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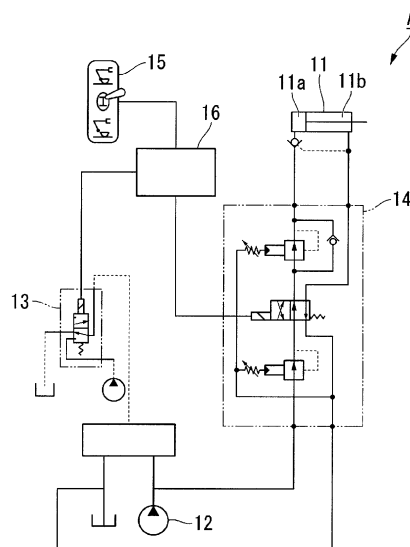
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(54) **QUICK COUPLER CIRCUIT FOR CONSTRUCTION EQUIPMENT**

(57) A switch (15) is configured so as to be operated with two positions of a locked position when an attachment is held and an unlocked position when an attachment is released. Furthermore, a control device (16) receives an operation signal that is output when the switch

(15) is operated to the locked position or the unlocked position and switches and controls an electromagnetic switching valve (13) so that the pressure of a hydraulic pump begins to rise and so that, at a stage when a pre-determined time has passed, the pressure raising in the hydraulic pump is stopped.

[Fig.1]



Description

Technical Field

[0001] The present invention relates to a quick coupler circuit for construction equipments for easily attaching or detaching an attachment such as a bucket or a breaker. Priority is claimed on Japanese Patent Application No. 2010-140514, filed June 21, 2010, the content of which is incorporated herein by reference.

Background Art

[0002] In the related art, as illustrated in FIG 3, a hydraulic shovel (construction equipment) 1 includes a lower travelling body 2, an upper pivoting body 3 pivotably provided on the lower travelling body 2, and a working machine 4 installed on the upper pivoting body 3 which is free to be raised or lowered in a vertical direction. Furthermore, the working machine 4 includes a boom 5, a rear end of which is supported by the upper pivoting body 3 in a freely turnable manner, an arm 6, a rear end of which is supported by a leading end of the boom 5 in a freely turnable manner, and a bucket (attachment) 7 installed on the leading end side of the arm 6 in a freely turnable manner. The working machine 4 is formed in a multiple joint form. Moreover, hydraulic oil is supplied and discharged depending on the lever operation of an operator, a boom cylinder 8, an arm cylinder 9 and a bucket cylinder 10 (working actuator) are each extended and retracted, and the boom 5, the arm 6 and the bucket 7 are each turned.

[0003] Meanwhile, the construction equipment 1 has been known which is configured so that various attachments 7 such as a bucket, a breaker and a crusher can be attached to and detached from the leading end of the arm 6. Since the attachments 7 can be exchanged in this construction equipment 1, a piece of the construction equipment 1 can be used for multiple purposes and multiple functions. In addition, construction equipment 1 has been known which includes a quick coupler circuit and easily and rapidly performs attachment and detachment of attachment 7 by operation of a switch by the operator.

[0004] Generally, the quick coupler circuit (quick coupler B) is provided between the leading end of the arm 6 and the attachment 7. Moreover, the quick coupler circuit includes a quick coupler cylinder that is extended and retracted by supplying and discharging of the hydraulic oil to hold/detach the attachment 7, a hydraulic pump, an electromagnetic switching valve that switches a supplying direction of the hydraulic oil supplied from the hydraulic pump to a working actuator (the boom cylinder 8, the arm cylinder 9 and the bucket cylinder 10) side or a quick coupler cylinder side, a coupler switching valve for extending or retracting the quick coupler cylinder by switching the supplying direction of the hydraulic oil to the quick coupler cylinder, and a control device that switches and controls the electromagnetic switching valve and the cou-

pler switching valve based on a pilot signal (operation signal) that is output by operation of the switch (for example, see Patent Document 1).

5 Citation List

Patent Document

[0005] [Patent Document 1] Japanese Unexamined Patent Application, First Publication No. 2007-327291

Summary of Invention

Problem to be solved by the Invention

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[0006] Herein, in order that the extension and retraction operation (attachment and detachment of the attachment 7) of the quick coupler cylinder is reliably performed, there is a need for a pump pressure-raising operation of an operator. For this reason, in the above-mentioned quick coupler circuit of the related art, the electromagnetic switching valve has been used. Moreover, the pilot signal for forcibly raising the pressure of the pump is controlled, and the pressure of the hydraulic pump is forcibly raised. Furthermore, in the above-mentioned quick coupler circuit of the related art, the electromagnetic switching valve and the coupler switching valve are switched and driven depending on the switch operation, and a three-position switch and a relay circuit are required so as to control two valves.

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[0007] That is, in the quick coupler circuit of the related art, a switch operated by three positions and a relay circuit are combined with each other to perform the control of raising the pressure of the hydraulic pump. The three positions include a working position when extending and retracting the working actuator to perform working, a locked position when extending (or retracting) the quick coupler cylinder to hold (install) the attachment 7, and an unlocked position when retracting (or extending) the quick coupler cylinder to detach the attachment 7. Moreover, when exchanging the attachment 7, the locked position and the unlocked position are used, and the pressure of the hydraulic pump is always raised between the locked position and the unlocked position.

[0008] For this reason, only the performed control is whether or not the pressure of the hydraulic pump always rises or the pressure of the hydraulic pump does not always rise so that the quick coupler cylinder is extended or retracted, depending on the position of the switch. That is, it is impossible to control the time and the timing of the pressure raising. As a result, the movements of working actuators 8, 9 and 10 (working machine 4) are unstable while the pressure of the pump rises. Furthermore, unnecessary pump pressure raising time is generated, and thus fuel efficiency is degraded.

[0009] In view of the above, an object of the present invention is to provide a quick coupler circuit for construction equipment that is able to control the time and the

timing of the pressure raising, stabilizes the operation of the working machine while the pressure of the hydraulic pump rises, and is able to improve the fuel efficiency.

Solution to Problem

[0010] In order to achieve the above-mentioned object, the present invention adopts the following means.

[0011] The quick coupler circuit for construction equipment of the present invention is a quick coupler circuit for construction equipment for attaching or detaching the attachment to or from the working machine. Moreover, the quick coupler circuit of the present invention includes a quick coupler cylinder that is subjected to extension and retraction driving and holds/detaches the attachment to or from the working machine; a hydraulic pump; an electromagnetic switching valve that switches forced pressure raising of the hydraulic pump; a coupler switching valve for performing extension and retraction driving of the quick coupler cylinder by switching a supplying direction of hydraulic oil to the quick coupler cylinder; and a control device that switches and controls the electromagnetic switching valve and the coupler switching valve, respectively. Furthermore, in the quick coupler circuit of the present invention, the switch for switching and operating the electromagnetic switching valve and the coupler switching valve is operated with two positions of a locked position where extending and retracting the quick coupler cylinder to hold the attachment, and an unlocked position where extending and retracting the quick coupler cylinder to detach the attachment. Furthermore, in the quick coupler circuit of the present invention, the control device switches and controls the coupler switching valve by receiving the operation signal that is output by operating the switch to the locked position or the unlocked position. In addition, in the quick coupler circuit of the present invention, the control device switches and controls the electromagnetic switching valve so that the pressure raising of the hydraulic pump begins by operation of the switch and the pressure raising of the hydraulic pump is stopped at a stage when a predetermined time elapses.

Advantageous Effects of Invention

[0012] In the quick coupler circuit for construction equipment of the present invention, the quick coupler circuit transmits the operation signal of the switch to the electromagnetic switching valve via the control device. For that reason, it is possible to control the time when the electromagnetic switching valve is switched so as to raise the pressure of the hydraulic pump. That is, the control device switches and controls the electromagnetic switching valve so that the pressure of the hydraulic pump rises, based on the operation signal that is output by operating the switch to the locked position or the unlocked position. After that, at a stage when a predetermined time elapses, the control device is able to control the pump

pressure raising time and timing by switching and controlling the electromagnetic switching valve so that the pressure raising of the hydraulic pump is completed.

[0013] Thereby, it is possible to perform the control so that the pressure of the hydraulic pump rises only while the quick coupler cylinder is moved, by operating the switch operated with two positions of the locked position and the unlocked position. Thus, since the pressure raising time can be minimalized compared to the quick coupler circuit of the related art, it is possible to suppress the unstable movement of each actuator (working machine) during pressure raising of the pump to the minimum. Furthermore, since an unnecessary pressure raising time of the pump is reduced, the fuel efficiency is improved.

Brief Description of Drawings

[0014]

FIG. 1 is a diagram that illustrates a quick coupler circuit for a construction equipment according to an embodiment of the present invention.

FIG. 2 is a diagram that illustrates a quick coupler circuit for a construction equipment according to modified example of an embodiment of the present invention.

FIG. 3 is a diagram that illustrates a hydraulic shovel (construction equipment).

Description of Embodiments

[0015] Hereinafter, a quick coupler circuit for construction equipment according to an embodiment of the present invention will be described referring to FIGS. 1 and 3.

[0016] Construction equipment 1 of the present embodiment is a hydraulic shovel (see FIG. 3), and includes a quick coupler circuit A for easily attaching or detaching various attachments 7 such as a bucket and a breaker to or from a leading end of an arm 6 (working machine).

[0017] Moreover, as illustrated in FIG. 1, the quick coupler circuit A of the present embodiment includes a quick coupler cylinder 11, a hydraulic pump (for example, variable capacity pump) 12, an electromagnetic switching valve (solenoid valve) 13, a coupler switching valve 14, a switch 15, and a control device 16.

[0018] The quick coupler cylinder 11 is a member for holding (installing)/detaching the attachments 7 to or from the leading end of the arm 6 by being extended and retracted by supplying and discharging of the hydraulic oil. The quick coupler cylinder 11 is built in an attaching and detaching apparatus attached to the leading end of the arm 6, and is provided between the leading end of the arm 6 and the attachment 7. Furthermore, in the quick coupler circuit A of the present embodiment, hydraulic pipes are each connected to a piston chamber 11a and a rod chamber 11b of the quick coupler cylinder 11 so that when the quick coupler cylinder 11 is extended, the

attachment 7 is fixed, and when the quick coupler cylinder 11 is retracted, the attachment 7 is removed.

[0019] The electromagnetic switching valve 13 is able to change a supplying direction of the hydraulic oil supplied by the hydraulic pump 12 of a hydraulic source to a working actuator (a boom cylinder 8, an arm cylinder 9 and a bucket cylinder 10) side of the working machine 4 or the quick coupler cylinder 11 side. The electromagnetic switching valve 13 is connected to the hydraulic pump 12, each of the working actuators 8, 9 and 10, and a coupler switching valve 14 via the hydraulic pipes.

[0020] The coupler switching valve 14 is a member for extending or retracting the quick coupler cylinder 11. The coupler switching valve 14 is connected to the quick coupler cylinder 11 by the hydraulic pipes, and is able to change the supplying direction of the hydraulic oil supplied from the hydraulic pump 12 to the quick coupler cylinder 11.

[0021] The switch 15 is used when an operator changes the electromagnetic switching valve 13 and the coupler switching valve 14 at the time of exchanging (attaching or detaching) the attachment 7. The switch 15 is connected to the control device 16 using a wire harness. Furthermore, the switch 15 of the present embodiment is operated with two positions of the locked position where extending the quick coupler cylinder 11 to hold the attachment 7 and the unlocked position where retracting the quick coupler cylinder 11 to detach the attachment 7.

[0022] The control device 16 is a member for switching and controlling the electromagnetic switching valve 13 and the coupler switching valve 14, respectively. The control device 16 is connected to the electromagnetic switching valve 13 and the coupler switching valve 14 using the wire harness. The control device 16 of the present embodiment switches and controls the coupler switching valve 14 by receiving the operation signal that is output by the operation of the switch 15 to the locked position or the unlocked position. Furthermore, the control device 16 of the present embodiment switches and controls the electromagnetic switching valve so that pressure raising of the hydraulic pump 12 begins by the operation of the switch 15, and pressure raising of the hydraulic pump 12 is stopped at a stage when a predetermined time elapses.

[0023] When exchanging (attaching or detaching) the attachment 7 with the quick coupler circuit A of the present embodiment, firstly, an operator operates the lever, and drives the working actuators 8, 9 and 10. Moreover, an operator places the attachment 7 attached to on the leading end of the arm 6 at a predetermined position.

[0024] Next, when an operator turns the switch 15 to the unlocked position, the operation signal is input to the control device 16. Moreover, the switching signals are each output to the electromagnetic switching valve 13 and the coupler switching valve 14 from the control device 16 based on the operation signal. Moreover, the electromagnetic switching valve 13 is switched by the switching signal that is output from the control device 16, and the

pressure of the hydraulic pump 12 rises. Furthermore, the coupler switching valve 14 is switched by the switching signal that is output from the control device 16, and hydraulic oil is supplied and discharged so that the quick coupler cylinder 11 is retracted. The holding state of the attachment 7 installed on the leading end of the arm 6 is released by retraction of the quick coupler cylinder 11, and the attachment 7 is detached from the leading end of the arm 6.

[0025] Furthermore, in the present embodiment, after the electromagnetic switching valve 13 is switched and controlled by the control device 16 (after an operator operates the switch to the unlocked position), for example, at a stage when a predetermined time of about 10 seconds elapses, the electromagnetic switching valve 13 is switched and controlled, and the pressure raising of the hydraulic pump 12 is stopped. That is, when an operator operates the switch to the unlocked position, the quick coupler cylinder 11 is retracted, and the attachment 7 is detached from the leading end of the arm 6, the electromagnetic switching valve 13 is automatically switched and controlled by the control device 16, and the oil pressure returns to a normal pressure at the time of work.

[0026] Thereby, as in the quick coupler circuit of the related art, when an operator turns the switch 15 to the unlocked position, the pressure does not rise so as to always contract the quick coupler cylinder 11. For that reason, the pressure raising time of the hydraulic pump 12 becomes minimum. For this reason, the unstable movement is also suppressed to the minimum when driving the respective working actuators 8, 9 and 10. Furthermore, the unnecessary pump pressure raising time is also reduced.

[0027] Next, when attaching a new attachment 7 to the leading end of the arm 6, firstly, the working machine 4 is driven so that the new attachment 7 is placed at a predetermined position of the leading end side of the arm 6 by the lever operation of the operator. At this time, since the respective working actuators 8, 9 and 10 are not unstably moved, it is possible to very suitably place the leading end side of the arm 6 at a predetermined position.

[0028] Moreover, an operator operates the switch to the locked position in a state where the leading end side of the arm 6 is placed at a predetermined position. Then, the operation signal is input to the control device 16, and the switching signals are output to the electromagnetic switching valve 13 and the coupler switching valve 14 from the control device 16 based on the operation signal, respectively. The pressure of the hydraulic pump 12 rises by the switching signals that are output from the control device 16. Furthermore, the coupler switching valve 14 is switched by the switching signals that are output from the control device 16, and the hydraulic oil is supplied and discharged so that the quick coupler cylinder 11 is extended. Moreover, a connection pin and a wedge of the new attachment 7 is caught by the extension of the quick coupler cylinder 11, and the new attachment 7 is connected to the leading end of the arm 6 and is held

(installed).

[0029] Furthermore, even when the attachment 7 is installed, after the electromagnetic switching valve 13 is switched and controlled (after an operator operates the switch to the locked position) by the control device 16, for example, at a stage when a predetermined time of about 10 seconds elapse, the electromagnetic switching valve 13 is switched and controlled, and pressure raising of the hydraulic pump 12 is stopped. That is, when an operator operates the switch to the locked position, the quick coupler cylinder 11 is extended, and the attachment 7 is installed to the leading end of the arm 6, the electromagnetic switching valve 13 is automatically switched and controlled by the control device 16, and the oil pressure returns to the normal pressure at the time of work.

[0030] For that reason, when the switch 15 is turned to the locked position, the pressure of the hydraulic pump 12 does not rise so as to always extend the quick coupler cylinder 11. For that reason, pressure raising of the hydraulic pump 12 is performed in a minimum pressure raising time. Thus, even at the time of installing the attachment 7, the unstable movement of the respective working actuators 8, 9 and 10 is suppressed to the minimum when driving the respective working actuators 8, 9 and 10. Furthermore, the unnecessary pressure raising time is also reduced.

[0031] Furthermore, when installing the attachment 7, after the electromagnetic switching valve 13 is switched and controlled and the oil pressure returns to the normal pressure at the time of work, the working actuators 8, 9 and 10 may be driven by the control device 16, for a predetermined time, for example, 5 seconds. In this case, it is possible to check whether or not the installed attachment 7 is reliably (suitably) connected and installed.

[0032] Thus, in the quick coupler circuit A for construction equipment of the present embodiment, each quick coupler circuit A transmits the operation signal output from the switch 15 to the electromagnetic switching valve 13 via the control device 16. For that reason, it is possible to control the time when the electromagnetic switching valve 13 is switched so as to raise the pressure of the hydraulic pump 12. That is, after the control device 16 switches and controls the electromagnetic switching valve 13 so as to raise the pressure of the hydraulic pump 12, based on the operation signal that is output by operating the switch 15 to the locked position or the unlocked position, by switching and controlling the electromagnetic switching valve 13 so as to finish pressure raising of the hydraulic pump 12 at a stage when a predetermined time elapses, the pump pressure raising time and timing can be controlled.

[0033] For that reason, it is possible to perform the control so that the pressure of the hydraulic pump 12 rises only while the quick coupler cylinder 11 is moved, by operating the switch 15 that is operated with two positions of the locked position and the unlocked position. Thus, compared to the quick coupler circuit of the related art, pressure raising of the hydraulic pump 12 is per-

formed in a minimum pressure raising time in the quick coupler circuit A of the present invention. For that reason, it is possible to suppress the unstable movement of the respective working actuators 8, 9 and 10 (working machine 4) to minimum during pressure raising of the pump. Furthermore, since the unnecessary pump pressure raising time is reduced, the fuel efficiency is improved.

[0034] Although an embodiment of the quick coupler circuit for construction equipment related to the present invention has been described, the present invention is not limited to the above-mentioned embodiment but may be suitably changed within a scope that does not depart from the gist thereof. For example, in the present embodiment, although the case where the construction equipment 1 is the hydraulic shovel has been described, the construction equipment related to the present invention may be other construction equipments such as a shovel loader.

[0035] Furthermore, in the quick coupler circuit A of the present embodiment, the hydraulic pipes are each connected to the piston chamber 11a and the rod chamber 11b of the quick coupler cylinder 11 so that when the quick coupler cylinder 11 is extended, the attachment 7 is fixed, and when the quick coupler cylinder 11 is retracted, the attachment 7 is detached. On the contrary to the present embodiment, as illustrated in FIG. 2, the hydraulic pipes may be each connected to the piston chamber 11a and the rod chamber 11b of the quick coupler cylinder 11 so that when the quick coupler cylinder 11 is extended, the attachment 7 is detached, and when the quick coupler cylinder 11 is retracted, the attachment 7 is fixed.

[0036] Moreover, in the case of having the above-mentioned configuration, on the contrary to the present embodiment, when an operator operates the switch to the unlocked position, the switching signals are each output to the electromagnetic switching valve 13 and the coupler switching valve 14 from the control device 16. Moreover, the electromagnetic switching valve 13 is switched and the pressure of the hydraulic pump 12 rises. Furthermore, the coupler switching valve 14 is switched by the switching signal that is output from the control device 16, and the hydraulic oil is supplied and discharged so that the quick coupler cylinder 11 is extended. In this manner, the holding state of the attachment 7 installed to the leading end of the arm 6 is released by the extension of the quick coupler cylinder 11, and the attachment 7 is detached from the leading end of the arm 6.

[0037] Furthermore, after the electromagnetic switching valve 13 is switched and controlled (after an operator operates the switch to the unlocked position) by the control device 16, for example, at a stage when a predetermined time of about 10 seconds elapses, the electromagnetic switching valve 13 is switched and controlled, and pressure raising of the hydraulic pump 12 is stopped.

That is, when an operator operates the switch to the unlocked position, the quick coupler cylinder 11 is extended, and the attachment 7 is detached from the leading end of the arm 6, the electromagnetic switching valve 13 is

automatically switched and controlled by the control device 16, and the oil pressure returns to the normal pressure at the time of work.

[0038] For that reason, pressure raising of the hydraulic pump 12 is performed in a minimum pressure raising time. As a result, when driving the respective working actuators 8, 9 and 10, the unstable movement of the respective working actuators 8, 9 and 10 is suppressed to the minimum. Furthermore, the unnecessary pump pressure raising time is reduced.

[0039] Furthermore, even when a new attachment 7 is installed to the leading end of the arm 6, on the contrary to the present embodiment, an operator operates the switch to the locked position in a state where the leading end side of the arm 6 is placed at a predetermined position. Then, the switching signals are each output to the electromagnetic switching valve 13 and the coupler switching valve 14 from the control device 16, and thus the pressure of the hydraulic pump 12 rises. Furthermore, the coupler switching valve 14 is switched by the switching signal that is output from the control device 16, and the hydraulic oil is supplied and discharged so that the quick coupler cylinder 11 is retracted. In this manner, the connection pin or the wedge of the new attachment 7 is caught by the retraction of the quick coupler cylinder 11, and the new attachment 7 is connected to the leading end of the arm 6 and is held (installed).

[0040] Furthermore, even when installing the above-mentioned attachment 7, after the electromagnetic switching valve 13 is switched and controlled by the control device 16, for example, at a state when a predetermined time of about 10 seconds elapses, the electromagnetic switching valve 13 is switched and controlled, and pressure raising of the hydraulic pump 12 is stopped. That is, when an operator operates the switch to the locked position, the quick coupler cylinder 11 is retracted, and the attachment 7 is installed to the leading end of the arm 6, the electromagnetic switching valve 13 is automatically switched and controlled by the control device 16, and the oil pressure returns to the normal pressure at the time of work.

[0041] For that reason, when the switch 15 is turned to the locked position, the pressure of the hydraulic pump 12 does not rise so as to always contract the quick coupler cylinder 11. As a result, the hydraulic pump 12 is performed in a minimum pressure raising time. Thus, even at the time of installing the attachment 7, when driving the respective working actuators 8, 9 and 10, the unstable movement of the respective working actuators 8, 9 and 10 is suppressed to the minimum. Furthermore, the unnecessary pump pressure raising time is reduced.

Industrial Applicability

[0042] According to the present invention, there is provided a quick coupler circuit that is able to control the time when the electromagnetic switching valve is switched so as to raise the pressure of the hydraulic

pump.

Furthermore, according to the present invention, in the quick coupler circuit for construction equipment, the pressure raising time of the hydraulic pump can be reduced to the minimum level. For that reason, it is possible to suppress the unstable movement of each actuator to the minimum during pressure raising of the pump. Furthermore, since the unnecessary pump pressure raising time is reduced, the fuel efficiency is improved.

Reference Signs List

[0043]

- | | |
|----|--|
| 15 | 1 hydraulic shovel (construction equipment) |
| | 2 lower travelling body |
| | 3 upper pivoting body |
| | 4 working machine |
| | 5 boom |
| 20 | 6 arm |
| | 7 bucket (attachment) |
| | 8 boom cylinder (working actuator) |
| | 9 arm cylinder (working actuator) |
| | 10 bucket cylinder (working actuator) |
| 25 | 11 quick coupler cylinder |
| | 11a piston chamber |
| | 11b rod chamber |
| | 12 hydraulic pump |
| | 13 electromagnetic switching valve |
| 30 | 14 coupler switching valve |
| | 15 switch |
| | 16 control device |
| | A quick coupler circuit for construction equipment |
| | B quick coupler |
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Claims

1. A quick coupler circuit for construction equipments for attaching or detaching an attachment to or from a working machine, the quick coupler circuit comprising:

a quick coupler cylinder that is subject to extension and retraction driving and holds/detaches the attachment to or from the working machine;
 a hydraulic pump;
 an electromagnetic switching valve that switches forced pressure raising of the hydraulic pump;
 a coupler switching valve for performing extension and retraction driving of the quick coupler cylinder by switching a supplying direction of hydraulic oil to the quick coupler cylinder; and
 a control device that switches and controls the electromagnetic switching valve and the coupler switching valve, respectively,
 wherein a switch for switching and operating the electromagnetic switching valve and the coupler

switching valve is configured so as to be operated with two positions of a locked position where extending and retracting the quick coupler cylinder to hold the attachment, and an unlocked position where extending and retracting the quick coupler cylinder to detach the attachment, and
the control device switches and controls the coupler switching valve by receiving an operation signal that is output by operating the switch to the locked position or the unlocked position, and switches and controls the electromagnetic switching valve so that the pressure raising of the hydraulic pump begins by operation of the switch and the pressure raising of the hydraulic pump is stopped at a stage when a predetermined time elapses.

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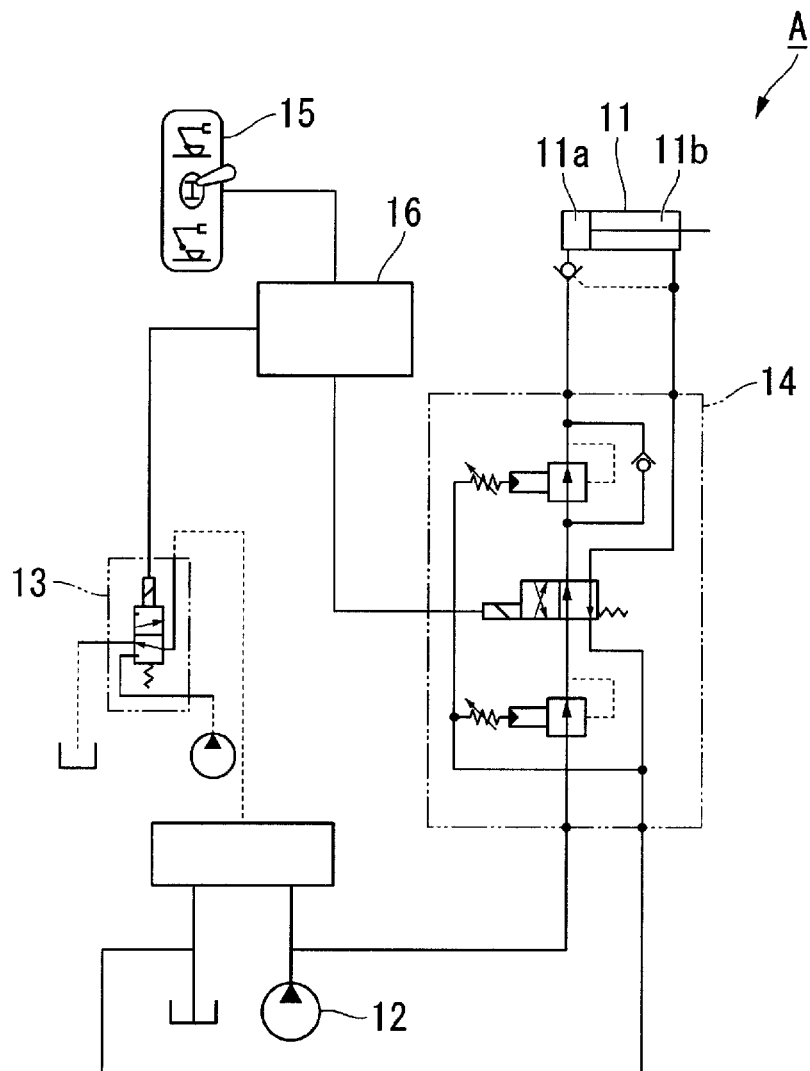
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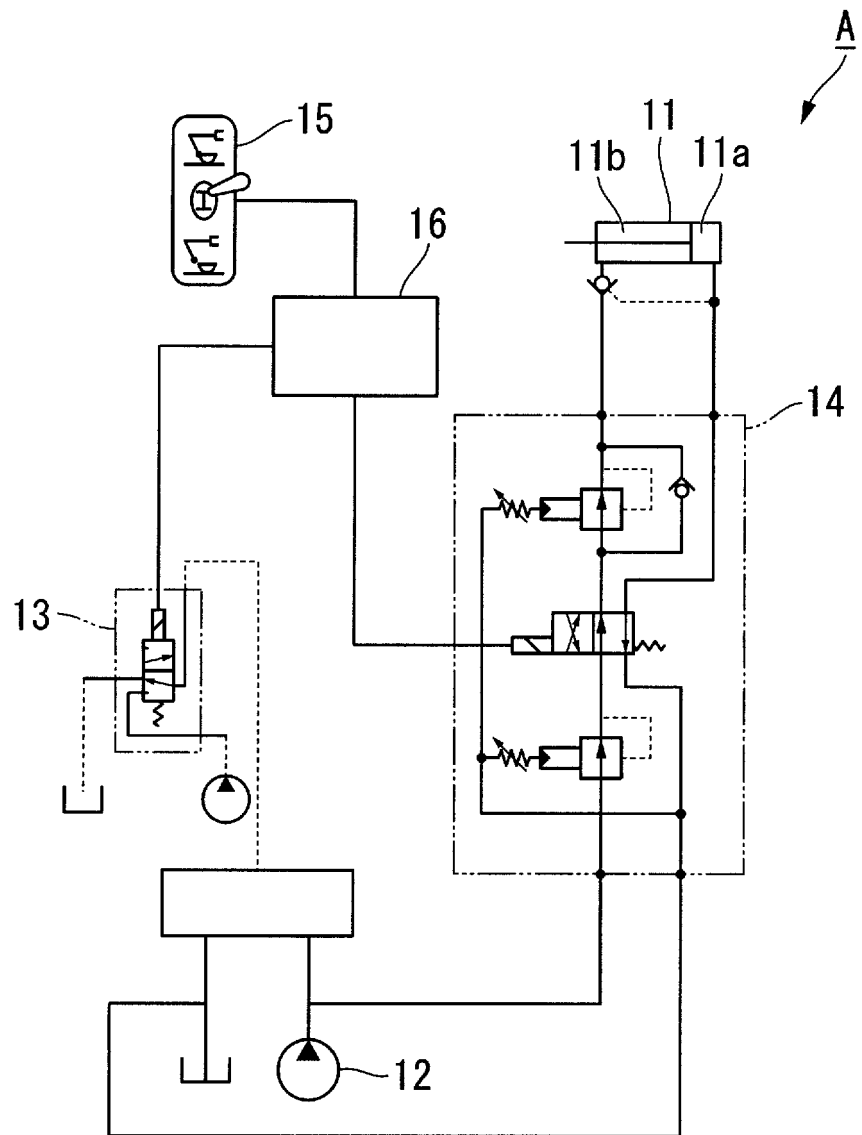
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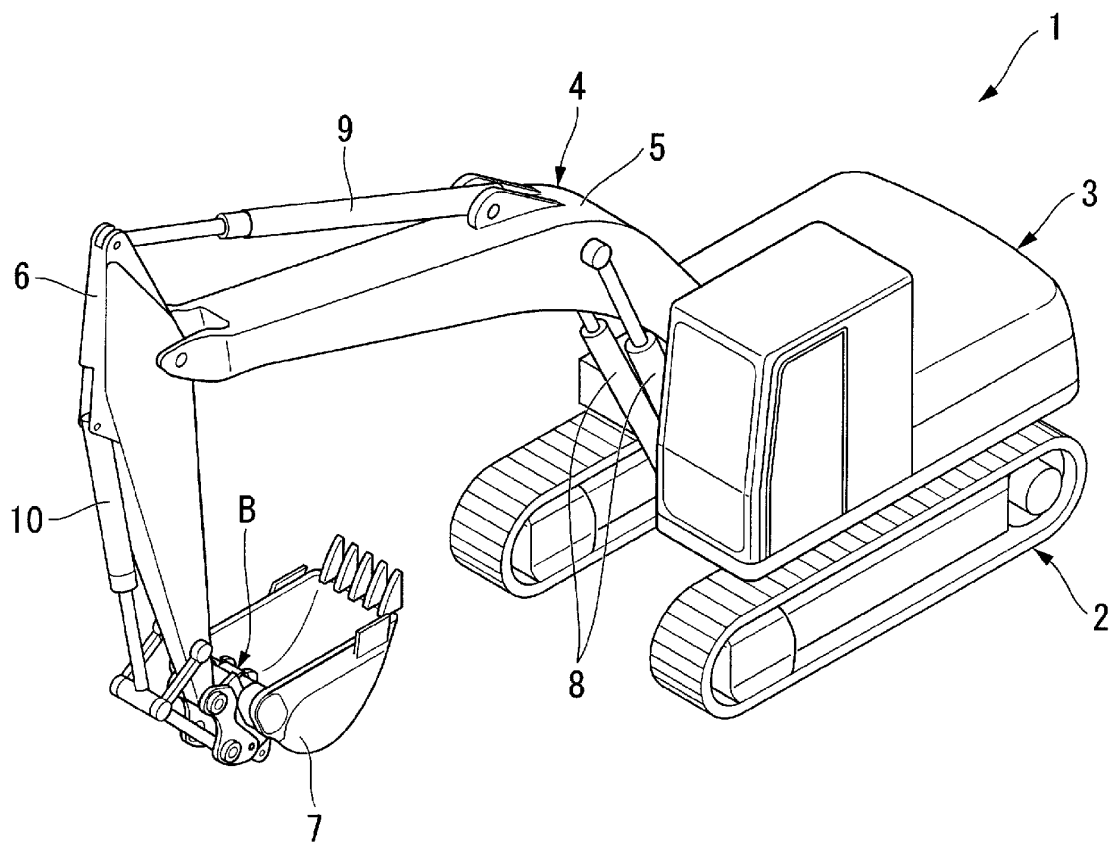
[Fig.1]



[Fig.2]



[Fig.3]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/064117

A. CLASSIFICATION OF SUBJECT MATTER

E02F3/40 (2006.01) i

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)

E02F3/40

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	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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 2003-138597 A (Shin Caterpillar Mitsubishi Ltd.), 14 May 2003 (14.05.2003), paragraphs [0022] to [0025]; fig. 5 (Family: none)	1
A	JP 11-324000 A (Caterpillar Inc.), 26 November 1999 (26.11.1999), paragraph [0024]; fig. 2 & US 6266960 B1 & GB 2335649 A	1
A	JP 11-181819 A (Komatsu Ltd.), 06 July 1999 (06.07.1999), paragraphs [0036] to [0039]; fig. 1 (Family: none)	1

☐ 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
20 September, 2011 (20.09.11)Date of mailing of the international search report
27 September, 2011 (27.09.11)Name and mailing address of the ISA/
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Facsimile No.

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Patent documents cited in the description

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- JP 2007327291 A [0005]