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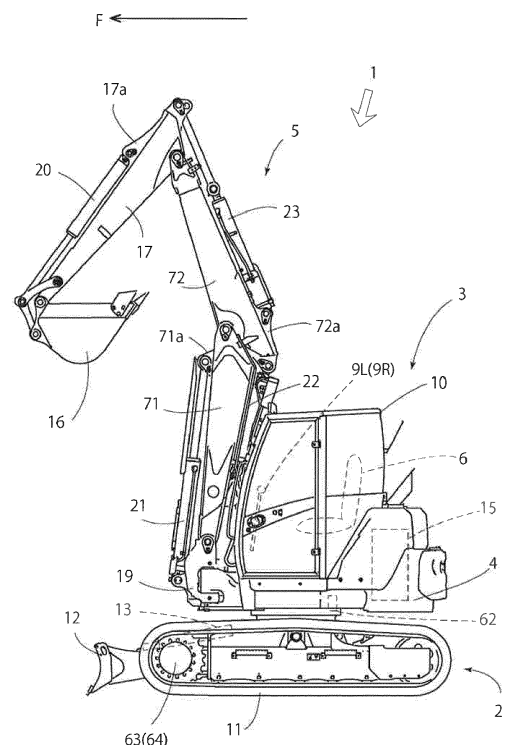
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(54) **HYDRAULIC CIRCUIT OF HYDRAULIC WORK VEHICLE**

(57) A hydraulic circuit includes: a first control valve unit (101) configured to operate hydraulic cylinders (20, 21, 23) for a work unit (5), hydraulic motors (62-65) and hydraulic cylinders provided to an upper revolving superstructure (3) and a traveling unit (2); a second control valve unit (102) configured to operate a second boom cylinder (22) and a hydraulic motor (24); an attachment operation switch (45) and a second boom operation pedal (46) as an operation unit configured to operate a second boom (72) and a hydraulic work attachment (24); and a pilot pressure oil control unit (80) configured to supply pilot pressure oil to an extraction control valve (41) as a switching valve on the most downstream side in the first control valve unit (101) and an attachment control valve (42) and a second boom control valve (43), when the operation unit (45, 46, 56, 57) is operated.

Fig. 1



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a hydraulic circuit of a hydraulic work vehicle such as a hydraulic excavator that has an attachment attached thereto and includes a boom including a first boom and a second boom.

Description of the Related Art

[0002] Some conventionally known hydraulic work vehicles have a two-piece boom structure featuring a boom separated into a first boom and a second boom to achieve a larger movable range of a work device. The two-piece boom structure is provided as follows. Specifically, a first boom on a base end portion side has a base end side pivotally coupled to an upper revolving superstructure via a coupling pin. A second boom on a distal end side has a base end side pivotally coupled to a distal end of the first boom via a coupling pin. The first boom is pivoted upward and downward by a boom cylinder. The second boom is pivoted upward and downward by a positioning cylinder (for example, Japanese Examined Patent Publication No. H06-37779 B).

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0003] In the technique disclosed in Japanese Examined Patent Publication No. H6-37779 B, the second boom has a distal end coupled to an arm to which a hydraulic work attachment is attached. The hydraulic work attachment and the boom cannot be operated at the same time. More specifically, a control circuit is provided so that a selecting switching valve is automatically operated in such a manner that when attempts to operate the hydraulic work attachment and the second boom are made at the same time, the hydraulic work attachment is prioritized to be operated.

[0004] A hydraulic circuit with which the hydraulic work attachment and the second boom can be operated at the same time has been called for, because the position of the hydraulic work attachment being operated may be desired to be changed in the height direction and the like in some cases. The hydraulic circuit with which the hydraulic work attachment and the second boom can be operated at the same time can be implemented by additionally providing a control valve unit, but this inevitably leads to a higher cost.

[0005] Thus, an object is to provide an improved hydraulic circuit with which the hydraulic work attachment and the second boom can be operated at the same time.

Means of Solving the Problems

[0006] An object of the present invention is as described above, and configurations for achieving the object are described below.

[0007] Specifically, according to a first aspect, a hydraulic circuit of a hydraulic work vehicle includes: a first control valve unit configured to operate a hydraulic actuator for a work unit and a hydraulic actuator provided to an upper revolving superstructure and a traveling unit, the first control valve unit including a plurality of pilot switching valves with which oil is supplied to the hydraulic actuators; a second control valve unit configured to operate hydraulic actuators for a second boom and a hydraulic work attachment, the second control valve unit including a plurality of pilot switching valves with which oil is supplied to the hydraulic actuators; an operation unit configured to operate the second boom and the hydraulic work attachment; and a pilot pressure oil control unit configured to supply pilot pressure oil to one of switching valves of the first control valve unit that is on most downstream side and to a switching valve of the second control valve unit, when the operation unit is operated.

[0008] According to a second aspect, an output port of the one of the switching valves of the first control valve unit that is on the most downstream side is in communication with an input port of the second control valve unit.

[0009] According to a third aspect, the pilot pressure oil control unit includes a plurality of shuttle valves, wherein pilot pressure oil to the operation control unit for the switching valves of the second control valve unit is branched by an operation of the operation unit, and pressure oil is supplied the shuttle valves and is input to the operation control unit for one of control valves of the first control valve unit that is on the most downstream side.

Advantageous Effects of the Invention

[0010] The present invention has the following advantageous effects.

[0011] The hydraulic work attachment and the second boom can be operated at the same time. This can be implemented simply by providing a control valve unit that can be appended to a conventional control valve unit at a minimum increase in cost, instead of additionally forming a control unit that can operate the hydraulic work attachment and the second boom at the same time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a side view illustrating an overall configuration of a hydraulic work vehicle including a hydraulic circuit according to the present invention.

FIG. 2 is a diagram illustrating the hydraulic circuit of the hydraulic work vehicle.

FIG. 3 is a diagram illustrating the hydraulic circuit according to the present invention.

FIG. 4 is a diagram illustrating the hydraulic circuit in a state where the hydraulic work attachment is operated.

FIG. 5 is a diagram illustrating the hydraulic circuit in a state where a second boom is operated.

FIG. 6 is a diagram illustrating the hydraulic circuit in a state where the hydraulic work attachment and the second boom are operated.

FIG. 7 is a side view illustrating an overall configuration of a hydraulic work vehicle having a one-piece boom structure.

FIG. 8 is a diagram illustrating a hydraulic circuit of the hydraulic work vehicle having the one-piece boom structure.

FIG. 9 is a diagram illustrating a hydraulic circuit of a hydraulic work vehicle dedicated to a two-piece boom structure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] An overall configuration of a backhoe (hydraulic excavator) 1 as an embodiment of a hydraulic work vehicle including a hydraulic circuit according to the present invention is described with reference to FIG. 1 and FIG. 2. In FIG. 1, a direction indicated by an arrow F is defined as a front direction.

[0014] As illustrated in FIG. 1, the backhoe 1 mainly includes a traveling unit 2, an upper revolving superstructure 3, and a work unit 5. The traveling unit 2 and the upper revolving superstructure 3 form a main body section.

[0015] The traveling unit 2, including a crawler traveling device, serves as a lower structure of the backhoe 1 and includes: a pair of left and right crawlers 11 and 11, a blade 12, and a blade cylinder 13. The crawlers 11 and 11 are each spanned around a driving wheel and a driven wheel. The blade 12 extends forward from a center of a truck frame, supporting the driving wheels and the driven wheels, in a left and right direction. The blade cylinder 13 serves as a hydraulic actuator that rotates the blade 12 upward and downward. The driving wheels are driven by hydraulic drive motors 63 and 64 attached to the truck frame. Thus, the traveling unit 2 travels by being driven by the right hydraulic drive motor 63 and the left hydraulic drive motor 64 serving as hydraulic actuators.

[0016] The upper revolving superstructure 3 includes an engine 15, a cabin 10 accommodating an operation section, and the like disposed on a swivel frame 4 that is a member serving as an upper structure. The upper revolving superstructure 3 is attached to an upper portion of the traveling unit 2 at the center of the truck frame in the front and rear direction and in the left and right direction, via a swing bearing, in such a manner as to be able to swivel. A hydraulic swivel motor 62 is attached on the swivel frame 4. A swivel drive gear fixed on an output

shaft of the hydraulic swivel motor 62 meshes with a ring gear fixed to the truck frame. Thus, the upper revolving superstructure 3 can swivel clockwise and counterclockwise with the hydraulic swivel motor 62 being driven.

[0017] The engine 15 serving as a driving source, as well as a first pump P1, a second pump P2, a third pump P3, and a fourth pump P4 driven by the engine 15 are disposed on a rear portion of the swivel frame 4.

[0018] The operation section is defined in an upper front portion of the swivel frame 4 and includes: a seat 6 above the engine 15; work operation levers 7 and 8 on the left and the right sides of the seat 6; traveling levers 9L and 9R on the front side of the seat 6; an attachment operation switch 45; and a second boom operation pedal 46. The operation section is enclosed by the cabin 10. A boom bracket 19 with which the work unit 5 is attached is disposed on the center portion of the swivel frame 4 in the front and rear direction and in the left and right direction.

[0019] The work unit 5 mainly includes an arm 17, a first boom 71, a second boom 72, a boom bracket 19, a bucket 16, a bucket cylinder 20, an arm cylinder 23, a first boom cylinder 21, a second boom cylinder 22, and a swing cylinder 25, and is disposed on a front portion of the swivel frame 4 of the backhoe 1.

[0020] The bucket 16 is attached to a distal end of the arm 17. The arm 17 has a base end portion attached to a distal end portion of the second boom 72 in such a manner as to be pivotable upward and downward.

[0021] A boom includes the first boom 71 and the second boom 72. The first boom 71 has a base end portion attached to the boom bracket 19 via a pin in such a manner as to be pivotable upward and downward. The second boom 72 has a base end portion attached to a distal end of the first boom 71 via a pin in such a manner as to be pivotable upward and downward. The arm 17 has a base end portion attached to a distal end of the second boom 72 via a pin in such a manner as to be pivotable upward and downward.

[0022] The boom bracket 19 serves as a base end portion of the work unit 5, and has a rear end portion attached to a front-end portion of the swivel frame 4 in such a manner as to be pivotable leftward and rightward.

[0023] The bucket cylinder 20 is a hydraulic cylinder for rotating the bucket 16 forward and rearward relative to the arm 17. The bucket cylinder 20 has a cylinder end portion pivotally attached to a bracket 17a disposed to a base end portion of the arm 17, and has a rod end portion pivotally attached to the bucket 16 via a link. A hydraulic work attachment other than the bucket 16, such as a clamshell bucket, a grapple, and a breaker, may be attached and controlled by the hydraulic circuit according to the present invention.

[0024] The arm cylinder 23 is a hydraulic cylinder that makes the arm 17 pivot with respect to the second boom 72. The arm cylinder 23 has a cylinder end portion pivotally attached to a bracket 72a provided to an upper surface of the second boom 72 on the base end portion

side. The arm cylinder 23 has a rod end portion pivotally attached to the bracket 17a.

[0025] The first boom cylinder 21 is a hydraulic cylinder that makes the first boom 71 pivot.

[0026] The first boom cylinder 21 has a cylinder end portion pivotally attached to a front-end portion of the boom bracket 19, and has a rod end portion pivotally attached to a bracket 71 disposed on a front surface of the distal end portion of the first boom 71.

[0027] The second boom cylinder 22 is a hydraulic cylinder for making the second boom 72 pivot.

[0028] The second boom cylinder 22 has a cylinder end portion pivotally attached to a rear surface of the first boom 71. The second boom cylinder 22 has a rod end portion pivotally attached to the bracket 72a provided to a base end portion of the second boom 72.

[0029] The swing cylinder 25 is a hydraulic cylinder that makes the work unit 5 rotate clockwise and counterclockwise with respect to the swivel frame 4. The swing cylinder 25 is provided between the boom bracket 19 and the swivel frame 4.

[0030] Next, a configuration of a hydraulic circuit 100 as an embodiment of the hydraulic circuit according to the present invention is described with reference to FIG. 2.

[0031] In the hydraulic circuit 100, pressure oil discharged from the first pump P1, the second pump P2, and the third pump P3, driven by the engine 15, is sent to hydraulic actuators via control valves for driving the hydraulic actuators. Pressure oil discharged from the fourth pump P4, driven by the engine 15, is sent to an operation control unit for control valves via remote control valves, so that the control valves are switched. The control valves include hydraulic pilot switching valves, switched with pilot pressure oil sent to the operation control unit, and are provided to each of a first control valve unit 101 and a second control valve unit 102. The first control valve unit 101 includes a right traveling control valve 31, a first boom control valve 32, a bucket control valve 33, a left traveling control valve 34, a swing control valve 35, a power-take off (PTO) control valve 36, an arm control valve 37, a swivel control valve 38, a blade control valve 39, and an extraction control valve 41. The second control valve unit 102 includes an attachment control valve 42, a second boom control valve 43, and a flow path control unit 80.

[0032] A hydraulic circuit is formed in such a manner that the oil from the first pump P1 can be supplied through a discharge oil path 26 to the left hydraulic drive motor 63 as the hydraulic actuator via the right traveling control valve 31, to the first boom cylinder 21 as the hydraulic actuator via the first boom control valve 32, and to the bucket cylinder 20 as the hydraulic actuator via the bucket control valve 33.

[0033] The oil supplied from the first pump P1 may be further supplied from the extraction control valve 41, on the most downstream side in the flow path, to a hydraulic motor 24, as the hydraulic actuator for a hydraulic work

attachment via the attachment control valve 42, and to the second boom cylinder 22 as the hydraulic actuator via the second boom control valve 43. This oil supply control will be described later.

[0034] The hydraulic circuit is formed in such a manner that the oil from the second pump P2 can be supplied through a discharge oil path 27 to the left hydraulic drive motor 64 as the hydraulic actuator via the left traveling control valve 34, and to the swing cylinder 25 as the hydraulic actuator via the swing control valve 35. The hydraulic circuit is formed in such a manner that when a confluence control valve 40 is switched to a communication state, the oil can be supplied to a PTO hydraulic motor 65 as the hydraulic actuator via the PTO control valve 36 and to the arm cylinder 23 as the hydraulic actuator via the arm control valve 37.

[0035] The hydraulic circuit is formed in such a manner that the oil from the third pump P3 can be supplied through a discharge oil path 28 to the hydraulic swivel motor 62 as the hydraulic actuator via the swivel control valve 38, to the blade cylinder 13 as the hydraulic actuator via the blade control valve 39, to the PTO hydraulic motor 65 via the PTO control valve 36, and to the arm cylinder 23 via the arm control valve 37.

[0036] The pilot pressure oil from the fourth pump P4 can be supplied through a discharge oil path 29 to a right remote control valve 51, a left remote control valve 52, a PTO remote control valve 53, a swing remote control valve 54, a traveling remote control valve 55, a blade remote control valve 58, an attachment remote control valve 56, and a second boom remote control valve 57.

[0037] When the work operation lever 8, disposed on the right side of the seat 6 in the operation section, is operated to pivot forward/backward, the right remote control valve 51 is switched. Thus, pilot pressure oil is supplied to the operation control unit for the first boom control valve 32, whereby the bucket control valve 32 is switched so that the first boom 71 can pivot through the telescopic movement of the first boom cylinder 21.

[0038] When the work operation lever 8 in the operation section is operated to pivot leftward/rightward, the right remote control valve 51 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the bucket control valve 33, whereby the bucket control valve 33 is switched so that the bucket 16 can pivot through the telescopic movement of the bucket cylinder 20.

[0039] When the work operation lever 7 on the left side of the operation section is operated to pivot forward/backward, the left remote control valve 52 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the arm control valve 37, whereby the arm control valve 37 is switched so that the arm 17 can pivot through the telescopic movement of the arm cylinder 23.

[0040] When the work operation lever 7 in the operation section is operated to pivot leftward/rightward, the left remote control valve 52 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for

the swivel control valve 38, whereby the swivel control valve 38 is switched so that the swivel frame 4 can swivel clockwise and counterclockwise through rotation of the hydraulic swivel motor 62.

[0041] When the right traveling lever 9R is pivoted, the traveling remote control valve 55 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the right traveling control valve 31, whereby the right traveling control valve 31 is switched so that the right hydraulic drive motor 63 can be rotated for forward or rearward traveling. When the left traveling lever 9L is pivoted, the traveling remote control valve 55 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the left traveling control valve 34, whereby the left traveling control valve 34 is switched so that the left hydraulic drive motor 64 can be rotated for forward or rearward traveling. Thus, the backhoe 1 can travel forward, backward, and swivel clockwise and counterclockwise.

[0042] When a PTO operation switch, provided in the operation section, is operated, the PTO remote control valve 53 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the PTO control valve 36, whereby the PTO control valve 36 is switched so that the PTO hydraulic motor 65 can be rotated forward and backward.

[0043] When a swing pedal provided in the operation section is stepped on and operated, the swing remote control valve 54 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the swing control valve 35, whereby the swing control valve 35 is switched so that the swing cylinder 25 can be extended or contracted. When a blade lever provided in the operation section is operated, the blade remote control valve 58 is switched. Thus, the pilot pressure oil is supplied to the operation control unit for the blade control valve 39, whereby the blade control valve 39 is switched so that the blade cylinder 13 can be extended or contracted.

[0044] When the attachment operation switch 45 or the second boom operation pedal 46 provided in the operation section is operated, the hydraulic oil is controlled by the second control valve unit 102, whereby the external work machine 24 or the second boom cylinder 22 is operated.

[0045] The second control valve unit 102 can be appended to the first control valve unit 101 having a one-piece boom structure. Thus, the hydraulic circuit of the backhoe of the one-piece boom structure as illustrated in FIG. 7 includes the attachment control valve 42 (or the extraction control valve 41) that is disposed on the most downstream side of the first pump P1, as illustrated in FIG. 8, and can be operated by being coupled to the hydraulic motor 24. The hydraulic circuit may be applied to the two-piece boom structure as illustrated in FIG. 9. In this configuration, the attachment control valve 42 and the second boom control valve 43 are coupled to the most downstream side of the first pump P1 to additionally form a control valve unit.

[0046] In the present invention, as illustrated in FIG. 3, the second control valve unit 102 includes the attachment control valve 42, the second boom control valve 43, and the flow path control unit 80 including a plurality of shuttle valves. The attachment control valve 42 and the second boom control valve 43 are each a switching valve operated by the pilot pressure oil, and thus the second control valve unit 102 can be appended with the extraction control valve 41 of the one-piece boom structure directly used. More specifically, the attachment can be easily achieved with an output port of the extraction control valve 41, disposed on the most downstream side of the first control valve unit 101, brought into communication with an input port of the second control valve unit 102.

[0047] A primary side (a pump port and a tank port) as the input port of the attachment control valve 42 is coupled to a secondary side as the output port of the extraction control valve 41. A secondary side of the attachment control valve 42 is coupled to the hydraulic motor 24 as an actuator for the hydraulic work attachment. The operation control unit for the attachment control valve 42 is coupled to the attachment remote control valve 56 via pilot oil paths 74 and 75. The attachment remote control valve 56 includes a solenoid proportional valve, with which by operating the attachment operation switch 45, the pressure oil from the fourth pump P4 can be supplied to the operation control unit for the attachment control valve 42, so that the attachment control valve 42 can be switched.

[0048] The pilot oil paths 74 and 75 are coupled with the flow path control unit 80 via oil paths 76 and 77. The flow path control unit 80 includes a first shuttle valve 81, a second shuttle valve 82, and a third shuttle valve 83, each including two input ports and one output port. The two input ports of the first shuttle valve 81 are coupled to the output ports of the second shuttle valve 82 and the third shuttle valve 83. The output port of the first shuttle valve 81 is coupled to the operation control unit for the extraction control valve 41 via an oil path 78.

[0049] The input ports of the second shuttle valve 82 are coupled to the oil paths 76 and 77. The input ports of the third shuttle valve 83 are respectively coupled to pilot oil paths 84 and 85, coupling between the second boom remote control valve 57 and the operation control unit for the second boom control valve 43, via oil paths 86 and 87. Thus, the flow path control unit 80 has a simple configuration including the first shuttle valve 81, the second shuttle valve 82, and the third shuttle valve 83, as the shuttle valves of the same configuration, symmetrically arranged in a lateral direction.

[0050] The primary side of the second boom control valve 43 is coupled to the secondary side of the extraction control valve 41. The secondary side of the second boom control valve 43 is coupled to the second boom cylinder 22. The second boom remote control valve 57 is switched by operating the second boom operation pedal 46. Thus, the pressure oil from the fourth pump P4 can be supplied to the operation control unit for the second boom control

valve 43, so that the second boom cylinder 22 can make telescopic movement.

[0051] For example, as illustrated in FIG. 4, when the attachment operation switch 45 is operated with the hydraulic motor 24 used as the actuator for the hydraulic work attachment, a work signal is transmitted to a solenoid of the attachment remote control valve 56, and the remote-control valve for the rotation in the normal or reverse direction is opened. When the valve is thus opened, the pressure oil from the fourth pump P4 is supplied to the operation control unit for the attachment control valve 42 via the oil path 74 (or the oil path 75), whereby the attachment control valve 42 can be switched. At the same time, the pilot pressure oil is supplied to the second shuttle valve 82 of the pilot pressure oil control unit 80 via the oil path 76 (or the oil path 77) branched from the oil path 74 (or the oil path 75). Thus, the first shuttle valve 81 is opened, and the oil is supplied to the operation control unit for the extraction control valve 41 via the oil path 78. As a result, the extraction control valve 41 is switched, and the pressure oil from the first pump P1 is supplied to the hydraulic motor 24, whereby the hydraulic motor 24 is drivingly rotated.

[0052] When the second boom operation pedal 46 is operated, one of the second boom remote control valves 57 is switched. Thus, as illustrated in FIG. 5, the pressure oil from the fourth pump P4 is supplied to the operation control unit for the second boom control valve 43 via the oil path 84 (or the oil path 85), whereby the second boom control valve 43 is switched. At the same time, the oil is supplied to the third shuttle valve 83 of the pilot pressure oil control unit 80 via the oil path 86 (or the oil path 87) branched from the oil path 84 (or the oil path 85). Thus, the first shuttle valve 81 is opened, whereby the oil is supplied to the operation control unit for the extraction control valve 41 via the oil path 78 so that the extraction control valve 41 is switched. Thus, the second boom cylinder 22 can be driven to be extended (contracted) with the pressure oil from the first pump P1 supplied thereto.

[0053] When the attachment operation switch 45 and the second boom operation pedal 46 are simultaneously operated, one of each of the attachment remote control valve 56 and the second boom remote control valve 57 is switched. Thus, as illustrated in FIG. 6, the pressure oil from the fourth pump P4 is supplied to the operation control unit for the attachment control valve 42 via the oil path 74 (or the oil path 75), whereby the attachment control valve 42 is switched. Similarly, the second boom control valve 43 is switched. At the same time, the oil is supplied to the second shuttle valve 82 and the third shuttle valve 83 of the pilot pressure oil control unit 80 via the oil path 76 (or the oil path 77) and the oil path 86 (or the oil path 87). The first shuttle valve 81 is opened, so that the oil is supplied to the operation control unit for the extraction control valve 41 via the oil path 78, whereby the extraction control valve 41 is switched. Thus, the hydraulic motor 24 and the second boom cylinder 22 are driven with the pressure oil from the first pump P1 sup-

plied thereto.

[0054] As described above, the hydraulic circuit includes: the first control valve unit 101 configured to operate the hydraulic cylinders 20, 21, and 23 as the hydraulic actuators for the work unit 5, the hydraulic motors 62, 63, and 64 and the hydraulic cylinders 13 and 25 as the hydraulic actuators provided to the upper revolving superstructure 3 and the traveling unit 2, the first control valve unit 101 including a plurality of pilot switching valves with which the oil is supplied to the hydraulic actuators; the second control valve unit 102 configured to operate the second boom cylinder 22 and the hydraulic motor 24 as the hydraulic actuators for the second boom and the hydraulic work attachment, the second control valve unit 102 including a plurality of pilot switching valves with which the oil is supplied to the hydraulic actuators; the attachment operation switch 45 and the second boom operation pedal 46 as an operation unit configured to operate the second boom 72 and the hydraulic work attachment; and the pilot pressure oil control unit 80 configured to supply the pilot pressure oil to the extraction control valve 41 as the switching valve on the most downstream side in the first control valve unit 101 and the attachment control valve 42 and the second boom control valve 43 as the switching valves of the second control valve unit 102, when the operation unit is operated. Thus, the second boom cylinder 22 and the hydraulic work attachment can be operated, at the same time so that higher operation efficiency can be achieved compared with a configuration where the second boom cylinder 22 and the hydraulic work attachment are operated one by one.

[0055] The pilot pressure oil control unit 80 includes the plurality of shuttle valves 81, 82, and 83. These shuttle valves are operated by the operation unit in such a manner that the pilot pressure oil to the operation control unit for the switching valves in the second control valve unit 102 is branched to be input to the operation control unit for the extraction control valve 41 as the control valve on the most downstream side in the first control valve unit 101. Thus, a hydraulic circuit with which the second boom cylinder 22 and the hydraulic work attachment can be operated at the same time can be implemented by adding the second control valve unit 102 and the pilot pressure oil control unit 80 with a simple configuration as a combination of the shuttle valves to the first control valve unit 101.

2 traveling unit

3 upper revolving superstructure
5 work unit
24 hydraulic motor
41 extraction control valve
45 attachment operation switch
46 second boom operation pedal
72 second boom
80 pilot pressure oil control unit
101 first control valve unit

102 second control valve unit

Claims

1. A hydraulic circuit of a hydraulic work vehicle, the hydraulic circuit comprising:
 - a first control valve unit configured to operate hydraulic actuators for a work unit and hydraulic actuators provided to an upper revolving super-structure and a traveling unit, the first control valve unit including a plurality of pilot switching valves with which oil is supplied to the hydraulic actuators;
 - a second control valve unit configured to operate hydraulic actuators for a second boom and a hydraulic work attachment, the second control valve unit including a plurality of pilot switching valves with which oil is supplied to the hydraulic actuators;
 - an operation unit configured to operate the second boom and the hydraulic work attachment; and
 - a pilot pressure oil control unit configured to supply pilot pressure oil to one of switching valves of the first control valve unit that is on most downstream side and to a switching valve of the second control valve unit, when the operation unit is operated.
2. A hydraulic circuit of a hydraulic work vehicle according to claim 1, wherein an output port of the one of the switching valves of the first control valve unit that is on the most downstream side is in communication with an input port of the second control valve unit.
3. A hydraulic circuit of a hydraulic work vehicle according to claim 1, wherein the pilot pressure oil control unit includes a plurality of shuttle valves, wherein pilot pressure oil to the operation control unit for the switching valves of the second control valve unit is branched by an operation of the operation unit, and pressure oil is supplied the shuttle valves and is input to the operation control unit for one of control valves of the first control valve unit that is on the most downstream side.

Fig. 1

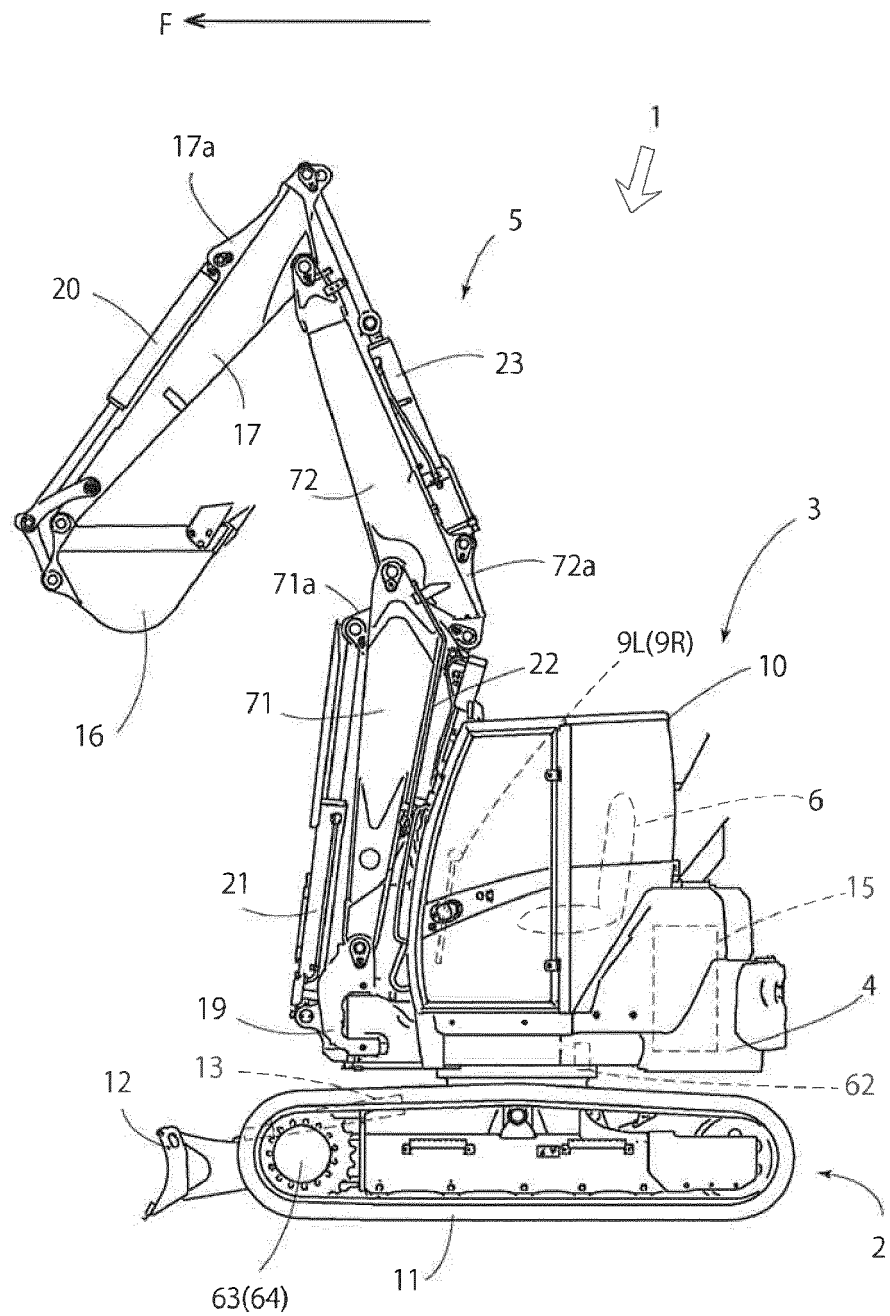


Fig. 2

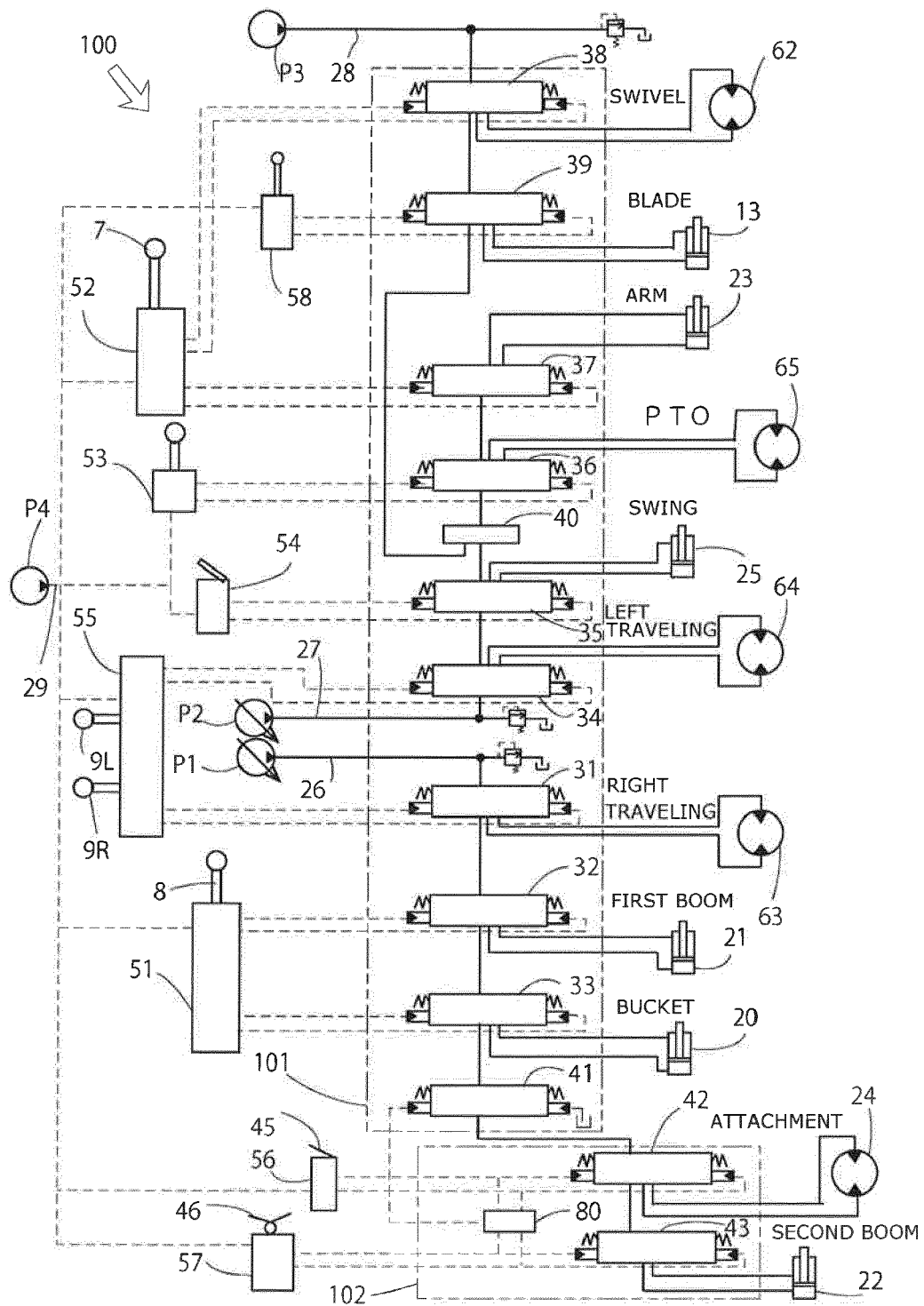


Fig. 3

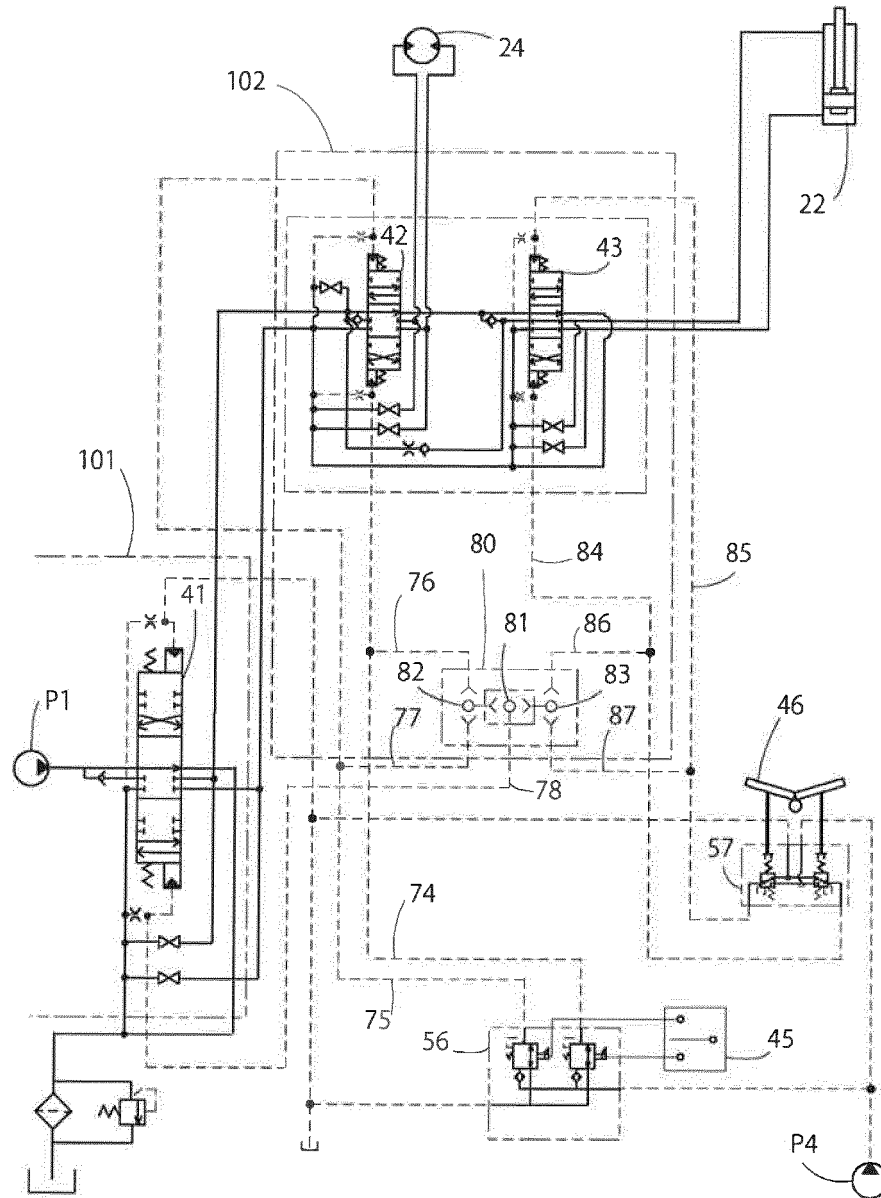


Fig. 4

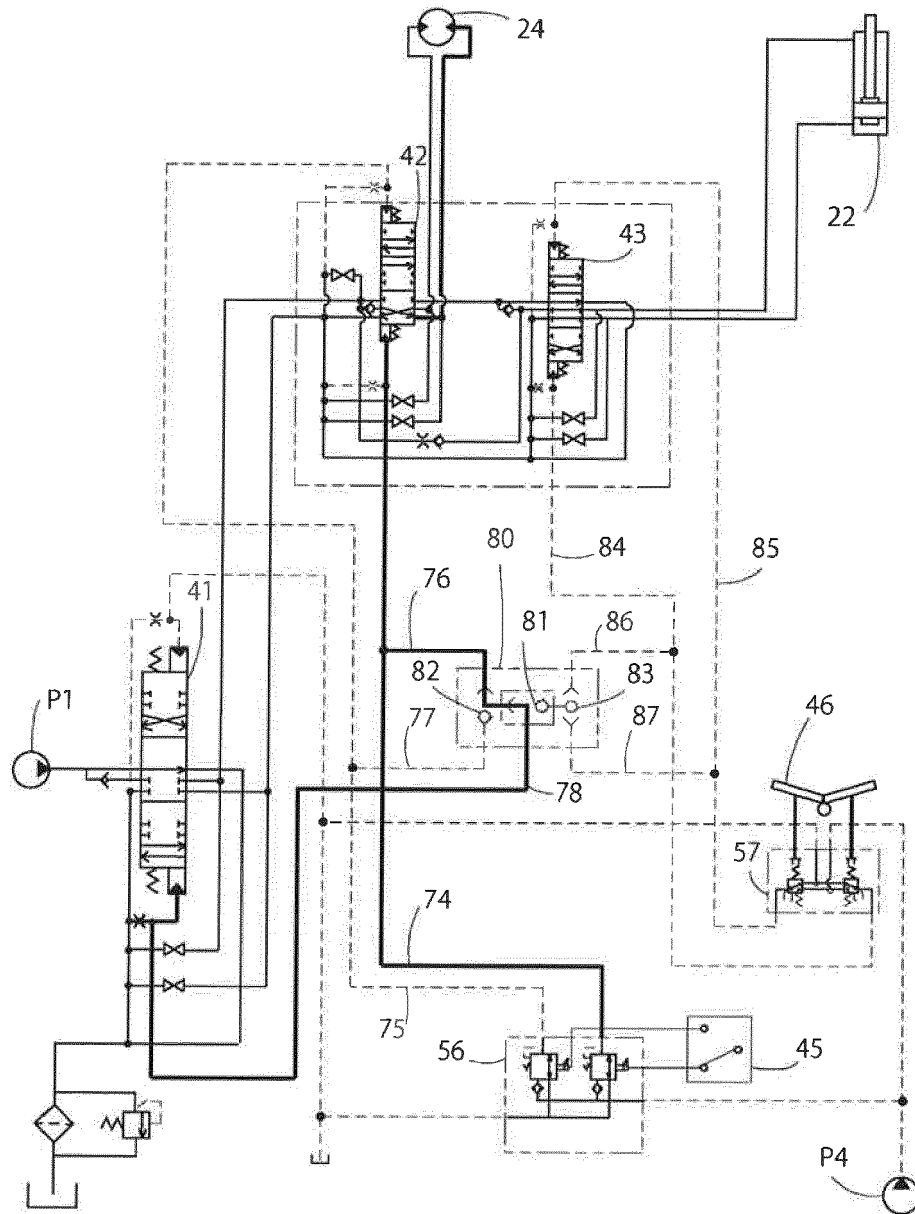


Fig. 5

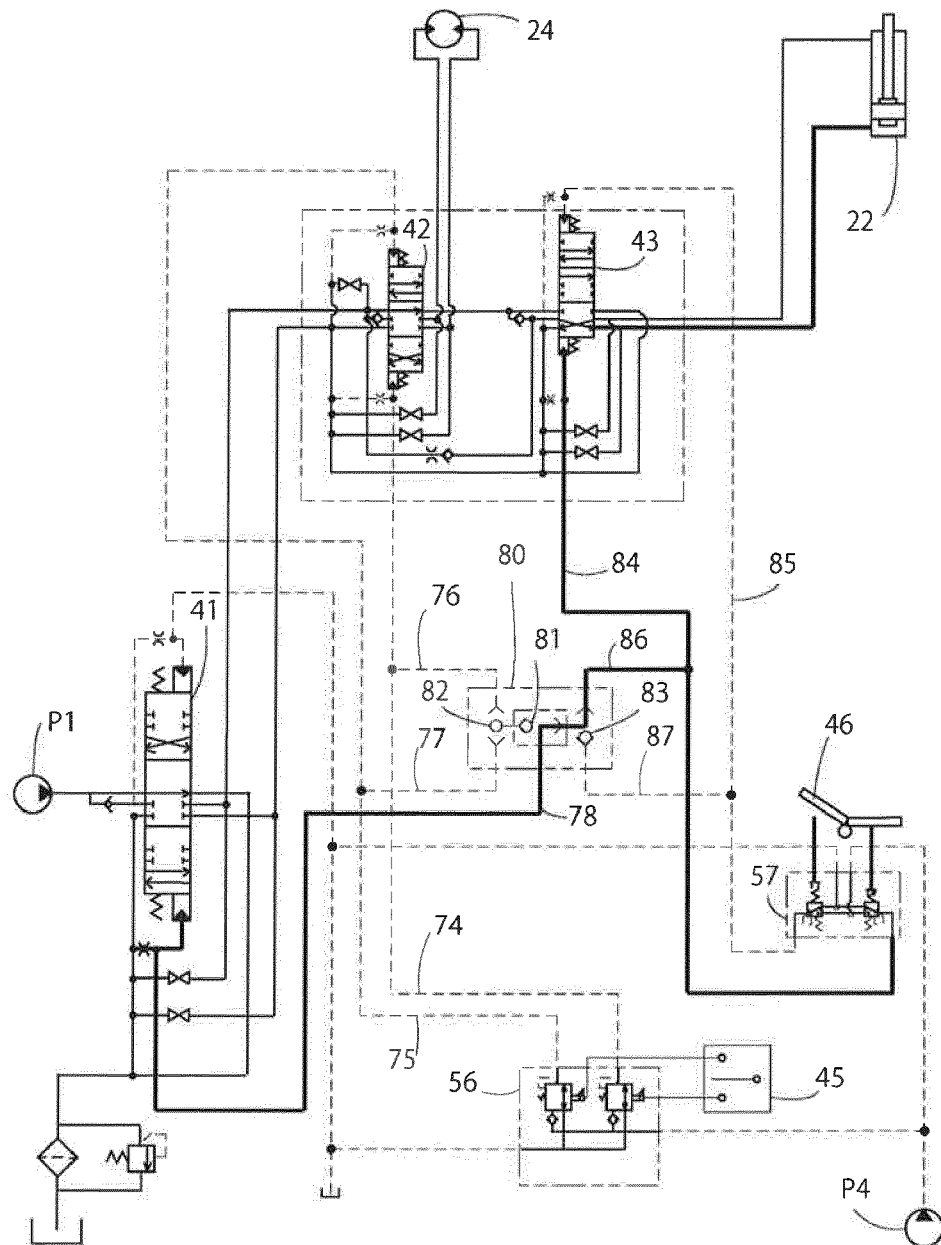


Fig. 6

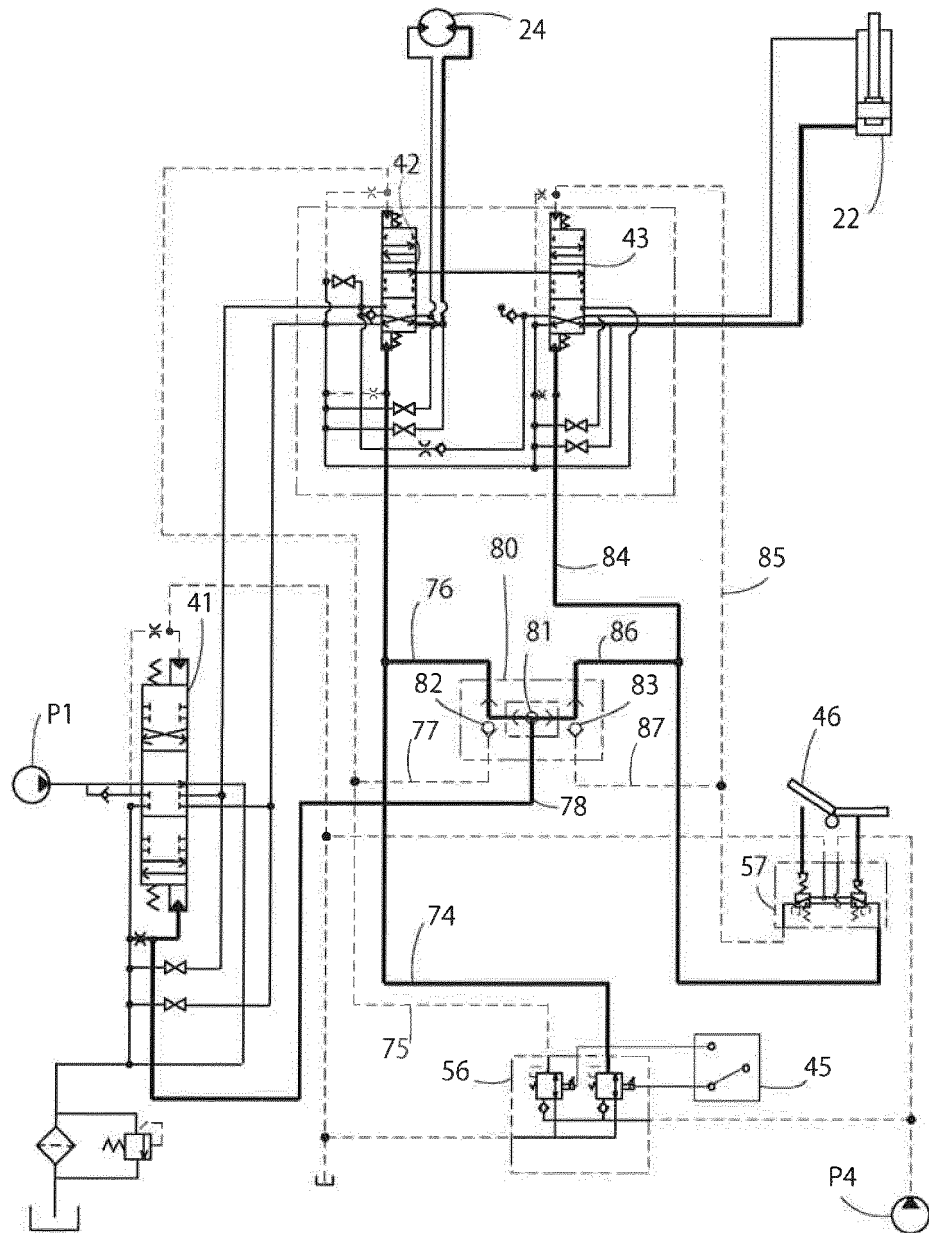


Fig. 7

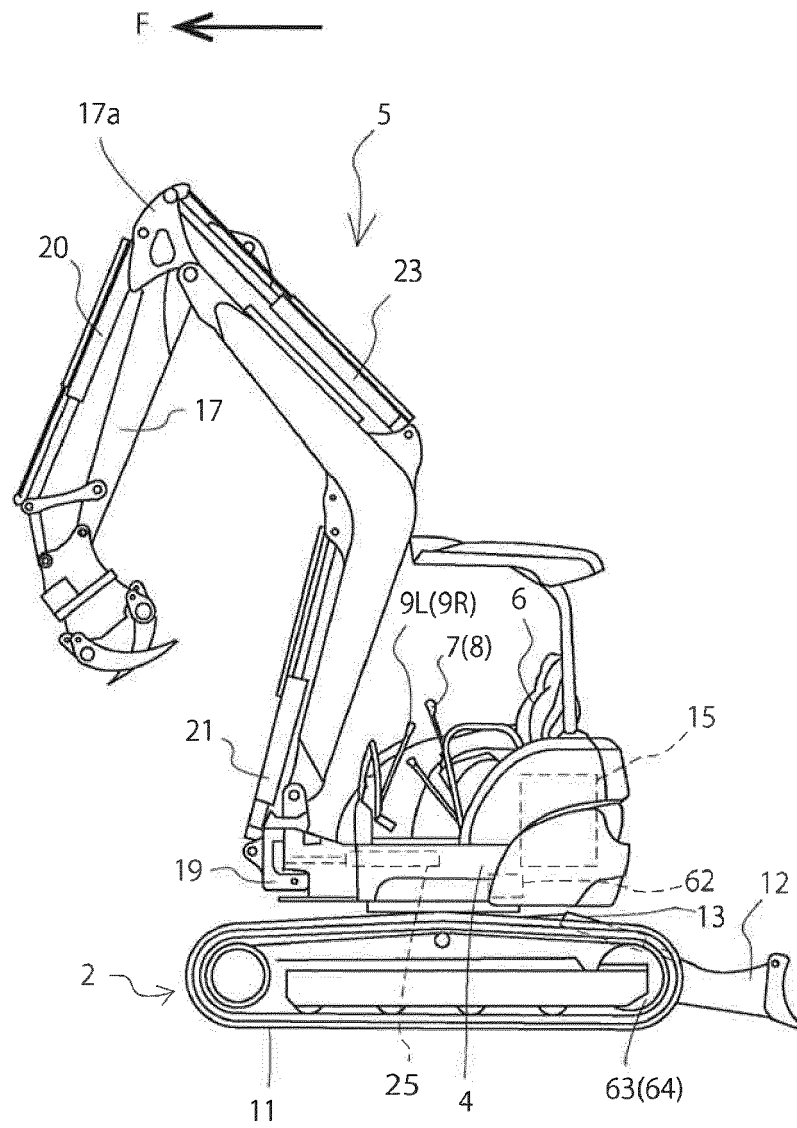


Fig. 8

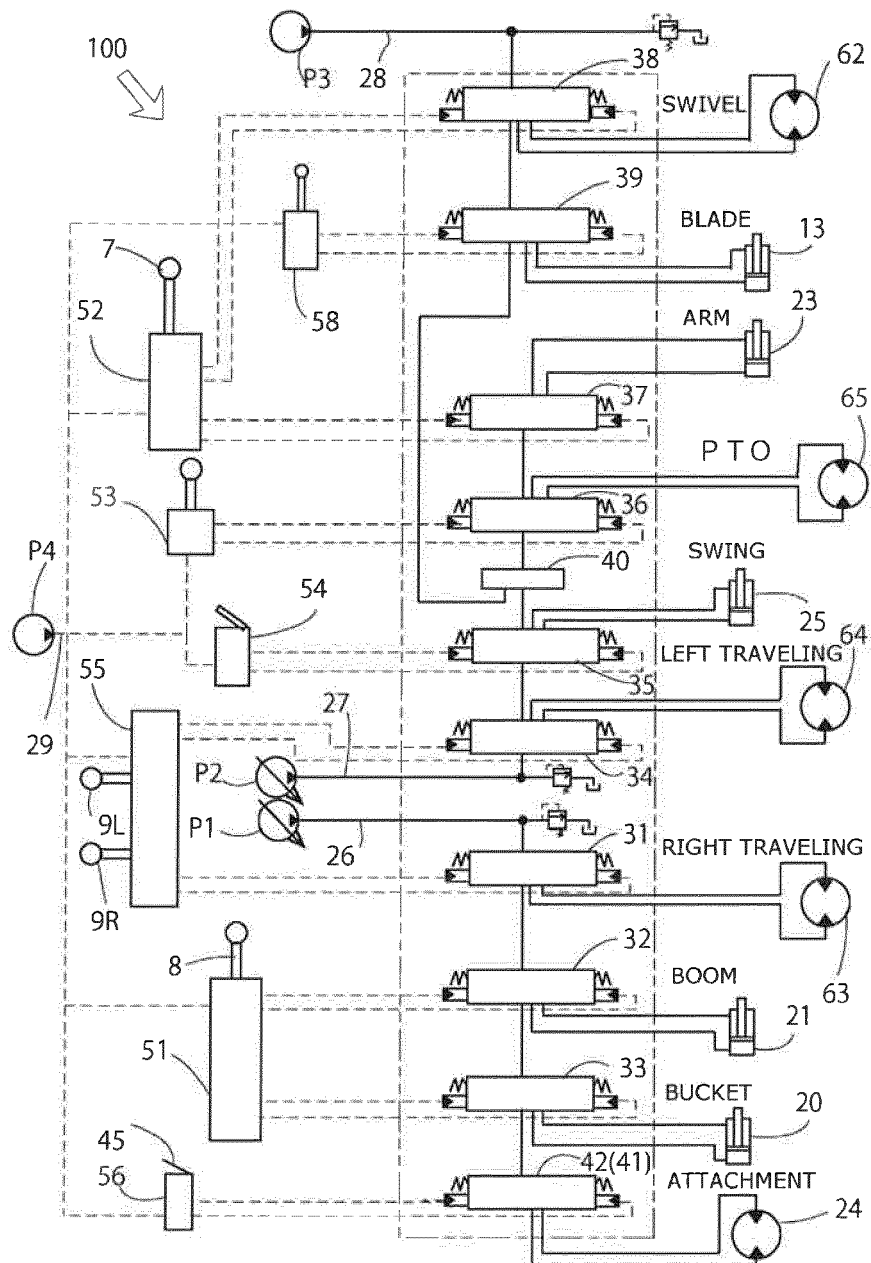
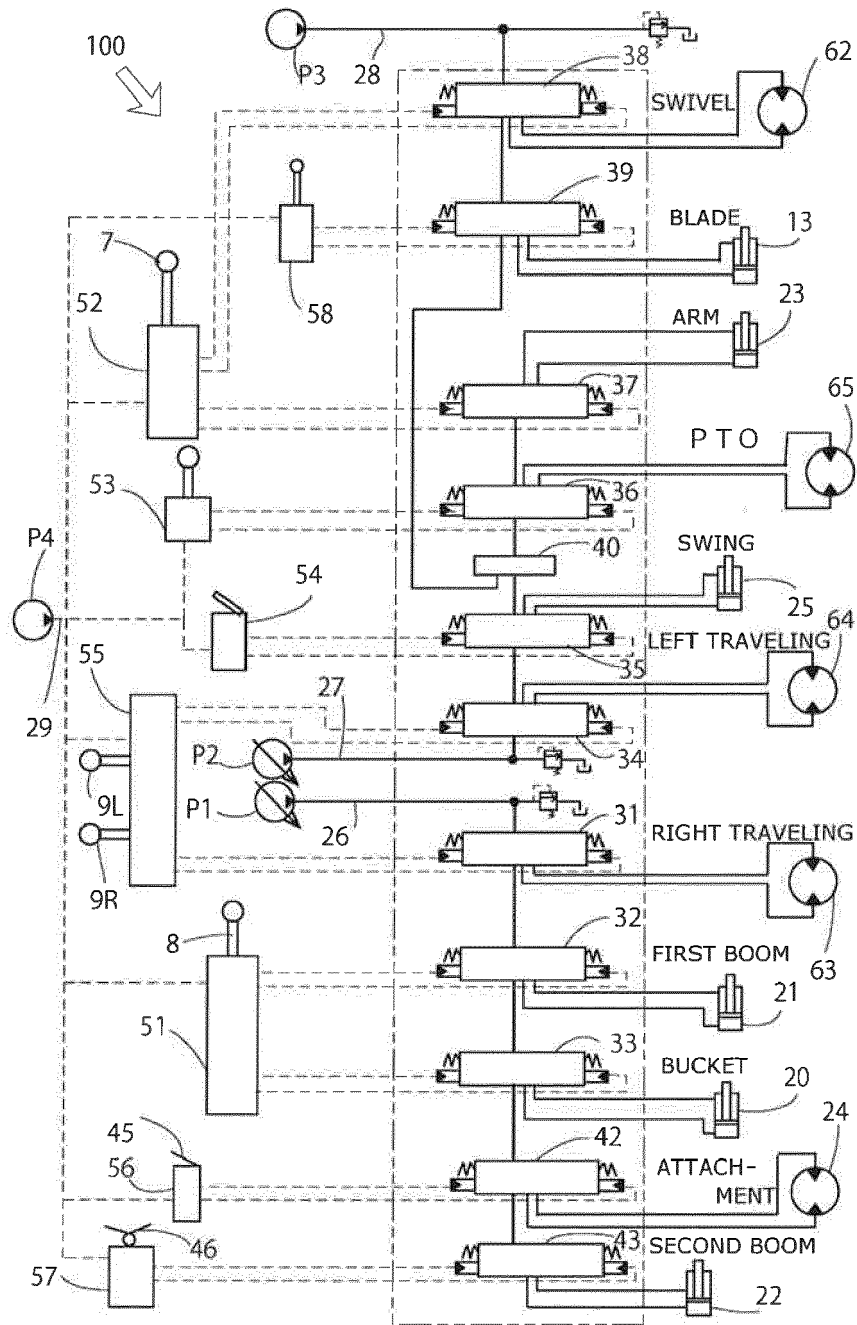


Fig. 9





EUROPEAN SEARCH REPORT

Application Number
EP 17 16 3628

5

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 875 337 A (SUGIYAMA GENROKU [JP] ET AL) 24 October 1989 (1989-10-24) * columns 1,2,5; figures 1,3 * -----	1-3	INV. E02F9/22 E02F3/30
			TECHNICAL FIELDS SEARCHED (IPC)
			E02F F15B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 August 2017	Examiner Laurer, Michael
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