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(54) **HYDRAULIC CONTROL SYSTEM IN WORKING MACHINE**

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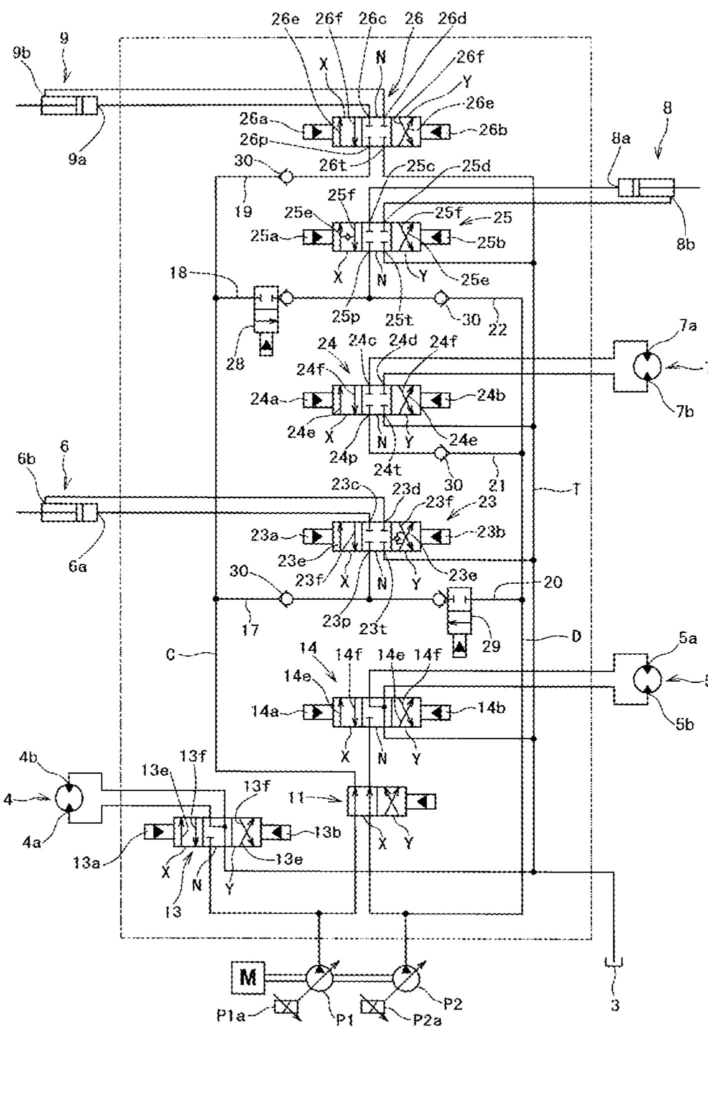
CPC ***E02F 9/2242*** (2013.01)

(57) **ABSTRACT**

Problem: In a case where the hydraulic actuator A supplied with hydraulic oil only from the first hydraulic pump and the hydraulic actuator B supplied with hydraulic oil from the first and second hydraulic pumps are operated simultaneously, even if the required flow rate for the first hydraulic pump of the hydraulic actuators A and B exceeds the first hydraulic pump maximum discharge flow rate, the hydraulic actuators A and B can be driven at the operation speed corresponding to the operation amount of the operation means.
Solution: A target flow rate correction means is provided for setting the bucket cylinder required flow rate as a target flow rate from the hydraulic pump to the bucket cylinder, a flow rate obtained by subtracting the bucket cylinder required flow rate from the pump maximum discharge flow rate as a target flow rate from the hydraulic pump to the boom cylinder, and setting a flow rate obtained by subtracting the target flow rate from the hydraulic pump to the boom cylinder from the bucket cylinder total required flow rate as a target flow rate from the hydraulic pump to the boom cylinder.



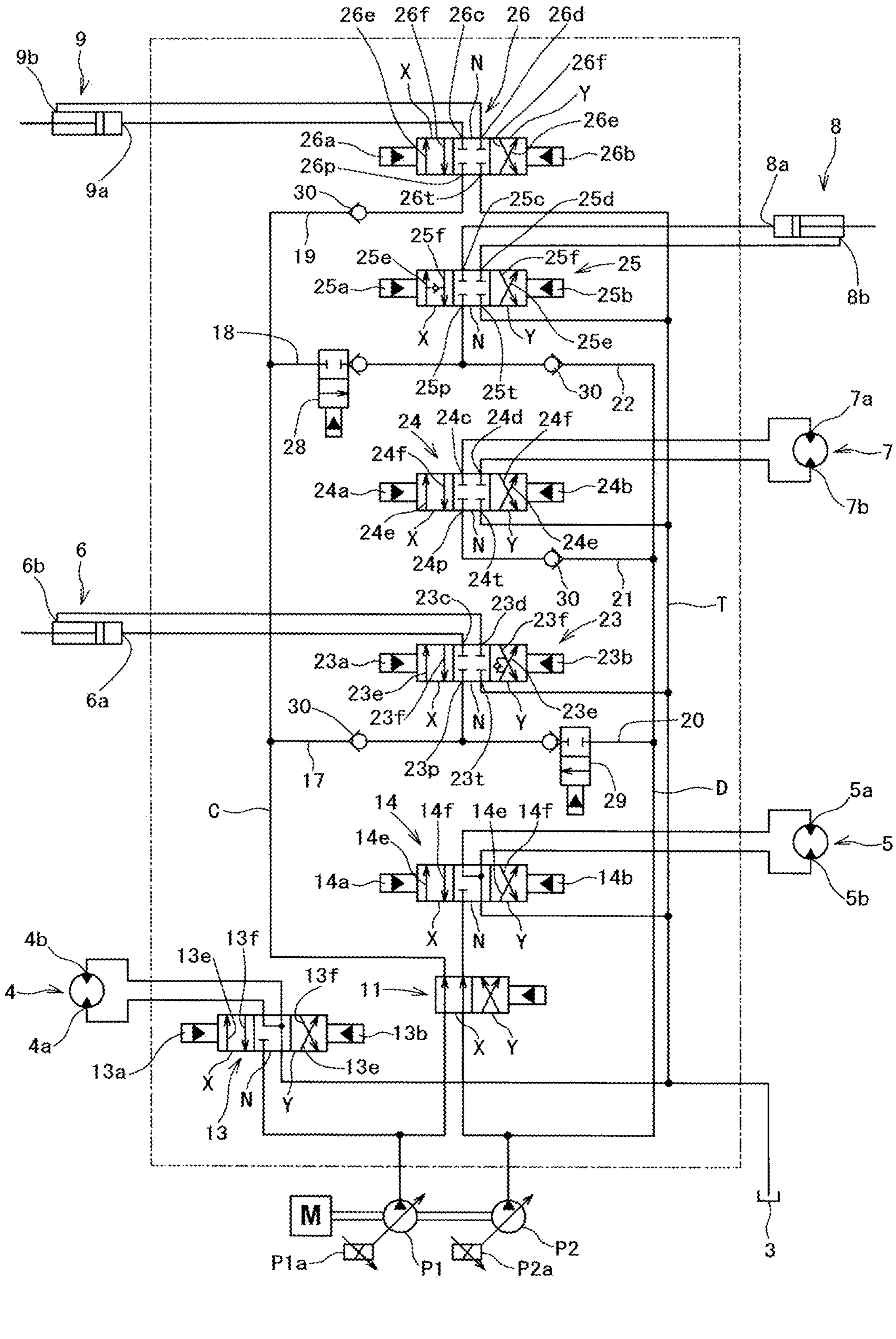


FIG. 1

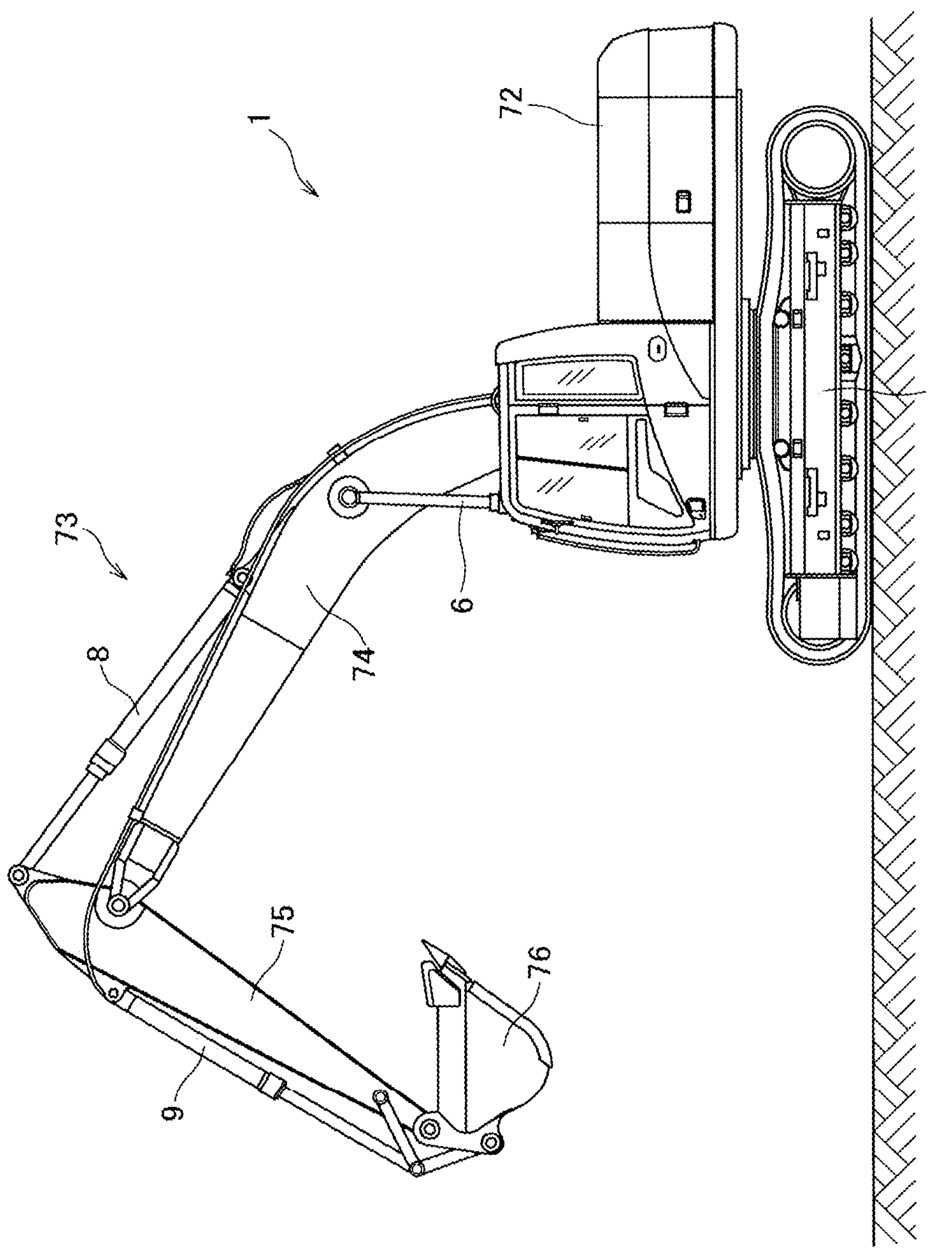


FIG. 2

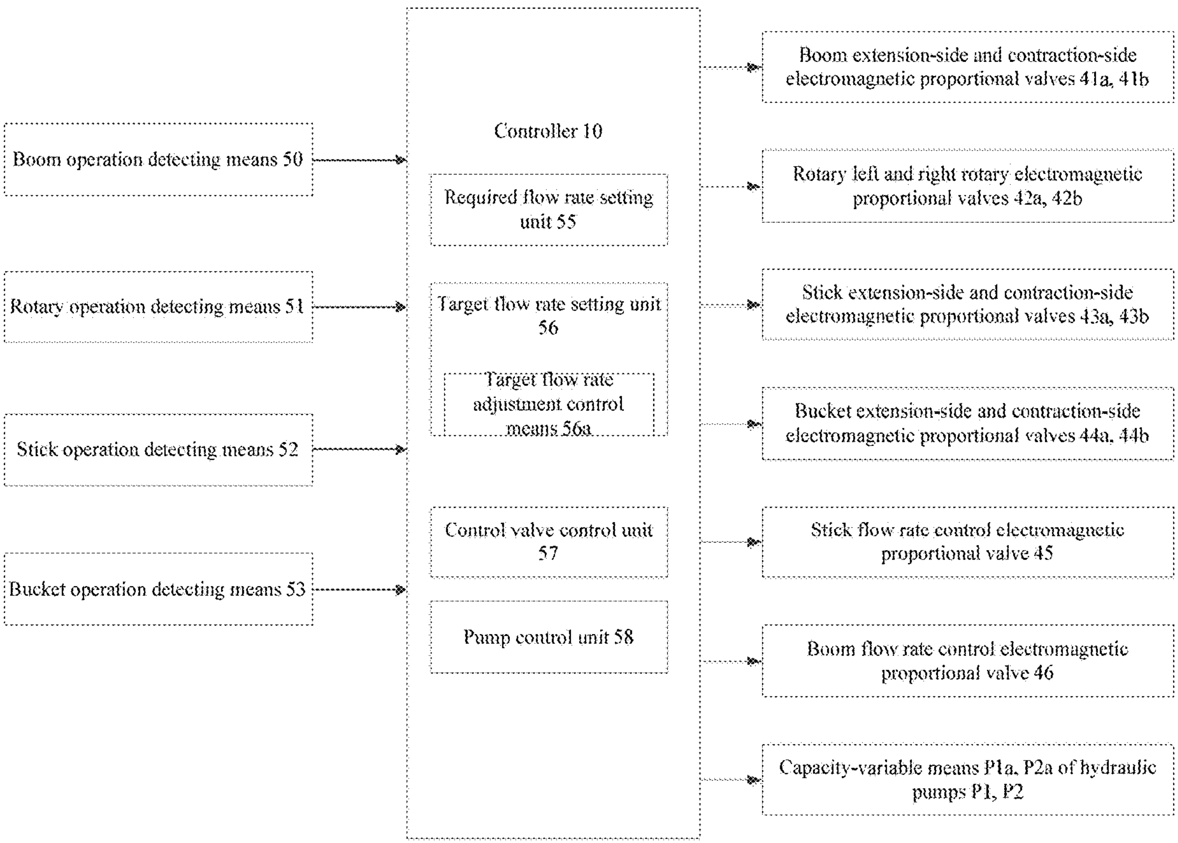

Boom operation detecting means 50
Rotary operation detecting means 51
Stick operation detecting means 52
Bucket operation detecting means 53
Controller 10
Required flow rate setting unit 55
Target flow rate setting unit 56
Target flow rate adjustment control means 56a
Control valve control unit 57
Pump control unit 58
Boom extension-side and contraction-side electromagnetic proportional valves 41a, 41b
Rotary left and right rotary electromagnetic proportional valves 42a, 42b
Stick extension-side and contraction-side electromagnetic proportional valves 43a, 43b
Bucket extension-side and contraction-side electromagnetic proportional valves 44a, 44b
Stick flow rate control electromagnetic proportional valve 45
Boom flow rate control electromagnetic proportional valve 46
Capacity-variable means P1a, P2a of hydraulic pumps P1, P2

FIG. 3

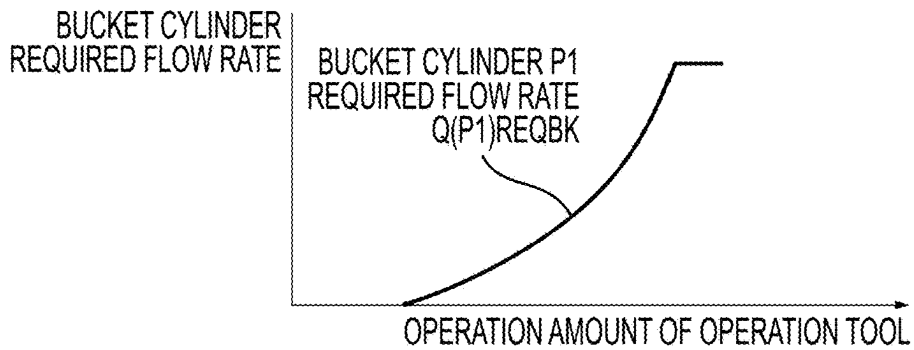


FIG. 4A

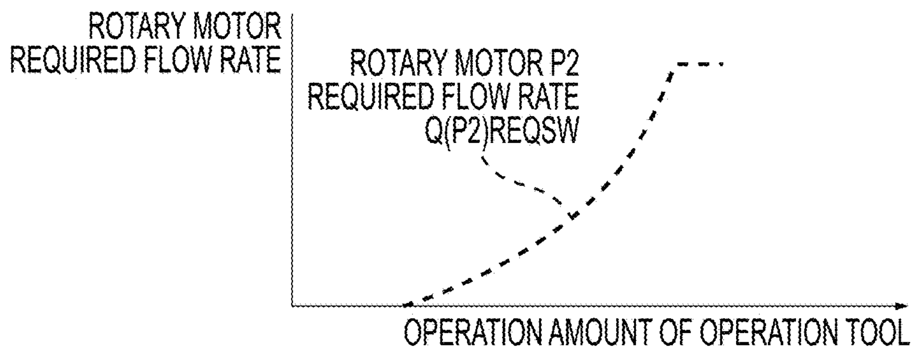


FIG. 4B

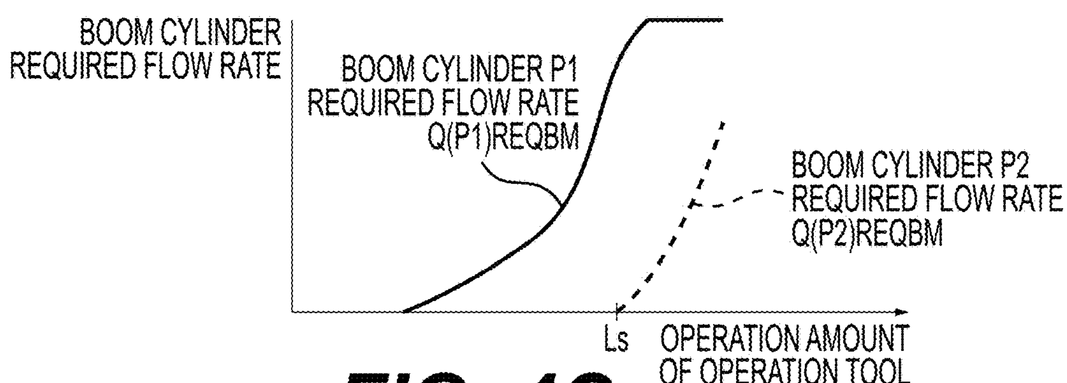


FIG. 4C

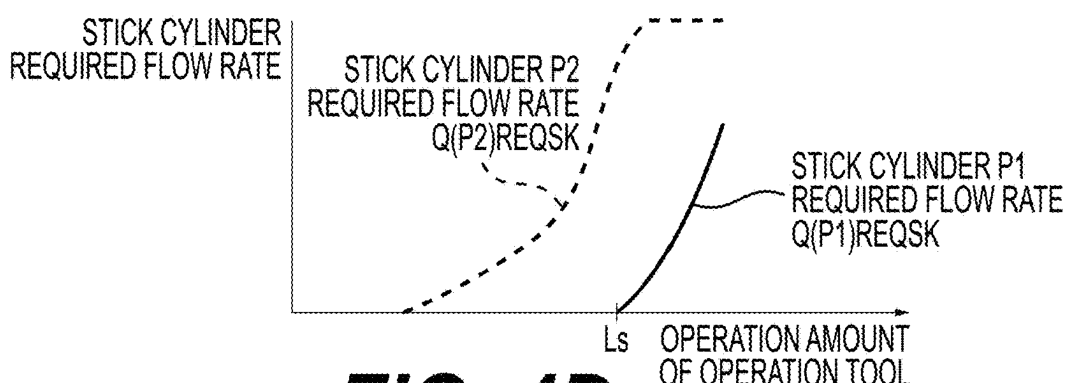


FIG. 4D

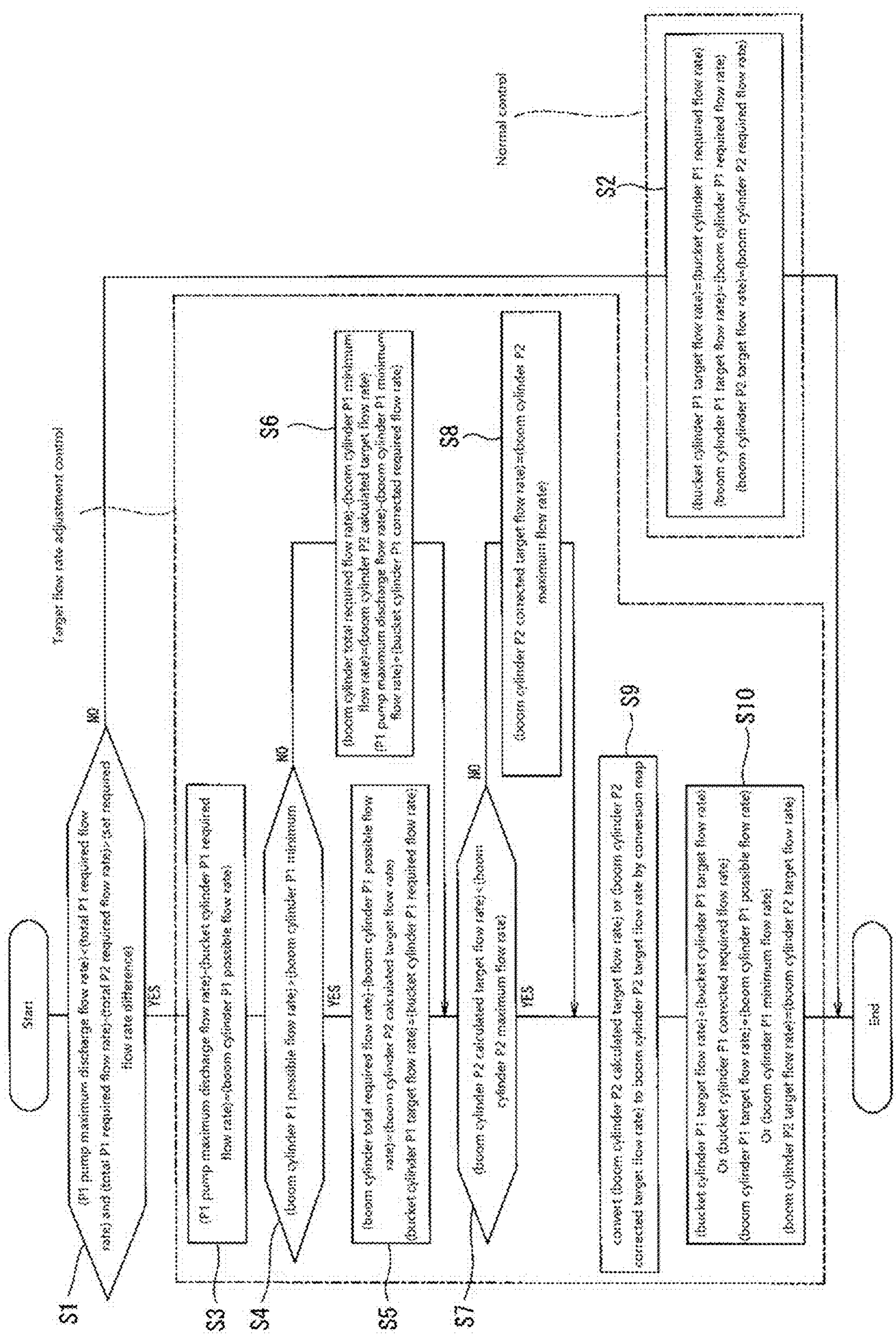

Start
S1
(P1 pump maximum discharge flow rate)<(total P1 required flow rate) and (total P1 required flow rate)-(total P2 required flow rate)>(set required flow rate difference)
YES
NO
Target flow rate adjustment control
Normal control
S2
(bucket cylinder P1 target flow rate)=(bucket cylinder P1 required flow rate)
(boom cylinder P1 target flow rate)=(boom cylinder P1 required flow rate)
(boom cylinder P2 target flow rate)=(boom cylinder P2 required flow rate)
S3
(P1 pump maximum discharge flow rate)-(bucket cylinder P1 required flow rate)=(boom cylinder P1 possible flow rate)
S4
(boom cylinder P1 possible flow rate)≥(boom cylinder P1 minimum
YES
NO
S5
(boom cylinder total required flow rate)-(boom cylinder P1 possible flow rate)=(boom cylinder P2 calculated target flow rate)
(bucket cylinder P1 target flow rate)=(bucket cylinder P1 required flow rate)
S6
(boom cylinder total required flow rate)-(boom cylinder P1 minimum flow rate)=(boom cylinder P2 calculated target flow rate)
(P1 pump maximum discharge flow rate)-(boom cylinder P1 minimum flow rate)=(bucket cylinder P1 corrected required flow rate)
S7
(boom cylinder P2 calculated target flow rate)≤(boom cylinder P2 maximum flow rate)
YES
NO
S8
(boom cylinder P2 corrected target flow rate)=(boom cylinder P2 maximum flow rate)
S9
convert (boom cylinder P2 calculated target flow rate) or (boom cylinder P2 corrected target flow rate) to boom cylinder P2 target flow rate by conversion map
S10
(bucket cylinder P1 target flow rate)=(bucket cylinder P1 target flow rate)
Or (bucket cylinder P1 corrected required flow rate)
(boom cylinder P1 target flow rate)=(boom cylinder P1 possible flow rate)
Or (boom cylinder P1 minimum flow rate)
(boom cylinder P2 target flow rate)=(boom cylinder P2 target flow rate)
End

FIG. 5

HYDRAULIC CONTROL SYSTEM IN WORKING MACHINE

TECHNICAL FIELD

[0001] The present invention relates to the technical field of a hydraulic control system in a working machine such as a hydraulic excavator.

BACKGROUND OF THE INVENTION

[0002] In general, a hydraulic system provided in a working machine such as a hydraulic excavator, includes a first hydraulic pump, a second hydraulic pump, and a plurality of hydraulic actuators using these first and second hydraulic pumps as hydraulic supply sources, and in the plurality of hydraulic actuators, there are a hydraulic actuator A which uses either one of the hydraulic pumps of the first and second hydraulic pumps as a hydraulic supply source, and a hydraulic actuator B using the first and second hydraulic pumps as a hydraulic supply source. In such a hydraulic system, hydraulic oil from both the first and second hydraulic pumps is merged and supplied to the hydraulic actuator B, but in this case, the hydraulic interference caused by the merging may lead to a decrease in efficiency and a deterioration in operability. Therefore, in the case where the hydraulic actuator B is supplied with the hydraulic oil, the oil pressure is supplied only from the first and second hydraulic pumps at first, and the oil pressure is supplied from the other hydraulic pump in accordance with an increase in the operation amount.

[0003] With this configuration, even if the hydraulic actuator B uses both the first and second hydraulic pumps as hydraulic pressure supply sources, the hydraulic oil is supplied only from one hydraulic pump when the operation amount of the operation tool is not large, so that the merging frequency of the hydraulic oil from the two hydraulic pumps can be reduced, and the reduction in efficiency and the deterioration in operability caused by the merging can be reduced.

[0004] When the hydraulic actuator A and the hydraulic actuator B are simultaneously operated (composite operation), the total flow rate of the hydraulic actuator A required flow rate depending on the operation amount of the operation tool for the hydraulic actuator A and the hydraulic actuator B required flow rate depending on the operation amount of the operation tool for the hydraulic actuator B may exceed the maximum discharge flow rate of the first hydraulic pump for the hydraulic pump (hereinafter referred to as the first hydraulic pump) serving as the hydraulic supply source of the hydraulic actuator A. In this case, the flow rate of the required flow rate cannot be supplied from the first hydraulic pump to the hydraulic actuator A or the hydraulic actuator B or both the hydraulic actuators A and B.

[0005] Therefore, when the total flow rate of the hydraulic actuator A required flow rate and the hydraulic actuator B required flow rate with respect to the first hydraulic pump exceeds the maximum discharge flow rate of the first hydraulic pump, there is a known technique that prioritizes the supply of hydraulic oil to the hydraulic actuator A using only the first hydraulic pump as a hydraulic oil supply source (see, for example, Patent Document 1). In this case, when the total flow rate of the hydraulic actuator A required flow rate and the hydraulic actuator B required flow rate for the first hydraulic pump is larger than the maximum discharge amount of the first hydraulic pump, an opening degree of the control valve (merging control valve) for controlling the supply flow rate from the first hydraulic pump to the hydraulic actuator B is controlled so that a flow rate obtained by subtracting the required flow rate of the hydraulic actuator A from the maximum discharge flow rate of the first hydraulic pump can pass. That is, while the flow rate corresponding to the operation amount is supplied to the hydraulic actuator A, only the remaining flow rate of the hydraulic actuator B is reduced from the maximum discharge flow rate of the first hydraulic pump to the hydraulic actuator A.

[0006] On the other hand, as a technique for improving operability at the time of composite operation, conventionally, a technique is also known in which the order of hydraulic oil supply from the first and second hydraulic pumps (front pump and rear pump) to each hydraulic actuator is prioritized in accordance with the combination of hydraulic actuators operated at the same time, and the hydraulic oil supply timing and the hydraulic oil supply amount are controlled separately (see, for example, Patent Document 2).

PRIOR ART LITERATURE

Patent Document

[0007] Patent Document 1: JP 2007-100779 A.

[0008] Patent Document 2: JPH 8-23768 A

SUMMARY OF THE INVENTION

The Problem to be Solved

[0009] However, as described above, in the above mentioned patent document 1, when the total flow rate of the hydraulic actuator A required flow rate and the hydraulic actuator B required flow rate for the first hydraulic pump is larger than the maximum discharge amount of the first hydraulic pump, the flow rate corresponding to an operation of an operation tool is supplied to the hydraulic actuator A, and the remaining flow rate is supplied to the hydraulic actuator B. For this reason, the hydraulic actuator A can be operated at a speed corresponding to an operation amount of the operation tool, but the operation speed of the hydraulic actuator B is lower than the operation speed required by the operation amount of the operation tool, and the degree of reduction thereof depends on the flow rate supplied to the hydraulic actuator A.

[0010] On the other hand, in the above mentioned patent document 2, it is structured that the hydraulic oil is supplied from the first and second hydraulic pumps to any one of the hydraulic actuators operated simultaneously at the time of the composite operation, and the bucket cylinder to which the hydraulic oil is supplied only from the first hydraulic pump at the time of the single operation is supplied with the hydraulic oil from the second hydraulic pump or from both the first and second hydraulic pumps at the time of the composite operation. That is, in the patent document 2, the first and second hydraulic pumps are frequently combined with each other, and therefore, there is a problem that the circuit becomes complicated because the possibility of lowering the efficiency and the operability from the merging of the first and second hydraulic pumps is increased, and the circuit for supplying the oil mixture to the hydraulic actuator which is not a large flow actuator is required, which is a problem to be solved by the present invention.

The Means to Solve the Problem

[0011] The present invention is proposed in view of the above-mentioned practical situations, and its purpose is to solve this problem. The invention of claim **1** is a hydraulic control system in a working machine, comprising:

[0012] a first hydraulic pump, a second hydraulic pump, a plurality of hydraulic actuators for driving at least one of the hydraulic pumps as a hydraulic pressure supply source, each hydraulic actuator operation means operated to drive each hydraulic actuator, a control valve for controlling a flow rate of hydraulic oil supplied from each hydraulic pump to each hydraulic actuator, and a control device for controlling the control valve to obtain a target flow rate from each hydraulic pump to each hydraulic actuator based on an operation of the hydraulic actuator operation means, and to supply the target flow rate to each hydraulic actuator,

[0013] the hydraulic actuator includes a hydraulic actuator A to which the hydraulic oil is supplied only from a first hydraulic pump of the first and second hydraulic pumps, and a hydraulic actuator B to which the hydraulic oil is supplied from both the first and second hydraulic pumps when a maximum flow rate is supplied, and the hydraulic actuator B is set to be supplied with the hydraulic oil from the first hydraulic pump first when the hydraulic actuator B operation means is operated, and to be supplied with the hydraulic oil from the second hydraulic pump in addition to the first hydraulic pump according to an increase in an operation amount,

[0014] wherein the control device includes a target flow rate adjustment means which, when the hydraulic actuator A operation means and the hydraulic actuator B operation means are simultaneously operated:

[0015] determines an actuator A first required flow rate that the hydraulic actuator A requires from the first hydraulic pump in accordance with an operation amount of the hydraulic actuator A operation means, actuator B first and second required flow rates that the hydraulic actuator B requires from the first and second hydraulic pumps respectively in accordance with an operation amount of the hydraulic actuator B operation means, total first and second required flow rates that are the sum of required flow rates that the hydraulic actuators including the hydraulic actuator A and the hydraulic actuator B being simultaneously operating respectively require from the first and second hydraulic pumps as a hydraulic supply source, and an actuator B total required flow rate that is the sum of the actuator B first required flow rate and the actuator B second required flow rate, and

[0016] sets the actuator A first required flow rate as a target flow rate from the first hydraulic pump to the hydraulic actuator A, a flow rate obtained by subtracting the actuator A first required flow rate from a first hydraulic pump maximum discharge flow rate as a target flow rate from the first hydraulic pump to the hydraulic actuator B, and a flow rate obtained by subtracting the target flow rate from the first hydraulic pump to the hydraulic actuator B from the actuator B total required flow rate as a target flow rate from the second hydraulic pump to the hydraulic actuator B.

[0017] For the invention of claim **2**, in the hydraulic control system in the working machine of claim **1**, when the flow rate obtained by subtracting the actuator A first required flow rate from the first hydraulic pump maximum discharge flow rate is equal to or less than an actuator B first minimum flow rate set in advance as a minimum supply flow rate from the first hydraulic pump to the hydraulic actuator B, an target flow rate adjustment means performs first correction and control of target flow rate to correct and set the flow rate obtained by subtracting the actuator B first minimum flow rate from the first hydraulic pump maximum discharge flow rate as the target flow rate from the first hydraulic pump to the hydraulic actuator A, correct and set the first minimum flow rate of the actuator B as the target flow rate from the first hydraulic pump to the hydraulic actuator B, and correct and set a flow rate obtained by subtracting the actuator B first minimum flow rate from the actuator B total required flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

[0018] For the invention of claim **3**, in the hydraulic control system in a work machine in claim **1**, when the target flow rate from the second hydraulic pump to the hydraulic actuator B set in claim **1** is equal to or greater than an actuator B second maximum flow rate set in advance as a maximum supply flow rate from the second hydraulic pump to the hydraulic actuator B, the target flow rate adjustment means performs second correction and control of target flow rate to correct and set the actuator B second maximum flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

[0019] The invention of claim **4** is a hydraulic control system in a work machine, wherein in claim **2**, when the target flow rate from the second hydraulic pump to the hydraulic actuator B set in claim **2** is equal to or greater than an actuator B second maximum flow rate that is set in advance as a maximum supply flow rate from the second hydraulic pump to the hydraulic actuator B, the target flow adjustment means performs second correction control of the target flow rate to correct and set the actuator B second maximum flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

Effects of the Invention

[0020] According to the invention of claim **1**, both the hydraulic actuator A and the hydraulic actuator B can be driven at an operation speed corresponding to the operation amount of the operation means, thereby contributing to the improvement of operability and improvement in the working efficiency, and avoiding an increase in the frequency of merging and a complication of the circuit.

[0021] According to the invention of claim **2**, even if the required flow rate required by the hydraulic actuator A is large, the minimum flow rate at which the hydraulic oil is supplied from the first hydraulic pump to the hydraulic actuator B can be ensured, and the complication of control can be avoided.

[0022] According to the invention of claims **3** and **4**, even when the operation means for the hydraulic pump A and the hydraulic actuator B operate and at the same time, the second hydraulic pump is operated by the operation means for other hydraulic actuators as the hydraulic supply source, it is ensured to supply the hydraulic oil to the other hydraulic actuators.

BRIEF DESCRIPTION OF DRAWINGS

[0023] FIG. **1** is a hydraulic circuit diagram of a hydraulic excavator.

[0024] FIG. **2** is a side view of a hydraulic excavator.

[0025] FIG. **3** is a block diagram showing input/output of a controller.

[0026] FIGS. **4**(*a*), **4**(*b*), **4**(*c*) and **4**(*d*) are diagrams showing relationships between an operation amount of an operation tool of a bucket cylinder, the rotary motor, the boom cylinder, and the stick cylinder, and the required flow rate, respectively.

[0027] FIG. **5** is a flowchart showing a control procedure of the target flow rate setting unit.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] Hereinafter, embodiments of the present invention will be described with reference to the drawings.

[0029] FIG. **1** is a hydraulic circuit diagram showing a hydraulic control system of the hydraulic excavator **1** according to the present invention. In FIG. **1**, P**1** and P**2** are variable capacity hydraulic pumps driven by the prime mover M; P**1***a* and P**2***a* are variable capacity means for varying capacities of the hydraulic pumps P**1** and P**2**; **3** is an oil tank; **4** is a left running motor; **5** is a right running motor; **6** is a boom cylinder; **7** is a rotary motor; **8** is a stick cylinder; and **9** is a bucket cylinder. The left running motor **4**, the right running motor **5**, the boom cylinder **6**, the rotary motor **7**, the stick cylinder **8**, and the bucket cylinder **9** are hydraulic actuators using the hydraulic pumps P**1** and P**2** as hydraulic supply sources, and among these hydraulic actuators, the rotary motor **7** and the bucket cylinder **9** use one hydraulic pumps of the hydraulic pumps P**1** and P**2** as an hydraulic supply source, and the boom cylinder **6** and the stick cylinder **8** are hydraulic actuators using both the hydraulic pumps P**1** and P**2** as the hydraulic supply source. In the present embodiment, the left running motor **4** and the right running motor **5** do not correspond to the hydraulic actuators of the present invention.

[0030] The hydraulic excavator **1** is an example of the work machine of the present invention, and as illustrated in FIG. **2**, is configured to include a lower running body **71** including a left and right running body driven by the left and right running motors **4** and **5**, an upper rotary body **72** freely rotatably supported by the lower running body **71** and rotatably driven by the rotary motor **7**, and a front working machine **73** mounted on the upper rotary body **72**, wherein the front working machine **73** is configured to include a boom **74** being supported on the upper rotary body **72** in a manner of freely vertically movable and driven by the boom cylinder **6**, a stick **75** freely rotaryably pivoted at a tip portion of the boom **74** and driven by the stick cylinder **8**, and a bucket **76** mounted on the tip portion of the stick **75** and driven by the bucket cylinder **9**.

[0031] The hydraulic pump P**1** is connected to a pump line C via a running straight valve **11** at a first position X, which will be described later, and is also connected to a left running directional switching valve **13**. On the other hand, the hydraulic pump P**2** is connected to a pump line D and is connected to a right running directional switching valve **14** via the running straight valve **11** at the first position X.

[0032] The running straight valve **11** is a two-position switching valve that switches between the first position X and a second position Y based on a control signal output from the controller **10** described later. In a state where the running straight valve **11** is located at the first position X, the discharge oil of the hydraulic pump P**1** is supplied to the pump line C and the left running directional switching valve **13**, and the discharge oil of the hydraulic pump P**2** is supplied to the pump line D and the right running directional switching valve **14**; and in a state where the running straight valve **11** is located at the second position Y, the discharge oil of the hydraulic pump P**1** is supplied to both the left and right running directional switching valves **13** and **14**, and the discharge oil of the hydraulic pump P**2** is supplied to both the pump lines C and D. Then, the controller **10** controls the running straight valve **11** to be positioned at the first position X when only the left and right running operation tool (not shown) is operated or when only other hydraulic actuator operation tools (not shown operation tools for boom, rotary, stick, and bucket operation tools) other than the running operation tool are operated. On the other hand, when both left and right running operation tool is operated to run straight and the other hydraulic actuator operation tools are simultaneously operated, a control signal is output to switch the running straight valve **11** to the second position Y. Thus, when only the left and right running operation tool is operated, the discharge oil of the hydraulic pumps P**1** and P**2** is supplied to the left and right running motors **4** and **5** via the left and right running directional switching valves **13** and **14**, respectively, by the running straight valve **11** positioned at the first position X, so that the supply flow rate to both the running motors **4** and **5** can be made equal, while the discharge flow rate of the hydraulic pump P**1** can be distributed only to the left and right running motors **4** and **5** and the supply flow rate to both the running motors **4** and **5** can be made equal, and the discharge flow rate of the hydraulic pump P**2** can be supplied to other hydraulic actuators. Note that, in the following description, the running straight valve **11** is located at the first position X; that is, the discharge oil of the hydraulic pump P**1** is supplied to the pump line C and the left running directional switching valve **13**, and the discharge oil of the hydraulic pump P**2** is supplied to the pump line D and the right running directional switching valve **14**.

[0033] The left and right running directional switching valves **13** and **14** are closed-center spool valves for performing the supply/discharge flow rate control for the left and right running motors **4** and **5** and for switching the supply/discharge direction, and includes a forward and backward pilot ports **13***a*, **13***b*, **14***a*, **14***b* connected to a left running forward electromagnetic proportional valve, a left running backward electromagnetic proportional valve, a right running forward electromagnetic proportional valve, and a right running backward electromagnetic proportional valve (not shown) for outputting pilot pressure based on a control signal output from the controller **10**. Then, the left and right running directional switching valves **13** and **14** are configured to be positioned at a neutral position N in which the supply and discharge control is not performed for the left and right running motors **4** and **5** in a state in which the pilot pressure is not input to the forward and backward pilot ports **13***a*, **13***b*, **14***a* and **14***b*, but the forward operation position X is switched to by inputting the pilot pressure input to the forward pilot ports **13***a* and **14***a,* then supply valve passages **13***e* and **14***e* for supplying the discharge oil from the hydraulic pumps P**1** and P**2** to forward ports **4***a* and **5***a* of the left running motor **4** and the right running motor **5** are opened, and discharge valve passages **13***f* and **14***f* for flowing the discharge oil from the backward ports **4***b* and **5***b* to the oil tank **3** are opened; and the backward operation position Y is switched to by inputting the pilot pressure to the backward pilot ports **13***b* and **14***b,* then the supply valve passages **13***e* and **14***e* for supplying the discharge oil of the hydraulic pumps P**1** and P**2** to the backward ports **4***b* and **5***b* of the left and right running motors **4** and **5** are opened, and the discharge valve passages **13***f* and **14***f* for supplying the discharge oil from the forward ports **4***a* and **5***a* to the oil tank **3** are opened.

[0034] Then, the supply flow rate and the discharge flow rate to the left running motor **4** and the right running motor **5** when the left running motor **4** and the right running motor **5** are positioned in the forward operation position or the backward operation position, are controlled by the opening areas of the supply valve passages **13***e,* **14***e* and the discharge valve passages **13***f,* **14***f,* and the opening areas are controlled to increase or decrease in accordance with the spool movement position accompanying the increase or decrease of the pilot pressure output from the running electromagnetic proportional valve (the left-running forward electromagnetic proportional valve, the left-running backward electromagnetic proportional valve, the right-running forward electromagnetic proportional valve, the right-running forward electromagnetic proportional valve, the right-running backward electromagnetic proportional valve) to the forward or backward pilot ports **13***a,* **13***b,* **14***a,* **14***b.* Then, when the left and right running operation tool is operated, the controller **10** controls the running electromagnetic proportional valve so as to output pilot pressure that increases or decreases in accordance with the operation amount of the running operation tool, whereby the left and right running motors **4** and **5** can be driven at a speed corresponding to the operation amount of the running operation tool.

[0035] On the other hand, from the pump line C connected to the hydraulic pump P**1**, a boom main-side supply oil passage **17**, a stick sub-side supply oil passage **18**, and a bucket supply oil passage **19** are branched and formed a state of being parallel with each other, and from the pump line D connected to the hydraulic pump P**2**, a boom sub-side supply oil passage **20**, a rotary oil supply passage **21**, and a stick main-side supply oil passage **22** are branched and formed a state of being parallel with each other. The boom main-side supply oil passage **17** and the boom sub-side supply oil passage **20** are oil passages connecting the hydraulic pumps P**1** and P**2** to a pump port **23***p* of a boom directional switching valve **23** described later; the stick main-side supply oil passage **22** and the stick sub-side supply oil passage **18** are oil passages connecting the hydraulic pumps P**2** and P**1** to the pump port **25***p* of the stick directional switching valve **25**; the rotary supply oil passage **21** is an oil passage connecting the hydraulic pump P**2** to the pump port **24***p* of the rotary directional switching valve **24**; and the bucket supply oil passage **19** is an oil passage connecting the hydraulic pump P**1** to the pump port **26***p* of the bucket directional switching valve **26**.

[0036] A stick flow rate control valve **28** for controlling the supply flow rate from the hydraulic pump P**1** to the stick directional switching valve **25** is disposed in the stick sub-side supply oil passage **18**, and a boom flow rate control valve **29** for controlling the supply flow rate from the hydraulic pump P**2** to the boom directional switching valve **23** is disposed in the boom sub-side supply oil passage **20**. The stick flow rate control valve **28** and the boom flow rate control valve **29** are poppet valves for performing the flow rate control and the pilot operation by a stick flow rate control electromagnetic proportional valve **45** and a boom flow rate control electromagnetic proportional valve **46** (shown in FIG. **3**) which are operating based on the control signal output from the controller **10**, and has a reverse flow preventing function, allowing the flow of oil from the hydraulic pumps P**1** and P**2** to the stick directional switching valve **25** and the boom directional switching valve **23**, but the reverse flow is prevented.

[0037] On the other hand, the flow rate control valves such as the stick flow rate control valve **28** and the boom flow rate control valve **29** described above are not disposed in the boom main-side supply oil passage **17**, the bucket supply oil passage **19**, the rotary supply oil passage **21**, and the stick main-side supply oil passage **22**, and the supply flow rate from the hydraulic pump P**1** or the hydraulic pump P**2** via the boom main-side supply oil passage **17**, the bucket supply oil passage **19**, the rotary supply oil passage **21**, and the stick main-side supply oil passage **22** is directly supplied to the boom directional switching valve **23**, the bucket directional switching valve **26**, the rotary directional switching valve **24**, and the stick directional switching valve **25** without flow rate control. In addition, check valves **30** are disposed in the boom main-side supply oil passage **17**, the bucket supply oil passage **19**, the rotary supply oil passage **21**, and the stick main-side supply oil passage **22**, respectively, and the flow of oil from the hydraulic pumps P**1** and P**2** to the boom directional switching valve **23**, the bucket directional switching valve **26**, the rotary directional switching valve **24**, and the stick directional switching valve **25** is permitted, but the reverse flow is prevented.

[0038] Thus, the hydraulic oil from the hydraulic pump P**1** passing through the boom main-side supply oil passage **17** and the hydraulic oil from the hydraulic pump P**2** passing through the boom sub-side supply oil passage **20** can be supplied to the pump port **23***p* of the boom directional switching valve **23**, and the hydraulic oil from the hydraulic pump P**2** is supplied to the boom directional switching valve **23** in a state (including a cut-off state) of the flow rate being controlled by the boom flow rate control valve **29** disposed in the boom sub-side supply oil passage **20**. Further, the hydraulic oil from the hydraulic pump P**2** passing through the stick main-side supply oil passage **22** and the hydraulic oil from the hydraulic pump P**1** passing through the stick sub-side supply oil passage **18** can be supplied to the pump port **25***p* of the stick directional switching valve **25**, and the hydraulic oil from the hydraulic pump P**1** is supplied to the stick directional switching valve **25** in a state (including a cut-off state) of the flow rate being controlled by the stick flow rate control valve **28** disposed in the stick sub-side supply oil passage **18**.

[0039] Next, the directional switching valves for the boom, rotary, stick and bucket **23** to **26** will be described.

[0040] First, a description will be given of the bucket and rotary directional control valves **26** and **24** supplied from the hydraulic pump P**1** or P**2**. The bucket directional switching valve **26** is a closed-center spool valve that controls the supply/discharge flow rate to the bucket cylinder **9** and switches the supply/discharge direction, and includes pilot ports **26***a* and **26***b* on an expansion side and a contraction side respectively connected to bucket expansion-side and contraction-side electromagnetic proportional valves **44***a* and **44***b* (shown in FIG. **3**), a pump port **26***p* connected to the bucket supply oil passage **19**, a tank port **26***t* connected to the tank line T leading to the oil tank **3**, one actuator port **26***c* connected to the head-side port **9***a* of the bucket cylinder **9**, and the other actuator port **26***d* connected to the rod side port **9***b* of the bucket cylinder **9** for outputting pilot pressure based on a control signal output from the controller **10**. Then, the bucket directional switching valve **26** is positioned at the neutral position N in which the supply/discharge control is not performed for the bucket cylinder **9** in a state in which the pilot pressure is not input to both the extension-side and contraction-side pilot ports **26***a* and **26***b,* but is switched to the extension side operation position X by inputting the pilot pressure to the extension-side pilot port **26***a,* then the supply valve passage **26***e* from the pump port **26***p* to the one actuator port **26***c* and the discharge valve passage **26***f* from the other actuator port **26***d* to the tank port **26***t* are opened, and then is switched to the contraction-side operation position Y by inputting the pilot pressure to the contraction side pilot port **26***b,* then the supply valve passage **26***e* from the pump port **26***p* to the one actuator port **26***c* and the discharge valve passage **26***f* from the other actuator port **26***d* to the tank port **26***t* are opened.

[0041] Then, the supply flow rate and the discharge flow rate to the bucket cylinder **9** when the bucket cylinder **9** is positioned at the extension-side operation position X or the contraction-side operation position Y are controlled by the opening areas of the supply valve passage **26***e* and the discharge valve passage **26***f,* and the opening areas are controlled to increase or decrease in accordance with the spool movement position accompanying the increase or decrease of the pilot pressure output from the bucket extension-side and contraction-side electromagnetic proportional valves **44***a* and **44***b* to the extension-side and contraction-side pilot ports **26***a* and **26***b*.

[0042] The rotary directional switching valve **24** is a closed-center spool valve performing supply/discharge flow rate control to the rotary motor **7** to switch the supply/discharge direction, and includes pilot ports **24***a* and **24***b* on the left and right rotary sides respectively connected to the left and right rotary electromagnetic proportional valves **42***a* and **42***b* (shown in FIG. **3**), a pump port **24***p* connected to the rotary supply oil passage **21**, a tank port **24***t* connected to the tank line T, one actuator port **24***c* connected to the left rotary side port **7***a* of the rotary motor **7**, and the other actuator port **24***d* connected to the right rotary side of the rotary motor **7**, which output pilot pressure based on a control signal output from the controller **10**.

[0043] The rotary directional switching valve **24** has the same structure as the bucket directional switching valve **26** described above, and is configured to open a supply valve passage **24***e* from the pump port **24***p* to the actuator port **24***c* or **24***d* and a discharge valve passage **24***f* from the actuator port **24***d* or **24***c* to the tank port **24***t* by switching from the neutral position N to the left rotary side operation position X and the right rotary side operation position Y, and then the supply flow rate and the discharge flow rate to the rotary motor **7** are controlled by the opening area of the supply valve passage **24***e* and the discharge valve passage **24***f,* and the opening area is controlled to increase or decrease in accordance with the spool movement position accompanying the increase or decrease of the pilot pressure output from the left rotary side and right rotary side electromagnetic proportional valves **42***a* and **42***b*.

[0044] Next, there provides the description of the boom and stick directional switching valves **23** and **25** for hydraulic oil supplied from both the hydraulic pumps P**1** and P**2**. The boom directional switching valve **23** is a closed-center spool valve that controls the supply/discharge flow rate to the boom cylinder **6** and switches the supply/discharge direction, and includes expansion-side and contraction-side pilot ports **23***a* and **23***b* respectively connected to the boom expansion-side and contraction-side electromagnetic proportional valves **41***a* and **41***b* (shown in FIG. **3**), a pump port **23***p* connected to the boom main-side supply oil passage **17** and the boom sub-side supply oil passage **20**, a tank port **23***t* connected to the tank line T, one actuator port **23***c* connected to the head side port **6***a* of the boom cylinder **6**, and the other actuator port **23***d* connected to the rob side port **6***b* of the boom cylinder **6**, which output pilot pressure based on a control signal output from the controller **10**.

[0045] Then, the boom directional switching valve **23** is positioned at the neutral position N in which the supply/discharge control is not performed with respect to the boom cylinder **6** in a state in which the pilot pressure is not input to both the pilot ports **23***a* and **23***b* on the extension side and the contraction side, but is switched to the extension side operation position X by the input of the pilot pressure to the extension-side pilot port **23***a* and opens the supply valve passage **23***e* from the pump port **23***p* to the one actuator port **23***c* and the discharge valve passage **23***f* from the other actuator port **23***d* to the other actuator port **23***t,* and it is switched to the contraction-side operation position Y by the input of the pilot pressure to the contraction-side pilot port **23***b,* and opens a discharge valve passage **23***f* from the one actuator port **23***c* to the tank port **23***t.* Then, the opening areas of the supply valve passage **23***e* and the discharge valve passage **23***f* are controlled to increase or decrease in accordance with the movement position of the spool moved by the pilot pressure output from the boom extension-side and contraction-side electromagnetic proportional valves **41***a* and **41***b,* and the discharge flow rate from the boom cylinder **6** is controlled by the opening areas of the discharge valve passage **23***f.* Further, the supply flow rate from the hydraulic pump P**1** to the boom cylinder **6** is controlled by the opening area of the supply valve passage **23***e* of the boom directional switching valve **23**, while the supply flow rate from the hydraulic pump P**2** is controlled by the opening area of the boom flow rate control valve **29** and the opening area of the supply valve passage **23***e* of the boom directional switching valve **23**.

[0046] In addition, the stick directional switching valve **25** is a closed-center spool valve that controls the supply/discharge flow rate for the stick cylinder **8** and switches the supply/discharge direction, and includes pilot ports **25***a* and **25***b* on the expansion side and contraction side respectively connected to the stick expansion-side and contraction-side electromagnetic proportional valves **43***a* and **43***b* (shown in FIG. **3**), a pump port **25***p* connected to the stick main-side supply oil passage **22** and the stick sub-side supply oil passage **18**, a tank port **25***t* connected to the tank line T, one actuator port **25***c* connected to the head-side port **8***a* of the stick cylinder **8**, and the other actuator port **25***d* connected to the rod side port **8***b* of the stick cylinder **8**, which output pilot pressure based on a control signal output from the controller **10**. The stick directional switching valve **25** has the same structure as the boom directional switching valve **23** described above, and is configured to open a supply valve passage **25***e* from the pump port **25***p* to the actuator port **25***c* or **25***d* and a discharge valve passage **25***f* from the actuator port **25***d* or **23***c* to the tank port **25***t* by switching from the neutral position N to the extension-side operation position X and the contraction-side operation position Y. Then, the opening areas of the supply valve passage **25***e* and the discharge valve passage **25***f* are controlled to increase or decrease in accordance with the movement position of the spool moved by the pilot pressure output from the stick extension-side and contraction-side electromagnetic proportional valves **43***a* and **43***b*, and the discharge flow rate from the stick cylinder **8** is controlled by the opening area of the discharge valve passage **25***f*. Further, the supply flow rate from the hydraulic pump P**2** to the stick cylinder **8** is controlled by the opening area of the supply valve passage **25***e* of the stick directional switching valve **25**, while the supply flow rate from the hydraulic pump P**1** is controlled by the opening area of the stick flow rate control valve **28** and the opening area of the supply valve passage **25***e* of the stick directional switching valve **25**.

[0047] The stick and boom flow rate control valves **28** and **29**, and the boom, rotary, stick and bucket directional switching valves **23** to **26** correspond to the control valves of the present invention.

[0048] On the other hand, as shown in the block diagram of FIG. **3**, the controller **10** (which corresponds to the control device of the present invention) is, at an input side, connected to a boom operation detecting means **50** for detecting the operation direction and the operation amount of the boom operation tool, a rotary operation detecting means **51** for detecting the operation direction and the operation amount of the rotary operation tool, a stick operation detecting means **52** for detecting the operation direction and the operation amount of the stick operation tool, a bucket operation detecting means **53** for detecting the operation direction and the operation amount of the bucket operation tool, and a plurality of pressure sensors for detecting the discharge pressure of the hydraulic pumps P**1** and P**2** and the load pressure of the hydraulic actuators (the boom cylinder **6**, the rotary motor **7**, the stick cylinder **8** and the bucket cylinder **9**, although not shown in the figure, respectively, and at an output side, connect to the boom extension-side and contraction-side electromagnetic proportional valves **41***a* and **41***b* for respectively outputting pilot pressure to the pilot ports **23***a*, **23***b* to **26***a* and **26***b* of the boom, rotary, stick, and bucket directional switching valves **23** to **26**, the rotary left rotary side and right rotary side electromagnetic proportional valves **42***a* and **42***b*, the stick extension-side and contraction-side electromagnetic proportional valves **43***a* and **43***b*, the bucket extension-side and contraction-side electromagnetic proportional valves **44***a* and **44***b*, the stick flow rate control electromagnetic proportional valve **45** for outputting pilot pressure to the stick flow rate control valve **28** disposed in the stick sub-side supply oil passage **18**, the boom flow rate control electromagnetic proportional valve **46** for outputting pilot pressure to the boom flow rate control valve **29** disposed in the boom sub-side supply oil passage **20**, the displacement variable means P**1***a* and P**2***a* of the hydraulic pumps P**1** and P**2**. The controller **10** includes various control units, such as a required flow rate setting unit **55**, a target flow rate setting unit **56**, a control valve control unit **57**, and a pump control unit **58**, which will be described later, and is configured to perform oil supply and discharge control of the hydraulic actuators **6** to **9**, discharge flow rate control of the hydraulic pumps P**1** and P**2**, and the like on the basis of the control performed by these control units. The boom, rotary, stick and bucket operation tools correspond to the hydraulic actuator operation means of the present invention. In addition, the controller **10** also performs the switching control of the above-described running straight valve **11** and the oil supply/discharge control to the left and right running motors **4** and **5**, but the description of the control will be omitted here.

[0049] Next, the control performed by the controller **10** will be described.

[0050] When a detection signal is input from each of the boom, rotary, stick and bucket operation detecting means **50** to **53**, the controller **10** first determines the required flow rate required by each of the boom cylinder **6**, the rotary motor **7**, the stick cylinder **8**, and the bucket cylinder **9** from the hydraulic cylinders P**1**, P**2** in accordance with the operation direction and the operation amount of each operation means. In this case, the relationship between the operation amount of the operation tool and the required flow rate is set in advance for each hydraulic actuator by a graph, a map, or the like (see FIG. **4**), and on the basis of the set relationship, the required flow rate for the hydraulic pump P1 or P2 serving as the hydraulic supply source is obtained for the hydraulic actuator using either of the hydraulic pumps P1 and P2 as the hydraulic supply source, and the required flow rate for both of the hydraulic pumps P1 and P2 is obtained for the hydraulic actuator using both of the hydraulic pumps P1 and P2 as the hydraulic supply sources. That is, in the present embodiment, the required flow rate for the hydraulic pump P1 (the bucket cylinder P**1** required flow rate Q (P**1**) reqBK) is obtained for the bucket cylinder **9**; the required flow rate for the hydraulic pump P**2** (the rotary motor P**2** required flow rate Q (P**2**) reqSW) is obtained for the rotary motor; and the required flow rates for the hydraulic pumps P**1** and P**2** (the boom cylinder P**1** required flow rate Q (P**1**) reqBM, the boom cylinder P**2** required flow rate Q (P**1**) reqSK, and the stick cylinder P**2** required flow rate Q (P**2**) reqSK) are obtained for the boom cylinder **6** and the stick cylinder **8**, respectively, but in this case, the required flow rates are set so as not to exceed the maximum discharge flow rates (Q (P**1**) max, Q (P**2**) max) for the boom cylinder **6** and the stick cylinder **8**, respectively. Further, the controller **10** obtains a total P**1** required flow rate Q (P**1**) toreq and a total P**2** required flow rate Q (P**2**) toreq, which are the sum of the required flow rates required by the operated hydraulic actuator from the hydraulic pumps P**1** and P**2** serving as hydraulic pressure supply sources, respectively.

[0051] Here, as shown in FIGS. **4**(C) and **4**(D), with respect to the boom cylinder **6** and the stick cylinder **8** using both the hydraulic pumps P1 and P2 as hydraulic supply sources, when the operation amount of the operation tool is less than a preset set operation amount Ls (the set operation amount Ls is set to 75% when the maximum operation amount is set to 100%, for example, but is set individually by the boom cylinder **6** and the stick cylinder **8**), the hydraulic oil is first supplied only from either one of the hydraulic pumps P1 or P2 (the hydraulic pump that supplies the hydraulic oil to the boom main-side supply oil passage 17 or the stick main-side supply oil passage 22), and when the operation amount increases to be equal to or greater than the set operation amount Ls, the hydraulic oil is supplied from the other hydraulic pump P2 or P1 (the hydraulic pump that supplies the hydraulic oil to the boom sub-side supply oil passage 20 or the stick sub-side supply oil passage 18). That is, only the boom cylinder P1 required flow rate Q (P1) reqBM is set when the operation amount of the boom operation tool is less than the set operation amount Ls, and the boom cylinder P1 required flow rate Q (P1) reqBM and the boom cylinder P2 required flow rate Q (P2) reqBM are set when the operation amount of the operation amount of the boom operation tool is an operation amount being equal to or greater than the set operation amount Ls; in addition, only the stick cylinder P2 required flow rate Q (P2) reqSK is set when the operation amount of the stick operation tool is less than the set operation amount Ls, and the stick cylinder P2 required flow rate Q (P2) reqSK and the stick cylinder P1 required flow rate Q (P1) reqSK are set when the operation amount of the stick operation tool is an operation amount being equal to or greater than the set operation amount Ls. In this case, as shown in FIG. 4, by setting an operation range in which the hydraulic oil is supplied only from one hydraulic pump (the operation range being less than the set operation amount Ls) to be large, the operation range in which the hydraulic oil is supplied from both the hydraulic pumps P1 and P2 becomes a narrow range close to the full operation (the maximum operation amount) even in the case of a hydraulic actuator using both the hydraulic pumps P1 and P2 as the hydraulic supply sources, so that the frequency of merging of the hydraulic oil supplied from the two hydraulic pumps P1 and P2 can be reduced, and the decrease in efficiency and the deterioration in operability caused by the merging can be reduced.

[0052] The hydraulic pumps P1 and P2 of the present embodiment are the first hydraulic pump or the second hydraulic pump of the present invention in accordance with the hydraulic actuators A and B. For example, in the present embodiment, when the bucket cylinder 9 is used as the hydraulic actuator A of the present invention; the hydraulic pump P1 serving as the hydraulic supply source of the bucket cylinder 9 corresponds to the first hydraulic pump of the present invention; the boom cylinder 6 to which both the hydraulic pumps P1 and P2 are used as hydraulic supply sources and the hydraulic pump P2 to which the hydraulic oil is first supplied from the hydraulic pump P1 corresponds to the hydraulic actuator B of the present invention; and the hydraulic pump P2 to which the hydraulic oil is supplied in accordance with the increase of the operation amount corresponds to the second hydraulic pump of the present invention. Further, in a case where the rotary motor 7 is used as the hydraulic actuator A of the present invention, the hydraulic pump P2 serving as the hydraulic supply source of the rotary motor 7 corresponds to the first hydraulic pump of the present invention, and the stick cylinder 8 to which both of the hydraulic pumps P1 and P2 are used as the hydraulic oil supply sources and to which the hydraulic oil is first supplied from the hydraulic pump P2 corresponds to the hydraulic actuator B of the present invention, and the hydraulic pump P1 that supplies the hydraulic oil to the stick cylinder 8 in accordance with an increase of the operation amount corresponds to the second hydraulic pump of the present invention.

[0053] Further, the controller 10 sets a target flow rate for each hydraulic actuator from the hydraulic pumps P1 and P2 in the target flow rate setting unit 56 on the basis of the required flow rate of each hydraulic actuator (the boom cylinder 6, the rotary motor 7, the stick cylinder 8, and the bucket cylinder 9) set by the required flow rate setting unit 55. In order to supply the target flow rate to each hydraulic actuator, the control valve control unit 57 controls the opening area of the directional switching valves 23 to 26 and the flow rate control valves 28 and 29, and also controls the discharge flow rate of the hydraulic pumps P1 and P2 in the pump control unit 58.

[0054] When setting the target flow rate in the target flow rate setting unit 56, the controller 10 executes normal control in a case where the operation tools for the hydraulic actuators are operated independently. In the normal control, the required flow rate of each of the above described hydraulic actuators is set as a target flow rate.

[0055] That is, when each hydraulic actuator operation tool (the operation tool for the bucket, rotary, boom and stick) is operated independently, the above mentioned required flow rates (the bucket cylinder P1 required flow rate Q (P1) reqBK, the rotary motor P2 required flow rate Q (P2) reqSW, the boom cylinder P1 required flow rate Q (P1) reqBM, the boom cylinder P2 required flow rate Q (P2) reqBM, the stick cylinder P1 required flow rate Q (P2) reqSK) is set as the target flow rate for the hydraulic pumps P1 and P2 (the bucket cylinder P1 target flow rate Q (P1) tgBK, the rotary motor P2 target flow rate tgSW, the boom cylinder P1 target flow rate Q(P1)tgBM, the boom cylinder P2 target flow rate Q (P2) tgBM, the stick cylinder P1 target flow rate Q (P1) tgSK, and the stick cylinder P2 target flow rate Q(P2)tgSK). In this case, since the target flow rate is equal to the required flow rate, and each of the required flow rates is smaller than the maximum discharge flow rates of the hydraulic pumps P1 and P2 as described above, the required flow rate required by the operation amount of the operation tool is supplied to the operated hydraulic actuators, whereby each of the hydraulic actuators can be operated at the speed required by the operation amount of the operation tool.

[0056] On the other hand, when the two or more hydraulic actuator operation tools are operated simultaneously (composite operation), the controller 10 executes the normal control or the target flow rate adjustment control described later in accordance with the required flow rate of the operated hydraulic actuator. The target flow rate adjustment control is carried out by the target flow rate adjustment control means 56*a* incorporated in the target flow rate setting unit 56, and these controls will be described with reference to the flow chart shown in FIG. 5 taking the case where the bucket operation tool and the boom operation tool are operated simultaneously.

[0057] In a case where the bucket operation tool and the boom operation tool are operated at the same time, the controller 10 sets the bucket cylinder P1 required flow rate Q (P1) reqBK and the boom cylinder P1 required flow rate Q (P1) reqBM as the required flow rate for the hydraulic pump P1 in the required flow rate setting unit 55, and sets the boom cylinder P2 required flow rate Q (P2) reqBM (only when the operation amount of the boom operation tool is equal to or greater than the set operation amount Ls) as the hydraulic pump P**2** required flow rate. Further, a flow rate obtained by summing the bucket cylinder P**1** required flow rate Q (P**1**) reqBK and the boom cylinder P**1** required flow rate Q (P**1**) reqBM is set as the total P**1** required flow rate Q (P**1**) toreq for the hydraulic pump P**1**, and a value of the boom cylinder P**2** required flow rate Q (P**2**) reqBM is set as the total P**2** required flow rate Q (P**2**) toreq for the hydraulic pump P**2**. Note that, when the operation tools for the other hydraulic actuators are operated simultaneously with the bucket operation tool and the boom operation tool, the total flow rates obtained by adding the required flow rates required by the other hydraulic actuators to the hydraulic pumps P**1** and P**2** serving as the hydraulic supply sources are set as the total P**1** required flow rate Q (P**1**) toreq and the total P**2** required flow rate Q (P**2**) toreq.

[0058] Also, when the bucket operation tool and the boom operation tool are operated at the same time, the bucket cylinder **9** and the boom cylinder **6** respectively correspond to the hydraulic actuator A and the hydraulic actuator B of the present invention; the bucket operation tool and the boom operation tool respectively correspond to the operation means for the hydraulic actuator A and the operation means for the hydraulic actuator B of the present invention; and the hydraulic pump P**1** and P**2** respectively correspond to the first and second hydraulic pump of the present invention. Correspondingly, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK corresponds to the actuator A first required flow rate of the present invention; the boom cylinder P**1** required flow rate Q (P**1**) reqBM, the boom cylinder P**2** required flow rate Q (P**2**) reqBM respectively correspond to the first required flow rate of the hydraulic actuator B and the second required flow rate of the hydraulic actuator B of the present invention; the boom cylinder total required flow rate QtoreqBM corresponds to the actuators B total required flow rate of the present invention; the P**1** pump maximum discharge flow rate Q (P**1**) max corresponds to the first hydraulic pump maximum discharge flow rate of the present invention; and the total Pl required flow rate Q (P**1**) toreq, and the total P**2** required flow rate Q (P**2**) toreq respectively correspond to the total first required flow rate and the total second required flow rate of the present invention. Further, the minimum flow rate Q (P**1**) of the boom cylinder P**1** described later corresponds to the first minimum flow rate of the actuator B of the present invention, and the maximum flow rate Q (P**2**) of the boom cylinder P**2** corresponds to the second maximum flow rate of the actuator B of the present invention.

[0059] On the other hand, in the present embodiment, the present invention is carried out not only when the bucket operation tool and the boom operation tool are simultaneously operated, but also when the rotary operation tool and the stick operation tool are operated at the same time. In this case, the rotary motor **7** and the stick cylinder **8** correspond to the hydraulic actuator A and the hydraulic actuator B of the present invention, respectively; the rotary operation tool and the stick operation tool correspond to the operation means for the hydraulic actuator A and the operation means for the hydraulic actuator B of the present invention; and the hydraulic pumps P**2** and P**1** correspond to the first and second hydraulic pumps of the present invention, respectively. Further in this case, the rotary motor P**2** required flow rate Q (P**2**) reqSW corresponds to the actuator A first required flow rate of the present invention; the stick cylinder P**2** required flow rate Q (P**2**) reqSK and the stick cylinder P**1** required flow rate Q (P**1**) reqSK respectively correspond to the hydraulic actuator B first required flow rate and the hydraulic actuator B second required flow rate; the total flow rate of the stick cylinder P**2** required flow rate Q (P**2**) reqSK and the stick cylinder P**1** required flow rate Q (P**1**) reqSK corresponds to the actuator B total required flow rate of the present invention; the maximum discharge flow rate of the hydraulic pump P**2** correspond to the maximum discharge flow rate of the first hydraulic pump of the present invention; and the total of the required flow rates for the hydraulic pumps P**2** and P**1** correspond to the total first required flow rate and the total second required flow rate of the present invention. Further, although the flow rate set in advance as the minimum supply flow rate from the hydraulic pump P**2** to the stick cylinder **8** corresponds to the first minimum flow rate of the actuator B of the present invention, and the flow rate set in advance as the maximum supply flow rate from the hydraulic pump P**1** to the stick cylinder **8** corresponds to the second maximum flow rate of the actuator B of the present invention, in order to make the description easier to understand, the following description will be given by taking the case where the bucket cylinder **9** and the boom cylinder **6** are the hydraulic actuator A and the hydraulic actuator B of the present invention as an example.

[0060] When the bucket operation tool and the boom operation tool are operated simultaneously, after setting the required flow rate, the controller **10** first determines in the target flow rate setting unit **56** whether the total of the bucket cylinder P**1** required flow rate Q (P**1**) reqBK and the boom cylinder P**1** required flow rate Q (P**1**) reqBM (total P**1** required flow rate Q (P**1**) toreq) exceeds the maximum discharge flow rate of the hydraulic pump P**1** (P**1** pump maximum discharge flow rate Q (P**1**) max) (P**1** pump maximum discharge flow rate<total P**1** required flow rate?), and further determines whether a difference between the total P**1** required flow rate Q (P**1**) toreq for the hydraulic pump P**1** and the total P**2** required flow rate Q (P**2**) toreq for the hydraulic pump P**2** exceeds a preset set required flow rate difference DQreq (total P**1** required flow rate-total P**2** required flow rate>set required flow rate difference?) (Step S**1**). The set required flow rate difference DQreq is an adjustable value set to determine whether there is a large deviation between the total required flow rate for the hydraulic pump P**1** and the total required flow rate for the hydraulic pump P**2**, and when the difference between the total P**1** required flow rate Q (P**1**) toreq for the hydraulic pump P**1** and the total P**2** required flow rate Q (P**2**) toreq for the hydraulic pump P**2** is equal to or less than the set required flow rate difference DQreq, it is determined that there is no large deviation between the required flow rate for the hydraulic pump P**1** and the required flow rate for the hydraulic pump P**2**, and when the set required flow rate difference DQreq is exceeded, it is determined that there is a large deviation (step S**1**).

[0061] Then, when one of the two determinations in step S**1** is "NO" or both of them are "NO", that is, when the total P**1** required flow rate Q (P**1**) toreq (the sum of the bucket cylinder P**1** required flow rate Q (P**1**) reqBK and the boom cylinder P**1** required flow rate Q (P**1**) reqBM) does not exceed the maximum discharge flow rate Q (P**1**) max of the hydraulic pump P**1**, or when it is determined that the difference between the total P**1** required flow rate Q (P**1**) toreq and the total P**2** required flow rate Q (P**2**) toreq is equal to or less than the set required flow rate difference DQreq and there is no large deviation, the normal control for setting the required flow rate of each hydraulic actuator described above as the target flow rate is executed (step **S2**).

[0062] That is, in step **S2**, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK is set as the target flow rate from the hydraulic pump P**1** to the bucket cylinder **9** (the bucket cylinder P**1** target flow rate Q (P**1**) tgBK); the boom cylinder P**1** required flow rate Q (P**1**) reqBM is set as the target flow rate from the hydraulic pump P**1** to the boom cylinder **6** (the boom cylinder P**1** target flow rate Q (P**1**) tgBM); and the boom cylinder P**2** required flow rate Q (P**2**) reqBM is set as the target flow rate from the hydraulic pump P**2** to the boom cylinder **6** (the boom cylinder P**2** target flow rate Q (P**2**) tgBM) (the bucket cylinder P**1** target flow rate=the bucket cylinder P**1** required flow rate, the boom cylinder P**1** target flow rate=the boom cylinder P**1** required flow rate, the boom cylinder target flow rate=the boom cylinder P**2** required flow rate).

[0063] In the normal control of step **S2**, when the sum of the bucket cylinder P**1** required flow rate Q (P**1**) reqBK and the boom cylinder P**1** required flow rate Q (P**1**) reqBM exceeds the maximum discharge flow rate Q (P**1**) max of the hydraulic pump P**1**, the P**1** pump maximum discharge flow rate Qmax (P**1**) is proportionally divided according to the ratio of the respective required flow rates Q (P**1**) reqBK and Q (P**1**) reqBM, and the proportionally divided flow rates are set as the bucket cylinder P**1** target flow rate (P**1**) tgBK, the boom cylinder P**1** target flow rate Q (P**1**) tgBM.

[0064] On the other hand, when both of the two determinations in step **S1** are "YES", that is, when it is determined that the total P**1** required flow rate Q (P**1**) toreq (the sum of the bucket cylinder P**1** required flow rate Q (P**1**) reqBK and the boom cylinder P**1** required flow rate Q (P**1**) reqBM) exceeds the maximum discharge flow rate Q (P**1**) max of the hydraulic pump P**1**, and the difference between the total P**1** required flow rate Q (P**1**) toreq and the total P**2** required flow rate Q (P**2**) toreq exceeds the set required flow rate difference DQreq and there is a large deviation, the target flow rate adjustment control shown in steps **S3** to **S10** described later is executed.

[0065] In the target flow rate adjustment control, first, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK is subtracted from the P**1** pump maximum discharge flow rate Q (P**1**) max, and the subtracted value is set as the boom cylinder P**1** possible flow rate Q (P**1**) avaBM (the P**1** pump maximum pump flow rate−the bucket cylinder P**1** required flow rate=the boom cylinder P**1** possible flow rate) (step **S3**).

[0066] Subsequently, it is determined whether or not the boom cylinder P**1** possible flow rate Q (P**1**) avaBM set in step **S3** is larger than the boom cylinder P**1** preset minimum flow rate Q (P**1**) minBM (the boom cylinder P**1** possible flow rate>the boom cylinder P**1** minimum flow rate) (step **S4**). The boom cylinder P**1** minimum flow rate Q (P**1**) minBM is a minimum flow rate which is assured as a supply flow rate from the hydraulic pump P**1** to the boom cylinder **6** when the target flow rate adjustment control is executed, and is a preset adjustable value.

[0067] When "YES" is determined in step **S4**, that is, when the boom cylinder P**1** possible flow rate Q (P**1**) avaBM is larger than the boom cylinder P**1** minimum flow rate Q (P**1**) minBM, a value obtained by subtracting the boom cylinder P**1** possible flow rate Q (P**1**) avaBM from the boom cylinder total required flow rate QtoreqBM (the sum of the boom cylinder P**1** required flow rate Q (P**1**) reqBM and the boom cylinder P**2** required flow rate Q (P**2**) reqBM) is set as the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM (the boom cylinder total required flow rate−the boom cylinder P**1** possible flow rate=the boom cylinder P**2** calculated target flow rate). Further, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK is set as the bucket cylinder P**1** target flow rate Q (P**1**) tgBK (the bucket cylinder P**1** target flow rate=the bucket cylinder P**1** required flow rate) (step **S5**). After the processing of step **S5**, the process proceeds to step **S7**.

[0068] On the other hand, when "NO" is determined in step **S4**, that is, when the boom cylinder P**1** possible flow rate Q (P**1**) avaBM is equal to or less than the boom cylinder P**1** minimum flow rate Q (P**1**) minBM, a value obtained by subtracting the boom cylinder P**1** minimum flow rate Q (P**1**) minBM from the boom cylinder total required flow rate QtoreqBM is set as the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM (the boom cylinder total required flow rate−the boom cylinder P**1** minimum flow rate=the boom cylinder P**2** calculated target flow rate). Further, a value obtained by subtracting the boom cylinder P**1** minimum flow rate Q (P**1**) minBM from the P**1** pump maximum discharge flow rate Q (P**1**) max is set as the bucket cylinder P**1** corrected required flow rate Q (P**1**) coreqBK (the P**1** pump maximum discharge flow rate−the boom cylinder P**1** minimum flow rate=the bucket cylinder P**1** corrected required flow rate) (step **S6**). Thus, when the boom cylinder P**1** possible flow rate Q (P**1**) avaBM is equal to or less than the boom cylinder P**1** minimum flow rate Q (P**1**) minBM, the target flow rate first correction control for correcting the setting of the target flow rate is performed using the boom cylinder P**1** minimum flow rate Q (P**1**) minBM, but the target flow rate first correction control will be described later. After the processing of step **S6**, the process proceeds to step **S7**.

[0069] In step **S7**, it is determined whether the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM set in step **S5** or step **S6** is smaller than the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM set in advance (the boom cylinder P**2** calculated target flow rate<the boom cylinder P**2** maximum flow rate?). The boom cylinder P**2** maximum flow rate Q (P**2**) maxBM is a maximum flow rate that the hydraulic pump P**2** can supply to the boom cylinder **6** when the target flow rate adjustment control is executed, and is a preset adjustable value.

[0070] If "YES" is determined in step **S7**, that is, when the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM is smaller than the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM, the process proceeds to step **S9** described later.

[0071] On the other hand, when the determination in step **S7** is "NO", that is, when the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM is equal to or greater than the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM, the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM is set as the boom cylinder P**2** corrected target flow rate Q (P**2**) cotgBM (the boom cylinder P**2** corrected target flow rate=the boom cylinder P**2** maximum flow rate) (step **S8**). Thus, when the boom cylinder P**2** calculated target flow rate Q (P**2**) catgBM is equal to or greater than the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM, the target flow rate second correction control for correcting the setting of the target flow rate is performed using the boom cylinder P**2**

maximum flow rate Q (P2) maxBM, but the target flow rate second correction control will be described later. After the processing of step S8, the process proceeds to step S9.

[0072] In step S9, when proceeding from step S7 to step S9 without passing through step S8 (in the case of "YES" in the determination of step S7, that is, when the boom cylinder P2 calculated target flow rate Q (P2) catgBM is smaller than the boom cylinder P2 maximum flow rate Q (P2) maxBM), the boom cylinder P2 calculated target flow rate Q (P2) cotgBM is converted into the boom cylinder P2 target flow rate Q (P2) tgBM by using the conversion map, or when proceeding to step S9 via step S8 (in the case of "No" in the determination of step S7, that is, when the boom cylinder P2 calculated target flow rate Q(P2)catgBM is equal to or greater than the boom cylinder P2 maximum flow rate Q(P2)maxBM), the boom cylinder P2 corrected target flow rate Q(P2)cotgBM is converted into the boom cylinder P2 target flow rate Q (P2) tgBM by using the conversion map. The conversion map is a tuning parameter used to adjust the flow rate obtained by calculation to the actual flow rate.

[0073] After the processing of step S9, the process proceeds to step S10. In step S10, the bucket cylinder P1 target flow rate Q (P1) tgBK set in step S5 is set as the bucket cylinder P1 target flow rate Q (P1) tgBK, or the bucket cylinder P1 corrected required flow rate Q (P1) coreqBK set in step S6 is set as the bucket cylinder P1 target flow rate Q (P1) tgBK (the bucket cylinder P1 target flow rate=the bucket cylinder P1 target flow rate or the bucket cylinder P1 corrected required flow rate). That is, when it is determined that the boom cylinder P1 possible flow rate Q (P1) avaBM is larger than the boom cylinder P1 minimum flow rate Q (P1) minBM in the determination in step **4**, the bucket cylinder P1 target flow rate Q (P1) tgBK set in step S5 is set as the bucket cylinder P1 target flow rate Q (P1) tgBK, and when it is determined that the boom cylinder P1 possible flow rate Q (P1) avaBM is equal to or less than the boom cylinder P1 minimum flow rate Q (P1) minBM, the bucket cylinder P1 corrected required flow rate Q (P1) coreqBK set in step S6 is set as the bucket cylinder P1 target flow rate Q (P1) tgBK.

[0074] Further, in step S10, the boom cylinder P1 possible flow rate Q (P1) avaBM is set as the boom cylinder P1 target flow rate Q (P1) tgBM when the determination in step S4 is "YES", that is, when the boom cylinder P1 possible flow rate Q (P1) avaBM is greater than the boom cylinder P1 minimum flow rate Q (P1) minBM; and the boom cylinder P1 minimum flow rate Q (P1) minBM is set as the boom cylinder P1 target flow rate Q (P1) tgBM (the boom cylinder P1 target flow rate=boom cylinder P1 possible flow rate or boom cylinder P1 minimum flow rate) when the determination in step S4 is "NO", that is, when the boom cylinder P1 possible flow rate Q (P1) avaBM is equal to or less than the boom cylinder P1 minimum flow rate Q (P1) minBM.

[0075] Further, in step **10**, the boom cylinder P2 target flow rate Q (P2) tgBM obtained by using the conversion map in step **9** is set as the boom cylinder P2 target flow rate Q (P2) tgBM (the boom cylinder P2 target flow rate=the boom cylinder P2 target flow rate).

[0076] However, the target flow rate adjustment control is executed when in step S1 the total P1 required flow rate Q (P1) toreq exceeds the maximum discharge flow rate Q (P1) max of the hydraulic pump Pl and the difference between the total P1 required flow rate Q (P1) toreq and the total P2 required flow rate Q (P2) toreq exceeds the set required flow rate difference DQreq, but in the target flow rate adjustment control, when the target flow rate first correction control in step S6 and the target flow rate second correction control in step S8 are not executed, the bucket cylinder P1 required flow rate Q (P1) reqBK is set as the bucket cylinder P1 target flow rate Q (P1) tgBK (step S5, step S10); the boom cylinder P1 possible flow rate Q (P1) avaBM, which is a flow rate obtained by subtracting the bucket cylinder P1 required flow rate Q (P1) reqBK from the P1 pump maximum discharge flow rate Q (P1) max, is set as the boom cylinder P1 target flow rate Q (P1) tgBM (step S3, step S10); and the boom cylinder P2 calculated target flow rate Q (P2) catgBM, which is a flow rate obtained by subtracting the boom cylinder P1 possible flow rate Q (P1) avaBM (=the boom cylinder P1 target flow rate Q (P1) tgBM) from the boom cylinder total required flow rate QtoreqBM, is converted by a conversion map and then set as the boom cylinder P2 target flow rate Q (P2) tgBM (step S5, step S9, step S10).

[0077] On the other hand, when the boom cylinder P1 possible flow rate Q (P1) avaBM is equal to or less than the boom cylinder P1 minimum flow rate Q (P1) minBM, the target flow rate first correction control is executed, and in the target flow rate first correction control, a flow rate obtained by subtracting the boom cylinder P1 minimum flow rate Q (P1) minBM from the P1 pump maximum discharge flow rate Q (P1) max is set as the bucket cylinder P1 corrected required flow rate Q (P1) coreqBK, and the bucket cylinder P1 corrected required flow rate Q (P1) coreqBK is set as the bucket cylinder P1 target flow rate Q (P1) tgBK (step S6, step S10). In addition, the boom cylinder P1 minimum flow rate Q (P1) minBM is set as the boom cylinder P1 target flow rate Q (P1) tgBM (step S10). Further, a flow rate obtained by subtracting the boom cylinder P1 minimum flow rate Q (P1) minBM from the boom cylinder total required flow rate QtoreqBM is set as the boom cylinder P2 calculated target flow rate Q (P2) catgBM, and the boom cylinder P2 calculated target flow rate Q (P2) catgBM is converted by the conversion map and then set as the boom cylinder P2 target flow rate Q (P2) tgBM (step S6, step S9, step S10).

[0078] Further, when the boom cylinder P2 calculated target flow rate Q (P2) catgBM is equal to or greater than the boom cylinder P2 maximum flow rate Q (P2) maxBM, the target flow rate second correction control is executed, but in the target flow rate second correction control, the boom cylinder P2 maximum flow rate Q (P2) maxBM is set as the boom cylinder P2 corrected target flow rate Q (P2) cotgBM, and the boom cylinder P2 corrected target flow rate Q (P2) cotgBM is converted by the conversion map and then set as the boom cylinder P2 target flow rate Q (P2) tgBM (step S8, step S9, step S10).

[0079] In the present embodiment, the conversion map is used to adjust the flow rate obtained by calculation to the actual flow rate, but the conversion by the conversion map may be omitted.

[0080] In the present embodiment configured as described above, the hydraulic control system of the hydraulic excavator **1** includes hydraulic pumps P1 and P2, a plurality of hydraulic actuators **6** to **9** (boom cylinder **6**, rotary motor **7**, stick cylinder **8**, and bucket cylinder **9**) that drive at least one of the hydraulic pumps P1 and P2 as a hydraulic supply source, hydraulic actuator operation tools (boom, rotary, stick, and bucket operation tools) that are operated to drive the hydraulic actuators, control valves **23** to **26**, **28**, and **29** (boom, rotary, stick, and bucket directional switching valves

23 to **26**, flow rate control valves **28**, **29**) that control the flow rate of hydraulic oil supplied from the hydraulic pumps P**1** and P**2** to the hydraulic actuators **6** to **9**, and a controller **10** that obtains a target flow rate for each of the hydraulic actuators **6** to **9** from the hydraulic pumps P**1** and P**2** based on the operations of the hydraulic actuator operation tools and controls the control valves **23** to **26**, **28**, and **29** to supply the target flow rate to each of the hydraulic actuators **6** to **9**, wherein the hydraulic actuators **6** to **9** include a bucket cylinder **9** (hydraulic actuator A) to which hydraulic oil is supplied only from the hydraulic pump P**1** (first hydraulic pump) of the hydraulic pumps P**1** and P**2**, and a boom cylinder **6** (hydraulic actuator B) to which hydraulic oil is supplied from both of the hydraulic pumps P**1** and P**2** when supplied at the time of maximum flow rate, and the boom cylinder **6** is set to be first supplied with hydraulic oil from the hydraulic pump P**1** when the boom operation tool (hydraulic actuator B operation means) is operated, and is also supplied with hydraulic oil from the hydraulic pump P**2** (second hydraulic pump) in addition to the hydraulic pump P**1** in accordance with an increase in the operation amount.

[0081] Then, when the bucket operation tool (hydraulic actuator A operation means) and the boom operation tool are operated simultaneously, the controller **10** obtains a bucket cylinder P**1** required flow rate Q (P**1**) reqBK (actuator A first required flow rate) required by the bucket cylinder **9** from the hydraulic pump P**1** according to the operation amount of the bucket operation tool, boom cylinder P**1**, P**2** required flow rates Q (P**1**) reqBM, Q (P**2**) reqBM (actuator B first and second required flow rates) required by the boom cylinder **6** from the hydraulic pumps P**1** and P**2** respectively according to the operation amount of the boom operation tool, and total P**1** and P**2** required flow rates Q (P**1**) toreq, Q (P**2**) toreq (total first and second required flow rates) that are the sum of the required flow rates required by the simultaneously operating hydraulic actuators including the bucket cylinder **9** and the boom cylinder **6**, respectively, and a boom cylinder total required flow rate QtoreqBM (actuator B total required flow rate) which is the sum of the boom cylinder P**1** required flow rate Q (P**1**) reqBM and the boom cylinder P**2** required flow rate Q (P**2**) reqBM.

[0082] Further, in a case where the total P**1** required flow rate Q (P**1**) toreq exceeds the maximum discharge flow rate Q (P**1**) max of the hydraulic pump P**1** (first hydraulic pump maximum discharge flow rate) and a difference between the total P**1** required flow rate Q (P**1**) toreq and the total P**2** required flow rate Q (P**2**) toreq exceeds a preset set required flow rate difference DQreq, the controller **10** performs target flow rate adjustment control by target flow rate adjustment means **56***a* incorporated in a target flow rate setting unit **56**, but in the target flow rate adjustment control, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK is set as a target flow rate from the hydraulic pump P**1** to the bucket cylinder **9**; a flow rate obtained by subtracting the bucket cylinder Pl required flow rate Q (P**1**) reqBK from the P**1** pump maximum discharge flow rate Q (P**1**) max is set as the target flow rate from the hydraulic pump P**1** to the boom cylinder **6**; and a flow rate obtained by subtracting the target flow rate from the hydraulic pump P**1** to the boom cylinder **6** from the boom cylinder total required flow rate QtoreqBM is set as the target flow rate from the hydraulic pump P**2** to the boom cylinder **6**.

[0083] Thus, in the present embodiment, even if the total P**1** required flow rate Q (P**1**) toreq required by the bucket cylinder **9** and the boom cylinder **6** from the hydraulic pump P**1** exceeds the Pl pump maximum discharge flow rate Q (P**1**) max, for the bucket cylinder **9** using only the hydraulic pump P**1** as the hydraulic supply source, the bucket cylinder P**1** required flow rate Q (P**1**) reqBK required by the bucket cylinder **9** from the hydraulic pump P**1** is set as the target flow rate from the hydraulic pump P**1** to the bucket cylinder **9** by the target flow rate adjustment control performed by the target flow rate adjustment means **56***a*, and thus the bucket cylinder P**1** required flow rate Q (P**1**) reqBK is supplied from the hydraulic pump P**1** to the bucket cylinder **9**. On the other hand, for the boom cylinder **6** using both the hydraulic pumps P**1** and P**2** as hydraulic supply sources, a flow rate obtained by subtracting the bucket cylinder P**1** required flow rate Q (P**1**) reqBK from the P**1** pump maximum discharge flow rate Q (P**1**) max is set as a target flow rate from the hydraulic pump P**1** to the boom cylinder **6**, and a flow rate obtained by subtracting the target flow rate from the hydraulic pump P**1** to the boom cylinder **6** from the boom cylinder total required flow rate QtoreqBM is set as a target flow rate from the hydraulic pump P**2** to the boom cylinder **6**, so that the boom cylinder total required flow rate QtoreqBM is supplied to the boom cylinder **6** from both hydraulic pumps P**1** and P**2**. As a result, the bucket cylinder **9** and the boom cylinder **6** are supplied with a required flow rate corresponding to the operation amount of the bucket operation tool and the boom operation tool, respectively, and both the bucket cylinder **9** and the boom cylinder **6** can be driven at an operation speed corresponding to the operation amount, thereby contributing to improvement of operability and improvement of work efficiency. Moreover, even if the target flow rate adjustment control is performed, the hydraulic oil is supplied to the bucket cylinder **9** only from the hydraulic pump P**1** and not from the hydraulic pump P**2**, so that an increase in the merging frequency and a complication of the circuit can be avoided.

[0084] Furthermore, in this embodiment, the target flow rate adjustment means **56***a* performs the target flow rate first correction control when the flow rate obtained by subtracting the bucket cylinder P**1** required flow rate Q (P**1**) reqBK from the P**1** pump maximum discharge flow rate Q (P**1**) max is equal to or less than the boom cylinder P**1** minimum flow rate Q (P**1**) minBM (hydraulic actuator B first minimum flow rate) set in advance as the minimum supply flow rate from the hydraulic pump P**1** to the boom cylinder **6**, but in the target flow rate first correction control, the flow rate obtained by subtracting the boom cylinder P**1** minimum flow rate Q (P**1**) minBM from the P**1** pump maximum discharge flow rate Q (P**1**) max; the boom cylinder P**1** minimum flow rate Q (P**1**) minBM is set as the target flow rate from the hydraulic pump P**1** to the boom cylinder **6**; the flow rate obtained by subtracting the boom cylinder P**1** minimum flow rate Q (P**1**) minBM from the boom cylinder total required flow rate QtoreqBM is corrected and set as the target flow rate from the hydraulic pump P**2** to the boom cylinder **6**. Thus, by ensuring the boom cylinder P**1** minimum flow rate Q (P**1**) minBM set in advance as the minimum target flow rate from the hydraulic pump P**1** to the boom cylinder **6**, the minimum flow rate at which the hydraulic oil is supplied from the hydraulic pump P**1** to the boom cylinder **6** can be ensured even if the required flow rate required by the bucket cylinder **9** is large, and it is not necessary to change the setting that when the boom operation tool is operated, the hydraulic oil is first supplied from the hydraulic pump P**1** to the boom cylinder **6** and then from the hydraulic pump P**2** in addition to the hydraulic pump P**1** in accordance with an increase of the operation amount, and the complication of the control can be avoided.

[0085] Further, in this embodiment, the target flow rate adjustment means **56***a* performs the target flow rate second correction control when the target flow rate from the hydraulic pump P**2** to the boom cylinder **6** is equal to or greater than the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM (actuator B second maximum flow rate) preset as the maximum supply flow rate from the hydraulic pump P**2** to the boom cylinder **6**, but in the target flow rate second correction control, the boom cylinder P**2** maximum flow rate Q (P**2**) maxBM is corrected and set as the target flow rate from the hydraulic pump P**2** to the boom cylinder **6**. In this way, by performing the correction for limiting the target flow rate from the hydraulic pump P**2** to the boom cylinder **6** so as not to exceed the preset boom cylinder P**2** maximum flow rate Q (P**2**) maxBM, it is possible to ensure the supply hydraulic oil to the other hydraulic actuators even when other hydraulic actuators for the hydraulic pump P**2** are operated simultaneously with the operation of the bucket operation tool and the boom operation tool.

[0086] It should be noted that the present invention is not limited to the above-described embodiments, and for example, the target flow rate correction control can be performed by expressing the required flow rate and the target flow rate by the operation amount of the hydraulic actuator operation means.

[0087] In addition, the present invention is not limited to the hydraulic excavator, and it is needless to say that the present invention can be applied to various types of work machines.

INDUSTRIAL APPLICABILITY

[0088] The present invention can be applied to a hydraulic control system of a working machine such as a hydraulic excavator.

1. A hydraulic control system in a working machine, comprising: a first hydraulic pump, a second hydraulic pump, a plurality of hydraulic actuators for driving at least one of the hydraulic pumps as a hydraulic pressure supply source, each hydraulic actuator operation means operated to drive each hydraulic actuator, a control valve for controlling a flow rate of hydraulic oil supplied from each hydraulic pump to each hydraulic actuator, and a control device for controlling the control valve to obtain a target flow rate from each hydraulic pump to each hydraulic actuator based on an operation of the hydraulic actuator operation means, and to supply the target flow rate to each hydraulic actuator,

the hydraulic actuator includes a hydraulic actuator A to which the hydraulic oil is supplied only from a first hydraulic pump of the first and second hydraulic pumps, and a hydraulic actuator B to which the hydraulic oil is supplied from both the first and second hydraulic pumps when a maximum flow rate is supplied, and the hydraulic actuator B is set to be supplied with the hydraulic oil from the first hydraulic pump first when the hydraulic actuator B operation means is operated, and to be supplied with the hydraulic oil from the second hydraulic pump in addition to the first hydraulic pump according to an increase in an operation amount,

wherein the control device includes a target flow rate adjustment means which, when the hydraulic actuator A operation means and the hydraulic actuator B operation means are simultaneously operated,

determines an actuator A first required flow rate that the hydraulic actuator A requires from the first hydraulic pump in accordance with an operation amount of the hydraulic actuator A operation means, actuator B first and second required flow rates that the hydraulic actuator B requires from the first and second hydraulic pumps respectively in accordance with an operation amount of the hydraulic actuator B operation means, total first and second required flow rates that are the sum of required flow rates that the hydraulic actuators including the hydraulic actuator A and the hydraulic actuator B being simultaneously operating respectively require from the first and second hydraulic pumps as a hydraulic supply source, and an actuator B total required flow rate that is the sum of the actuator B first required flow rate and the actuator B second required flow rate, and

sets the actuator A first required flow rate as a target flow rate from the first hydraulic pump to the hydraulic actuator A, a flow rate obtained by subtracting the actuator A first required flow rate from a first hydraulic pump maximum discharge flow rate as a target flow rate from the first hydraulic pump to the hydraulic actuator B, and a flow rate obtained by subtracting the target flow rate from the first hydraulic pump to the hydraulic actuator B from the actuator B total required flow rate as a target flow rate from the second hydraulic pump to the hydraulic actuator B.

2. The hydraulic control system in a working machine of claim **1**, wherein when the flow rate obtained by subtracting the actuator A first required flow rate from the first hydraulic pump maximum discharge flow rate is equal to or less than an actuator B first minimum flow rate set in advance as a minimum supply flow rate from the first hydraulic pump to the hydraulic actuator B, the target flow rate adjustment means performs first correction and control of target flow rate to correct and set the flow rate obtained by subtracting the actuator B first minimum flow rate from the first hydraulic pump maximum discharge flow rate as the target flow rate from the first hydraulic pump to the hydraulic actuator A, correct and set the actuator B first minimum flow rate as the target flow rate from the first hydraulic pump to the hydraulic actuator B, and correct and set a flow rate obtained by subtracting the actuator B first minimum flow rate from the actuator B total required flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

3. The hydraulic control system in a work machine of claim **1**, wherein when the target flow rate from the second hydraulic pump to the hydraulic actuator B set in claim **1** is equal to or greater than an actuator B second maximum flow rate set in advance as a maximum supply flow rate from the second hydraulic pump to the hydraulic actuator B, the target flow rate adjustment means performs second correction and control of target flow rate to correct and set the actuator B second maximum flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

4. The hydraulic control system in a work machine of claim **2**, wherein when the target flow rate from the second hydraulic pump to the hydraulic actuator B set in claim **2** is equal to or greater than an actuator B second maximum flow rate of the that is set in advance as a maximum supply flow rate from the second hydraulic pump to the hydraulic actuator B, the target flow adjustment means performs second correction control of the target flow rate to correct and set the actuator B second maximum flow rate as the target flow rate from the second hydraulic pump to the hydraulic actuator B.

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