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(54) **APPARATUS FOR CONTROLLING COMBINED-OPERATION OF CONSTRUCTION MACHINE**
VORRICHTUNG ZUR STEUERUNG DES KOMBINIERTEN BETRIEBS EINER BAUMASCHINE
APPAREIL POUR COMMANDER UNE OPÉRATION COMBINÉE D'UN ENGIN DE CHANTIER

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## Description

### [Technical Field]

**[0001]** An exemplary embodiment of the present disclosure relates to a construction machine, and more particularly, to an apparatus for controlling a combined-operations of a construction machine, which is capable of maintaining swing performance during a combined operations of driving and swinging of the construction machine.

### [Background Art]

**[0002]** In general, a construction machine such as an excavator includes an engine, a hydraulic pump which generates hydraulic pressure by using power from the engine, a control unit which controls the hydraulic pressure generated by the hydraulic pump by using a hydraulic pressure valve, and actuators which perform work by using hydraulic pressure.

**[0003]** In particular, the construction machine controls flow rates and hydraulic pressure to perform specific work by operating a boom, an arm, a bucket and the like, and in this case, the flow rates and the hydraulic pressure applied to the actuators need to be controlled.

**[0004]** The construction machine has at least two main pumps, and pressurized oil of the main pumps is appropriately distributed and used for a driving or front operation.

**[0005]** Here, the front operation means operations such as an operation of moving up/down the boom, arm crowd, bucket crowd/dump, and swing of the construction machine such as an excavator.

**[0006]** In the case of a hydraulic system for a construction machine in the related art, when the construction machine performs a combined operations of driving and swinging, pressurized oil discharged from a single main pump is used and distributed to a driving motor for performing a driving operation and a swing motor for performing a swinging operation.

**[0007]** However, even though the hydraulic pressure system includes two main pumps, the driving motor and the swing motor share the amount of oil discharged from the single main pump.

**[0008]** Therefore, there is a problem in that a larger amount of oil is supplied to the driving motor than the swing motor, such that a driving speed is high, while a swing speed is very low.

**[0009]** WO 2013/089295 A1 discloses a traveling control system for a construction machine, comprising first and second variable displacement hydraulic pumps; a left traveling motor connected to the first hydraulic pump and a first attachment; a plurality of switching valves installed in a flow path of the first hydraulic pump and configured to be shifted to control a hydraulic fluid being supplied to the left traveling motor and the first attachment; a right traveling motor connected to the second hydraulic pump and a second attachment; a plurality of switching valves installed in a flow path of the second hydraulic pump and configured to be shifted to control a hydraulic fluid being supplied to the right traveling motor and the second attachment; a straight traveling valve installed in the flow path of the second hydraulic pump and configured to be shifted to supply the hydraulic fluid discharged from the first hydraulic pump to the left and right traveling motors and to supply the hydraulic fluid discharged from the second hydraulic pump to the first attachment and the second attachment, respectively; and a control valve installed in a branch flow path having an inlet side that is connected to a flow path branched off from the flow path of the second hydraulic pump and an outlet side that is connected to the flow path of the second hydraulic pump on a downstream side of the straight traveling valve, and configured to serve as a check valve and an orifice so as to interrupt the supply of the hydraulic fluid from the second hydraulic pump to the left traveling motor and the right traveling motor via the straight traveling valve during a combined operation in which a traveling operation and a working operation are performed simultaneously.

### [Disclosure]

### [Technical Problem]

**[0010]** An exemplary embodiment of the present disclosure provides an apparatus for controlling a combined operations of a construction machine, which is capable of controlling a swing speed when the construction machine performs a combined operations of driving and swinging so that the swing speed is equal to a swing speed when only a swinging operation is performed.

### [Technical Solution]

**[0011]** According to the invention, an apparatus having the features of claim 1 is provided.

**[0012]** The driving priority valve may be positioned at a most upstream side of the second pump.

**[0013]** The apparatus may further include a switching valve which provides pressurized oil for switching the driving priority valve.

**[0014]** The switching valve may be switched by driving pilot pressure discharged from the operating unit when the combined operations of driving and swinging are performed by the operation of the operating unit, and swing pilot pressure discharged from the operating unit may be supplied to the driving priority valve.

**[0015]** The apparatus may further include a bypass valve which controls pressurized oil discharged from the second pump, in which the switching valve provides the swing pilot pressure to the bypass valve when the combined operations are performed.

**[0016]** The bypass valve may be positioned at the most downstream side of the second pump, and may allow the

second pump to communicate with a hydraulic oil tank.

**[Advantageous Effects]**

**[0017]** According to the exemplary embodiment of the present disclosure, in the apparatus for controlling the combined operations of the construction machine, the first pump is used only to perform the driving operation and the second pump is used to perform the swinging operation when the combined operations of driving and swinging are performed, such that the driving and swinging operations may have no effect on each other, and may use a maximum flow rate (maximum speed).

**[Description of Drawings]**

**[0018]**

FIGS. 1 and 2 are circuit diagrams of an apparatus for controlling a combined operations of a construction machine according to an exemplary embodiment of the present disclosure.

FIGS. 3 and 4 are circuit diagrams of an apparatus for controlling a combined operations of a construction machine according to another exemplary embodiment of the present disclosure, which uses a driving priority valve having a structure different from a structure of a driving priority valve illustrated in FIG. 1.

**[Description of Main Reference Numerals of Drawings]**

**[0019]**

10: Operating unit
11: First shuttle valve
12: First supply line
13: Second shuttle valve
14: Second supply line
20: Driving control spool
30: Swing control spool
40: Driving priority valve
50: Switching valve
51: First merging line
52: Second merging line
60: Bypass valve
PI: First pump
P2: Second pump
T: Hydraulic oil tank

**[Best Mode]**

**[0020]** Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings so that those skilled in the technical field to which the present disclosure pertains may easily carry out the exemplary embodiments. The present disclosure may be implemented in various different ways, and is not limited to the exemplary embodiments described herein.

**[0021]** It is noted that the drawings are schematic, and are not illustrated based on actual scales. Relative dimensions and proportions of parts illustrated in the drawings are exaggerated or reduced in size for the purpose of clarity and convenience in the drawings, and any dimension is just illustrative but not restrictive. Further, the same reference numerals designate the same structures, elements or components illustrated in two or more drawings in order to exhibit similar characteristics.

**[0022]** Exemplary embodiments of the present disclosure illustrate ideal exemplary embodiments of the present disclosure in more detail. As a result, various modifications of the drawings are expected. Therefore, the exemplary embodiments are not limited to specific forms in regions illustrated in the drawings, and also include, for example, modifications of forms by the manufacture.

**[0023]** Hereinafter, an apparatus for controlling a combined operations of a construction machine according to an exemplary embodiment of the present disclosure will be described with reference to FIGS. 1 and 2.

**[0024]** As illustrated in FIGS. 1 and 2, the apparatus for controlling the combined operations of the construction machine according to the exemplary embodiment of the present disclosure includes a first pump PI, a second pump P2, a driving control spool 20, a swing control spool 30, and a driving priority valve 40.

**[0025]** The apparatus for controlling the combined operations of the construction machine according to the exemplary embodiment of the present disclosure has the first pump P1 and the second pump P2 in order to perform driving and front operations.

**[0026]** Based on an operation of an operating unit 10, the first pump P1 provides pressurized oil to a plurality of actuators for performing the driving and front operations of the construction machine.

**[0027]** In addition, based on the operation of the operating unit 10, the second pump P2 provides pressurized oil to the plurality of actuators for performing front operations of the construction machine.

**[0028]** That is, the first pump P1 and the second pump P2 use pressurized oil by appropriately distributing the pressurized oil to the plurality of actuators.

**[0029]** In this case, the front operation means operations such as an operation of moving up/down the boom, arm crowd, bucket crowd/dump, and swing of the construction machine such as an excavator.

**[0030]** The driving control spool 20 and the swing control spool 30 are installed in a flow path which is connected with the first pump P1 and the second pump P2.

**[0031]** When the driving operation is performed by the operating unit 10, the driving control spool 20 allows the first pump P1 to communicate with a driving motor 70. That is, the driving control spool 20 controls a flow of the pressurized oil being supplied to the driving motor 70.

**[0032]** The swing control spool 30 is positioned at a downstream side of the driving control spool 20 and allows the first pump to communicate with a swing motor 80 when the swinging operation is performed by the operating unit 10. That is, the swing control spool 30 controls a flow of the pressurized oil being supplied to the swing motor 80.

**[0033]** When the combined operations of driving and swinging are performed by the operating unit 10, the driving priority valve 40 supplies the pressurized oil discharged from the first pump P1 only to the driving control spool 20, and supplies the pressurized oil discharged from the second pump P2 to the swing control spool 30.

**[0034]** In this case, the driving priority valve 40 may be positioned at a most upstream side of the second pump P2.

**[0035]** The apparatus for controlling the combined operations of the construction machine according to the exemplary embodiment of the present disclosure may further include a switching valve 50.

**[0036]** Specifically, the switching valve 50 provides pressurized oil for switching the driving priority valve 40. The direction of the switching valve 50 is changed to one direction by inputted pilot pressure, such that the switching valve 50 provides the pressurized oil to the driving priority valve 40.

**[0037]** The pilot pressure inputted to the switching valve 50 is generated when the operating unit 10 is operated. If the combined operations of driving and swinging are performed by the operating unit 10, driving pilot pressure and swing pilot pressure are discharged from the operating unit 10.

**[0038]** In this case, the swing pilot pressure discharged from the operating unit 10 is supplied to a lower end of the switching valve 50 through a first supply line 12, and the driving pilot pressure is supplied to one side of the switching valve 50 through a second supply line 14.

**[0039]** The direction of the switching valve 50 is changed to one direction only when the amount of the driving pilot pressure supplied to one side of the switching valve 50 is larger than pressure preset to the switching valve 50.

**[0040]** According to the exemplary embodiment of the present disclosure, a first shuttle valve 11 may be further provided in the first supply line 12, and a second shuttle valve 13 may be further provided in the second supply line 14.

**[0041]** The first shuttle valve 11 receives left swing pilot pressure and right swing pilot pressure generated by the swinging operation of the operating unit 10, and selects higher pressure from the inputted left and right swing pilot pressure and supplies the higher pressure to the lower end of the switching valve 50.

**[0042]** The second shuttle valve 13 receives forward driving (FWD) pilot pressure and reverse driving (REV) pilot pressure generated by the driving operation of the operating unit 10, and selects higher pressure from the inputted forward and reverse driving pilot pressures and supplies the higher pressure to one side of the switching valve 50.

**[0043]** When the switching valve 50 is switched by the driving pilot pressure, the swing pilot pressure, which is supplied to the lower end of the switching valve 50, is supplied to a first merging line 51 and a second merging line 52.

**[0044]** In this case, the swing pilot pressure supplied to the first merging line 51 is supplied to a bypass valve 60.

**[0045]** The swing pilot pressure supplied to the second merging line 52 is provided as pressure for switching the driving priority valve 40.

**[0046]** The bypass valve 60 is positioned at a most downstream side of the second pump P2. Therefore, the second pump P2 and a hydraulic oil tank T are in communication with each other.

**[0047]** When the construction machine according to the exemplary embodiment of the present disclosure only performs the driving operation without performing the swinging operation, the pressurized oil discharged from the second pump P2 is discharged into the hydraulic oil tank T.

**[0048]** At this time, if the combined operations of driving and swinging are performed by the operating unit 10, the pilot pressure supplied to the bypass valve 60 prevents the pressurized oil discharged from the second pump P2 from being discharged into the hydraulic oil tank T.

**[0049]** That is, the bypass valve 60 is switched in accordance with the swing pilot pressure, and as a result, it is possible to variably control the amount of oil being discharged from the second pump P2 into the tank T.

**[0050]** In this case, the structure of the driving priority valve 40 or 41 according to the exemplary embodiment of the present disclosure may be formed as illustrated in FIGS. 1 and 2 or as illustrated in FIGS. 3 and 4.

**[0051]** That is, the structure of the driving priority valve 40 is not particularly limited as long as the valve structure is a valve structure in which a flow path is disposed so that when the driving priority valve 40 is switched by the pilot pressure, a part of the pressurized oil discharged from the driving priority valve 40 may be supplied to the swing control spool 30, and the remaining part of the pressurized oil may be discharged into the hydraulic oil tank T.

**[0052]** Therefore, the structure of the driving priority valve 40 illustrated in FIGS. 1 to 4 may vary depending on those skilled in the art who implement the present disclosure.

**[0053]** According to the apparatus for controlling the combined operations of the construction machine which have the aforementioned configurations, the first pump P1 is used only to perform the driving operation and the second pump P2 is used to perform the swinging operation when the combined operations of driving and swinging are performed, such that the driving and swinging operations may have no effect on each other, and may

use a maximum flow rate (maximum speed).

## Claims

1. An apparatus for controlling a combined operations of a construction machine, the apparatus comprising:

   a plurality of actuators including one driving motor (70) for performing driving operation and a swing motor (80) for performing swinging operation;
   an operating unit (10);
   a first pump (P1) and a second pump (P2) which provide pressurized oil to the plurality of actuators for performing driving and swinging operations of the construction machine by an operation of the operating unit (10);
   a driving control spool (20) which allows the first pump (P1) to communicate with the driving motor (70); and
   a swing control spool (30) which is positioned at a downstream of the driving control spool (20) and allows the first pump (P1) to communicate with the swing motor (80),
   wherein the driving control spool (20) allows the driving motor (70) to selectively communicate with the first pump (P1), and the apparatus comprises a driving priority valve (40) which allows the pressurized oil discharged from the first pump (P1) to be supplied to only the driving control spool (20) and allows the pressurized oil discharged from the second pump (P2) to be supplied to the swing control spool (30) when a combined operations of driving and swinging of the construction machine are performed.

2. The apparatus of claim 1, wherein the driving priority valve (40) is positioned at a most upstream side of the second pump (P2).

3. The apparatus of claim 1, further comprising:
   a switching valve (50) which provides pressurized oil for switching the driving priority valve (40).

4. The apparatus of claim 3, wherein the switching valve (50) is switched by driving pilot pressure discharged from the operating unit (10) when the combined operations of driving and swinging are performed by the operation of the operating unit (10), and swing pilot pressure discharged from the operating unit (10) is supplied to the driving priority valve (40) to be switched,
   wherein the switching valve (50) is switched only when the amount of the driving pilot pressure supplied to one side of the switching valve (50) is larger than pressure preset to the switching valve (50).

5. The apparatus of claim 4, further comprising:

   a bypass valve (60) which controls pressurized oil discharged from the second pump (P2),
   wherein the switching valve (50) provides the swing pilot pressure for switching the bypass valve (60) when the combined operations are performed.

6. The apparatus of claim 5, wherein the bypass valve (60) is positioned at the most downstream side of the second pump (P2), and allows the second pump (P2) to communicate with a hydraulic oil tank (T).

## Patentansprüche

1. Vorrichtung zum Steuern eines kombinierten Betriebs einer Baumaschine, wobei die Vorrichtung Folgendes umfasst:

   mehrere Aktuatoren, die einen Antriebsmotor (70) zum Durchführen eines Fahrbetriebs und einen Schwenkmotor (80) zum Durchführen eines Schwenkbetriebs enthalten;
   eine Betriebseinheit (10);
   eine erste Pumpe (P1) und eine zweite Pumpe (P2), die die mehreren Aktuatoren mit Drucköl versorgen, um den Fahr- und Schwenkbetrieb der Bauschmaschine durch eine Betätigung der Betriebseinheit (10) durchzuführen;
   einen Antriebssteuerschieber (20), der der ersten Pumpe (P1) erlaubt, mit dem Antriebsmotor (70) zu kommunizieren; und
   einen Schwenksteuerschieber (30), der hinter dem Antriebssteuerschieber (20) positioniert ist und der ersten Pumpe (P1) erlaubt, mit dem Schwenkmotor (80) zu kommunizieren,
   wobei der Antriebssteuerschieber (20) dem Antriebsmotor (70) erlaubt, wahlweise mit der ersten Pumpe (P1) zu kommunizieren, und die Vorrichtung ein Antriebsprioritätsventil (40) umfasst, das dem Drucköl, das durch die erste Pumpe (P1) gefördert wird, erlaubt, nur dem Antriebssteuerschieber (20) zugeführt zu werden, und dem Drucköl, das durch die zweite Pumpe (P2) gefördert wird, erlaubt, dem Schwenksteuerschieber (30) zugeführt zu werden, wenn ein kombinierter Betrieb des Fahrens und Schwenkens des Baumaschine durchgeführt wird.

2. Vorrichtung nach Anspruch 1, wobei das Antriebsprioritätsventil (40) an einer stromaufseitigen Seite der zweiten Pumpe (P2) positioniert ist.

3. Vorrichtung nach Anspruch 1, die ferner Folgendes umfasst:
   ein Schaltventil (50), das Drucköl zum Schalten des

Antriebsprioritätsventils (40) bereitstellt.

**4.** Vorrichtung nach Anspruch 3, wobei das Schaltventil (50) durch Antriebsvorsteuerdruck, der durch die Betriebseinheit (10) ausgegeben wird, geschaltet wird, wenn der kombinierte Betrieb des Fahrens und Schwenkens durch das Betätigen der Betriebseinheit (10) durchgeführt wird, und Schwenkvorsteuerdruck, der von der Betriebseinheit (10) gefördert wird, dem zu schaltenden Antriebsprioritätsventils (40) zugeführt wird,
wobei das Schaltventil (50) nur dann geschaltet wird, wenn die Stärke des Antriebsvorsteuerdrucks, der einer Seite des Schaltventils (50) zugeführt wird, größer ist als eine Druckvorgabe des Schaltventils (50) .

**5.** Vorrichtung nach Anspruch 4, die ferner Folgendes umfasst:

ein Umgehungsventil (60), das Drucköl, das aus der zweiten Pumpe (P2) gefördert wird, steuert, wobei das Schaltventil (50) den Schwenkvorsteuerdruck zum Schalten des Umgehungsventils (60) bereitstellt, wenn der kombinierte Betrieb durchgeführt wird.

**6.** Vorrichtung nach Anspruch 5, wobei das Umgehungsventil (60) an der stromabseitigen Seite der zweiten Pumpe (P2) positioniert ist und der zweiten Pumpe (P2) erlaubt, mit einem Hydrauliköltank (T) zu kommunizieren.

**Revendications**

**1.** Appareil de commande d'opérations combinées d'un engin de chantier, l'appareil comprenant :

une pluralité d'actionneurs comprenant un moteur de conduite (70) pour effectuer une opération de conduite et un moteur de pivotement (80) pour effectuer une opération de pivotement ;
une unité d'opération (10) ;
une première pompe (P1) et une seconde pompe (P2) qui fournissent de l'huile sous pression à la pluralité d'actionneurs pour effectuer des opérations de conduite et de pivotement de l'engin de chantier par une opération de l'unité d'opération (10) ;
un tiroir de commande de conduite (20) qui permet à la première pompe (P1) de communiquer avec le moteur de conduite (70) ; et
un tiroir de commande de pivotement (30) qui est positionné en aval du tiroir de commande de conduite (20) et permet à la première pompe (P1) de communiquer avec le moteur de pivotement (80),
le tiroir de commande de conduite (20) permettant au moteur de conduite (70) de communiquer sélectivement avec la première pompe (P1), et l'appareil comprenant une vanne de priorité de conduite (40) qui permet que l'huile sous pression refoulée par la première pompe (P1) soit fournie uniquement au tiroir de commande de conduite (20) et que l'huile sous pression refoulée par la seconde pompe (P2) soit fournie au tiroir de commande de pivotement (30) lorsque des opérations combinées de conduite et de pivotement de l'engin de chantier sont effectuées.

**2.** Dispositif selon la revendication 1, la vanne de priorité de conduite (40) étant positionnée sur un côté le plus en amont de la seconde pompe (P2).

**3.** Appareil selon la revendication 1, comprenant en outre :
une vanne de commutation (50) qui fournit de l'huile sous pression pour commuter la vanne de priorité de conduite (40).

**4.** Appareil selon la revendication 3, la vanne de commutation (50) étant commutée par la pression pilote de conduite refoulée de l'unité d'opération (10) lorsque les opérations combinées de conduite et de pivotement sont effectuées par le fonctionnement de l'unité d'opération (10), et la pression pilote de pivotement refoulée de l'unité d'opération (10) étant fournie vers la vanne de priorité de conduite (40) devant être commutée,
la vanne de commutation (50) n'étant commutée que lorsque la valeur de la pression pilote de conduite fournie à un côté de la vanne de commutation (50) est supérieure à la pression prédéfinie pour la vanne de commutation (50).

**5.** Appareil selon la revendication 4, comprenant en outre :

une vanne de dérivation (60) qui commande l'huile sous pression refoulée par la seconde pompe (P2),
la vanne de commutation (50) fournissant la pression pilote de pivotement pour commuter la vanne de dérivation (60) lorsque les opérations combinées sont effectuées.

**6.** Appareil selon la revendication 5, la vanne de dérivation (60) étant positionnée sur le côté le plus en aval de la seconde pompe (P2), et permettant à la seconde pompe (P2) de communiquer avec un réservoir d'huile hydraulique (T).

FIG. 1

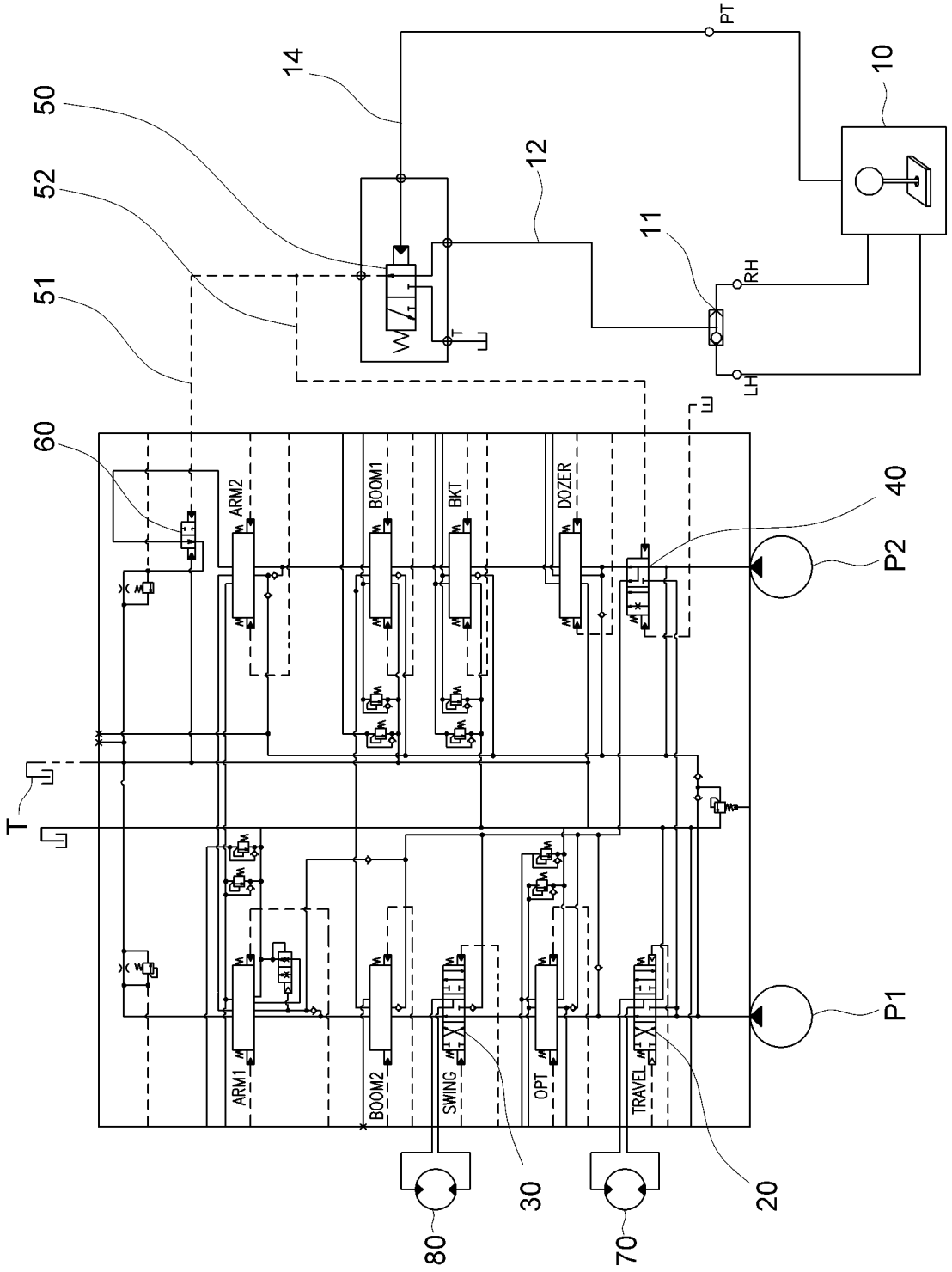

PT
14
10
50
12
52
11
RH
51
LH
T
60
ARM2
BOOM1
BKT
DOZER
40
P2
T
ARM1
BOOM2
SWING
OPT
TRAVEL
P1
80
30
70
20

FIG. 2

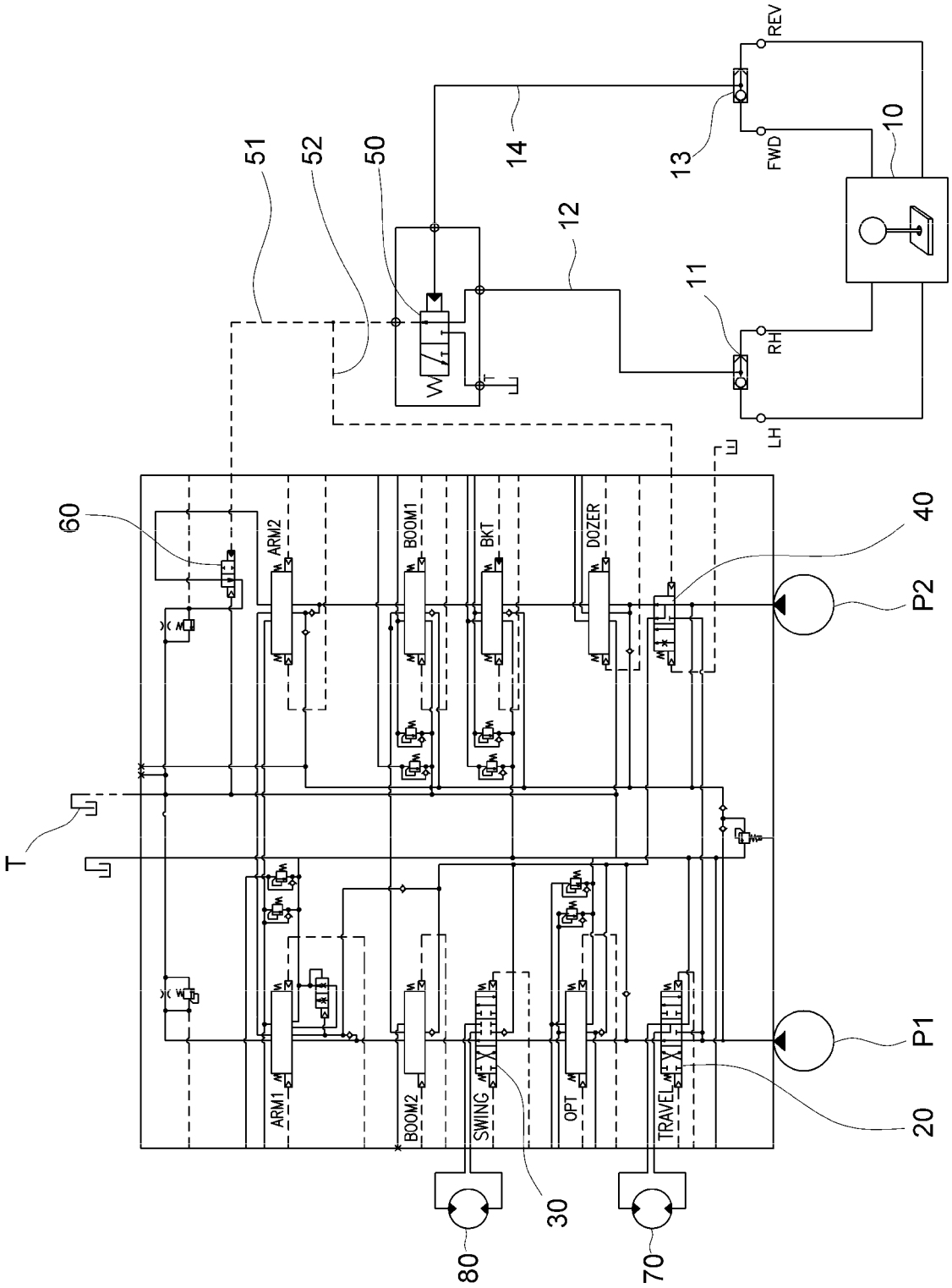

REV
FWD
RH
LH
10
11
12
13
14
50
51
52
60
40
P2
P1
20
30
70
80
T
ARM2
BOOM1
BKT
DOZER
ARM1
BOOM2
SWING
OPT
TRAVEL

FIG. 3

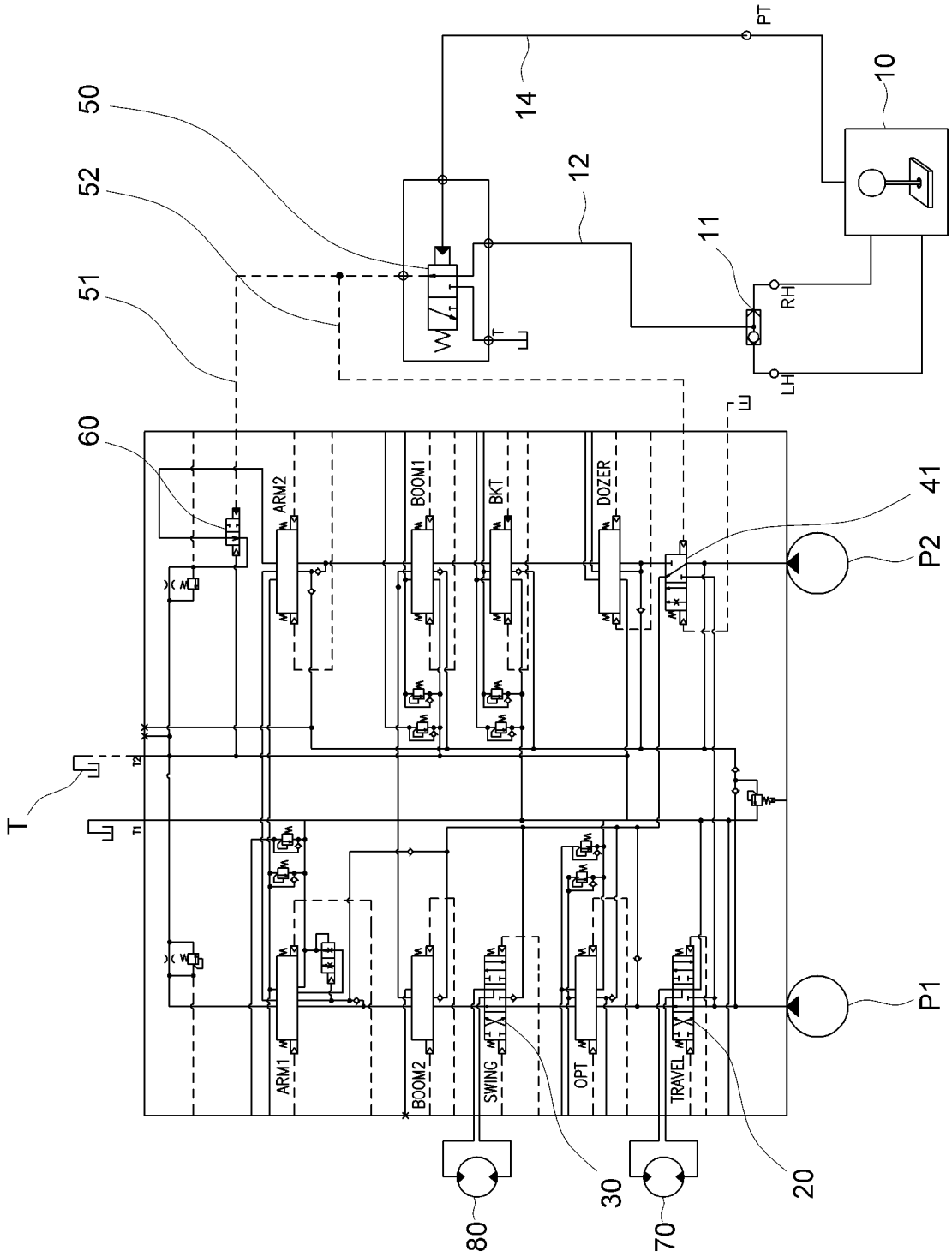
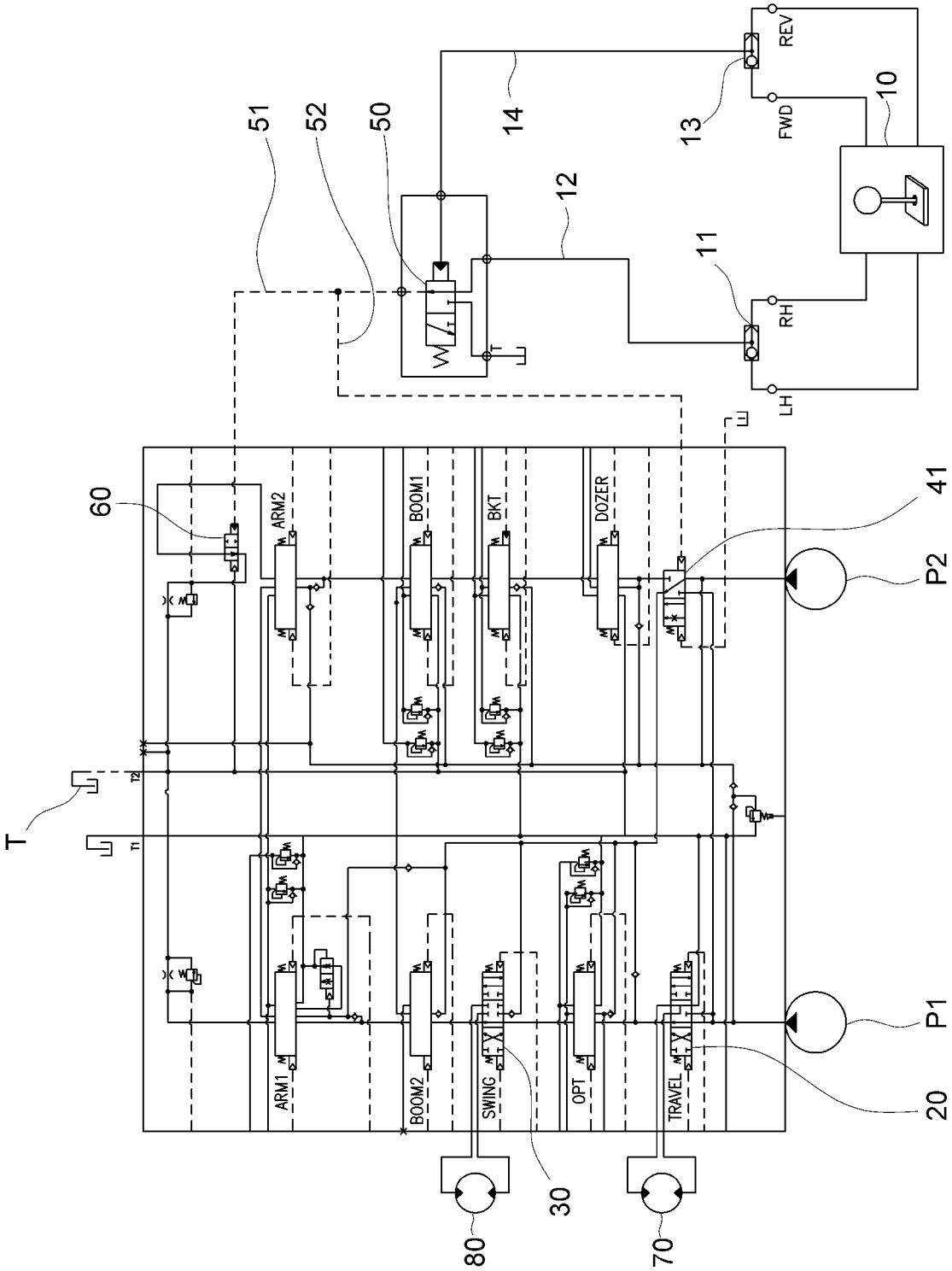

PT
14
10
50
12
52
11
51
RH
LH
60
ARM2
BOOM1
BKT
DOZER
41
P2
T
T2
T1
ARM1
BOOM2
SWING
OPT
TRAVEL
P1
30
20
80
70

FIG. 4


REV
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T
T2
T1
ARM1
BOOM2
SWING
OPT
TRAVEL
P1
20
30
80
70

## REFERENCES CITED IN THE DESCRIPTION

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