



(11)

EP 2 660 478 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
15.03.2017 Bulletin 2017/11

(51) Int Cl.:
F15B 13/02 ^(2006.01) **E02F 9/22** ^(2006.01)
F15B 13/044 ^(2006.01) **E02F 9/20** ^(2006.01)
F15B 11/17 ^(2006.01)

(21) Application number: **10861359.7**

(86) International application number:
PCT/KR2010/009361

(22) Date of filing: **27.12.2010**

(87) International publication number:
WO 2012/091187 (05.07.2012 Gazette 2012/27)

(54) **BOOM-SWIVEL COMPOUND DRIVE HYDRAULIC CONTROL SYSTEM OF CONSTRUCTION MACHINE**

HYDRAULISCHES STEUERSYSTEM EINES AUSLEGERDREHGELENKVERBUNDANTRIEBS
EINER EINER BAUMASCHINE

SYSTÈME DE COMMANDE HYDRAULIQUE D'ENTRAÎNEMENT COMBINÉ FLÈCHE/PIVOT POUR
MACHINE DE CONSTRUCTION

(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**

(43) Date of publication of application:
06.11.2013 Bulletin 2013/45

(73) Proprietor: **Volvo Construction Equipment AB
631 85 Eskilstuna (SE)**

(72) Inventors:
• **BANG, Sang-Ho
Changwon-si
Gyeongsangnam-do 642-360 (KR)**

• **ROH, Byung-Uk
Changwon-si
Gyeongsangnam-do 642-360 (KR)**

(74) Representative: **Zimmermann, Tankred Klaus et al
Schoppe, Zimmermann, Stöckeler
Zinkler, Schenk & Partner mbB
Patentanwälte
Radtkoferstrasse 2
81373 München (DE)**

(56) References cited:
**EP-A2- 1 672 128 JP-A- H 093 977
JP-A- 6 280 814 JP-A- 10 220 411
JP-A- 2002 047 691 JP-A- 2002 047 691
KR-B1- 920 010 874 KR-B1- 960 013 596**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 660 478 B1

Description

[Field of the Invention]

[0001] The present invention relates to a hydraulic control system for a combined boom and swing operation of a construction machine such as an excavator. More particularly, the present invention relates to a hydraulic system for a construction machine, in which the driving speeds of the boom and the swing device are adjusted according to working conditions during a combined operation in which boom-up and swing manipulations are carried out to perform an excavating and loading work, thereby ensuring a smooth work.

[Background of the Invention]

[0002] A conventional hydraulic control system for a combined boom and swing operation of a construction machine in accordance with the prior art as shown in Fig. 1 includes:

first and second variable displacement hydraulic pumps (hereinafter, referred to as "first and second hydraulic pumps") 1 and 2 connected to an engine (not shown);

an actuator (referring to "arm cylinder") for a swing device and a work apparatus, which is connected to the first hydraulic pump 1;

an actuator for a work apparatus (referring to "boom cylinder") connected to the second hydraulic pump 2; and a flow rate control valve (MCV) 3 configured to control a flow rate of a hydraulic fluid supplied respectively to the actuators for the swing device and the work apparatus from the first and second hydraulic pumps 1 and 2.

[0003] In Fig. 1, a non-explained reference numeral 11 denotes a boom confluence spool that allows the hydraulic fluid discharged from the first hydraulic pump 1 to join the hydraulic fluid discharged from the second hydraulic pump 2 when a boom-up operation is performed.

[0004] Thus, an operator manipulates a boom manipulation lever 4 to shift a boom spool 5 and a boom confluence spool 11 so that the hydraulic fluid supplied to the boom cylinder via the boom spool 5 from the second hydraulic pump 2 and the hydraulic fluid supplied to the boom cylinder from the first hydraulic pump 1 via the boom confluence spool 11 join each other to cause the boom cylinder to be driven to perform a boom-up operation.

[0005] On the other hand, an operator manipulates a manipulation lever (not shown) for the swing device to shift a swing spool 6 so that the hydraulic fluid supplied to the arm cylinder from the first hydraulic pump 1 via the swing spool 6 causes the swing device to be driven to swivel the upper swing structure.

[0006] During a combined operation in which the boom

and the swing device are operated to perform an excavating and loading work, the hydraulic fluid discharged from the first hydraulic pump 1 is supplied to the boom cylinder via the boom spool 5 to drive the boom cylinder and the hydraulic fluid discharged from the first hydraulic pump 1 is distributively supplied to the boom cylinder and the swing device, respectively, due to a difference in the pressure between the front ends of the boom confluence spool 11 and the swing spool 6.

[0007] Meanwhile, in the case where the excavating and loading work is performed, there is required an adjustment of the driving speeds of the boom and the swing device depending on various kinds of working conditions such as the excavation depth or the height of a dump vehicle. That is, the distributed flow rate of the hydraulic fluid supplied to the boom confluence spool 11 and the swing spool 6 from the first hydraulic pump 1 needs to be controlled.

[0008] In the conventional hydraulic control system, since the flow rate of the hydraulic fluid distributively supplied to the supplied to the boom confluence spool 11 and the swing spool 6 from the first hydraulic pump 1 is fixed to a constant level, the driving speeds of the boom and the swing device are inevitably adjusted to conform to only one kind of working condition. Thus, such a conventional hydraulic control system entails a problem in that an operator must perform a combined operation of the manipulation levers for the boom and the swing device based on the operator's manipulation experience in order to attain the smooth matching of the work apparatus (i.e., attachment of the upper swing structure), thereby resulting in a deterioration of manipulability and workability.

[0009] EP 1 672 128 A2, in accordance with the preamble of the independent claim, describes a hydraulic control device of an excavator for controlling combined operation of boom-raising and swing on a slope. A swing priority valve is provided on a pressured fluid supply line that connects a first hydraulic pump to a boom high-speed control valve. If an excavator performs its tasks on a slope, the swing priority valve is automatically shifted under a control of an electronic controller into a throttling position to thereby restrict hydraulic flow through the boom high-speed control valve so that an increased amount of hydraulic flow can be supplied to a swing motor, thus increasing a swing operating pressure more rapidly than a boom operating pressure and consequently facilitating combined operation of boom-raising and swing on a slope.

[0010] JP H 09 3977 A describes a construction machine in which operation detecting signals are generated from a boom operation detecting switch, an arm operation detecting switch and a swing detecting switch on the basis of the operation of each joy stick, and input to an electronic control unit. In the case where any one of each operation detecting signal is not generated, the electronic control unit outputs a predetermined reference current to an electromagnetic proportional pressure-reduction

valve so that the reference control pressure is supplied to discharge flow rate control spools. In the case where any one of the boom or the arm operation detecting signals is generated, the electronic

[0011] control unit outputs a delay control current to the pressure-reduction valve so that a delay control pressure is supplied to the discharge capacity control spools. In the case where the swing detecting signal is generated, the control pressure is not supplied.

[0012] JP 2002 047691 A describes a work vehicle with a mode switching means comprising a mode selector switch of work modes of one or more work machines. A speed fine control switch finely adjusting the work speed and/or travel speed set in each mode to the speed outside the range by a manual action is provided.; A flow adjusting valve arranged on drive circuits of an engine, pumps, one or more work machines and a travel motor is operated by the output signal via the operation of the speed fine control switch, and the engine speed and pump discharge quantity are adjusted. The optimum work mode of the work machine is effectively obtained according to the work contents and work conditions under implementation or the skill of an operator even in the environment that the work range is changed or an obstacle exists, and stable vehicle travelability and the operability of the work machine can be realized.

[Detailed Description of the Invention]

[Technical Problems]

[0013] Accordingly, the present invention was made to solve the aforementioned problem occurring in the prior art, and it is an object of the present invention to provide a hydraulic control system for a combined boom and swing operation of a construction machine, in which an operator can easily adjust the driving speeds of the boom and the swing device depending on various kinds of working conditions such as the excavation depth or the height of a dump vehicle during a combined operation in which the boom and the swing device are manipulated to smoothly perform an excavating and loading work.

[0014] Another object of the present invention to provide a hydraulic control system for a combined boom and swing operation of a construction machine, in which in the case where an operator selects a certain work mode needed for the working conditions within an operator cab during the excavating and loading work, the flow rate of the hydraulic fluid distributed to a boom confluence spool and a swing spool is controlled depending on the selected work mode so that the driving speeds of the boom and the swing device can be adjusted under the working conditions needed by the operator.

[Technical Solution]

[0015] To accomplish the above object, in accordance with an embodiment of the present invention, there is

provided a hydraulic control system for a combined boom and swing operation of a construction machine, which includes first and second variable displacement hydraulic pumps, an actuator for a swing device and a work apparatus, which is connected to the first hydraulic pump, an actuator for a work apparatus connected to the second hydraulic pump, and a flow rate control valve configured to control a low rate of a hydraulic fluid supplied respectively to the actuators for the swing device and the work apparatus from the first and second hydraulic pumps, the hydraulic control system including:

a work mode selection switch configured to select a preset work mode according to working conditions; an electronic proportional pressure control valve mounted in a pilot fluid path that discharges a pilot signal pressure according to a manipulation amount of a boom manipulation lever when the boom manipulation lever is manipulated to perform a boom-up operation, the electronic proportional pressure control valve being configured to output a control signal pressure that is in proportion to the manipulation of the work mode selection switch;

a variable flow rate control valve mounted in a flow path between the first hydraulic pump and a spool for the swing device, the variable flow rate control valve having an opening area variably adjusted in proportion to the control signal pressure of the electronic proportional pressure control valve; and a controller configured to previously set and store various kinds of work modes according to working conditions to control a flow rate of the hydraulic fluid supplied to the swing device spool and a boom confluence spool according to a work mode selected when the work mode selection switch is manipulated, wherein in the case where an operator selects a certain work mode according to the working conditions during a combined operation in which boom-up and swing manipulations are carried out, the flow rate of the hydraulic fluid supplied to the swing device spool and the boom confluence spool is variably controlled according to the selected work mode to adjust the driving speeds of the boom and the swing device.

[0016] According to a more preferable embodiment, the electronic proportional pressure control valve is mounted inside the flow rate control valve.

[0017] The electronic proportional pressure control valve is mounted outside the flow rate control valve.

[0018] The variable flow rate control valve uses a variable orifice whose opening area is variably adjusted in proportion to the control signal pressure from the electronic proportional pressure control valve.

[Advantageous Effect]

[0019] The hydraulic control system for a combined boom and swing operation of a construction machine in

accordance with an embodiment of the present invention as constructed above has the following advantages.

[0020] An operator can easily adjust the driving speeds of the boom and the swing device depending on various kinds of working conditions such as the excavation depth or the height of a dump vehicle during a combined operation in which the boom and the swing device are manipulated to perform an excavating and loading work, thereby improving workability.

[0021] In the case where an operator selects a certain work mode needed for the working conditions within an operator cab during the excavating and loading work, the driving speeds of the boom and the swing device can be adjusted under the working conditions needed by the operator, thereby improving convenience of the operator.

[Brief Description of the Invention]

[0022] The above objects, other features and advantages of the present invention will become more apparent by describing the preferred embodiments thereof with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram showing the main elements of a hydraulic control system for a combined boom and swing operation of a construction machine in accordance with the prior art;

Fig. 2 is a block diagram showing the main elements of a hydraulic control system for a combined boom and swing operation of a construction machine in accordance with an embodiment of the present invention; and

Fig. 3 is a graph showing the effects of a hydraulic control system for a combined boom and swing operation of a construction machine in accordance with an embodiment of the present invention.

* Explanation on reference numerals of main elements in the drawings *

[0023]

- 1: first variable displacement hydraulic pump
- 2: second variable displacement hydraulic pump
- 3: flow rate control valve (MCV)
- 4: boom manipulation lever:
- 5: boom spool
- 6: spool for the swing device (i.e., swing spool)
- 7: pilot flow path
- 8: work mode selection switch
- 9: electronic proportional pressure control valve (EP-PRV)
- 10: variable flow rate control valve
- 11: boom confluence spool

[Preferred Embodiments of the Invention]

[0024] Now, preferred embodiments of the present in-

vention will be described in detail with reference to the accompanying drawings. The matters defined in the description, such as the detailed construction and elements, are nothing but specific details provided to assist those of ordinary skill in the art in a comprehensive understanding of the invention, and the present invention is not limited to the embodiments disclosed hereinafter.

[0025] A hydraulic control system for a combined boom and swing operation of a construction machine in accordance with an embodiment of the present invention as shown in Fig. 2 includes first and second variable displacement hydraulic pumps, an actuator for a swing device and a work apparatus, which is connected to the first hydraulic pump, an actuator for a work apparatus connected to the second hydraulic pump, and a flow rate control valve configured to control a flow rate of a hydraulic fluid supplied respectively to the actuators for the swing device and the work apparatus from the first and second hydraulic pumps.

[0026] The hydraulic control system includes:

a work mode selection switch 8 configured to select a preset work mode according to working conditions; an electronic proportional pressure control valve 9 mounted in a pilot fluid path 7 that discharges a pilot signal pressure according to a manipulation amount of a boom manipulation lever 4 when the boom manipulation lever 4 is manipulated to perform a boom-up operation, the electronic proportional pressure control valve 9 being configured to output a control signal pressure that is in proportion to a the manipulation of the work mode selection switch 8; a variable flow rate control valve 10 mounted in a flow path between the first hydraulic pump 1 and a spool 6 for the swing device, the variable flow rate control valve having an opening area variably adjusted in proportion to the control signal pressure of the electronic proportional pressure control valve 9; and a controller (not shown) configured to previously set and store various kinds of work modes according to working conditions to control a flow rate of the hydraulic fluid supplied to the swing device spool 6 and a boom confluence spool 11 according to a work mode selected when the work mode selection switch 8 is manipulated, wherein in the case where an operator selects a certain work mode according to the working conditions during a combined operation in which boom-up and swing manipulations are carried out to perform an excavating and loading work, the flow rate of the hydraulic fluid supplied to the swing device spool 6 and the boom confluence spool 11 is variably controlled according to the selected work mode to adjust the driving speeds of the boom and the swing device.

[0027] Herein, the electronic proportional pressure control valve 9 is mounted inside the flow rate control

valve (MCV) 3. The electronic proportional pressure control valve 9 may be constructed as an electro proportional pressure reducing valve (EPPRV), and may be mounted inside the flow rate control valve (MCV) 3.

[0028] The electronic proportional pressure control valve 9 is mounted outside the flow rate control valve.

[0029] The variable flow rate control valve 10 may use a variable orifice whose opening area is variably adjusted in proportion to the control signal pressure from the electronic proportional pressure control valve 9.

[0030] In Fig. 2, a non-explained reference numeral 11 denotes a boom confluence spool that allows the hydraulic fluid of the first hydraulic pump 1 to join the hydraulic fluid of the second hydraulic pump 2 when a boom-up operation is performed.

[0031] Hereinafter, a use example of the hydraulic control system for a combined boom and swing operation of a construction machine in accordance with the present invention will be described in detail with reference to the accompanying drawings.

[0032] As shown in Figs. 2 and 3, in the case where an operator within an operator cab manipulates the boom manipulation lever 4 to conduct a boom-up operation and drives the swing device to swivel an upper swing structure in order to perform an excavating and loading work, the operator manipulates the work mode selection switch 8 to select a certain work mode suitable for various kinds of working conditions such as the height of the ground surface of an excavation work site or the height of a dump vehicle.

[0033] A part of a pilot signal pressure passing by the boom manipulation lever 4 is supplied to a boom spool 5 to shift the boom spool according to the boom-up manipulation of the boom manipulation lever 4. Thus, the hydraulic fluid discharged from the second hydraulic pump 2 is supplied to a boom cylinder (not shown) after passing through the boom spool 5 to perform the boom-up operation.

[0034] On the other hand, a part of the pilot signal pressure passing by the boom manipulation lever 4 is supplied to the electronic proportional pressure control valve 9 mounted in the pilot flow path 7. At this time, the electronic proportional pressure control valve 9 outputs a pilot signal pressure in proportion to a select signal corresponding to a work mode selected according to the manipulation of the work mode selection switch 8.

[0035] By virtue of this operation, the signal pressure passing through the electronic proportional pressure control valve 9 is supplied to the variable flow rate control valve 10 so that the opening area of the variable flow rate control valve 10 is controlled. That is, the opening diameter of the variable flow rate control valve 10 is controlled in proportion to the control signal pressure outputted from the electronic proportional pressure control valve 9 depending on the selected work mode.

[0036] Therefore, the flow rate of the hydraulic fluid discharged from the first hydraulic pump 1 and supplied to the spool 6 for the swing device is reduced to match

the selected work mode, and the flow rate of the hydraulic fluid supplied to the boom confluence spool 11 is increased. In other words, since the flow rate of the hydraulic fluid supplied to the boom confluence spool 11 from the first hydraulic pump 1 is increased, the boom-up operation is performed at a relatively high speed as compared to the swing operation of the upper swing structure so that the loading work can be carried out safely.

[0037] For this reason, in the case where the manipulation lever of the boom-up device and the swing device is manipulated at a full stroke to perform a combined operation, the matching between the boom-up operation and the swing operation is accomplished so that the operator can conveniently perform the excavating and loading work in a desired direction.

[0038] As shown in Fig. 3, it can be seen that the hydraulic fluid discharged from the first hydraulic pump 1 is supplied to the boom cylinder in proportion to a pilot signal pressure Pi1 outputted from the electronic proportional pressure control valve 9 to fit the work mode (meaning a line "a" on the graph of Fig. 3) selected by the manipulation of the work mode selection switch 8.

[0039] While the present invention has been described in connection with the specific embodiments illustrated in the drawings, they are merely illustrative, and the invention is not limited to these embodiments. It is to be understood that various equivalent modifications and variations of the embodiments can be made by a person having an ordinary skill in the art. Therefore, the true technical scope of the present invention should not be defined by the above-mentioned embodiments but should be defined by the appended claims and equivalents thereof.

35 [Industrial Applicability]

[0040] As described above, in the hydraulic control system for a combined boom and swing operation of a construction machine in accordance with an embodiment of the present invention, it is possible to adjust the driving speeds of the boom and the swing device depending on various kinds of working conditions such as the excavation depth or the height of a dump vehicle during a combined operation in which boom-up and swing manipulations are carried out to perform an excavating and loading work. In addition, in the case where an operator selects a certain work mode needed for the working conditions within an operator cab during the excavating and loading work, the driving speeds of the boom and the swing device are adjusted under the working conditions needed by the operator, thereby improving convenience and manipulability.

55 Claims

1. A hydraulic control system for a combined boom and swing operation of a construction machine, which

includes first and second variable displacement hydraulic pumps (1, 2), an actuator for a swing device and a work apparatus, which is connected to the first hydraulic pump (1), an actuator for a work apparatus connected to the second hydraulic pump (2), and a first flow rate control valve (3) configured to control a flow rate of a hydraulic fluid supplied respectively to the actuators for the swing device and the work apparatus from the first and second hydraulic pumps (1, 2), the hydraulic control system comprising:

a work mode selection switch (8);
 a proportional pressure control valve (9) mounted in a pilot fluid path (7) that discharges a pilot signal pressure according to a manipulation amount of a boom manipulation lever (4) when the boom manipulation lever (4) is manipulated to perform a boom-up operation, the proportional pressure control valve (9) being configured to output a control signal pressure that is in proportion to the manipulation of the work mode selection switch (8);
 a second variable flow rate control valve (10) mounted in a flow path between the first hydraulic pump (1) and a swing device spool (6) for the swing device, the second variable flow rate control valve (10) having an opening area variably adjusted in proportion to the control signal pressure of the proportional pressure control valve (9);
 a boom confluence spool (11); and
 a controller;

characterized in that

the proportional pressure control valve (9) is an electronic proportional pressure control valve,
 the work mode selection switch (8) is configured to select a preset work mode according to working conditions,
 the controller is configured to set and store various kinds of work modes according to working conditions to control a flow rate of the hydraulic fluid supplied to the swing device spool (6) and the boom confluence spool (11) according to a work mode selected when the work mode selection switch (8) is manipulated,
 in the case where an operator selects a certain work mode according to the working conditions during a combined operation in which boom-up and swing manipulations are carried out, the flow rate of the hydraulic fluid supplied to the swing device spool (6) and the boom confluence spool (11) is variably controlled according to the selected work mode to adjust the driving speeds of the boom and the swing device,
 a part of the pilot signal pressure passing by the boom manipulation lever (4) is supplied to a boom spool (5) to shift the boom spool (5) according to the boom-up manipulation of the

boom manipulation lever (4) so that the hydraulic fluid discharged from the second hydraulic pump (2) is supplied to a boom cylinder after passing through the boom spool (5) to perform the boom-up operation, and
 another part of the pilot signal pressure passing by the boom manipulation lever (4) is supplied to the electronic proportional pressure control valve (9) mounted in the pilot flow path (7).

2. The hydraulic control system according to claim 1, wherein the electronic proportional pressure control valve (9) is mounted inside the first flow rate control valve (3).
3. The hydraulic control system according to claim 1, wherein the electronic proportional pressure control valve (9) is mounted outside the first flow rate control valve (3).
4. The hydraulic control system according to claim 1, wherein the second variable flow rate control valve (10) uses a variable orifice whose opening area is variably adjusted in proportion to the control signal pressure from the electronic proportional pressure control valve (9).

Patentansprüche

1. Ein Hydrauliksteuersystem für einen kombinierten Ausleger- und Schwenkbetrieb einer Baumaschine, das eine erste und zweite Verstell-Hydraulikpumpe (1, 2), eine Betätigungseinrichtung für eine Schwenkvorrichtung und eine Arbeitsvorrichtung, die mit der ersten Hydraulikpumpe (1) verbunden ist, eine Betätigungseinrichtung für eine Arbeitsvorrichtung, die mit der zweiten Hydraulikpumpe (2) verbunden ist, und ein erstes Flussratensteuerventil (3) umfasst, das ausgebildet ist, um eine Flussrate eines Hydraulikfluids zu steuern, das von der ersten und zweiten Hydraulikpumpe (1, 2) jeweils den Betätigungseinrichtungen für die Schwenkvorrichtung und die Arbeitsvorrichtung zugeführt wird, wobei das Hydrauliksteuersystem folgende Merkmale aufweist:

einen Arbeitsmodusauswahlschalter (8);
 ein Proportionaldrucksteuerventil (9), das in einem Pilotfluidweg (7) befestigt ist, das einen Pilotsignaldruck ablässt gemäß einem Bedienbetrag eines Auslegerbedienhebels (4), wenn der Auslegerbedienhebel (4) bedient wird, um einen Ausleger-nach-oben-Betrieb durchzuführen, wobei das Proportionaldrucksteuerventil (9) ausgebildet ist, um einen Steuersignaldruck auszugeben, der proportional zu der Bedienung des Arbeitsmodusauswahlschalters (8) ist;
 ein zweites Variable-Flussrate-Steuerventil

(10), das in einem Flussweg zwischen der ersten Hydraulikpumpe (1) und einem Schwenkvorrichtungsteuerkolben (6) für die Schwenkvorrichtung befestigt ist, wobei das zweite Variable-Flussrate-Steuerventil (10) einen Öffnungsbereich aufweist, der proportional zu dem Steuersignaldruck des Proportionaldrucksteuerventils (9) variabel eingestellt wird; ein Auslegerzusammenflusssteuerkolben (11), und eine Steuerung;

gekennzeichnet dadurch, dass

das Proportionaldrucksteuerventil (9) ein elektronisches Proportionaldrucksteuerventil ist, der Arbeitsmodusauswahlschalter (8) ausgebildet ist, um gemäß Arbeitsbedingungen einen Voreinstellungsarbeitsmodus auszuwählen, die Steuerung ausgebildet ist, um gemäß Arbeitsbedingungen verschiedene Arten von Arbeitsmodi einzustellen und zu speichern, um eine Flussrate des Hydraulikfluids zu steuern, das dem Schwenkvorrichtungsteuerkolben (6) und dem Auslegerzusammenflusssteuerkolben (11) zugeführt wird gemäß einem Arbeitsmodus, der ausgewählt wird, wenn der Arbeitsmodusauswahlschalter (8) bedient wird, in dem Fall, in dem eine Bedienperson gemäß den Arbeitsbedingungen während eines kombinierten Betriebs einen bestimmten Arbeitsmodus auswählt, bei dem eine Ausleger-nach-oben- und eine Schwenk-Bedienung ausgeführt werden, wird die Flussrate des Hydraulikfluids, das dem Schwenkvorrichtungsteuerkolben (6) und dem Auslegerzusammenflusssteuerkolben (11) zugeführt wird, gemäß dem ausgewählten Arbeitsmodus variabel gesteuert, um die Antriebsgeschwindigkeiten des Auslegers und der Schwenkvorrichtung einzustellen, ein Teil des Pilotsignaldrucks, der entlang dem Auslegerbedienhebel (4) verläuft, einem Auslegersteuerkolben (5) zugeführt wird, um den Auslegersteuerkolben (5) gemäß der Ausleger-nach-oben-Bedienung des Auslegerbedienhebels (4) zu verschieben, so dass das Hydraulikfluid, das von der zweiten Hydraulikpumpe (2) abgelassen wird, einem Auslegerzylinder zugeführt wird nach dem Verlaufen durch den Auslegersteuerkolben (5), um den Ausleger-nach-oben-Betrieb durchzuführen, und ein anderer Teil des Pilotsignaldrucks, der entlang dem Auslegerbedienhebel (4) verläuft, dem elektronischen Proportionaldrucksteuerventil (9) zugeführt wird, das in dem Pilotflussweg (7) befestigt ist.

2. Das Hydrauliksteuersystem gemäß Anspruch 1, bei dem das elektronische Proportionaldrucksteuerventil (9) in dem ersten Flussratensteuerventil (3) befestigt ist.

tigt ist.

3. Das Hydrauliksteuersystem gemäß Anspruch 1, bei dem das elektronische Proportionaldrucksteuerventil (9) außerhalb des ersten Flussratensteuerventils (3) befestigt ist.
4. Das Hydrauliksteuersystem gemäß Anspruch 1, bei dem das zweite variable-Flussrate-Steuerventil (10) eine variable Öffnung verwendet, deren Öffnungsbereich proportional zu dem Steuersignaldruck von dem elektronischen Proportionaldrucksteuerventil (9) variabel eingestellt wird.

Revendications

1. Système de commande hydraulique pour une opération combinée de flèche-pivot pour machine de construction, qui comporte une première et une deuxième pompe hydraulique à déplacement variable (1, 2), un actionneur pour un dispositif de pivotement et un appareil de travail qui est connecté à la première pompe hydraulique (1), un actionneur pour un appareil de travail connecté à la deuxième pompe hydraulique (2), et une première soupape de commande de débit (3) configurée pour commander un débit d'un fluide hydraulique alimenté respectivement vers les actionneurs pour le dispositif de pivotement et l'appareil de travail à partir des première et deuxième pompes hydrauliques (1, 2), le système de commande hydraulique comprenant:

un commutateur de sélection de mode de travail (8);
 une soupape de commande de pression proportionnelle (9) montée dans un trajet de fluide de commande (7) qui décharge une pression de signal de commande selon une quantité de manipulation d'un levier de manipulation de flèche (4) lorsque le levier de manipulation de flèche (4) est manipulé pour effectuer une opération de montée de flèche, la soupape de commande de pression proportionnelle (9) étant configurée pour sortir une pression de signal de commande qui est proportionnelle à la manipulation du commutateur de sélection de mode de travail (8);
 une deuxième soupape de commande de débit variable (10) montée dans un trajet de circulation entre la première pompe hydraulique (1) et une bobine de dispositif de pivotement (6) pour le dispositif de pivotement, la deuxième soupape de commande de débit variable (10) présentant une superficie d'ouverture réglée de manière variable proportionnellement à la pression de signal de commande de la soupape de commande de pression proportionnelle (9);
 une bobine de confluence de flèche (11); et

un dispositif de commande;

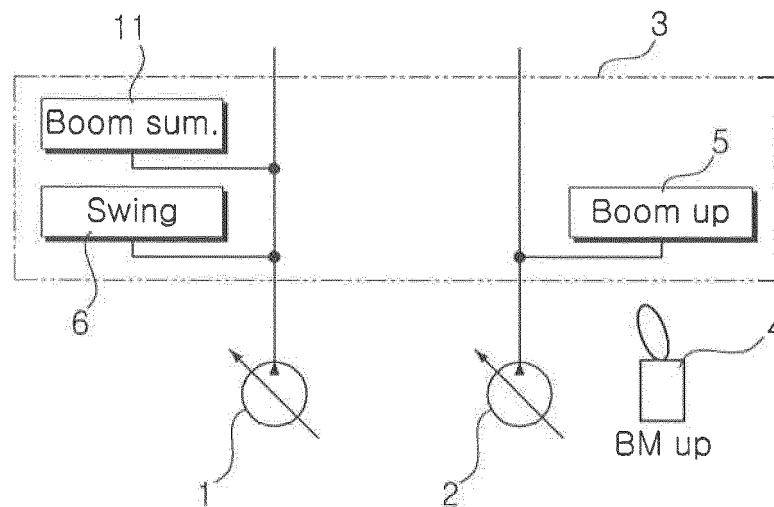
caractérisé par le fait que

la soupape de commande de pression proportionnelle (9) est une soupape de commande de pression proportionnelle électronique, 5
le commutateur de sélection de mode de travail (8) est configuré pour sélectionner un mode de travail préétabli selon les conditions de travail, 10
le dispositif de commande est configuré pour régler et mémoriser divers types de modes de travail selon les conditions de travail pour commander un débit du fluide hydraulique alimenté vers la bobine de dispositif de pivotement (6) et vers la bobine de confluence de flèche (11) selon un mode de travail sélectionné lorsque le commutateur de sélection de mode de travail (8) est manipulé, 15
dans le cas où un opérateur sélectionne un certain mode de travail selon les conditions de travail pendant une opération combinée dans laquelle sont réalisées des manipulations de montée de flèche et de pivotement, le débit du fluide hydraulique alimenté vers la bobine de dispositif de pivotement (6) et la bobine de confluence de flèche (11) est commandée de manière variable selon le mode de travail sélectionné pour ajuster les vitesses d'entraînement de la flèche et du dispositif de pivotement, 20
une partie de la pression de signal de commande passant par le levier de manipulation de flèche (4) est alimentée vers une bobine de flèche (5) pour déplacer la bobine de flèche (5) selon la manipulation de montée de flèche du levier de manipulation de flèche, de sorte que le fluide hydraulique déchargé de la deuxième pompe hydraulique (2) soit alimenté vers un cylindre de flèche après avoir traversé la bobine de flèche (5) pour effectuer l'opération de montée de flèche, et 25
une autre partie de la pression du signal de commande passant par le levier de manipulation de flèche (4) est alimentée vers la soupape de commande de pression proportionnelle électronique (9) montée dans le trajet de circulation de commande (7). 30 35 40 45

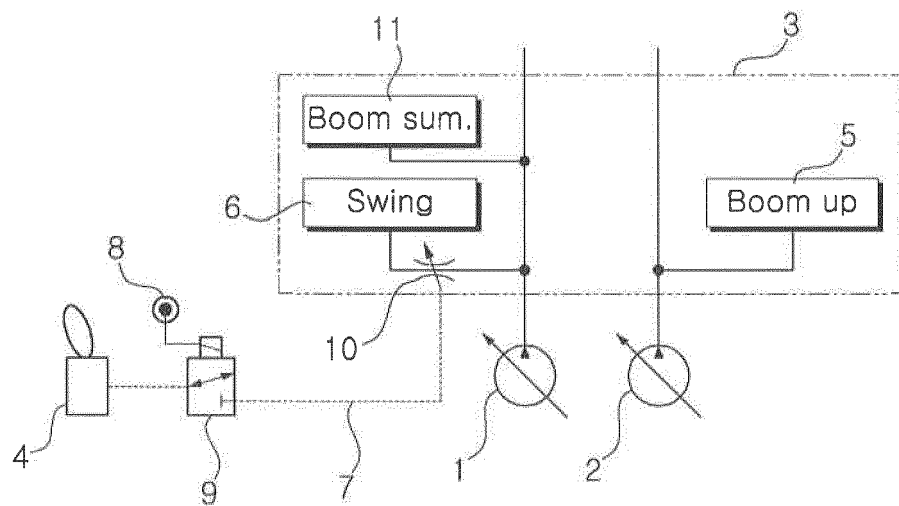
2. Système de commande hydraulique selon la revendication 1, dans lequel la soupape de commande de pression proportionnelle électronique (9) est montée à l'intérieur de la première soupape de commande de débit (3). 50
3. Système de commande hydraulique selon la revendication 1, dans lequel la soupape de commande de pression proportionnelle électronique (9) est montée à l'extérieur de la première soupape de commande de débit (3). 55

4. Système de commande hydraulique selon la revendication 1, dans lequel la deuxième soupape de commande de débit variable (10) utilise un orifice variable dont la superficie d'ouverture est réglée de manière variable proportionnellement à la pression de signal de commande de la soupape de commande de pression proportionnelle électronique (9).

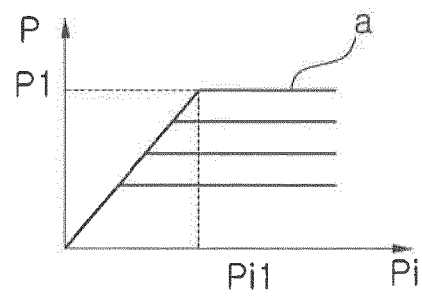
[Fig. 1]



[Fig.2]



[Fig.3]



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

- EP 1672128 A2 [0009]
- JP H093977 A [0010]
- JP 2002047691 A [0012]