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(54) **DEVICE FOR OPERATING TRAVELING AND WORKING MACHINES OF HYDRAULIC EXCAVATOR.**

(57) An operating device for the traveling and working machines of the excavator, which is provided whith a separation-mode release switch (18) capable of temporarily changing over a separation mode providing a low working speed of an actuator to a standard mode allowing a high working speed when the working speed of the actuators (6, 7, 8, 9, 10, and 11) is desired to be increased during working performed in the low-working-speed separation mode in which the operability of the actuators (6, 7, 8, 9, 10, and 11) is an important factor.

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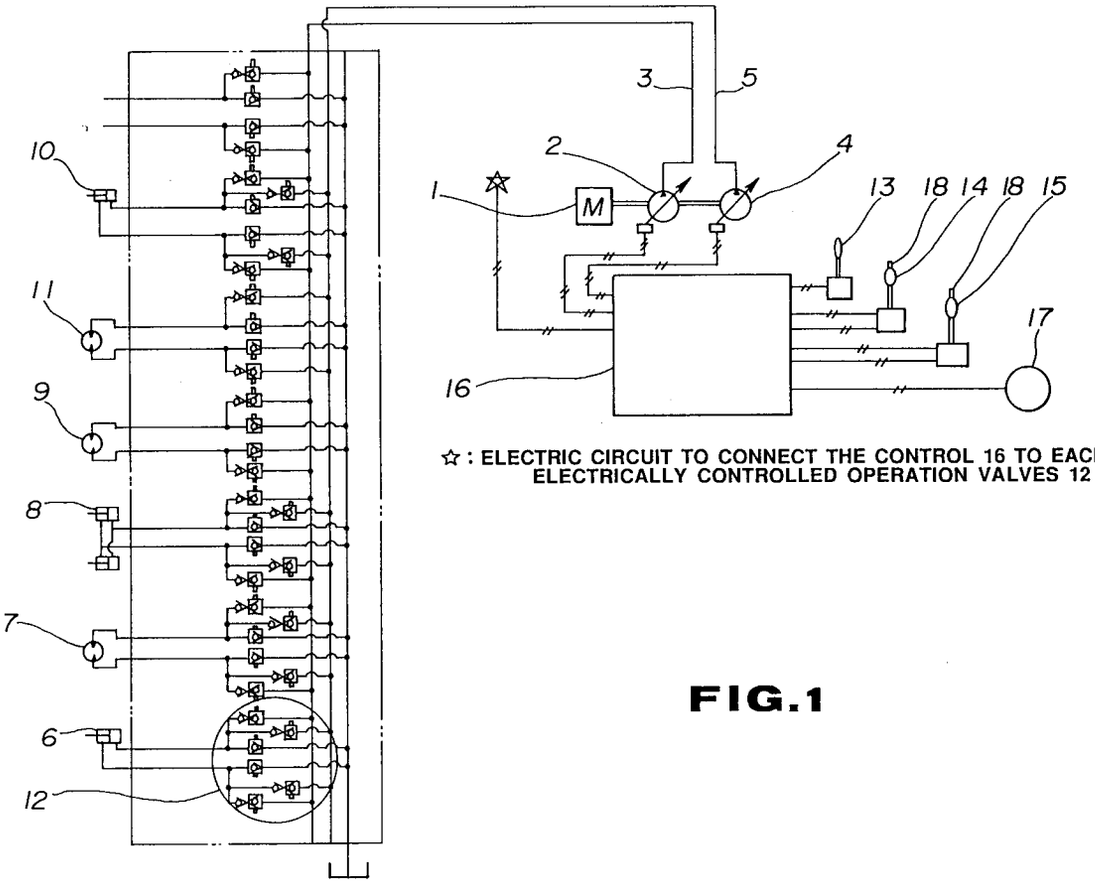
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FIG.1

TECHNICAL FIELD

This invention relates to a device for operating traveling and working machines of a hydraulic excavator, and more particularly it pertains to such an operating device arranged such that a plurality of electrical control actuating valves are switchingly controlled by means of an input signal provided by a controller so that hydraulic oil discharged from a plurality of hydraulic pumps are caused to selectively flow into a respective actuator of the hydraulic excavator, thereby improving the operating and working performance of the traveling and working machines of the hydraulic excavator.

BACKGROUND ART

With a conventional hydraulic excavator, it has been the common practice to provide a plurality of hydraulic pumps for distributing operating hydraulic oil when each of the traveling, working and swivelling machines thereof is to be driven by means of oil pressure.

Fig. 3 illustrates an example of an electric-hydraulic control circuit for supplying operating hydraulic oil to leftward/rightward drive hydraulic motors and actuators of the working and swivelling machines by using a two-hydraulic pump system which has widely been used with the above-mentioned conventional hydraulic excavator.

In this control circuit, respective actuators such as a bucket cylinder 6, a leftward-drive motor 7, a boom cylinder 8, a swivel motor 9, and an arm cylinder 10 are connected, via electrical control actuating valves (not shown), to a hydraulic circuit 3 coupled to a hydraulic pump 2 which is driven by an engine 1.

Further, the respective actuators such as the bucket cylinder 6, leftward-drive motor 7, boom cylinder 8, arm cylinder 10,and a rightward-drive motor 11 are also connected, via the electrical control valves (not shown), to a hydraulic circuit 5 coupled to a hydraulic pump 4 which is driven by the engine 1.

As a command to the electrical control actuating valves (not shown) which operate the above-mentioned respective actuators, an electric signal converted from changes in the quantity of actuation of a traveling/actuating lever 13, a bucket/boom actuating lever 14, and an arm/swivel actuating lever 15 each of which comprises an electric lever is first transmitted to a controller 16 and then transmitted to the electrical control actuating valves as an output signal from the controller 16.

In Fig. 3, a reference numeral 17 indicates a separation mode switch for switching the working mode of each actuator between a standard mode and a separation mode. By setting this separation mode switch 17 at the standard mode, the discharge hydraulic oil from the two hydraulic pumps 2 and 4 are caused to flow into each actuator either individually or in combination depending on the quantity of actuation of the above-mentioned actuating levers. In particular, the boom cylinder 8 and arm cylinder 10 are provided with the discharge oil from the two pumps. In this way, the working speed of the actuators is increased.

Further, by operating and setting the separation mode switch 17 at a traveling/working machine separation mode included in the separation mode, when only the traveling machine is operated, an independent circuit is formed with respect to the leftward-drive and rightward-drive motors so that the leftward-drive motor 7 is driven by means of the discharged oil pressure of the hydraulic pump 2 while the rightward-drive motor 11 is driven by means of the discharged oil pressure of the hydraulic pump 4. In the separation mode, when the traveling and working machines are operated at the same time, the leftward-drive and rightward-drive motors 7 and 11 are driven by means of the discharged oil pressure of the hydraulic pump 4, and the actuator (either one of 6, 8, 9, 10) of the working machine is driven by means of the discharged oil pressure of the hydraulic pump 2. In this way, in the separation mode, it is possible to prevent speed interference with respect to the actuators of the working machine by separating the hydraulic circuits 3 and 5.

With a device for operating traveling and working machines which includes a two-hydraulic pump system, when work is performed with the operating device set at the separation mode, the working speed of the actuator becomes lower than when the operating device is set at the standard mode; thus, advantageously, the operability of the working machine is improved, and speed interference with respect to the actuators of the working machine can be prevented.

In the separation mode, on the other hand, the quantity of discharge hydraulic oil used to operate each actuator is the one provided by only one of the hydraulic pumps so that the quantity of hydraulic oil is reduced by half. Thus in the case of working operation in which the quantity of hydraulic oil corresponding to the quantity discharged from the two hydraulic pumps is required as in the case where the traveling machine alone is moved during suspending operation with the operating device set at the traveling/working machine separation mode or as in the case where the arm is returned during plowing operation with the operating device set at the boom/arm separation mode, there occurs such a disadvantage that the working speed is slow so that the working efficiency is not enhanced.

In view of the above-mentioned state of the art,

an object of the present invention is to provide a device for operating traveling and working machines of a hydraulic excavator, which is arranged such that the operating device is set at a separation mode providing a low working speed, with respect to working contents in which the operability is an important factor, while when it becomes necessary to increase the working speed during the working operation, the operating device is temporarily released from the separation mode so that there is established a hydraulic circuit for permitting the quantity of hydraulic oil corresponding to the quantity discharged from two hydraulic pumps to flow into a traveling motor or a working machine actuator.

DISCLOSURE OF THE INVENTION

According to the present invention, there is provided a device for operating traveling and working machines of a hydraulic excavator, comprising a plurality of hydraulic pumps driven by an engine; hydraulic circuits for connecting respective discharge pipes of the plurality of hydraulic pumps to respective actuators of the hydraulic excavator through a plurality of electrical control actuating valves; and a controller for controlling the electrical control actuating valves so that, when the operating device is set at a standard mode, the actuators of the hydraulic excavator are simultaneously operated by means of the discharged oil pressure of the respective hydraulic pumps and, when the operating device is set at a separation mode, a predetermined one of the actuators of the hydraulic excavator is driven by means of the plurality of hydraulic pumps, wherein the operation device is provided with a separation mode release switch for temporarily releasing the separation mode and switching over to the standard mode when the switch is operated with the operating device being set at the separation mode, and for switching over from the standard mode back to the original separation mode when the switch operation is released.

With the device for operating traveling and working machines of a hydraulic excavator, which is provided with such a separation mode release switch, while carrying out a slow-working speed working performance in which operability is an important factor with the operating device being set at the separation mode, if a high-speed working performance is required suddenly for a single operation, the operating device is switched from the separation mode to the standard-mode plural-pump system simply by operating the separation mode release switch, whereby the working speed of the respective actuators can be increased by an amount corresponding to the number of the pumps and the working efficiency can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an operation control circuit diagram of a device for operating traveling and working machines of a hydraulic excavator according to the present invention.

Fig. 2 is an enlarged view of the main portion of Fig. 1, illustrating in particular an operation control circuit diagram of an arm cylinder portion.

Fig. 3 is an operation control circuit diagram of a conventional device for operating traveling and working machines of a hydraulic excavator.

BEST MODE FOR CARRYING OUT THE INVENTION

Detailed description will now be made of a device for operating traveling and working machines of a hydraulic excavator according to an embodiment of the present invention.

Fig. 1 illustrates an operation control circuit for the device for operating traveling and working machines of a hydraulic excavator according to the present invention, wherein parts corresponding to those of Fig. 3 are indicated by like references.

Fig. 2 is an enlarged view of the main portion of Fig. 1 which illustrates in particular the operation control circuit associated with the arm cylinder portion.

As shown in Fig. 1, a bucket cylinder 6, a leftward-drive motor 7, a boom cylinder 8, a swivel motor 9, an arm cylinder 10 are coupled, via electrical control actuation valves 12, to a hydraulic circuit 3 leading to a variable-capacity hydraulic pump 2 which is driven by an engine 1. Further, the bucket cylinder 6, the leftward-drive motor 7, the boom cylinder 8, a rightward-drive motor 11, and the arm cylinder 10 are coupled, via the electrical control actuation valves 12, to a hydraulic circuit 5 leading to a variable-capacity hydraulic pump 4 which is driven by the engine 1.

Respective changes of quantities in the actuation of a travel actuating lever 13, a bucket/boom actuating lever 14 and an arm swivel actuating lever 15 each of which comprises an electric lever, are converted to an electric signal which in turn is passed to a controller 16, and a signal outputted from the controller 16 is transmitted to the electrical control actuation valves 12 which permit each of the above-mentioned actuators to be operated.

Fig. 2 illustrates the relationship between the electrical control actuating valve and the electric/hydraulic circuit related to the arm cylinder 10. The operation of the operating device for traveling and working machines according to the present invention will now be described in detail with reference to Fig. 2.

If the arm swivel actuating lever 15 is actuated so as to cause the arm to damp while a separation-mode switch 17 is set at a standard mode, then the quantity of a change in the actuation of the actuating lever 15 is converted to an electric signal which in turn is passed to the controller 16 from which an input signal is provided to pilot valves 19 and 20. Thus, meter-in and meter-out side pilot check valves 23, 24, and 25 are opened so that discharge oil supplied from the variable-capacity hydraulic pumps 2 and 4 is permitted to flow into a head-side chamber 10a of the arm cylinder 10, thus causing the arm to be moved in the damping direction.

On the other hand, if the actuating lever 15 is actuated to permit the arm to excavate, then pilot valves 21 and 22 are provided with an input signal from the controller 16 so that meter-in and meter-out side pilot check valves 26, 27, and 28 are opened so that discharge oil supplied from the pumps 2 and 4 is permitted to flow into a bottom-side chamber 10b of the arm cylinder 10, thus causing the arm to be moved in the excavating direction.

If the actuating lever 15 is actuated, as in the above-mentioned case, so as to cause the arm to damp while the separation-mode switch 17 is set at a boom/arm separation mode in the separation mode, for example, then an electric signal resulting from the actuation of the lever is passed to the controller 16; in this case, however, since the separation-mode switch 17 is set at the separation mode, an input signal from the controller 16 is inputted only to the pilot valve 20 alone so that the meter-in and meter-out side pilot check valves 25 and 24 are opened. Thus, only the discharge oil supplied from the variable-capacity type pump 4 is permitted to flow into the head-side chamber 10a of the arm cylinder 10.

More specifically, in the case where the separation mode switch 17 is set at the boom/arm separation mode as mentioned above, then only the discharge oil supplied from the variable-capacity hydraulic pump 2 is permitted to flow into the boom cylinder 8 shown in Fig. 1, while only the discharge oil supplied from the variable-capacity type hydraulic pump 4 is permitted to flow into the arm cylinder 10. In this way, the hydraulic circuits 3 and 5 of the two pumps are isolated from each other so that speed interference between the actuators is prevented.

The separation mode as set up includes, besides the above-mentioned boom/arm separation mode, a separation mode for the traveling and working machines (the pump 2 is for the working machine, and the pump 4 is for the leftward-drive and rightward-drive motors), a separation mode for the and working machines (the pump 2 is for the swivel motor, and the pump 4 is for the leftward-drive and rightward-drive motors).

Such separation modes are set up for the purposes of improving the operability during a complex operation, while at the same time preventing speed interference between the actuators. During single operation in which the operability is not important factor, however, it may sometimes be more desirable that the working speed be increased. When the bucket is moved while being suspended during suspending operation (separation mode for the traveling and working machines), for example, or when only the arm is returned without moving the boom during plowing operation (boom/arm separation mode), the working efficiency becomes higher as the working speed is increased. When a high working speed is desired with the separation mode set up, a separation mode release switch 18 provided on the actuating lever 15 is depressed, and thereupon the electric signal from the separation mode switch 17 is canceled in the controller 16 so that the input signal provided from the controller 16 to the electrical control actuating valves 12 becomes the same as that provided during the normal mode. Thus, the discharge oil from the pump 2 and that from the pump 4 are merged and permitted to flow into the actuators, thereby increasing the working speed of the actuators.

As described above, the device for operating traveling and working machines of a hydraulic excavator according to the present invention is set at the standard mode during a single operation of the actuators, and is set at the separation mode in accordance with the working contents during a complex operation of the actuators in which operability is an important factor and a speed interference is to be avoided; in case it is required that the working speed be increased during the single operation while working operation is being performed in the separation mode, the operating device can be returned to the standard mode simply by depressing the separation mode release switch so that the working speed is increased; and when the device is to be returned to the separation mode in which the operability is an important factor during the complex operation, it is simply required that the depression of the separation mode release switch be interrupted. In this way, it is possible to greatly enhance the working efficiency of the traveling and working machines of a hydraulic excavator.

The present invention is by no means limited to the embodiments illustrated and described above, but encompasses various changes and modifications which will become possible within the scope of the appended claims.

INDUSTRIAL APPLICABILITY

As described above, the device for operating traveling and working machines of a hydraulic excavator according to the present invention is suitable for a hydraulic excavator of the type that is required to temporarily increase the working speed while working contents in which the operability is an important factor is being performed during a complex operation.

Claims

1. A device for operating traveling and working machines of a hydraulic excavator, comprising:

a plurality of hydraulic pumps driven by an engine;

hydraulic circuits for connecting respective discharge pipes of said plurality of hydraulic pumps to respective actuators of the hydraulic excavator through a plurality of electrical control actuating valves; and

a controller for controlling said electrical control actuating valves so that, when said operating device is set at a standard mode, simultaneous actuation of the respective actuators of said hydraulic excavator is effected with discharge oil pressure from each of said hydraulic pumps and, when said operation device is set at a separation mode, only predetermined one of said actuators of said hydraulic excavator is driven by said plurality of hydraulic pumps, characterized by:

a separation mode release switch, when switch actuation is effected while said operating device is set at said separation mode, for temporarily releasing and changing over the separation mode to the standard mode and, when said switch actuation is released, for switching over said operating device from said standard mode back to said separation mode.

2. A device for operating traveling and working machines of a hydraulic excavator according to Claim 1, characterized in that said separation mode includes a boom/arm separation mode, a separation mode for the traveling and working machines, and a separation mode for swivelling and working machines.

3. A device for operating traveling and working machines of a hydraulic excavator according to Claim 1, characterized in that said separation mode release switch is provided on a bucket-boom actuating lever for actuating a bucket and a boom of said hydraulic excavator and on an arm/swivel actuation lever for actuating an arm and a swivel actuation.

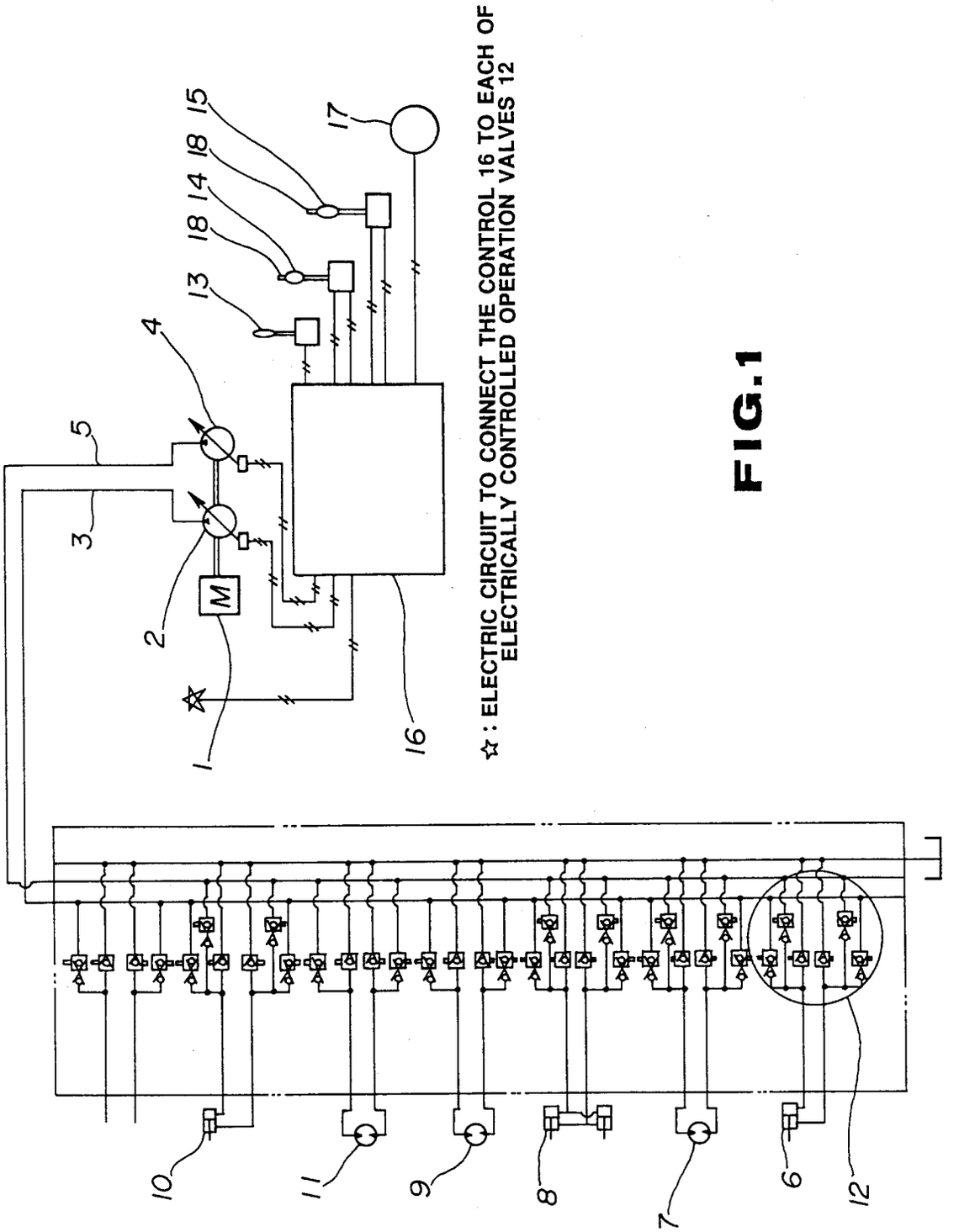
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FIG.1

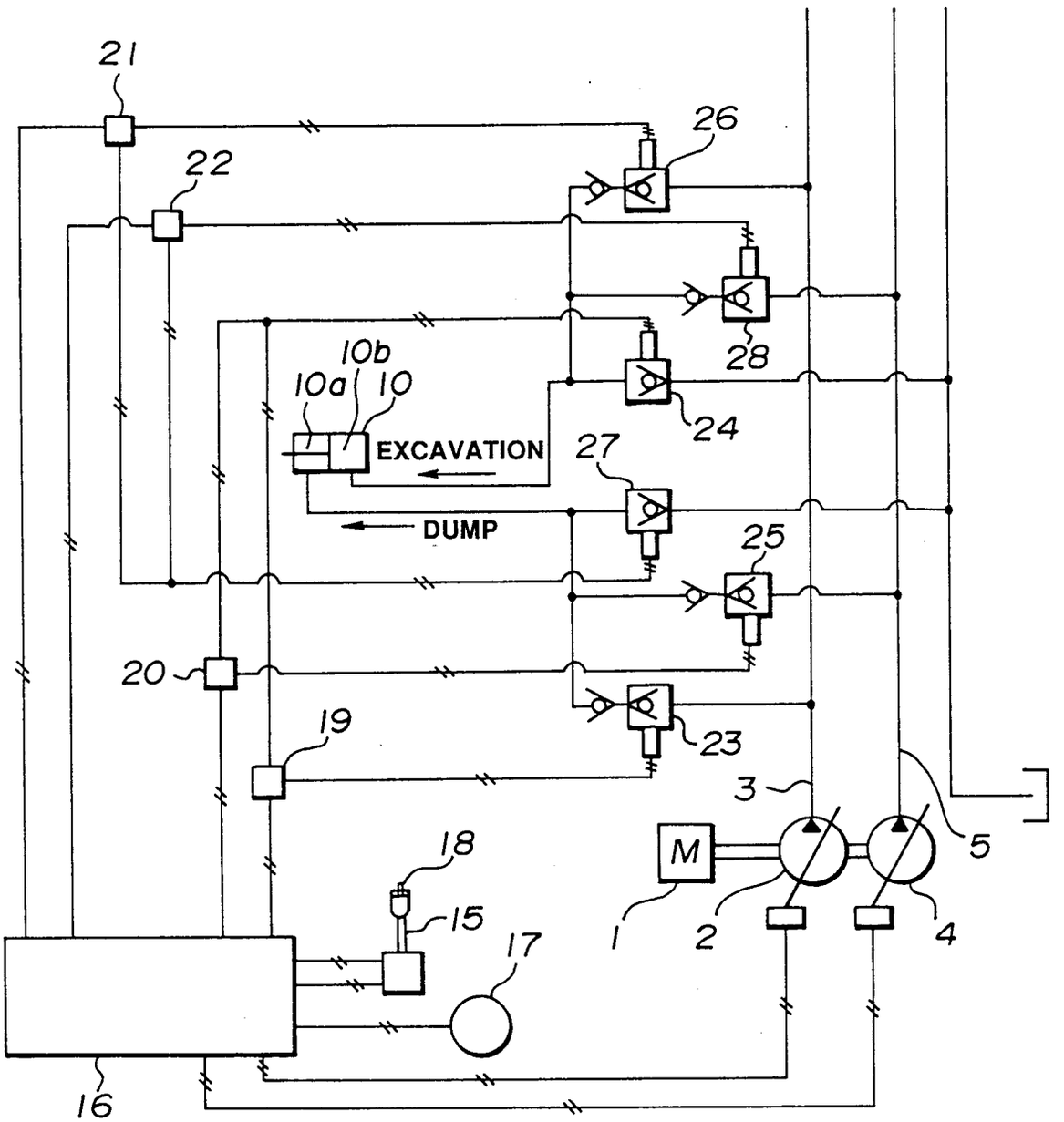
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FIG. 2

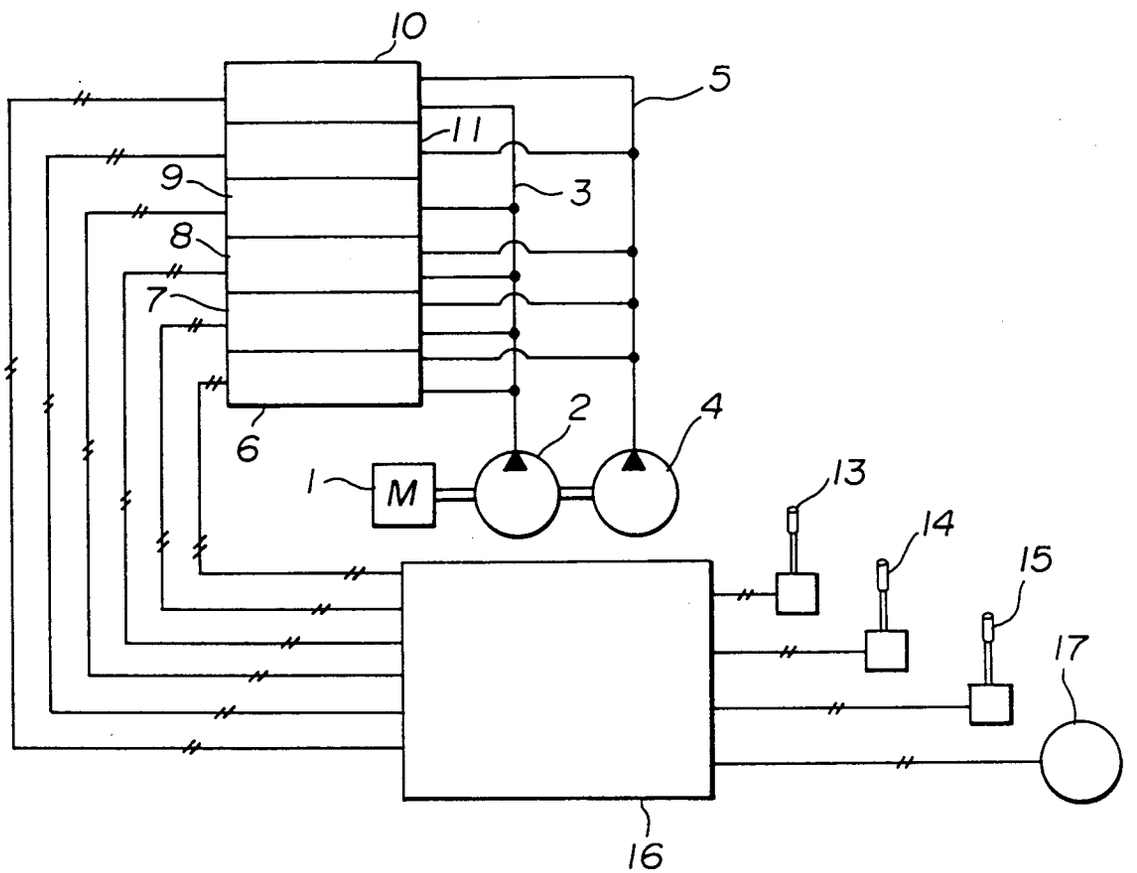

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00852

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] E02F3/43, 9/20, 9/22

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	E02F3/43, 9/20, 9/22

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1972 - 1990
Kokai Jitsuyo Shinan Koho	1972 - 1990

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 1-158123 (Komatsu Ltd.), 21 June 1989 (21. 06. 89), (Family: none)	1 - 3
A	JP, A, 61-142234 (Sumitomo Heavy Industries, Ltd.), 30 June 1986 (30. 06. 86), (Family: none)	1 - 3
A	JP, A, 62-58033 (Hitachi Construction Machinery Co., Ltd.), 13 March 1987 (13. 03. 87) & EP, A1, 214633 & CN, A, 86106816 & US, A, 4697418	1 - 3
A	JP, A, 64-90325 (Hitachi Construction Machinery Co., Ltd.), 6 April 1989 (06. 04. 89), (Family: none)	1 - 3
A	JP, U, 57-85060 (Komatsu Ltd.), 26 May 1982 (26. 05. 82), (Family: none)	1 - 3

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
September 12, 1990 (12. 09. 90)	September 25, 1990 (25. 09. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	