attached to the work machinery, involve the following problems: When parts have to be removed from a car in a car dismantling work by using a dismantling attachment, if there is only one front work implement attached to the work machinery, the front work implement is used naturally for the removal of car parts and thus cannot firmly fix the car body. Thus, the car body exhibits unstable behavior when parts are removed with the dismantling attachment, and consequently, the workability is deteriorated.

[0004] Further, in a structure demolition work, if there is only one front work implement attached to the work machinery when a structure has to be demolished by using a breaker, crusher, reinforcing bar cutter or the like, the front work implement is used naturally for the demolition of the structure and thus cannot hold the structure. Thus, each time the structure is smashed by a breaker or the like, fragments drop from the structure and scatter around due to the momentum of the dropping. The fragments have to be collected and disposed of and these tasks deteriorate the efficiency. Furthermore, in cases where the object of the demolition includes a part that should be preserved, the part has to be previously suspended by using a machinery such as a crane in order to prevent the part from dropping. Workers and operations become necessary for such a preparation.

[0005] To eliminate these problems arising from works, there is a technology disclosed in Patent Literature 1. Patent Literature 1 discloses a double arm type work machinery, in which a first front work implement of the multijoint type having a first work tool freely rotatable up and down and a second front work implement of the multijoint type having a second work tool freely rotatable up and down are attached respectively to the left and right sides of the front part of the upper swing structure to be freely pivotable up and down.

[0006] In the double arm type work machinery disclosed in Patent Literature 1, two operating devices for operating the first front work implement and the second front work implement are arranged on the left and right sides of the cab seat in the cab, one on each side of the cab seat. The configuration of these operating devices is as follows: For example, the operating device on the left side includes a control arm bracket which is provided on the left side of the cab seat, a control arm which is attached to the control arm bracket to be freely pivotable to the left and right for commanding the left/right pivoting of the first front work implement, an armrest which is attached to the control arm so as to pivot integrally with the control arm, and a control lever which is attached to a tip end part of the control arm to extend toward the inside (cab seat's side) in a horizontal direction and to be freely pivotable up and down and back and forth for commanding the operation of the tip end of the arm of the first front work implement.

Prior Art Literature

Patent Literature

[0007] Patent Literature 1: JP-2006-252224-A

Summary of the Invention

Problem to be Solved by the Invention

[0008] However, with such a configuration, the control lever extending toward the inside in the horizontal direction can make contact with the operator when the operator sits down on the cab seat, by which a feeling of discomfort can be caused to the operator or the control lever can be broken due to an excessive load applied thereto.

[0009] The object of the present invention, which has been made in consideration of the above-described situation, is to provide an operating device for a work machinery with which the operation of the work machinery can be performed in a manner similar to that in conventional technology and the operator can sit down on the cab seat without a hitch while avoiding the breakage caused by the contact with the control lever.

Means for Solving the Problem

[0010] To achieve the above object, the present invention provides an operating device for a work machinery, the work machinery comprising: a work machinery main body; a cab which is provided on the work machinery main body or outside the work machinery main body; a first front work implement and a second front work implement which are provided at the front of the work machinery main body to be driven and freely pivoted up and down; a cab seat which is provided in the cab; a left operating device which is provided on the left side of the cab seat; and a right operating device which is provided on the right side of the cab seat. The left operating device includes a first left operating unit and a second left operating unit provided on the first left operating unit. The right operating device includes a first right operating unit and a second right operating unit provided on the first right operating unit. The shortest distance between the first left operating unit and the first right operating unit is greater than the width of the cab seat. The operation of the first front work implement is performed by using the first left operating unit and the first right operating unit. The operation of the second front work implement is performed by using the second left operating unit and the second right operating unit.

Effect of the Invention

[0011] According to the present invention, by use of the left operating device and the right operating device described above, the operation of the work machinery can be performed in a manner similar to that in the conventional technology. Further, the avoidance of the breakage of a control lever, which has been difficult in the conventional technology, can be achieved and it becomes possible for the operator to sit down on the cab seat without a hitch. As a result, the present invention increases the comfortability of the operator and the operating life of components such as the control levers.

Brief Description of the Drawings

[0012]

Fig. 1 is a side view showing a double arm type hydraulic excavator as an example of a construction machinery comprising an operating device according to a first embodiment of the present invention.

Fig. 2 is a plan view of the double arm type hydraulic excavator shown in Fig. 1.

Fig. 3 is a side view showing an operating device which is provided on the double arm type hydraulic excavator shown in Fig. 1.

Fig. 4 is a front view of the operating device shown in Fig. 3.

Fig. 5 is a schematic diagram showing principal parts of a control system of the double arm type hydraulic excavator in the first embodiment of the present invention and the relationship between inputs and outputs of the control system.

Fig. 6 is a schematic diagram showing the relationship between operating directions outputted from the operating device and driving directions of actuators of the double arm type hydraulic excavator in the first embodiment of the present invention. Fig. 6(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 6(b) shows the operating directions of the operating device.

Fig. 7 is a schematic diagram showing principal parts of a control system of a double arm type hydraulic excavator in a second embodiment of the present invention and the relationship between inputs and outputs of the control system.

Fig. 8 is a schematic diagram showing the relationship between operation commands from the operating device and driving directions of actuators of the double arm type hydraulic excavator in the second embodiment of the present invention. Fig. 8(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 8(b) shows the operating directions of the operating device.

Fig. 9 is a schematic diagram showing principal parts of a control system of a double arm type hydraulic excavator in a third embodiment of the present invention and the relationship between inputs and outputs of the control system.

Fig. 10 is a front view showing an operating device which is provided on a double arm type hydraulic excavator in a fourth embodiment of the present invention.

Fig. 11 is a schematic diagram showing principal parts of a control system of the double arm type hydraulic excavator in the fourth embodiment of the present invention and the relationship between inputs and outputs of the control system.

Fig. 12 is a schematic diagram showing the relationship between operation commands from the operating device and driving directions of actuators of the double arm type hydraulic excavator in the fourth embodiment of the present invention. Fig. 12(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 12(b) shows the operating directions of the operating device.

Modes for Carrying Out the Invention

[0013] Referring now to the drawings, a description will be given in detail of preferred embodiments in accordance with the present invention.

First Embodiment

[0014] Fig. 1 is a side view showing a double arm type hydraulic excavator as an example of a construction machinery comprising an operating device according to a first embodiment of the present invention. Fig. 2 is a plan view of the double arm type hydraulic excavator shown in Fig. 1. In the following explanation, the forward direction viewed from the cab seat (upper left direction in the figure) is assumed to correspond to the forward direction (front) of the machinery unless otherwise noted.

[0015] In the double arm type hydraulic excavator 1 (work machinery) shown in Fig. 1, an upper swing structure 3 is attached to a lower track structure 2 to be swingable, and a cab 4 is arranged at the front of the upper swing structure 3. A left front work implement A (second front work implement) and a right front work implement B (first front work implement) are provided on the left front and the right front of the cab 4, respectively. An engine 40, a pump 41 and some other components are arranged on the side and rear of the cab 4.

[0016] The lower track structure 2 includes left and right travel motors 43a and 43b (the right travel motor 43b is unshown) provided respectively at the rear of left and right track frames 5a and 5b (the right track frame 5b is unshown) to be freely rotatable, and left and right crawlers 44a and 44b (the right crawler 44b is unshown) provided for the track frames 5a and 5b and the travel motors 43a and 43b. The left and right travel motors 43a and 43b are supplied with hydraulic fluid from the pump 41 and thereby performs rotary driving, by which the left and right crawlers 44a and 44b rotate with respect to the track frames 5a and 5b to let the double arm type hydraulic excavator 1 travel.

[0017] The upper swing structure 3 is equipped with a swing motor 48 for its swing operation. By the rotation of the swing motor 48, the upper swing structure 3 is swung (rotated) with respect to the lower track structure 2.

[0018] As shown in Figs. 1 and 2, the left front work implement A includes a swing post 7a (member) which is attached to the left front of the upper swing structure 3 to be freely pivotable to the left and right, a boom 10a (member) which is attached to the swing post 7a to be freely pivotable up and down, an arm 12a (member) which is attached to the boom 10a to be freely pivotable up and down, and a grapple 14a (member) as a first work tool attached to the arm 12a to be freely rotatable up and down.

[0019] The left front work implement A further includes a swing post cylinder 9a (actuator) which is connected to the swing post 7a and the upper swing structure 3 to pivot the swing post 7a to the left and right, a boom cylinder 11a (actuator) which is connected to the swing post 7a and the boom 10a to pivot the boom 10a up and down, an arm cylinder 13a (actuator) which is connected to the boom 10a and the arm 12a to pivot the arm 12a up and down, and a work tool cylinder 15a (actuator) which is connected to the arm 12a and the work tool 14a to rotate the work tool 14a up and down. Incidentally, the grapple shown in Figs. 1 and 2 as the work tool 14a can be arbitrarily replaced with one of other work tools (cutter, breaker, bucket, etc.) depending on the contents of the work.

[0020] The right front work implement B is provided on the right front of the upper swing structure 3. The configuration of the right front work implement B is substantially bilaterally symmetrical with that of the left front work implement A, and thus repeated explanation thereof is omitted here and components of the right front work implement B will be represented by reference characters obtained by replacing the suffix "a" with "b" in the reference characters of the corresponding components of the left front work implement A.

[0021] Fig. 3 is a side view showing an operating device which is provided on the double arm type hydraulic excavator shown in Fig. 1. Fig. 4 is a front view of the operating device shown in Fig. 3.

[0022] A cab seat 49 is set in the cab 4, and left and right operating devices 50 and 51 are arranged respectively on the left and right sides of the cab seat 49. A swing pedal 58 and left and right travel pedals 59a and 59b are arranged at lower positions in front of the cab seat.

[0023] The left operating device 50 includes a left control lever bracket 52 arranged on the left side of the cab seat 49, a left control lever 54 (first left operating unit) provided on the left control lever bracket 52 to be freely pivotable back and forth and left and right, and a left control switch 56 (second left operating unit) provided at the tip end of the left control lever 54 to be freely pivotable back and forth and left and right.

[0024] Similarly, the right operating device 51 includes a right control lever bracket 53 arranged on the right side of the cab seat 49, a right control lever 55 (first right operating unit) provided on the right control lever bracket 53 to be freely pivotable back and forth and left and right, and a right control switch 57 (second right operating unit) provided at the tip end of the right control lever 55 to be freely pivotable back and forth and left and right.

[0025] Here, the left control lever 54 and the right control lever 55 are arranged in parallel with the cab seat 49 so that the control levers 54 and 55 do not overlap with a seating part 491 included in the cab seat 49 and having the greatest width, for example, that is, so that the shortest distance L1 between the left control lever 54 and the right control lever 55 is greater than the width L2 of the cab seat 49.

[0026] The left operating device 50 is equipped with a displacement sensor 541 and a displacement sensor 542 for sensing displacements of the left control lever 54 caused by the tilting of the left control lever 54 in the longitudinal (forward/backward) direction and in the transverse (leftward/rightward) direction. The displacement sensor 541 senses the displacement of the left control lever 54 in the longitudinal direction, while the displacement sensor 542 senses the displacement of the left control lever 54 in the transverse direction. The tilting

of the left control lever 54 in the longitudinal (forward/backward) direction or in the transverse (leftward/rightward) direction commands the driving direction of an actuator (e.g., expansion/contraction direction of a cylinder), and the amount of the displacement of the left control lever 54 commands a speed for the actuator. The right operating device 51 is also equipped with displacement sensors 551 and 552 corresponding to the displacement sensors 541 and 542, respectively. Incidentally, the forward/backward/leftward/rightward directions, in which the left control lever 54, the right control lever 55, the left control switch 56 and the right control switch 57 are tilted, will hereinafter be referred to as "operating directions".

[0027] The left operating device 50 is further equipped with displacement sensors 561 and 562 for sensing displacements of the left control switch 56 caused by the tilting of the left control switch 56 in the longitudinal direction and in the transverse direction. The displacement sensor 561 senses the displacement of the left control switch 56 in the longitudinal direction, while the displacement sensor 562 senses the displacement of the left control switch 56 in the transverse direction. The tilting of the left control switch 56 in the longitudinal direction or in the transverse direction (i.e., the aforementioned operating direction) commands the driving direction of an actuator (e.g., expansion/contraction direction of a cylinder), and the amount of the displacement of the left control switch 56 commands a speed for the actuator. The right operating device 51 is also equipped with displacement sensors 571 and 572 corresponding to the displacement sensors 561 and 562, respectively.

[0028] The swing pedal 58 is equipped with a swing pedal displacement sensor 581 for sensing the displacement of the swing pedal 58 and transmitting a corresponding signal. The left and right travel pedals 59a and 59b are equipped with travel pedal displacement sensors 591a and 591b for sensing the displacements of the travel pedals 59a and 59b and transmitting corresponding signals.

[0029] Fig. 5 is a schematic diagram showing principal parts of a control system of the double arm type hydraulic excavator in the first embodiment of the present invention and the relationship between inputs and outputs of the control system.

[0030] The control system 161 receives inputs representing the displacements from the aforementioned displacement sensors 541 and others provided for the left and right operating devices 50 and 51 in the cab 4, generates drive signals by performing prescribed calculations based on the displacements from the input systems, and outputs the generated drive signals to solenoid valves that operate the aforementioned parts of the left and right front work implements A and B.

[0031] The sensors outputting the displacements to the control system 161 are as explained above. The solenoid valves receiving the outputs from the control system 161 include swing post drive solenoid valves 218a and 218b, boom drive solenoid valves 215a and 215b, arm drive solenoid valves 216a and 216b, work tool drive solenoid valves 217a and 217b, a swing drive solenoid valve 213, and travel drive solenoid valves 214a and 214b.

[0032] Next, the operation of the first embodiment will be described below.

[0033] Fig. 6 is a schematic diagram showing the relationship between the operating directions outputted from the operating device and the driving directions of the actuators of the double arm type hydraulic excavator in the first embodiment of the present invention. Fig. 6(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 6(b) shows the operating directions of the operating device.

[0034] When the left control lever 54 is shifted (i.e., displaced) forward (111) as shown in Fig. 6(b), the longitudinal direction displacement sensor 541 of the left control lever 54 outputs a sensing signal to a drive signal generation unit 161A in the control system 161 as shown in Fig. 5. The drive signal generation unit 161A receiving the sensing signal transmits a drive signal to the solenoid valve 216b for driving a right arm 12b. According to the drive signal, a right arm cylinder 13b is contracted and the right arm 12b is pivoted forward (LL1) as shown in Fig. 6(a). In this case, the pivoting speed of the right arm 12b is in a monotonically increasing relation (e.g., proportional relation) with the displacement inputted from the longitudinal direction displacement sensor 541, and thus the displacement sensed by the longitudinal direction displacement sensor 541 controls the speed of the pivoting of the right arm 12b.

[0035] Similarly, when the left control lever 54 is shifted backward (112), the right arm 12b is pivoted backward (LL2). When the left control lever 54 is shifted leftward (113), a right swing post 7b is pivoted leftward (LL3). Further, when the left control lever 54 is shifted rightward (114), the right swing post 7b is pivoted rightward (LL4).

[0036] Similarly to the case of the left control lever 54, when the right control lever 55 is shifted forward (rl1), a right boom 10b is pivoted downward (RL1). When the right control lever 55 is shifted backward (rl2), the right boom 10b is pivoted upward (RL2). When the right control lever 55 is shifted leftward (rl3), a right work tool 14b is pivoted backward (RL3). Further, when the right control lever 55 is shifted rightward (rl4), the right work tool 14b is pivoted forward (RL4).

[0037] Further, when the left control switch 56 is shifted forward (ls1) as shown in Fig. 6(b), the longitudinal direction displacement sensor 561 of the left control switch 56 transmits a sensing signal to a drive signal generation unit 161E in the control system 161 as shown in Fig. 5. The drive signal generation unit 161E receiving the sensing signal transmits a drive signal to the solenoid valve 216a for driving the left arm 12a. According to the drive signal, the left arm cylinder 13a is contracted and the left arm 12a is pivoted forward (LS1) as shown in Fig. 6(a). In this case, the pivoting speed of the left arm 12a is in

a monotonically increasing relation (e.g., proportional relation) with the displacement inputted from the longitudinal direction displacement sensor 561, and thus the displacement inputted from the longitudinal direction displacement sensor 561 controls the speed of the pivoting of the left arm 12a.

[0038] Similarly, when the left control switch 56 is shifted backward (ls2), the left arm 12a is pivoted backward (LS2). When the left control switch 56 is shifted leftward (ls3), the left swing post 7a is pivoted leftward (LS3). When the left control switch 56 is shifted rightward (ls4), the left swing post 7a is pivoted rightward (LS4).

[0039] Similarly to the case of the left control switch 56, when the right control switch 57 is shifted forward (rs1), the left boom 10a is pivoted downward (RS1). When the right control switch 57 is shifted backward (rs2), the left boom 10a is pivoted downward (RS2). When the right control switch 57 is shifted leftward (rs3), the left work tool 14a is pivoted downward (RS3). When the right control switch 57 is shifted rightward (rs4), the left work tool 14a is pivoted upward (RS4).

[0040] It should be noted that the actuators operated (controlled) by the left control lever 54, the right control lever 55, the left control switch 56 and the right control switch 57 and the operating directions of the control levers/switches 54, 55, 56 and 57 can be set arbitrarily by changing the combination of the drive signal generation units 161A, and the solenoid valves 216a, 216b (specifically, by changing the electric wiring) in the control system 161. Thus, it goes without saying that it is also possible in the double arm type hydraulic excavator to set the actuators operated by the left control lever 54 and the right control lever 55 and the operating directions of the control levers 54 and 55 in the same way as those of conventional hydraulic excavators.

[0041] According to this embodiment configured as above, the left front work implement A and the right front work implement B can be operated at the same time by using the left control lever 54, the left control switch 56 provided on the left control lever 54, the right control lever 55, and the right control switch 57 provided on the right control lever 55 similarly to the conventional technology. Further, since the shortest distance between the left control lever 54 and the right control lever 55 is greater than the seating part 491 included in the cab seat 49 and having the greatest width, for example, the operator's possibility of contacting the operating means when sitting down on the cab seat is low. Thus, the comfortability of the operator and the operating life of components such as the left control lever 54 and the right control lever 55 can be increased.

[0042] Further, in this embodiment, the driving direction of an actuator of the right front work implement B commanded by the operating direction of the left control lever 54 and the driving direction of an actuator included in the left front work implement A commanded by the operating direction of the left control switch 56 are the same as each other, and the driving direction of an actuator of the right front work implement B commanded by the operating direction of the right control lever 55 and the driving direction of an actuator included in the left front work implement A commanded by the operating direction of the right control switch 57 are the same as each other. Therefore, the operator can perform the operations of the left and right front work implements (objects of the operations) in similar operating directions, and thus can master the operations with high efficiency.

[0043] Furthermore, in this embodiment, the actuators operated by the left control lever 54 and the right control lever 55 and the operating directions of the control levers 54 and 55 can be set in the same way as those of conventional hydraulic excavators. Thus, operators operating conventional hydraulic excavators can easily master the operation of the double arm type hydraulic excavator 1 without the need of memorizing new operations.

Second Embodiment

[0044] Fig. 7 is a schematic diagram showing principal parts of a control system of a double arm type hydraulic excavator in a second embodiment of the present invention and the relationship between inputs and outputs of the control system. Fig. 8 is a schematic diagram showing the relationship between operation commands from the operating device and driving directions of actuators of the double arm type hydraulic excavator in the second embodiment of the present invention. Fig. 8(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 8(b) shows the operating directions of the operating device.

[0045] This embodiment differs from the first embodiment only in that the operating directions of the left control switch 56 and the operating directions of the right control switch 57 have been interchanged with each other. The rest of the configuration is equivalent to that in the first embodiment.

[0046] The operating directions of the left control lever 54 and the right control lever 55 are the same as those in the first embodiment as mentioned above. However, when the left control switch 56 is shifted (i.e., displaced) forward (ls1) as shown in Fig. 8(b), the longitudinal direction displacement sensor 561 of the left control switch 56 outputs a sensing signal to a drive signal generation unit 161G in the control system 161 as shown in Fig. 7. The drive signal generation unit 161G receiving the sensing signal transmits a drive signal to the solenoid valve 215a for driving the left boom 11a. According to the drive signal, the left boom cylinder 11a is contracted and the left boom 10a is pivoted downward (LS1) as shown in Fig. 8(a). When the left control switch 56 is shifted backward (ls2), the left boom 10a is pivoted upward (LS2). When the left control switch 56 is shifted leftward (ls3), the left work tool 14a is pivoted forward (LS3). Further, when the left control switch 56 is shifted rightward (ls4), the left work tool 14a is pivoted backward (LS4).

[0047] Similarly, when the right control switch 57 is shifted forward (rs1), the left arm 12a is pivoted upward (RS1). When the right control switch 57 is shifted backward (rs2), the left arm 12a is pivoted downward (RS2). When the right control switch 57 is shifted leftward (rs3), the left swing post 7a is pivoted leftward (RS3). Further, when the right control switch 57 is shifted rightward (rs4), the left swing post 7a is pivoted rightward (RS4).

[0048] The effects of this embodiment configured as above differs from those of the first embodiment as follows: The driving direction of an actuator of the right front work implement B commanded by the operating direction of the left control lever 54 and the driving direction of an actuator included in the left front work implement A commanded by the operating direction of the right control switch 57 are the same as each other; and the driving direction of an actuator of the right front work implement B commanded by the operating direction of the right control lever 55 and the driving direction of an actuator included in the left front work implement A commanded by the operating direction of the left control switch 56 are the same as each other. Therefore, it becomes easier for the operator to move the left front work implement A and the right front work implement B (objects of the operations) at the same time. Since similar configurations are employed also for the swing posts, the arms and the work tools, the work is facilitated when the operator operates corresponding left and right actuators at the same time.

Third Embodiment

[0049] Fig. 9 is a schematic diagram showing principal parts of a control system of a double arm type hydraulic excavator in a third embodiment of the present invention and the relationship between inputs and outputs of the control system.

[0050] This embodiment differs from the first embodiment only in that an operation assignment switching unit 161Z, as a front work implement switching unit or an operated actuator switching unit, is provided in the control system 161. The rest of the configuration is equivalent to that in the first embodiment.

[0051] As shown in Fig. 9, the operation assignment switching unit 161Z is provided between the displacement sensors of the left control lever 54, the right control lever 55, the left control switch 56 and the right control switch 57 and the drive signal generation units. The operation assignment switching unit 161Z has a function of switching the signal destination (one of the drive signal generation units) to which the sensing signal obtained from each displacement sensor should be outputted.

[0052] An unshown selector switch that can be switched to three positions R, N and C is provided in the cab 4 and is electrically connected to the operation assignment switching unit 161Z in the control system 161.

[0053] The selector switch at the position N means that a command for no switching is issued to the operation assignment switching unit 161Z.

[0054] The selector switch at the position R means that a switching command for having the right front work implement B (which has been operated by the left control lever 54 and the right control lever 55) operated by the left control switch 56 and the right control switch 57 and having the left front work implement A (which has been operated by the left control switch 56 and the right control switch 57) operated by the left control lever 54 and the right control lever 55 is issued to the operation assignment switching unit 161Z.

[0055] The selector switch at the position C means that a switching command for having the left front work implement A (which has been operated by the left control lever 54 and the right control lever 55) operated by the left control switch 56 and the right control switch 57 and having the right front work implement B (which has been operated by the left control switch 56 and the right control switch 57) operated by the left control lever 54 and the right control lever 55 is issued to the operation assignment switching unit 161Z.

[0056] Upon the input of a command signal from the selector switch, the operation assignment switching unit 161Z changes the assignment to the solenoid valves 216a and 216b according to the command signal.

[0057] Incidentally, while the switching between the left front work implement A and the right front work implement B has been illustrated in this embodiment, other types of switching (e.g., switching between actuators) may also be conducted.

[0058] According to this embodiment configured as above, effects similar to those of the first embodiment can be achieved while also allowing the operator to select an actuator that should be driven by each sensing signal sent from the operating device. Therefore, the operator can select an operation assignment that facilitates the operation. Consequently, the workability is improved.

Fourth Embodiment

[0059] Fig. 10 is a front view showing an operating device which is provided on a double arm type hydraulic excavator in a fourth embodiment of the present invention. Fig. 11 is a schematic diagram showing principal parts of a control system of the double arm type hydraulic excavator in the fourth embodiment of the present invention and the relationship between inputs and outputs of the control system.

[0060] This embodiment differs from the first embodiment in a left control switch 60 and a right control switch 61 having relatively low-priced configurations and in the processing of output signals from the left control switch 60 and the right control switch 61 in the control system 161. The rest of the configuration is equivalent to that in the first embodiment.

[0061] As shown in Fig. 10, each of the left and right control switches 60 and 61 includes four switches arranged in a cross-hair pattern so that a displacement can

be implemented (commanded) by pressing each of the switches. The switches of the left control switch 60 are respectively equipped with forward/backward/leftward/rightward displacement sensors 601 - 604, while the switches of the right control switch 61 are respectively equipped with forward/backward/leftward/rightward displacement sensors 611 - 614. The longitudinal (forward/backward) direction or the transverse (leftward/rightward) direction in regard to the pressing of the left control switch 60 or the right control switch 61 commands the driving direction of an actuator (e.g., expansion/contraction direction of a cylinder), and the amount of displacement of the pressing commands a speed for the actuator. Incidentally, the forward/backward/leftward/rightward directions of the left control switch 60 and the right control switch 61 will be referred to as "operating directions".

[0062] As shown in Fig. 11, a displacement outputted from a front part displacement sensor 601 or a rear part displacement sensor 602 of the left control switch 60 is inputted to the drive signal generation unit 161E of the control system 161. The drive signal generation unit 161E calculates the driving direction and the speed of the left arm cylinder 13a and outputs the calculation result to a pertinent solenoid valve. Similar processes are conducted also by using displacements outputted from the other displacement sensors 603, 604, 611 - 614 of the left and right control switches 60 and 61.

[0063] Next, the operation of the fourth embodiment will be described below.

[0064] Fig. 12 is a schematic diagram showing the relationship between operation commands from the operating device and driving directions of actuators of the double arm type hydraulic excavator in the fourth embodiment of the present invention. Fig. 12(a) shows the driving directions of the double arm type hydraulic excavator corresponding to the operating directions of the operating device and Fig. 12(b) shows the operating directions of the operating device.

[0065] As mentioned above, the operating directions of the left control lever 54 and the right control lever 55 are the same as those in the first embodiment, and thus repeated explanation thereof is omitted here.

[0066] When a front part of the left control switch 60 is depressed (ls1) as shown in Fig. 12(b), the left control switch front part displacement sensor 601 transmits a sensing signal to the drive signal generation unit 161E in the control system 161 as shown in Fig. 11. The drive signal generation unit 161E receiving the sensing signal transmits a drive signal to the left arm drive solenoid valve 216a. According to the drive signal, the left arm cylinder 13a is contracted and the left arm 12a is pivoted forward (LS1) as shown in Fig. 12(a). In this case, the pivoting speed of the left arm 12a is in a monotonically increasing relation (e.g., proportional relation) with the displacement inputted from the left control switch front part displacement sensor 601, and thus the displacement inputted from the left control switch front part displacement sensor 601 controls the speed of the pivoting of the left arm 12a. Conversely, when a rear part of the left control switch 60 is depressed (ls2), the left control switch rear part displacement sensor 601 transmits a sensing signal to the drive signal generation unit 161E in the control system 161. Accordingly, the left arm cylinder is expanded and the left arm is pivoted backward (LS2).

[0067] Similarly, when a left part of the left control switch 60 is depressed (ls3), the left swing post 7a is pivoted leftward (LS3). When a right part of the left control switch 60 is depressed (ls4), the left swing post 7a is pivoted rightward (LS4).

[0068] When a front part of the right control switch 61 is depressed (rs1), the left boom 10a is pivoted forward (RS1). When a rear part of the right control switch 61 is depressed (rs2), the left boom 10a is pivoted upward (RS2). When a left part of the right control switch 61 is depressed (rs3), the left work tool 14a is pivoted downward (RS3). Further, when a right part of the right control switch 61 is depressed (rs4), the left work tool 14a is pivoted upward (RS4).

[0069] This embodiment configured as above achieves effects similar to those of the first embodiment, while also being effective in terms of costs since the left control switch 60 and the right control switch 61 are simple in structure and low-priced.

Other Examples

[0070] While the right front work implement B has been described to include the swing post 7b in the first through fourth embodiments, a configuration with no swing post 7b is also possible. In this case, it is also possible to drive the swing motor 48 of the upper swing structure 3 by using the sensing signal from the transverse direction displacement sensor 542 of the left control lever 54. Accordingly, the right arm 12b is driven when the left control lever 54 is operated in the longitudinal (forward/backward) direction, while the swing motor 48 is driven when the left control lever 54 is operated in the transverse (leftward/rightward) direction. Further, in this configuration, the right boom 10b is driven when the right control lever 55 is operated in the longitudinal (forward/backward) direction, while the right work tool 14b is driven when the right control lever 55 is operated in the transverse (leftward/rightward) direction.

[0071] While the first through fourth embodiments have been configured so that the value of each operating signal can change continuously by equipping the left control switch 54 (60) and the right control switch 55 (61) with displacement sensors, the first through fourth embodiments may also be configured to obtain the value of each operating signal as an ON/OFF value by replacing the displacement sensors with contact sensors.

[0072] While the cab seat 4 is provided on the double arm type hydraulic excavator 1 in the first through fourth embodiments, it is also possible to employ a system configuration enabling remote control and provide the cab

seat 4 not on the double arm type hydraulic excavator 1 but at a position remote or separate from the double arm type hydraulic excavator 1.

[0073] Finally, it goes without saying that the embodiments described above can also be properly implemented in combination with each other.

Claims

1. An operating device for a work machinery, the work machinery comprising:

a work machinery main body;
a cab which is provided on the work machinery main body or outside the work machinery main body;
a first front work implement and a second front work implement which are provided at the front of the work machinery main body to be driven and freely pivoted up and down;
a cab seat which is provided in the cab;
a left operating device which is provided on the left side of the cab seat; and
a right operating device which is provided on the right side of the cab seat, **characterized in that**:

the left operating device includes a first left operating unit and a second left operating unit provided on the first left operating unit,
the right operating device includes a first right operating unit and a second right operating unit provided on the first right operating unit,
the shortest distance between the first left operating unit and the first right operating unit is greater than the width of the cab seat,
the operation of the first front work implement is performed by using the first left operating unit and the first right operating unit, and
the operation of the second front work implement is performed by using the second left operating unit and the second right operating unit.

2. The operating device for a work machinery according to claim 1, wherein:

the first front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure,
the second front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure,
the first left operating unit and the second left operating unit of the left operating device and the first right operating unit and the second right operating unit of the right operating device are configured to command driving directions of the actuators,
the driving direction commanded by the first left operating unit for one of the actuators in the first front work implement and the driving direction commanded by the second left operating unit for one of the actuators in the second front work implement are the same as each other, and
the driving direction commanded by the first right operating unit for another one of the actuators in the first front work implement and the driving direction commanded by the second right operating unit for another one of the actuators in the second front work implement are the same as each other.

3. The operating device for a work machinery according to claim 1, wherein:

the first front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure,
the second front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure,
the first left operating unit and the second left operating unit of the left operating device and the first right operating unit and the second right operating unit of the right operating device are configured to command driving directions of the actuators,
the driving direction commanded by the first left operating unit for one of the actuators in the first front work implement and the driving direction commanded by the second right operating unit for one of the actuators in the second front work implement are the same as each other, and
the driving direction commanded by the first right operating unit for another one of the actuators in the first front work implement and the driving direction commanded by the second left operating unit for another one of the actuators in the second front work implement are the same as each other.

4. The operating device for a work machinery according to claim 1, wherein the work machinery has a front work implement switching unit which switches the object of the operation by use of the first left operating unit and the first right operating unit from the first front work implement to the second front work implement while switching the object of the operation by use of the second left operating unit and the sec-

ond right operating unit from the second front work implement to the first front work implement.

5. The operating device for a work machinery according to claim 1, wherein:

the first front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure,
the second front work implement has a link structure made by linking a plurality of members together and a plurality of actuators provided for driving the link structure, and
the work machinery has an operated actuator switching unit which switches the object of the operation by use of the first left operating unit and the first right operating unit from the actuators in the first front work implement to the actuators in the second front work implement while switching the object of the operation by use of the second left operating unit and the second right operating unit from the actuators in the second front work implement to the actuators in the first front work implement.

FIG.1

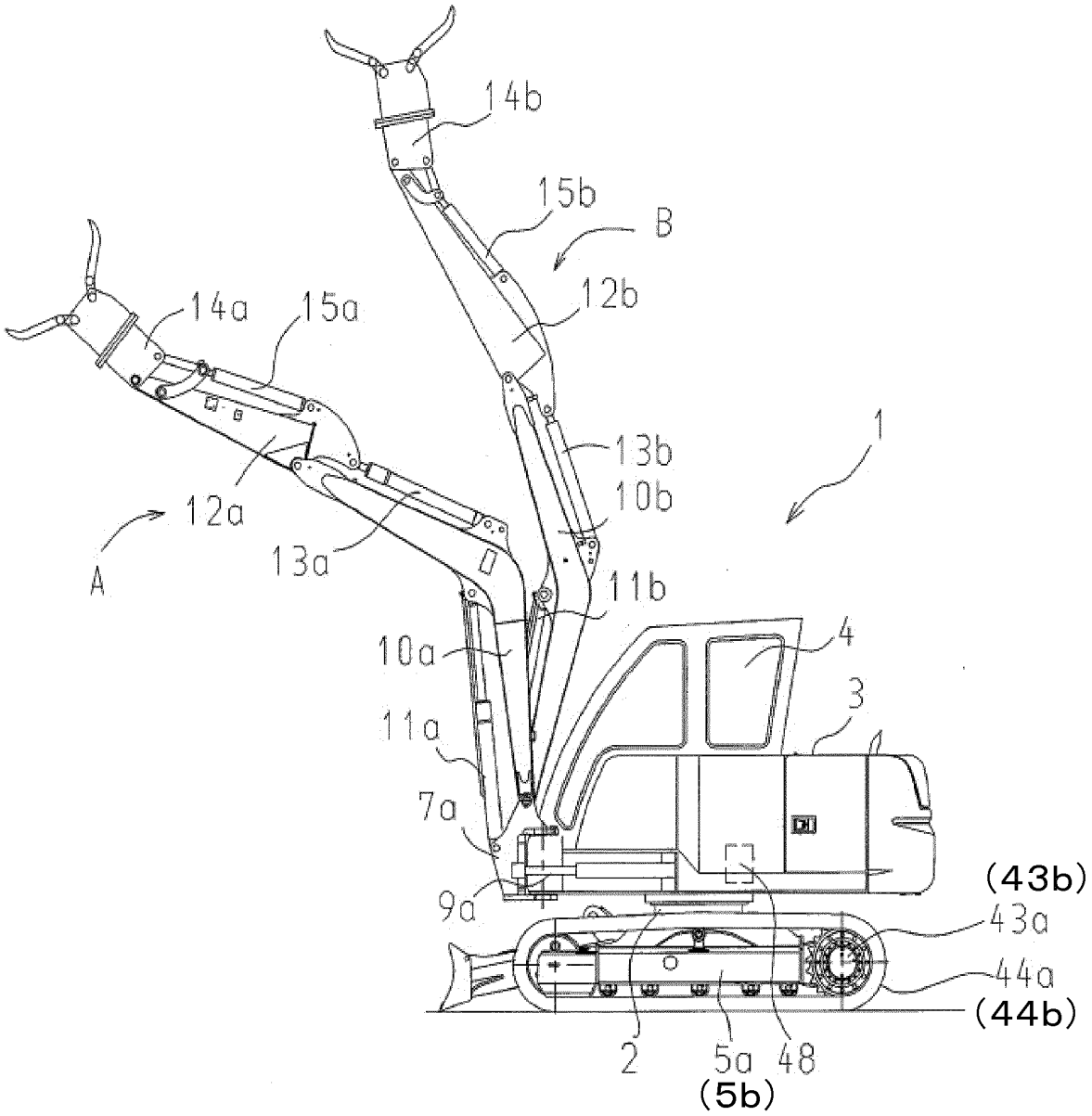

14b
15b
B
12b
14a
15a
13b
1
10b
12a
A
13a
11b
10a
4
3
11a
7a
9a
(43b)
43a
44a
(44b)
2
5a
(5b)
48

FIG.2

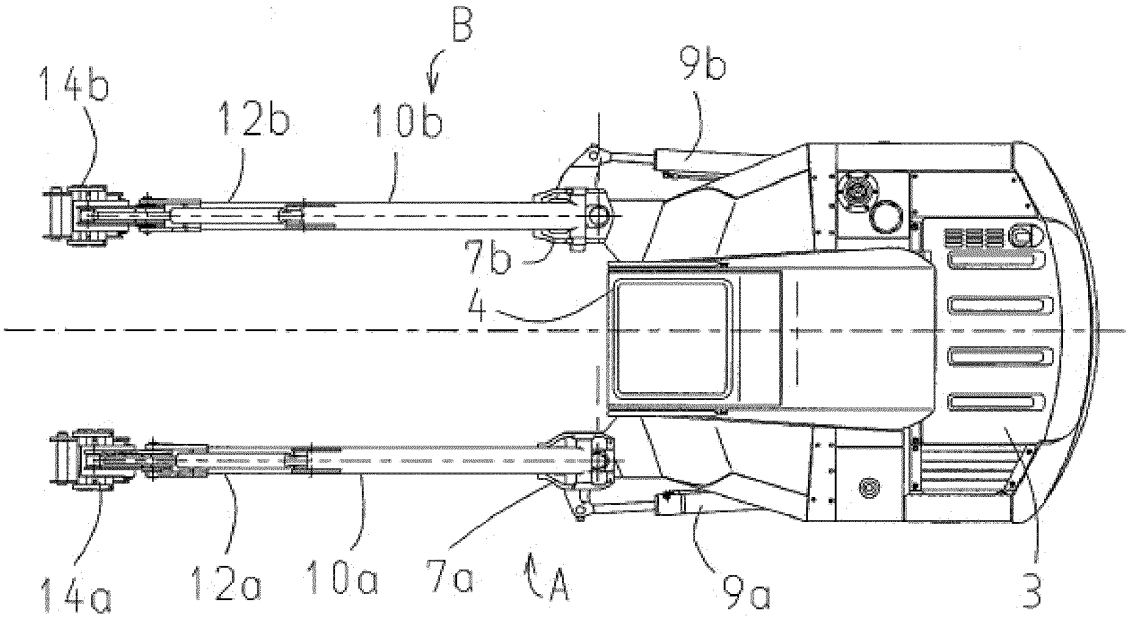


FIG.3

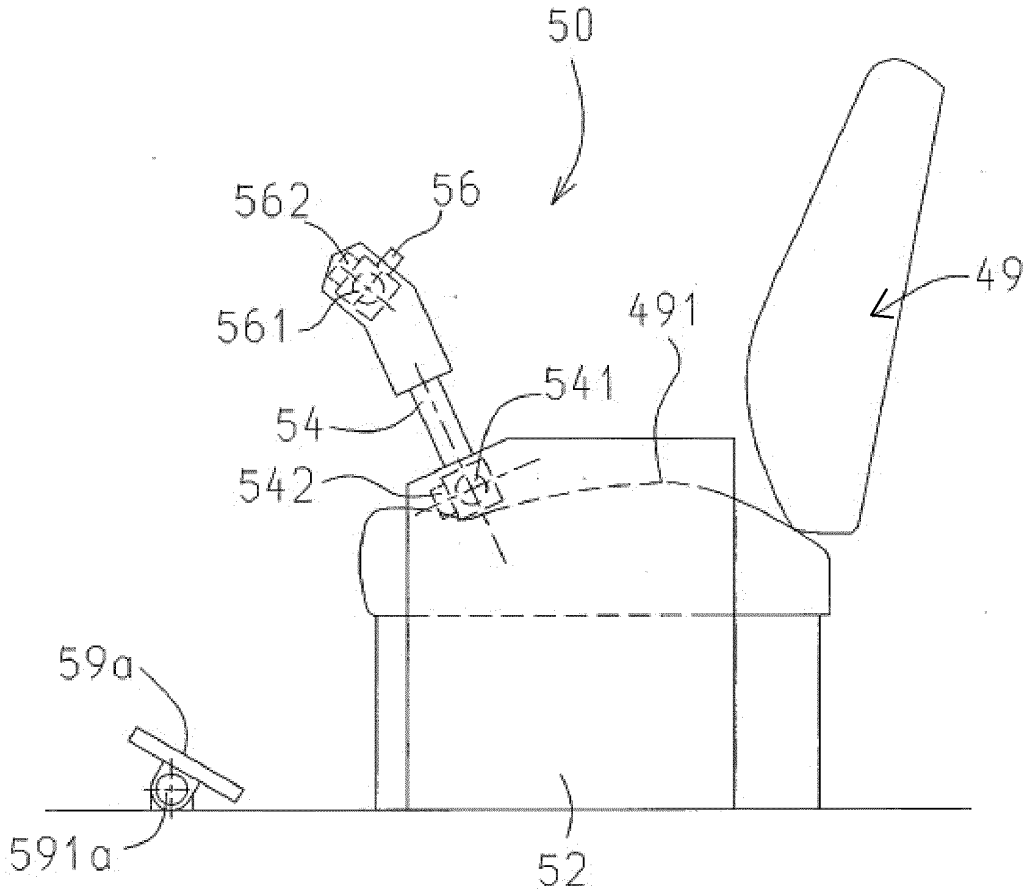


FIG.4

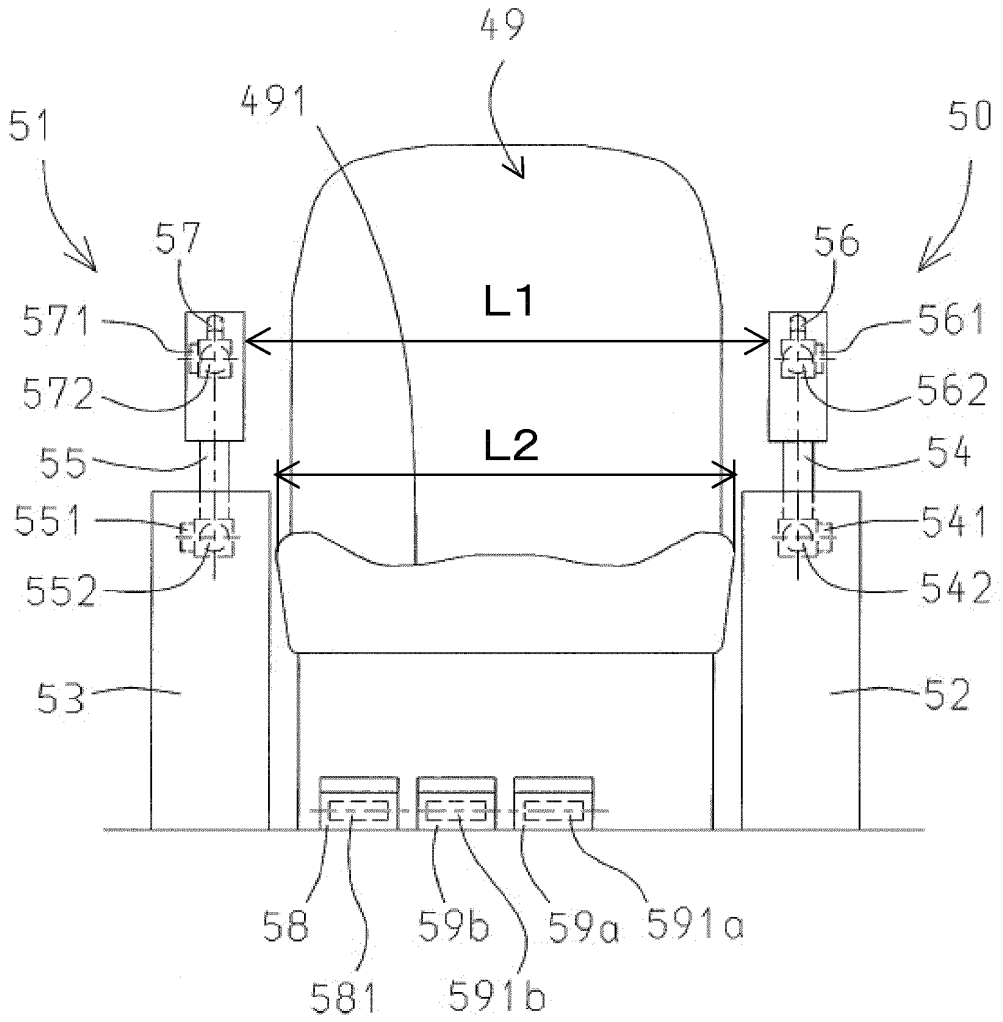

49
491
51
50
57
56
571
561
L1
572
562
55
L2
54
551
541
552
542
53
52
58
59b
59a
591a
581
591b

FIG.5

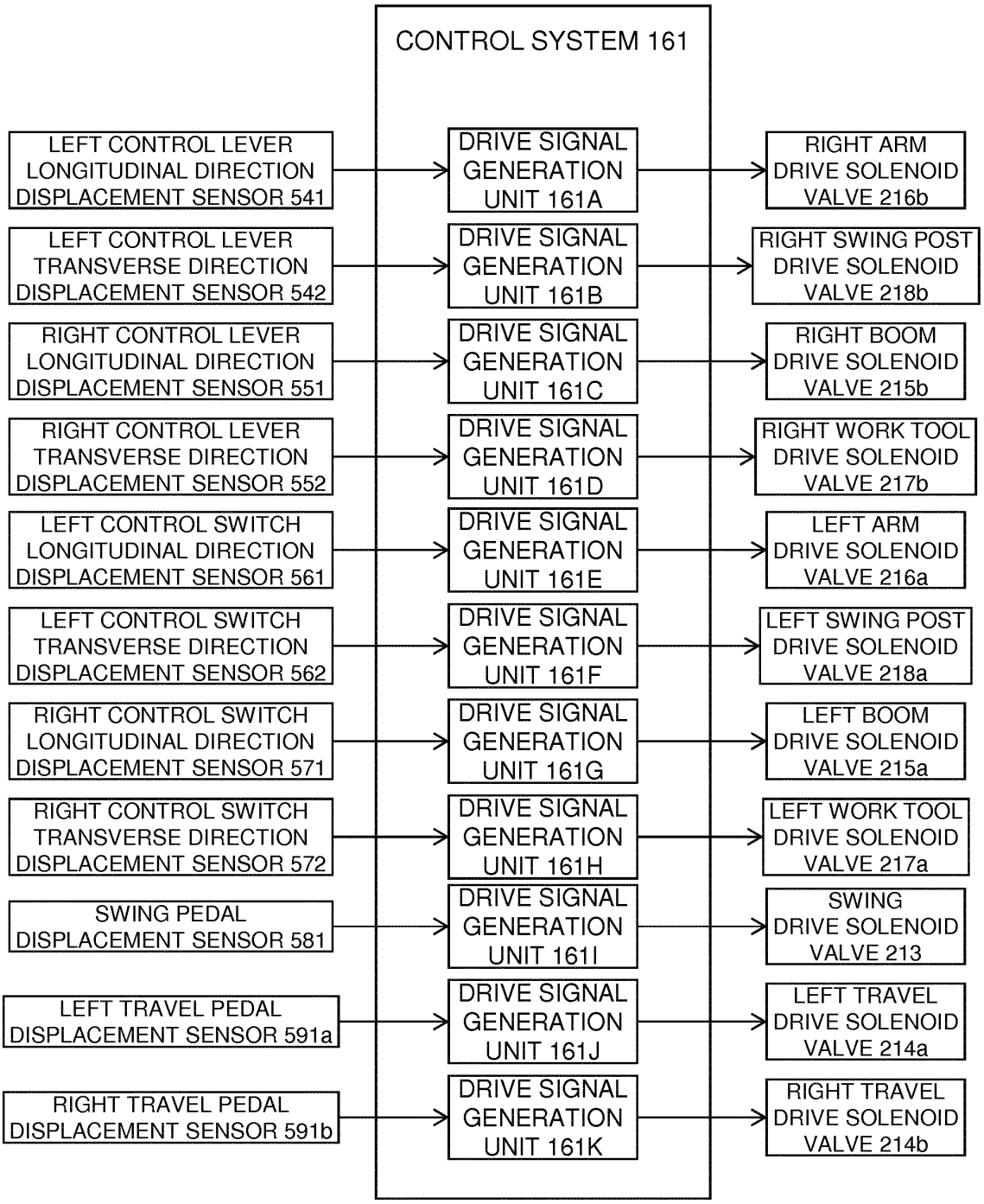
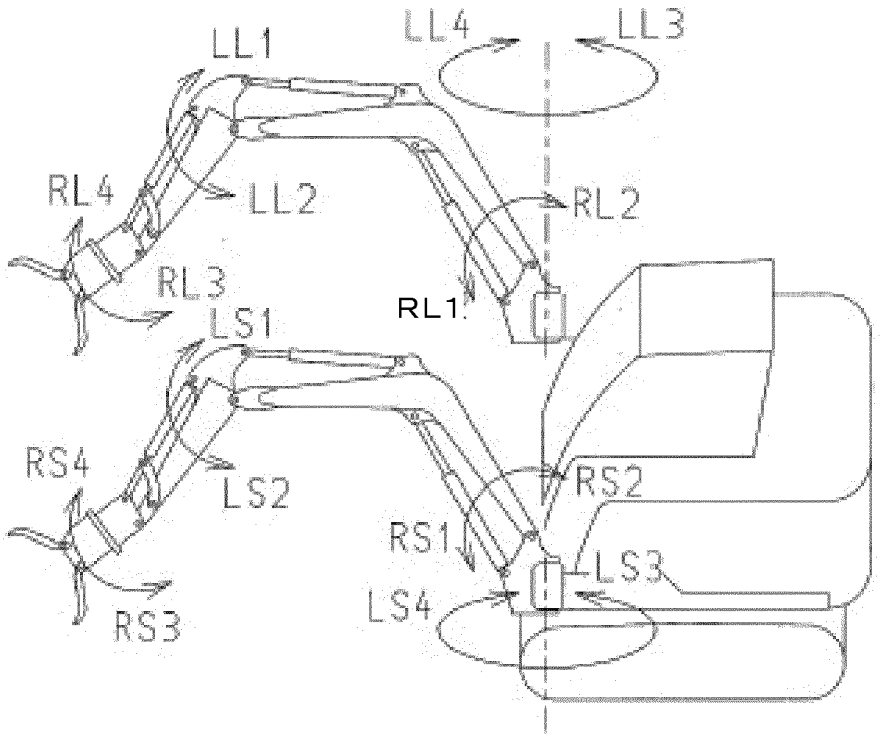

CONTROL SYSTEM 161
LEFT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 541
LEFT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 542
RIGHT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 551
RIGHT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 552
LEFT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 561
LEFT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 562
RIGHT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 571
RIGHT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 572
SWING PEDAL DISPLACEMENT SENSOR 581
LEFT TRAVEL PEDAL DISPLACEMENT SENSOR 591a
RIGHT TRAVEL PEDAL DISPLACEMENT SENSOR 591b
DRIVE SIGNAL GENERATION UNIT 161A
DRIVE SIGNAL GENERATION UNIT 161B
DRIVE SIGNAL GENERATION UNIT 161C
DRIVE SIGNAL GENERATION UNIT 161D
DRIVE SIGNAL GENERATION UNIT 161E
DRIVE SIGNAL GENERATION UNIT 161F
DRIVE SIGNAL GENERATION UNIT 161G
DRIVE SIGNAL GENERATION UNIT 161H
DRIVE SIGNAL GENERATION UNIT 161I
DRIVE SIGNAL GENERATION UNIT 161J
DRIVE SIGNAL GENERATION UNIT 161K
RIGHT ARM DRIVE SOLENOID VALVE 216b
RIGHT SWING POST DRIVE SOLENOID VALVE 218b
RIGHT BOOM DRIVE SOLENOID VALVE 215b
RIGHT WORK TOOL DRIVE SOLENOID VALVE 217b
LEFT ARM DRIVE SOLENOID VALVE 216a
LEFT SWING POST DRIVE SOLENOID VALVE 218a
LEFT BOOM DRIVE SOLENOID VALVE 215a
LEFT WORK TOOL DRIVE SOLENOID VALVE 217a
SWING DRIVE SOLENOID VALVE 213
LEFT TRAVEL DRIVE SOLENOID VALVE 214a
RIGHT TRAVEL DRIVE SOLENOID VALVE 214b

FIG.6

(a)


LL1
LL4
LL3
RL4
LL2
RL2
RL3
RL1
LS1
RS4
LS2
RS2
RS1
LS3
LS4
RS3

(b)

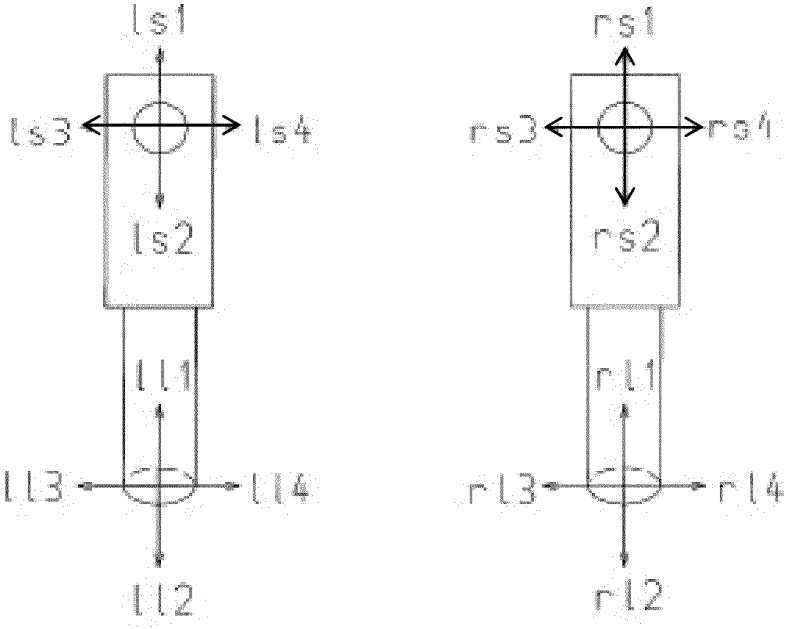

ls1
ls3
ls4
ls2
ll1
ll3
ll4
ll2
rs1
rs3
rs4
rs2
rl1
rl3
rl4
rl2

FIG.7

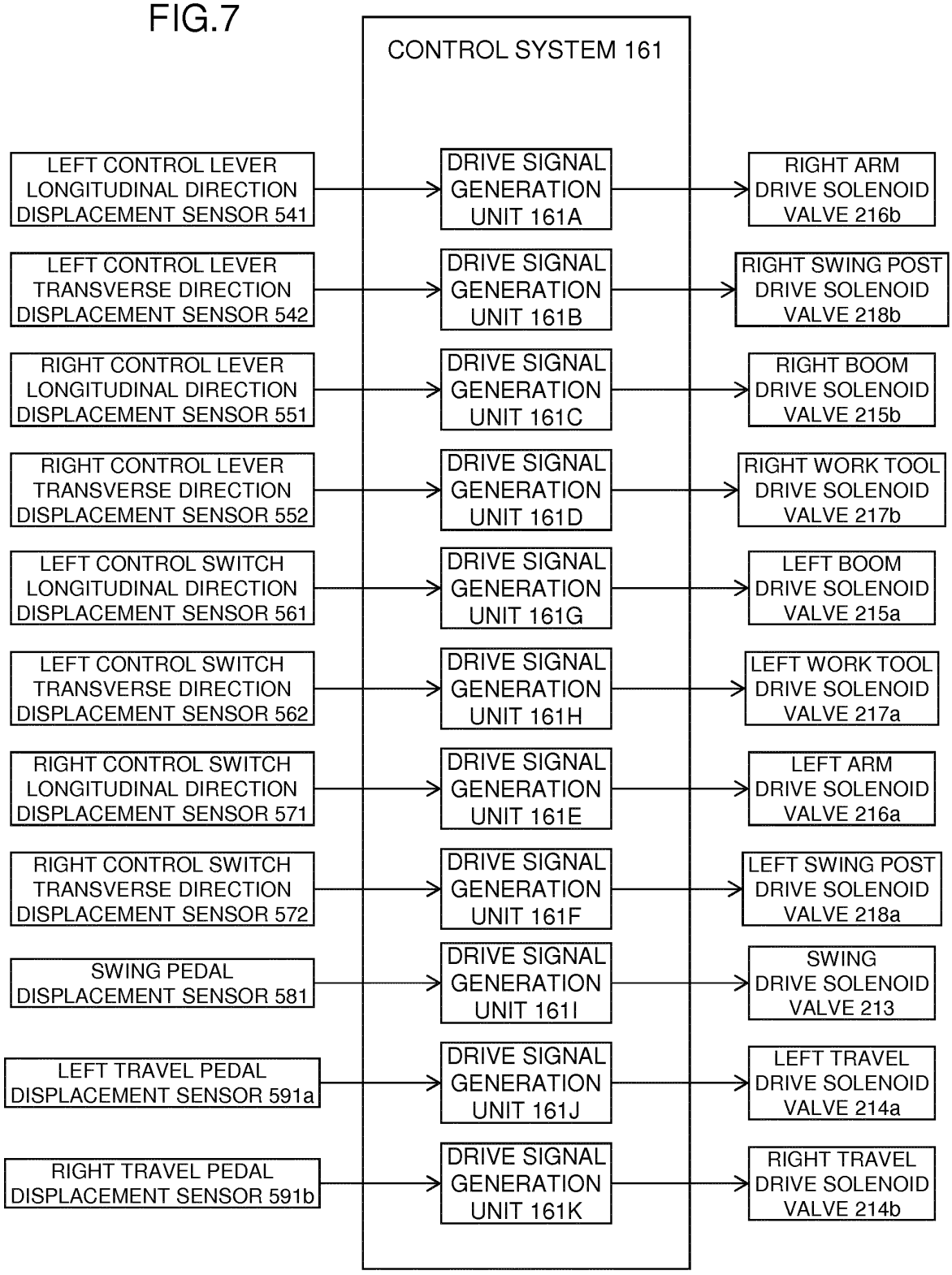

CONTROL SYSTEM 161
LEFT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 541
LEFT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 542
RIGHT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 551
RIGHT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 552
LEFT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 561
LEFT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 562
RIGHT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 571
RIGHT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 572
SWING PEDAL DISPLACEMENT SENSOR 581
LEFT TRAVEL PEDAL DISPLACEMENT SENSOR 591a
RIGHT TRAVEL PEDAL DISPLACEMENT SENSOR 591b
DRIVE SIGNAL GENERATION UNIT 161A
DRIVE SIGNAL GENERATION UNIT 161B
DRIVE SIGNAL GENERATION UNIT 161C
DRIVE SIGNAL GENERATION UNIT 161D
DRIVE SIGNAL GENERATION UNIT 161G
DRIVE SIGNAL GENERATION UNIT 161H
DRIVE SIGNAL GENERATION UNIT 161E
DRIVE SIGNAL GENERATION UNIT 161F
DRIVE SIGNAL GENERATION UNIT 161I
DRIVE SIGNAL GENERATION UNIT 161J
DRIVE SIGNAL GENERATION UNIT 161K
RIGHT ARM DRIVE SOLENOID VALVE 216b
RIGHT SWING POST DRIVE SOLENOID VALVE 218b
RIGHT BOOM DRIVE SOLENOID VALVE 215b
RIGHT WORK TOOL DRIVE SOLENOID VALVE 217b
LEFT BOOM DRIVE SOLENOID VALVE 215a
LEFT WORK TOOL DRIVE SOLENOID VALVE 217a
LEFT ARM DRIVE SOLENOID VALVE 216a
LEFT SWING POST DRIVE SOLENOID VALVE 218a
SWING DRIVE SOLENOID VALVE 213
LEFT TRAVEL DRIVE SOLENOID VALVE 214a
RIGHT TRAVEL DRIVE SOLENOID VALVE 214b

FIG.8

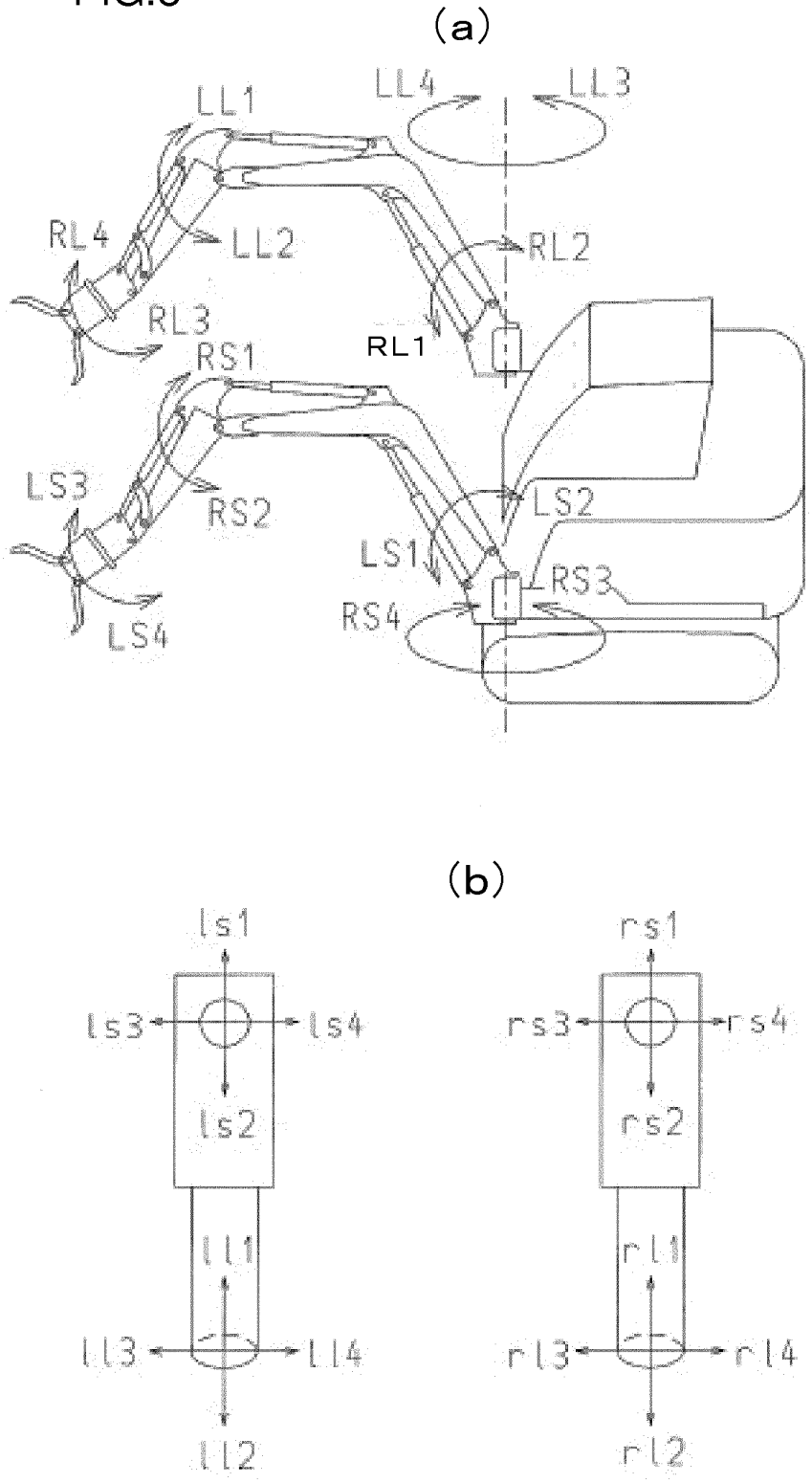

(a)
LL1
LL4
LL3
RL4
LL2
RL2
RL3
RL1
RS1
LS3
RS2
LS2
LS1
RS3
RS4
LS4
(b)
ls1
ls3
ls4
ls2
ll1
ll3
ll4
ll2
rs1
rs3
rs4
rs2
rl1
rl3
rl4
rl2

FIG.9

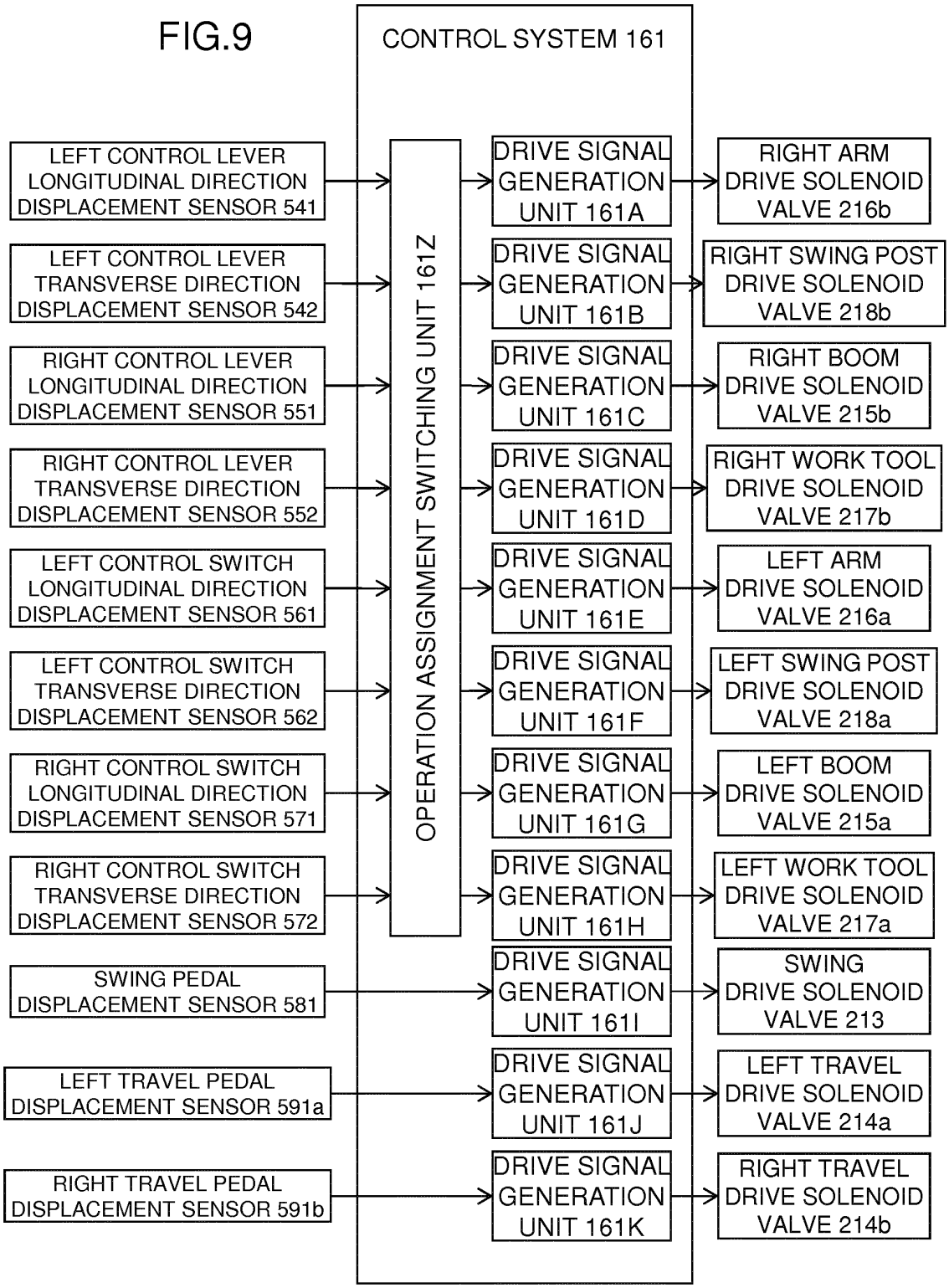

CONTROL SYSTEM 161
LEFT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 541
LEFT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 542
RIGHT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 551
RIGHT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 552
LEFT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 561
LEFT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 562
RIGHT CONTROL SWITCH LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 571
RIGHT CONTROL SWITCH TRANSVERSE DIRECTION DISPLACEMENT SENSOR 572
SWING PEDAL DISPLACEMENT SENSOR 581
LEFT TRAVEL PEDAL DISPLACEMENT SENSOR 591a
RIGHT TRAVEL PEDAL DISPLACEMENT SENSOR 591b
OPERATION ASSIGNMENT SWITCHING UNIT 161Z
DRIVE SIGNAL GENERATION UNIT 161A
DRIVE SIGNAL GENERATION UNIT 161B
DRIVE SIGNAL GENERATION UNIT 161C
DRIVE SIGNAL GENERATION UNIT 161D
DRIVE SIGNAL GENERATION UNIT 161E
DRIVE SIGNAL GENERATION UNIT 161F
DRIVE SIGNAL GENERATION UNIT 161G
DRIVE SIGNAL GENERATION UNIT 161H
DRIVE SIGNAL GENERATION UNIT 161I
DRIVE SIGNAL GENERATION UNIT 161J
DRIVE SIGNAL GENERATION UNIT 161K
RIGHT ARM DRIVE SOLENOID VALVE 216b
RIGHT SWING POST DRIVE SOLENOID VALVE 218b
RIGHT BOOM DRIVE SOLENOID VALVE 215b
RIGHT WORK TOOL DRIVE SOLENOID VALVE 217b
LEFT ARM DRIVE SOLENOID VALVE 216a
LEFT SWING POST DRIVE SOLENOID VALVE 218a
LEFT BOOM DRIVE SOLENOID VALVE 215a
LEFT WORK TOOL DRIVE SOLENOID VALVE 217a
SWING DRIVE SOLENOID VALVE 213
LEFT TRAVEL DRIVE SOLENOID VALVE 214a
RIGHT TRAVEL DRIVE SOLENOID VALVE 214b

FIG.10

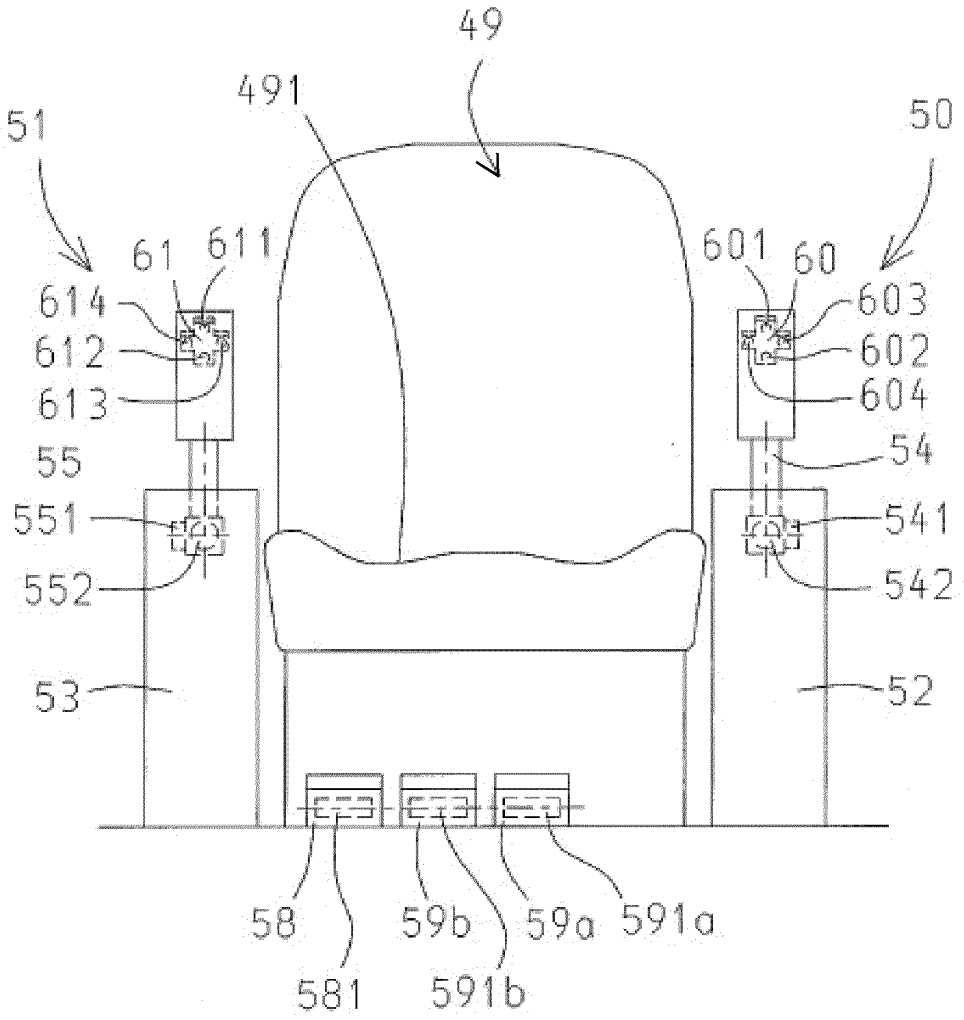

49
491
51
50
61
611
601
60
614
612
613
603
602
604
55
54
551
541
552
542
53
52
58
59b
59a
591a
581
591b

FIG.11

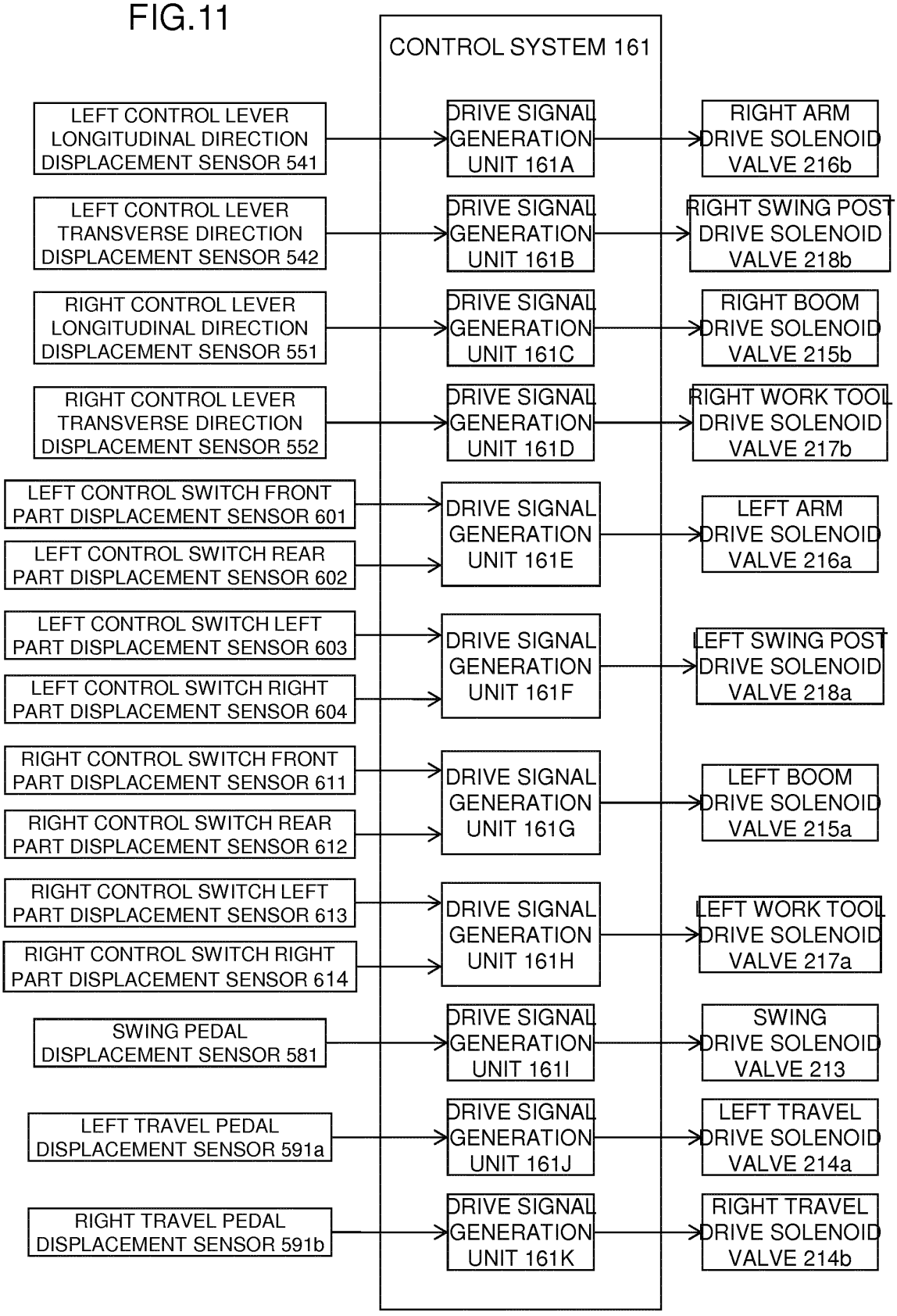
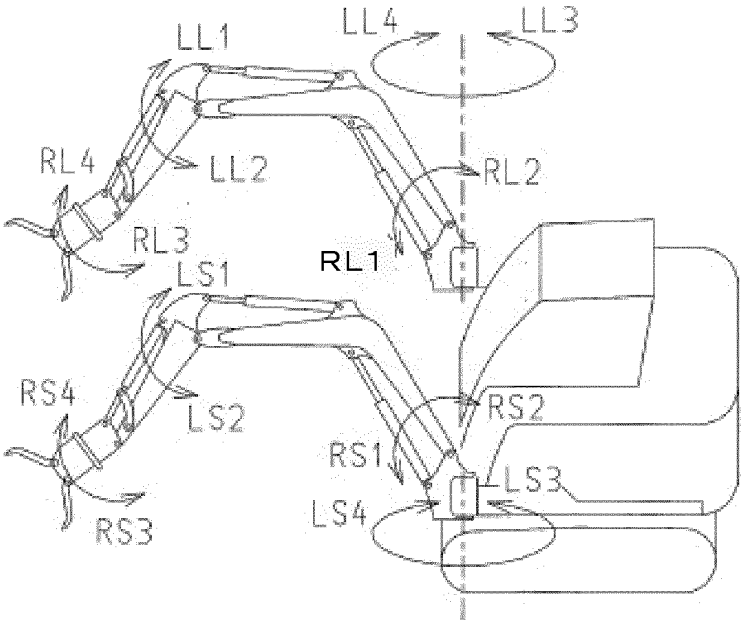
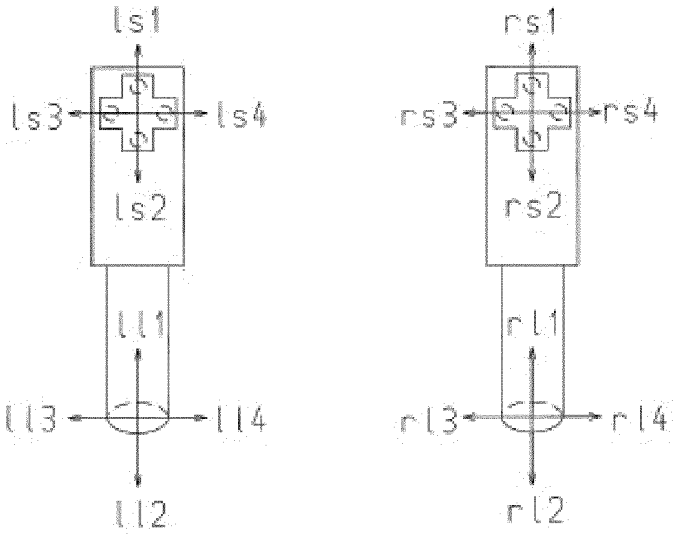

CONTROL SYSTEM 161
LEFT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 541
LEFT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 542
RIGHT CONTROL LEVER LONGITUDINAL DIRECTION DISPLACEMENT SENSOR 551
RIGHT CONTROL LEVER TRANSVERSE DIRECTION DISPLACEMENT SENSOR 552
LEFT CONTROL SWITCH FRONT PART DISPLACEMENT SENSOR 601
LEFT CONTROL SWITCH REAR PART DISPLACEMENT SENSOR 602
LEFT CONTROL SWITCH LEFT PART DISPLACEMENT SENSOR 603
LEFT CONTROL SWITCH RIGHT PART DISPLACEMENT SENSOR 604
RIGHT CONTROL SWITCH FRONT PART DISPLACEMENT SENSOR 611
RIGHT CONTROL SWITCH REAR PART DISPLACEMENT SENSOR 612
RIGHT CONTROL SWITCH LEFT PART DISPLACEMENT SENSOR 613
RIGHT CONTROL SWITCH RIGHT PART DISPLACEMENT SENSOR 614
SWING PEDAL DISPLACEMENT SENSOR 581
LEFT TRAVEL PEDAL DISPLACEMENT SENSOR 591a
RIGHT TRAVEL PEDAL DISPLACEMENT SENSOR 591b
DRIVE SIGNAL GENERATION UNIT 161A
DRIVE SIGNAL GENERATION UNIT 161B
DRIVE SIGNAL GENERATION UNIT 161C
DRIVE SIGNAL GENERATION UNIT 161D
DRIVE SIGNAL GENERATION UNIT 161E
DRIVE SIGNAL GENERATION UNIT 161F
DRIVE SIGNAL GENERATION UNIT 161G
DRIVE SIGNAL GENERATION UNIT 161H
DRIVE SIGNAL GENERATION UNIT 161I
DRIVE SIGNAL GENERATION UNIT 161J
DRIVE SIGNAL GENERATION UNIT 161K
RIGHT ARM DRIVE SOLENOID VALVE 216b
RIGHT SWING POST DRIVE SOLENOID VALVE 218b
RIGHT BOOM DRIVE SOLENOID VALVE 215b
RIGHT WORK TOOL DRIVE SOLENOID VALVE 217b
LEFT ARM DRIVE SOLENOID VALVE 216a
LEFT SWING POST DRIVE SOLENOID VALVE 218a
LEFT BOOM DRIVE SOLENOID VALVE 215a
LEFT WORK TOOL DRIVE SOLENOID VALVE 217a
SWING DRIVE SOLENOID VALVE 213
LEFT TRAVEL DRIVE SOLENOID VALVE 214a
RIGHT TRAVEL DRIVE SOLENOID VALVE 214b

FIG.12

(a)


LL1
LL4
LL3
RL4
LL2
RL2
RL3
RL1
LS1
RS4
LS2
RS2
RS1
LS3
LS4
RS3

(b)


ls1
ls3
ls4
ls2
ll1
ll3
ll4
ll2
rs1
rs3
rs4
rs2
rl1
rl3
rl4
rl2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/074726

A. CLASSIFICATION OF SUBJECT MATTER
G05G1/01(2008.04)i, *E02F9/16*(2006.01)i, *E02F9/20*(2006.01)i, *G05G9/047*(2006.01)i, *B25J13/02*(2006.01)n

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)
G05G1/01, E02F9/16, E02F9/20, G05G9/047, B25J13/02

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 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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.
A	JP 11-181815 A (Hitachi Construction Machinery Co., Ltd.), 06 July 1999 (06.07.1999), entire text; all drawings (Family: none)	1-5
A	JP 2013-7190 A (Hitachi Construction Machinery Co., Ltd.), 10 January 2013 (10.01.2013), entire text; all drawings (Family: none)	1-5
A	JP 2006-307433 A (Hitachi Construction Machinery Co., Ltd.), 09 November 2006 (09.11.2006), entire text; all drawings (Family: none)	1-5

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 December, 2014 (05.12.14)	16 December, 2014 (16.12.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/074726

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-173014 A (Takahashi Works Co., Ltd.), 26 June 2001 (26.06.2001), entire text; all drawings (Family: none)	1-5
A	JP 10-88619 A (FFC Ltd.), 07 April 1998 (07.04.1998), paragraphs [0086] to [0096]; fig. 26 to 28 & US 5826483 A	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 2006252224 A **[0007]**