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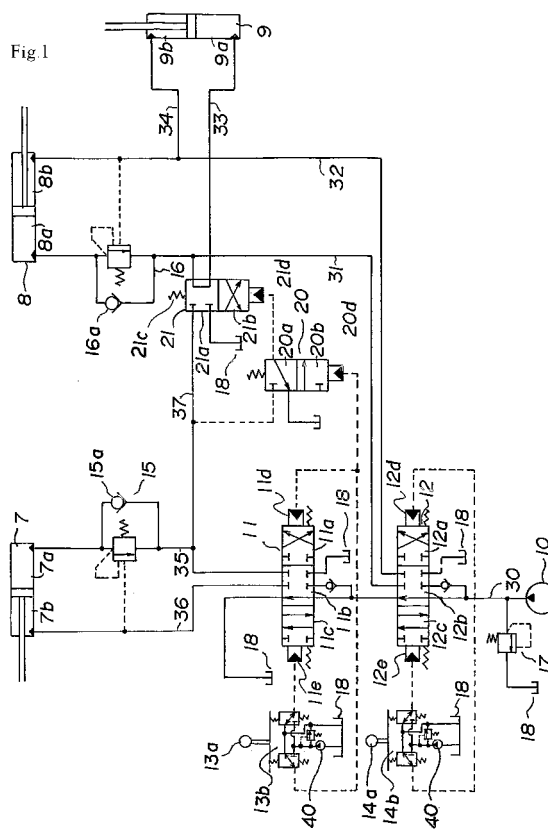
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(54) **HYDRAULIC CONTROL DEVICE OF HYDRAULIC WORKING MACHINE**

(57) Provided are a lift cylinder 7 for causing a free end of a boom in a raising/lowering direction, an attachment pivotally mounted on a free end portion of the boom, a tilt cylinder 8 for causing the attachment to turn in a raising/lowering direction relative to the boom, and a level cylinder 9 extendable/retractable in an interlocked relation with an up/down motion of the boom such that responsive to a change in the up/down angle of the boom, an angle of the attachment in a raising/lowering direction is maintained at a preset angle. When an operating pressure for the lift cylinder 7 becomes higher than a preset pressure during a boom raising operation, a line 35 on a side of a bottom chamber of the lift cylinder 7 and a line 33 on a side of a bottom chamber of the level cylinder 9 are brought into communication with each other. This communication is effected by a line 37, which is arranged between the lines 35 and 33, and a first and second selector valves 21, 21 which changes over a circuit of this line 37.



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Description

Technical Field

[0001] This invention relates to a hydraulic control system for a hydraulic working machine, such as a lift truck, provided with a boom and an attachment an angle of which in a raising/lowering direction relative to a body can be maintained at a preset angle irrespective of an up/down angle of the boom.

Background Art

[0002] Conventionally known hydraulic working machines include cargo handling vehicles called lift trucks, and also high-lift work platform vehicles. As high-lift work platform vehicles, those disclosed, for example, in JP-B-2566631 [U] are known.

[0003] In hydraulic working machines of high-lift work platform vehicles and lift trucks of such a type, a greater importance is attached to the lift capacity, that is, the performance regarding up to what weight each hydraulic working machine can lift. To provide a hydraulic working machine with an increased lift capacity, it is a common practice to use as a lift cylinder a hydraulic cylinder having a greater pressure-receiving area.

[0004] Force which a hydraulic cylinder can produce is, however, expressed by its pressure-receiving area $\times$ pressure. Use of a hydraulic cylinder the pressure-receiving area of which is large makes it possible to provide a hydraulic working machine with an improved lift capacity. However, the use of a hydraulic cylinder with such a large pressure-receiving area develops an inconvenience that the boom-raising speed is reduced, because the extension speed of the hydraulic cylinder is expressed by an inflow rate of hydraulic pressure/the pressure-receiving area. In addition, a hydraulic cylinder becomes more expensive with the pressure-receiving area, and therefore, the use of a hydraulic cylinder having a large pressure-receiving area develops another inconvenience that the manufacturing cost of a hydraulic working machine becomes higher.

[0005] According to the above-described conventional technology, a level correcting operation is selected by a selector switch to perform a level correction independently. However, nothing is taken into consideration with respect to the speed and lift performance during a boom-raising operation.

[0006] The present invention has been completed in view of the above-described circumstances of the conventional technology, and has as an object thereof the provision of a hydraulic control system for a hydraulic working machine, which provides the hydraulic working machine with a high lift capacity without making its boom-raising operation speed slower than the conventional boom-raising operation speed.

Disclosure of the Invention

[0007] To achieve the above-described object, the present invention provides, in a first aspect thereof, a hydraulic control system for a hydraulic working machine provided with a boom pivotally mounted at an end thereof on a stationary side, a first cylinder for causing an opposite end of the boom to turn as a free end in a raising/lowering direction, an attachment pivotally mounted on a free end portion of the boom, a second cylinder for causing the attachment to turn in a raising/lowering direction relative to the boom, a third cylinder extendable/retractable in an interlocked relation with an up/down motion of the boom such that responsive to a change in the up/down angle of the boom, an angle of the attachment in the raising/lowering direction is maintained at a preset angle, a hydraulic pump for feeding pressure oil to the first and second cylinders, respectively, a directional control valve for controlling flows of the pressure oil to be fed from the hydraulic pump to the first and second cylinders, respectively, and a control unit for changing over the directional control valve, characterized in that the hydraulic control system is provided with a means for bringing a bottom chamber of the first cylinder and a bottom chamber of the third cylinder into communication with each other when an operating pressure for the first cylinder becomes higher than a preset pressure during a boom raising operation.

[0008] In a second aspect, the present invention is characterized in that in the first aspect, a third line is arranged connecting a first line, which is connected to the bottom chamber of the first cylinder, and a second line, which is connected to the bottom chamber of the third cylinder, with each other.

[0009] In a third aspect, the present invention is characterized in that in the second aspect, the communicating means comprises a first selector valve arranged on the third line, and a second selector valve arranged for being changed over responsive to an operation of the control unit such that a pressure in the first line is guided to a pilot port of the first selector valve.

[0010] In a fourth aspect, the present invention is characterized in that in the third aspect, the control unit is a hydraulically-piloted control unit, and the second selector valve guides the hydraulic pilot pressure to the pilot port to perform a change-over of the first selector valve.

[0011] In a fifth aspect, the present invention is characterized in that in the first aspect, the boom is provided with a telescopic mechanism of at least two stages.

[0012] In a sixth aspect, the present invention is characterized in that in the first aspect, the attachment comprises one of a fork, a basket and a bucket.

[0013] In a seventh aspect, the present invention is characterized in that in the first aspect, the stationary side is arranged on a body of the hydraulic working machine.

[0014] In an eighth aspect, the present invention is

characterized in that in any one of the first to seventh aspects, the hydraulic working machine comprises one of a lift truck and a high-lift work platform vehicle.

[0015] In an the embodiment to be described subsequently herein, the first cylinder corresponds to the lift cylinder 7, the second cylinder to the tilt cylinder 8, the third cylinder to the level cylinder 9, the communicating means to the first and second selector valves 21, 22, the hydraulic pump to numeral 10, the directional control valve to numeral 11, the control unit to numeral 13, the first selector valve to the first selector valve 21, the second selector valve to the second selector valve 20, the first line to the line 35, the second line to the line 33, the third line to the line 37, and the pilot port of the first selector valve to sign 21d, respectively.

[0016] According to the present invention, when the working pressure for the first cylinder becomes higher than a preset pressure during a boom-raising operation, the pressure oil delivered from the hydraulic pump is fed to both of the bottom chamber of the first cylinder and the bottom chamber of the third cylinder. The extending force of the third cylinder can, therefore, be used as drive force for causing the boom to turn, thereby making it possible to provide the hydraulic working machine with a higher lift capacity.

Brief Description of the Drawings

[0017]

FIG. 1 is a circuit diagram of a hydraulic circuit arranged on a hydraulic working machine according to an embodiment of the present invention.

FIG. 2 is a side view illustrating one example of a hydraulic working machine according to the embodiment of the present invention.

Best Modes for Carrying out the Invention

[0018] With reference to the drawings, a description will hereinafter be made about best modes for carrying out the present invention.

[0019] FIG. 2 is a view illustrating one example of a lift truck as a hydraulic working machine according to the embodiment of the present invention. As can be seen clearly from this drawing, the lift truck according to this embodiment is provided with a body 1 having front wheels 2, rear wheels 3 and an operator's cab 4, an extendable/retractable boom 5 pivotally mounted at an end thereof on the body 1, an attachment 6 such as fork pivotally mounted on a free end portion of the boom 5, a lift cylinder 7 for causing the boom 5 to turn in a raising/lowering direction (direction A-B) relative to the body 1, a tilt cylinder 8 arranged between the boom 5 and the attachment 6 to cause the attachment 6 to turn in a tilt direction (direction C-D) relative to the boom 5, and a level cylinder 9 arranged between the body 1 and the boom 5 such that the level cylinder is caused to extend

or retract in an interlocked relation with a raising or lowering operation of the boom 5.

[0020] The level cylinder 9 serves to maintain at a preset angle a relative angle (tilt angle) of the attachment 6 in the raising/lowering direction relative to the body 1 even when the up/down angle of the boom 5 relative to the body 1 is changed, and is connected with the tilt cylinder 8 via an unillustrated line. When the boom 5 is operated upwards or downwards, the pressure oil pushed out of the level cylinder 9 is fed to the tilt cylinder 8 so that the tilt angle of the attachment 6 relative to the boom 5 is changed. In this embodiment, a load-carrying fork is shown as the attachment 6 by way of example. It is also possible to use, for example, a bucket for performing earth or sand digging or land grading or a basket for carrying one or more loads or people upwards.

[0021] Illustrated in FIG. 1 is a circuit diagram of a hydraulic circuit arranged on the lift truck of the above-described construction. It is to be noted that in the circuit diagram of FIG. 1, the boom 5 is extendable or retractable in plural stages, for example, five stages although a hydraulic circuit for causing the boom 5 to extend or retract is omitted as it is not directly relevant to the description of the present invention.

[0022] As readily envisaged from FIG. 1, the hydraulic circuit according to this embodiment is constructed of a hydraulic pump 10 as a hydraulic pressure source, a directional control valve 11 for controlling a flow of pressure oil to be fed from the hydraulic pump 10 to the lift cylinder 7, a directional control valve 12 for controlling a flow of pressure oil to be fed from the hydraulic pump 10 to the tilt cylinder 8, a control unit 13 for the directional control valve 11, a control unit 14 for the directional control valve 12, lines 35, 36 connecting the directional control valve 11 and the lift cylinder 7 with each other, a counterbalance valve 15 arranged on the line 35 (the line on the side of a bottom chamber of the lift cylinder 7), lines 31, 32 connecting the directional control valve 12 and the tilt cylinder 8 with each other, a counterbalance valve 16 arranged on the line 31 (the line on the side of a bottom chamber of the tilt cylinder 8), a line 33 connecting the line 31 and a bottom chamber 9a of the level cylinder 9 (the line on the side of the bottom chamber of the level cylinder 9), a line 34 connecting the line 32 and a rod chamber 9b of the level cylinder 9 with each other, and a relief valve 17 arranged on a line via which an outlet line 30 of the hydraulic pump 10 and a reservoir 18 are connected with each other. The control units 13, 14 are constructed of control levers 13a, 14a, reducing valves 13b, 14b, and a pilot pump 40 for feeding pilot pressures, respectively.

[0023] In this embodiment, a line 37 is arranged to connect the line 35 on the side of the bottom chamber of the lift cylinder 7 and the line 33 on the side of the bottom chamber of the level cylinder 9 with each other. Arranged on this line 37 are the first selector valve 21 and the second selector valve 20 which is changed over by a boom-raising operation through the control unit 13

to feed a pressure from the line 35 on the side of the bottom chamber of the lift cylinder 7 to the pilot port 21d of the first selector valve 21. It is to be noted that the preset pressure or the preset change-over pressure for the first selector valve 21, which is set by a return spring 21c arranged on the first selector valve 21, is set at a value slightly lower than a preset valve for the relief valve 17. It is also to be noted that the term "communicating means" as used in the claims is constructed of a combination of the first selector valve 21 and the second selector valve 20.

[0024] When an operator manipulates the control lever 14a to feed a pilot pressure to a pilot port 12d such that the directional control valve 12 is changed over from a neutral position 12b to a position 12a, the pressure oil delivered from the hydraulic pump 10 is fed to a rod chamber 8b of the tilt cylinder 8 through the line 30, directional control valve 12 and line 32. As a result, the tilt cylinder 8 operates in a retracting direction so that the attachment 6 turns in a lowering direction (direction D). The working oil pushed out of a bottom chamber 8a of the tilt cylinder 8 as a result of the retracting operation of the tilt cylinder 8 is allowed to return to the reservoir 18 through the counterbalance valve 16, line 31 and directional control valve 12.

[0025] When the operator manipulates the control lever 14a to feed a pilot pressure to a pilot port 12e such that the directional control valve 12 is changed over to a position 12c, on the other hand, the pressure oil delivered from the hydraulic pump 10 is fed to the bottom chamber 8a of the tilt cylinder 8 through the line 30, directional control valve 12, line 31, and a check valve 16a arranged in the counterbalance valve 16. As a result, the tilt cylinder 8 operates in an extending direction so that the attachment 6 turns in a raising direction (direction C). The working oil pushed out of the rod chamber 8b of the tilt cylinder 8 as a result of the extending operation of the tilt cylinder 8 is allowed to return to the reservoir 18 through the line 32 and directional control valve 12.

[0026] When the operator manipulates the control lever 13a to feed a pilot pressure to a pilot port 11d such that the directional control valve 11 is changed over to a position 11a from a neutral position 11b, the pressure oil delivered from the hydraulic pump 10 is fed to a bottom chamber 7a of the lift cylinder 7 through the line 30, directional control valve 11, line 35, and a check valve 15a arranged in the counterbalance valve 15. As a result, the lift cylinder 7 operates in an extending direction so that the boom 5 turns in a raising direction (direction A). The working oil pushed out of a rod chamber 7b of the lift cylinder 7 in association with the extending operation of the lift cylinder 7 is allowed to return to the reservoir 18 through the line 36 and directional control valve 11. When the boom 5 is caused to turn in the raising direction, the level cylinder 9 is forced to extend so that the working oil is pushed out of the rod chamber 9b of the level cylinder 9. Therefore, the working oil flows into

the rod chamber 8b of the tilt cylinder 8 through the line 34 and line 32, the tilt cylinder 8 is operated in the retracting direction, and the attachment 6 turns in the lowering direction (direction D). The working oil pushed out of the bottom chamber 8a of the tilt cylinder 8 in association with the retracting operation of the tilt cylinder 8 is guided to the bottom chamber 9a of the level cylinder 9 via the counterbalance valve 16, line 31 and line 33. As a result, the relative angle of the attachment 6 in the raising/lowering direction relative to the body 1 is changed responsive to the raising operation of the boom 5, so that the attachment is maintained in its position before the boom-raising operation.

[0027] When no boom-raising pilot pressure is acting on a pilot port 20d of the second selector valve 20, the second selector valve 20 is maintained at a position 20a. Because it is only the tank pressure that is acting on the pilot port 21d of the first selector valve 21 at this time, the first selector valve 21 is maintained at a position 21a, the line 31 and the line 37 are cut off, and the line 31 and the line 33 are communicated with each other via the first selector valve 21.

[0028] When the operator manipulates the control lever 13a to feed a pilot pressure to a pilot port 11e such that the directional control valve 11 is changed over to the side of a chamber 11c, on the other hand, the pressure oil delivered from the hydraulic pump 10 is fed to the rod chamber 7b of the lift cylinder 7 through the line 30, directional control valve 11 and line 36. Accordingly, the lift cylinder 7 operates in the retracting direction, and the boom 5 turns in the lowering direction (direction B). The working oil pushed out of the bottom chamber 7a of the lift cylinder 7 in association with the retracting operation of the lift cylinder 7 is allowed to return to the reservoir 18 through the counterbalance valve 15, line 35 and directional control valve 11. When the boom 5 is caused to turn in the lowering direction, the level cylinder 9 is forced to retract so that the working oil is pushed out of the bottom chamber 9a of the level cylinder 9. Therefore, the working oil flows into the bottom chamber 8a of the tilt cylinder 8 through the line 33, line 31 and the check valve 16a of the counterbalance valve 16, the tilt cylinder 8 operates in the extending direction, and the attachment 6 turns in the raising direction (direction C). The working oil pushed out of the rod chamber 8b of the tilt cylinder 8 in association with the extending operation of the tilt cylinder 8 is guided to the rod chamber 9b of the level cylinder 9 via the line 32 and line 34. As a result, irrespective of the lowering operation of the boom 5, the tilt angle of the attachment 6 relative to the body 1 is automatically maintained in the state before the boom-raising operation.

[0029] When a boom-raising operation is performed by the operator, the directional control valve 11 is changed over to the position 11a and the second selector valve 20 is changed over to a position 20b, both, by a pilot pressure from the control unit 13. As a consequence, the pressure oil delivered from the hydraulic

pump 10 is fed to the bottom chamber 7a of the lift cylinder 7 through the line 30, directional control valve 11, line 35, and the check valve 15a of the counterbalance valve 15. As the second selector valve 20 has been changed over to the position 20b, the pressure in the line 35 (the working pressure for the lift cylinder 7) also acts on the pilot port 21d of the first selector valve 21 via the line 37. The working pressure for the lift cylinder 7 becomes higher as the weight of a load under lifting by the attachment 6 becomes greater.

[0030] When the working pressure for the lift cylinder 7 is lower than the preset pressure for the first selector valve 21, the first selector valve is maintained at the position 21a, and therefore, the cut-off state between the line 31 and the line 37 and the communicated state between the line 31 and the line 33 are maintained. Accordingly, a raising operation of the boom 5 and an adjusting operation of the tilt angle of the attachment 6 in association with the raising operation of the boom 5 are also performed in the above-described procedure.

[0031] When the working pressure for the lift cylinder 7 is higher than the preset pressure for the first selector valve 21, on the other hand, the first selector valve 21 is changed over to a position 21b, and therefore, the line 33 and the line 35 are connected with each other via the line 37 and the line 31 and the tank 18 are connected with each other. Accordingly, the pressure oil delivered from the hydraulic pump 10 is fed to the bottom chamber 7a of the lift cylinder 7 through the line 30, directional control valve 11 and line 35, and a portion of the pressure oil in the line 35 is fed to the bottom chamber 9a of the level cylinder 9 through the line 37, selector valve 21 and line 33. As a consequence, forces are produced in extending direction at both of the lift cylinder 7 and the level cylinder 9, and act as a force to cause the boom 5 to turn in the raising direction. Compared with the turning of the boom 5 in the raising direction by the lift cylinder alone, the hydraulic working machine is provided with an increased lift capacity.

[0032] It is to be noted that as the control units 13, 14, electrically-operated control units are also usable although the hydraulically-piloted control units are exemplified in this embodiment. In this case, the control units are each constructed such that a manipulation of the control lever 13a outputs an electrical signal and the second selector valve 20 is changed over by the electrical signal outputted by the manipulation of the control lever 13a.

[0033] In the construction of FIG. 1, it is also possible to construct in such a way that a pressure sensor is arranged in the pilot circuit connected to the pilot port 11d on the side of the bottom chamber of the directional control valve 11, a change in pressure is detected by the pressure sensor, and the detection signal (electrical signal) is converted into a pressure, for example, by an electrohydraulic valve, and the pressure is then guided to the pilot port 20d of the second selector valve 20 to change over the second selector valve 20.

[0034] In this embodiment, the change-over means for communicating the line 37 is constructed of the first and second selector valves 21, 20. It is also possible to construct in such a way that pressure sensors are arranged on the line 37 and in the pilot circuit connected to the pilot port 11d on the side of the bottom chamber of the directional control valve 11, respectively, and, when a controller detects based on signals from the respective pressure sensors that the pressure in the line 37 is higher than a preset pressure and the directional control valve 11 has been changed over to the boom-raising side, the first selector valve 21 is changed over by a control signal from the controller. It is to be noted that this change-over can be performed by converting the control signal from the controller into a pressure, for example, through an electrohydraulic valve and applying the pressure to the pilot port 21d of the first selector valve 21.

[0035] As has been described above, the hydraulic working machine according to this embodiment is provided with a means (the selector valve 20, 21) for changing the communicated state between the line 35 on the side of the bottom chamber of the lift cylinder 7 and the line 33 on the side of the bottom chamber of the level cylinder 9 on the basis of a pressure value preset for the line 37 through which the lines 35 and 33 are connected with each other, the lines 33, 35 on the side of the respective bottom chambers are brought into communication with each other when the working pressure for the lift cylinder 7 becomes higher than the preset pressure for the circuit change-over means during a boom-raising operation, and as a result, the pressure oil delivered from the hydraulic pump 10 is fed to both of the bottom chamber of the lift cylinder 7 and the bottom chamber of the level cylinder 9. This has made it possible to also use the extending force of the level cylinder 9 as a drive force for causing the boom to turn, thereby making it possible to provide the hydraulic working machine with an increased lift capacity.

[0036] Further, the pressure-receiving area of the lift cylinder 7 can be reduced without sacrificing the lift capacity of the hydraulic working machine, thereby making it possible to reduce the manufacturing cost of the hydraulic working machine.

[0037] Moreover, the means for feeding the pressure oil, which has been delivered from the hydraulic pump, to the level cylinder is constructed of the two selector valves 20, 21 in the hydraulic working machine of this embodiment. This construction has made it possible to make up the feed means by a combination of general-purpose components.

[0038] The communicating means is constructed of the first selector valve 21 and the second selector valve 20 in this embodiment. It is, however, to be noted that the communicating means is not limited to the above-described combination of the selector valves 21 and 22 and can have a desired design as needed insofar as the communicating means is provided with a function to

bring the side of the bottom chamber of the first cylinder and the side of the bottom chamber of the third cylinder into communication with each other when the working pressure for the first cylinder becomes higher than the present pressure during a boom-raising operation.

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Claims

1. A hydraulic control system for a hydraulic working machine provided with:

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a boom pivotally mounted at an end thereof on a stationary side,
a first cylinder for causing an opposite end of said boom to turn as a free end in a raising/lowering direction,
an attachment pivotally mounted on a free end portion of said boom,
a second cylinder for causing said attachment to turn in a raising/lowering direction relative to said boom,
a third cylinder extendable/retractable in an interlocked relation with an up/down motion of said boom such that responsive to a change in said up/down angle of said boom, an angle of said attachment in said raising/lowering direction is maintained at a preset angle,
a hydraulic pump for feeding pressure oil to said first and second cylinders, respectively,
a directional control valve for controlling flows of said pressure oil to be fed from said hydraulic pump to said first and second cylinders, respectively, and
a control unit for changing over said directional control valve, **characterized in that:**

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said hydraulic control system is provided with a means for bringing a bottom chamber of said first cylinder and a bottom chamber of said third cylinder into communication with each other when an operating pressure for said first cylinder becomes higher than a preset pressure during a boom raising operation.

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2. A hydraulic control system according to claim 1, wherein a third line is arranged connecting a first line, which is connected to said bottom chamber of said first cylinder, and a second line, which is connected to said bottom chamber of said third cylinder, with each other.

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3. A hydraulic control system according to claim 2, wherein said communicating means comprises:

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a first selector valve arranged on said third line, and

a second selector valve arranged for being changed over responsive to an operation of said control unit such that a pressure in said first line is guided to a pilot port of said first selector valve.

4. A hydraulic control system according to claim 3, wherein said control unit is a hydraulically-piloted control unit, and said second selector valve guides said hydraulic pilot pressure to said pilot port to perform a change-over of said first selector valve.

5. A hydraulic control system according to claim 1, wherein said boom is provided with a telescopic mechanism of at least two stages.

6. A hydraulic control system according to claim 1, wherein said attachment comprises one of a fork, a basket and a bucket.

7. A hydraulic control system according to claim 1, wherein said stationary side is arranged on a body of said hydraulic working machine.

8. A hydraulic control system according to any one of claims 1-7, wherein said hydraulic working machine comprises one of a lift truck and a high-lift work platform vehicle.

Fig.1

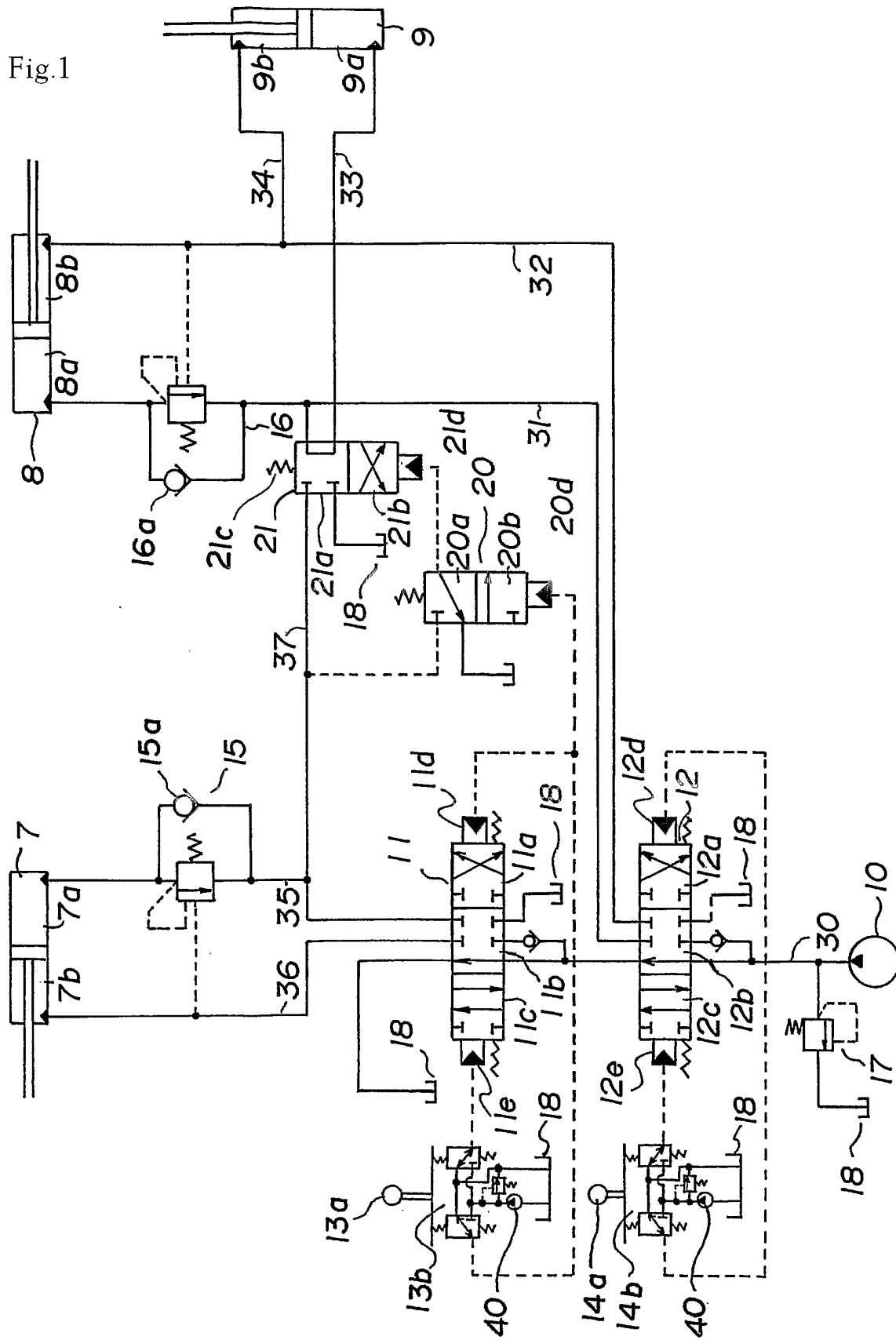
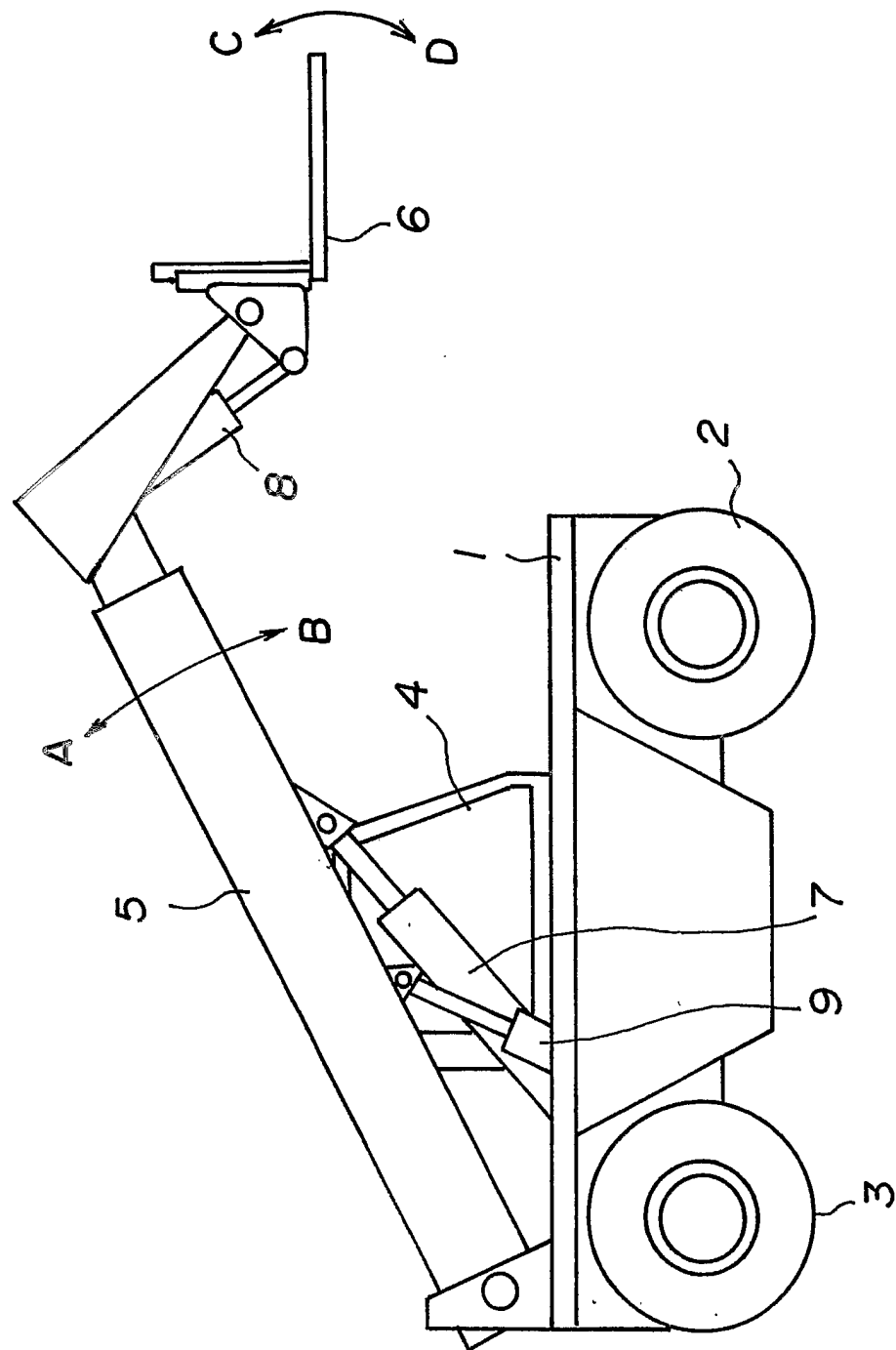


Fig.2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/002380

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ B66F9/22, B66F9/06, B66F9/065

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ B66F9/22, B66F9/06, B66F9/065

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2004

Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-34494 A (Aichi Corp.), 07 February, 2003 (07.02.03), (Family: none)	1-8
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 125074/1989 (Laid-open No. 65765/1992) (Mitsubishi Heavy Industries, Ltd.), 26 June, 1991 (26.06.91), (Family: none)	1-8
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 46681/1992 (Laid-open No. 1397/1994) (Tadano Inc.), 11 January, 1994 (11.01.94), (Family: none)	1-8

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

* Special categories of cited documents:

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Date of the actual completion of the international search
11 May, 2004 (11.05.04)Date of mailing of the international search report
25 May, 2004 (25.05.04)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/002380

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4822237 A (THE GRADALL CO.), 18 April, 1989 (18.04.89), (Family: none)	1-8

Form PCT/ISA/210 (continuation of second sheet) (January 2004)