

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 480 036 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art.
158(3) EPC

(21) Application number: **90909837.8**

(51) Int. Cl.⁵: **E02F 3/43**

(22) Date of filing: **29.06.90**

(86) International application number:
PCT/JP90/00853

(87) International publication number:
WO 91/00397 (10.01.91 91/02)

(30) Priority: **30.06.89 JP 170414/89**

(43) Date of publication of application:
15.04.92 Bulletin 92/16

(84) Designated Contracting States:
DE FR GB

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(54) **DEVICE FOR DISPLAYING OPERATION PATTERN OF HYDRAULIC EXCAVATOR.**

(57) A device (12) for displaying the operation pattern of a hydraulic excavator, which displays, upon reception of pattern changeover signals from a pattern changeover device (3), a specific operation pattern display board identified and selected on changeover

of the operation patterns from a plurality of operation pattern display boards (13a, 13b, 13c, and 13d) containing predetermined graphic operation patterns of working machines.

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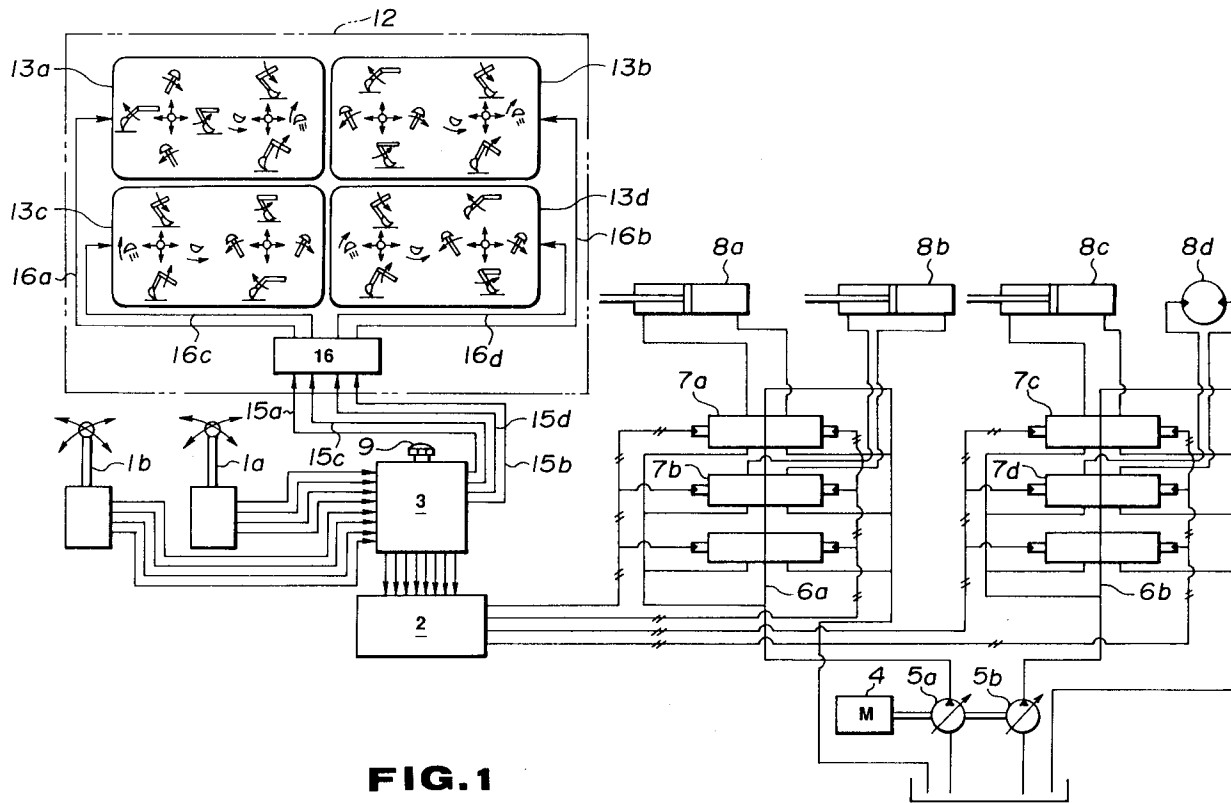


FIG. 1

TECHNICAL FILED

The present invention relates generally to an apparatus for actuating a working unit of a hydraulic excavator. More particularly, the present invention relates to an apparatus for displaying an actuation pattern for actuating a working unit of the hydraulic excavator by handling actuation levers.

BACKGROUND ART

Fig. 5 is a schematic side view of a conventional hydraulic excavator.

Referring to Fig. 5, the hydraulic excavator includes a boom d, an arm e and a bucket f in front of an upper turnable section b mounted on a lower movable section a to constitute a working unit c. The boom d, the arm e and the bucket f are operatively connected to each other via joints such that they are turnably displaced not only in the forward/rearward direction but also in the upward/downward direction. The hydraulic excavator performs various kinds of operations such as an excavating operation for excavating soil and gravel, a loading operation for loading excavated soil and gravel or the like by actuating the boom d, the arm e and the bucket f with the aid of hydraulic actuators d1, e1 and f1 while turning the upper turnable section b with the aid of a hydraulic actuator b1. It should be noted that the aforementioned operations are performed by handling two levers h1 and h2 standing upright at the positions located leftward and rightward of an operator's seat arranged in an operator's cabin g.

Specifically, the direction of actuation of the respective actuators is determined depending on the direction of tilting of the actuation levers h1 and h2. As shown in Fig. 6, e. g., the following eight operations are performed by tilting the two actuating levers h1 and h2 with operator's hands, one of them being turnable displacement of the boom d in the upward direction, other one being turnable displacement of the same in the downward direction, another ones being excavating and dumping operations to be performed by actuating the arm e, another ones being excavating and dumping operations to be performed by actuating the bucket f and another ones being turning movement of the upper movable section b to be achieved in the leftward/rightward direction by actuating the actuator b1.

However, an actuation pattern of the working unit as mentioned above differs from manufacturer to manufacturer of an hydraulic excavator, and a controller for the hydraulic excavator is constructed such that the actuation pattern employable for the working unit can freely be shifted to another one in conformity with an operator's request.

It should be noted that means for shifting the actuation pattern of the working unit to another one is constructed in the form of a selector valve unit proposed by a common applicant to the present invention under Japanese Utility Model Application NO. 57-172258 such that one of a plurality of preset actuation patterns can be selected in conformity with a desired actuation pattern at an operator's discretion or the foregoing means is constructed in the form of an electric type actuation pattern shifting unit or the like proposed by the same applicant as mentioned above under Japanese Utility Model Application NO. 63-166511 such that the present actuation pattern can selectively be proposed to a desired one at an operator's discretion.

In a case where the present actuation pattern is shifted to another one by actuating the actuating pattern shifting means, there is a possibility that an erroneous actuating operation is performed by an operator unless he is well aware of the actuation pattern which has been shifted. For this reason, to prevent the erroneous actuating operation from being performed, a card type display plate having the shifted actuation pattern diagrammized at every time when the present actuation pattern is shifted to another one has been hitherto exchangeably placed in the vicinity of the actuation levers.

However, an operation for exchangeably placing an actuation pattern card in that way at every time when the present actuation pattern is changed to another one is troublesome, and moreover, there arise inconveniences that an incorrect actuation pattern card is unintentionally placed, an operator forgets to perform an exchangeable placing operation or the exchanged actuation pattern card is lost for an unidentified reason.

The present invention has been made with the foregoing background in mind and its object resides in providing an apparatus for displaying an actuation pattern for a hydraulic excavator wherein the apparatus assures that a shifted actuation pattern is automatically displayed without fail at every time when the present actuation pattern is shifted to another one.

DISCLOSURE OF THE INVENTION

According to the present invention, there is provided an apparatus for displaying an actuation pattern for a hydraulic excavator, wherein the apparatus is characterized in that a plurality of actuation pattern displaying boards each having a predetermined actuation pattern previously diagrammized thereon are arranged for a working unit of the hydraulic excavator and that specific actuation pattern display boards selected from the plurality of actuation pattern displaying boards

when the actuation pattern is shifted to another one are discriminatively illuminated in response to a pattern shifting signal outputted from an actuation pattern shifting unit adapted to shift the actuation pattern to another one. A plurality of liquid crystal displaying boards are preferably employed to serve as actuation pattern displaying means for the actuation pattern displaying boards. Alternatively, a plurality of lamps may be employed for the same purpose. In practice, when the present actuation pattern is shifted to another one, specific actuation pattern displaying boards selected from the plurality of actuation pattern displaying boards at that time are discriminatively illuminated in response to a signal outputted from the actuation pattern shifting unit via electric circuits.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an electric-hydraulic circuit diagram which schematically illustrates the structure of an apparatus for displaying an actuation pattern for a hydraulic excavator in accordance with an embodiment of the present invention.

Fig. 2 is a circuit diagram which illustrates circuits for shifting the actuation pattern of the apparatus of the present invention to another one.

Fig. 3 is an electrical circuit diagram which illustrates by way of example an output signal to be outputted to the apparatus of the present invention when the actuation pattern is shifted to another one.

Fig. 4 is an electric circuit diagram for an apparatus for displaying an actuation pattern for a hydraulic excavator in accordance with another embodiment of the present invention.

Fig. 5 is a schematic side view of a hydraulic excavator.

Fig. 6 is an illustrative view which schematically shows by way of example an actuation pattern for actuating an actuating unit of the hydraulic excavator by handling actuating levers.

BEST MODE FOR CARRYING OUT THE INVENTION

Now, the present invention will be described in detail hereinafter with reference to the accompanying drawings which illustrate preferred embodiments of the present invention.

Fig. 1 is an electric-hydraulic circuit diagram which schematically illustrates the structure of an apparatus of displaying an actuation pattern for a hydraulic excavator in accordance with an embodiment of the present invention wherein the apparatus is equipped with an electric type actuation pattern shifting unit.

It should be noted that the electric actuation

pattern shifting unit is described in detail in the specification of Japanese Utility Model Application NO. 63-166511 filed by a common applicant to the present invention. To facilitate understanding of the present invention, an out line of the electric type actuation pattern shifting unit constituting a part of the apparatus will be described below in conjunction with description of the apparatus of the present invention.

In Fig. 1, reference numerals 1a and 1b designate actuating levers each of which is constructed in the form of an electric lever. When the actuating levers 1a and 1b are tilted from the shown neutral positions only in the forward/rearward direction but also in the leftward/rightward direction, their displacement is converted into electric signals. Then, the displacement of the actuating levers 1a and 1b which has been converted into electric signals is first inputted into an actuating pattern shifting unit 3 in which the electric signals are converted into a desired actuation pattern, and thereafter, the converted actuation pattern is inputted into a controller 2 for a working unit of the hydraulic excavator. Respective actuators for driving the working unit are controlled in response to command signals outputted from the controller 2 based on the actuation of the actuating levers 1a and 1b.

Next, a hydraulic control circuit for the actuators will be described below. Actuating valves each constructed in the form of a solenoid valve for controlling the hydraulic actuators for the working unit are disposed in main hydraulic pipings 6a and 6b by way of which pressurized hydraulic oil pumped from two variable hydraulic pumps 5a and 5b driven by an engine 4 is delivered to the respective hydraulic actuators. In the drawing, reference numeral 7a designates an actuating valve for a boom cylinder 8, reference numeral 7b designates an actuating valve for an arm cylinder 8b, reference numeral 7c designates an actuating valve for a bucket cylinder 8c and reference numeral 7d designates an actuating valve for a motor 8d for generating turning movement.

The respective actuating valves 7a to 7d each constructed in the form of a solenoid type pilot valve are controlled to shift from ON to OFF and vice versa in response to command signals outputted from the controller 2.

Next, the actuation pattern shifting unit 3 will be described in detail below with reference to Fig. 2.

The actuation pattern shifting unit 3 is provided with eight levers 11 of which bottom ends are secured to a pattern actuation shaft 10 that is a shaft fixed to a shift knob 9. When the shift knob 9 is turned with an operator's hand after the present actuation pattern is shifted to another one, signal

circuits extending to the controller 2 are simultaneously shifted to another ones. With respect to the actuation pattern shown in Fig. 2, when, e.g., the right-hand actuating lever 1a is tilted in the forward direction, an electric signal corresponding to the displacement of the actuating lever 1a is transmitted to a terminal A0 of the actuation pattern shifting unit 3 so that it is inputted into a terminal A of the controller 2 via the terminals A1 and A of the actuation pattern shifting unit 3. Then, a command signal corresponding to a quantity of the displacement of the actuating lever 1a is outputted from a terminal A0 of the controller 2 to one of solenoids in the actuating valve 7d for the motor 8d, whereby the hydraulic excavator turns in the rightward direction. On the contrary, when the right-hand actuating lever 1a is tilted in the rearward direction, an electric signal corresponding to the displacement of the actuation lever 1a is transmitted to a terminal B0 of the actuation pattern shifting unit 3 so that it is inputted into a terminal B of the controller 2 via the terminals B1 and B of the actuation pattern shifting unit 3. Then, a command signal corresponding to a quantity of the displacement of the actuating lever 1a is outputted from a terminal B0 of the controller 2 to other one of the solenoids in the actuating valve 7d for the motor 8d, whereby the hydraulic excavator turns in the leftward direction.

Other hydraulic actuators 8a, 8b and 8c are actuated corresponding to the direction of tilting of the actuating levers 1a and 1b as well as a quantity of displacement of the same in the substantially same manner as mentioned above with respect to the hydraulic actuator 8d.

Subsequently, when the shift knob 9 of the actuation pattern shifting unit 3 is rotated with an operator's hand to turn the lever 11 so as to allow the terminals A, B --- H to be electrically connected to terminals A2, B2 --- H2, the present actuation pattern is shifted to a second actuation pattern. Similarly, the second actuation pattern is shifted to a third actuation pattern and the third actuation pattern is then shifted to a fourth actuation pattern by turning the shift knob 9 so as to allow electric connection positions to be shifted to another ones in the same manner as mentioned above. Thus, the respective actuators are controlled via the controller 2 in accordance with each of the shifted actuation patterns.

Next, the apparatus 12 for displaying an actuation pattern for a hydraulic actuator which is selected by a shifting operation performed by the actuation pattern shifting unit 3 will be described in detail below.

According to the embodiment of the present invention as shown in Fig. 1, the apparatus 12 includes four actuation pattern display boards 13a, 13b, 13c and 13d which are composed of liquid

crystal display units having four kinds of actuation patterns, i.e., first to fourth actuation patterns previously diagrammized thereon.

On the other hand, as shown in Fig. 3, the pattern shifting shaft 10 of the actuation pattern shifting unit 3 to be turned by the shift knob 9 shown in Fig. 2 is equipped with four switches 14a to 14d corresponding to the actuation pattern display boards 13a to 13d, and the switches 14a to 14d are electrically connected to a central processing unit 16 via electric circuits 15a to 15d.

When the pattern shifting shaft 10 of the actuation pattern shifting unit 3 shown in Fig. 2 are turned to select a desired actuation pattern, electric connection is achieved with selected ones of the pattern switches 14a to 14d shown in Fig. 3 corresponding to the desired actuation pattern, causing the resultant electric signal to be inputted into the central processing unit 16 shown in Fig. 1 via the electric circuits 15a to 15d. Then, the central processing unit 16 is activated to display the selected actuation patterns on selected ones of the actuation pattern display boards 13a to 13d wherein electrical connection is achieved with the selected actuation pattern display boards via electric circuits 16a to 16d.

Thus, with the apparatus 12 constructed in the above-described manner, the selected actuation patterns are automatically displayed on the corresponding display boards in operative association with the shifting of the actuation patterns as mentioned above.

Fig. 4 is an electric circuit diagram which schematically illustrates the structure of an apparatus for displaying an actuation pattern for a hydraulic excavator in accordance with another embodiment of the present invention. Referring to the drawing, the apparatus includes actuation pattern display boards 18a, 18b, 18c and 18d having first to four actuation patterns diagrammized thereon, and lamps 19a, 19b, 19c and 19d are arranged in front of the respective actuation pattern display boards 18a, 18b, 18c and 18d. The lamps 19a, 19b, 19c and 19d are electrically connected to switches on the pattern shifting shaft 10 via electric circuits 20a to 20d to which the shift knob 9 of the actuation pattern shifting unit 3 shown in Fig. 2 is fixed in the same manner as mentioned above with respect to the preceding embodiment of the present invention. Thus, when the present actuation pattern is shifted to a desired one by turning the shift knob 9, specific lamps corresponding to the selected actuation patterns are turned on, whereby the actuation pattern display boards having the selected actuation patterns formed thereon are illuminated.

The present invention has been described above with respect to the apparatus designated by reference numerals 12 and 17 wherein an electric

type actuation pattern shifting unit is practically employed for the actuation pattern shifting unit 3. It should of course be understood that the present invention should not be limited only to the electric type actuation pattern shifting unit but other type of actuation pattern shifting unit such as a selector valve type actuation pattern shifting unit may be employed for the apparatus of the present invention. In addition, means for outputting output signals from a plurality of actuation pattern display boards in operative association with the actuation pattern shifting unit to discriminatively indicate specific actuation pattern display boards may be determined variously. At any rate, the present invention should not be limited only to the preferred embodiments as mentioned above.

As is apparent from the above description, with the apparatus of the present invention, since the actuation pattern selected by the apparatus in operative association with the actuation pattern shifting unit is reliably displayed, there does not arise a malfunction that the selected actuation pattern does not coincide with an actually displayed one. This leads to the result that the hydraulic excavator can adequately be driven by an operator. Especially, in a case where the operator is shifted to another operator or in a case where the present actuation pattern is unpreparedly shifted to another one, the actuation pattern which has been shifted in that way can quickly and exactly be recognized by the operator.

Additionally, since the actuation pattern display boards clearly displaying the respective actuation patterns are illuminated with the aid of liquid crystal display boards or lamps, an advantageous effect of the present invention is that the actuation pattern display boards can clearly discriminatively be recognized by the operator not only in the nighttime but also in the daytime.

INDUSTRIAL APPLICABILITY

As described above, the apparatus for displaying an actuation pattern for a hydraulic excavator according to the present invention can suitably be employed for a hydraulic excavator which requires that an actuation pattern for a working unit of the hydraulic excavator can quickly and exactly be recognized by an operator at any time when the present actuation pattern is shifted to another one.

Claims

1. An apparatus for displaying an actuation pattern for a hydraulic excavator, characterized in that a plurality of actuation pattern displaying boards each having a predetained actuation pattern previously diagrammized thereon are

arranged for a working unit of said hydraulic excavator and that specific actuation pattern displaying boards selected from said plurality of actuation pattern displaying boards when said actuation pattern is shifted to another one are discriminatively illuminated in response to a pattern shifting signal outputted from an actuation pattern shifting unit adapted to shift said actuation pattern to another one.

2. An apparatus for displaying an actuation pattern for a hydraulic excavator as claimed in claim 1, characterized in that said plurality of actuation pattern displaying boards are discriminatively illuminated by using of a plurality of liquid crystal display boards.
3. An apparatus for displaying an actuation pattern for a hydraulic excavator as claimed in claim 1, characterized in that said plurality of actuation pattern displaying boards are discriminatively illuminated by turning on a plurality of lamps.

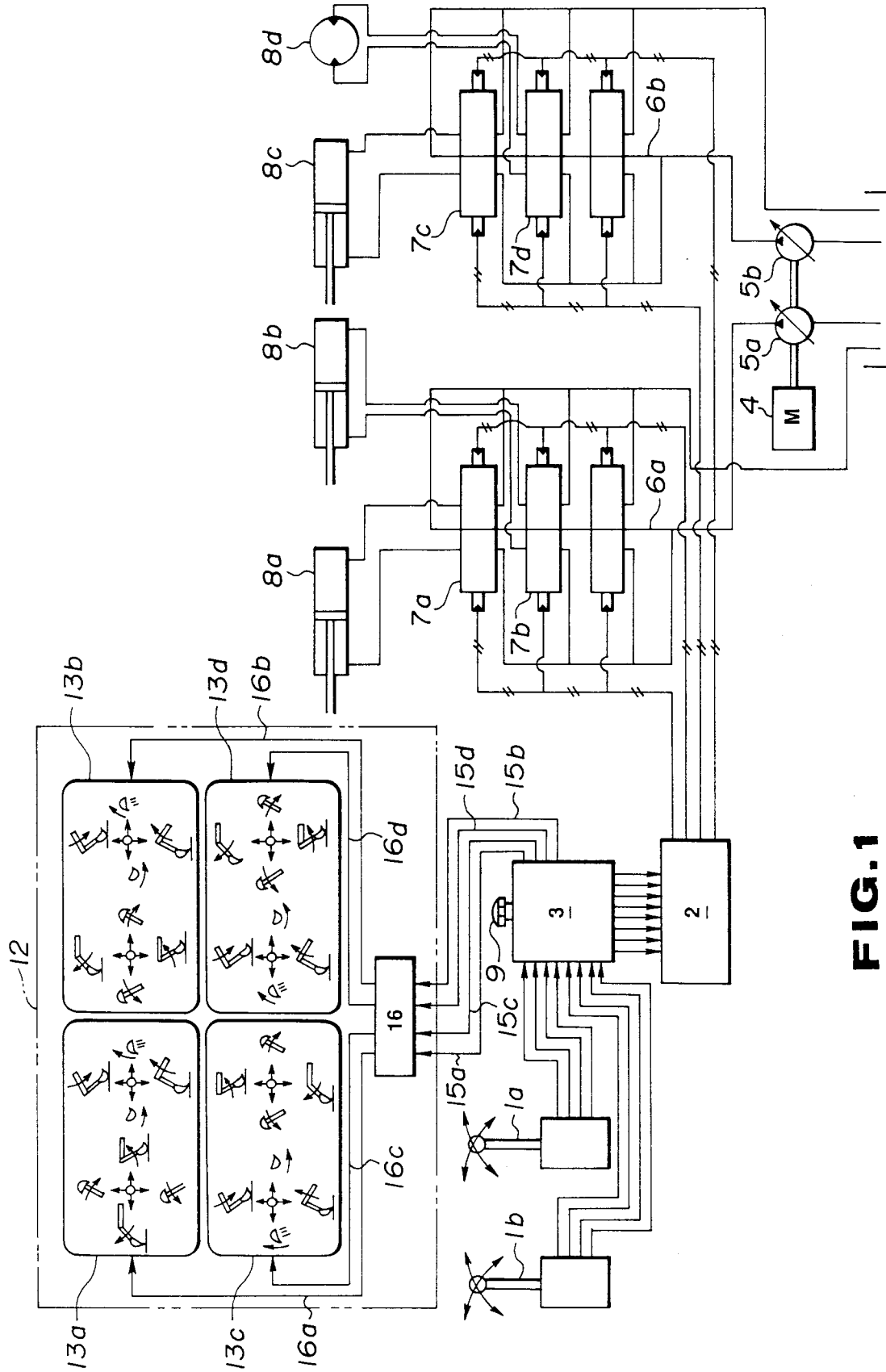
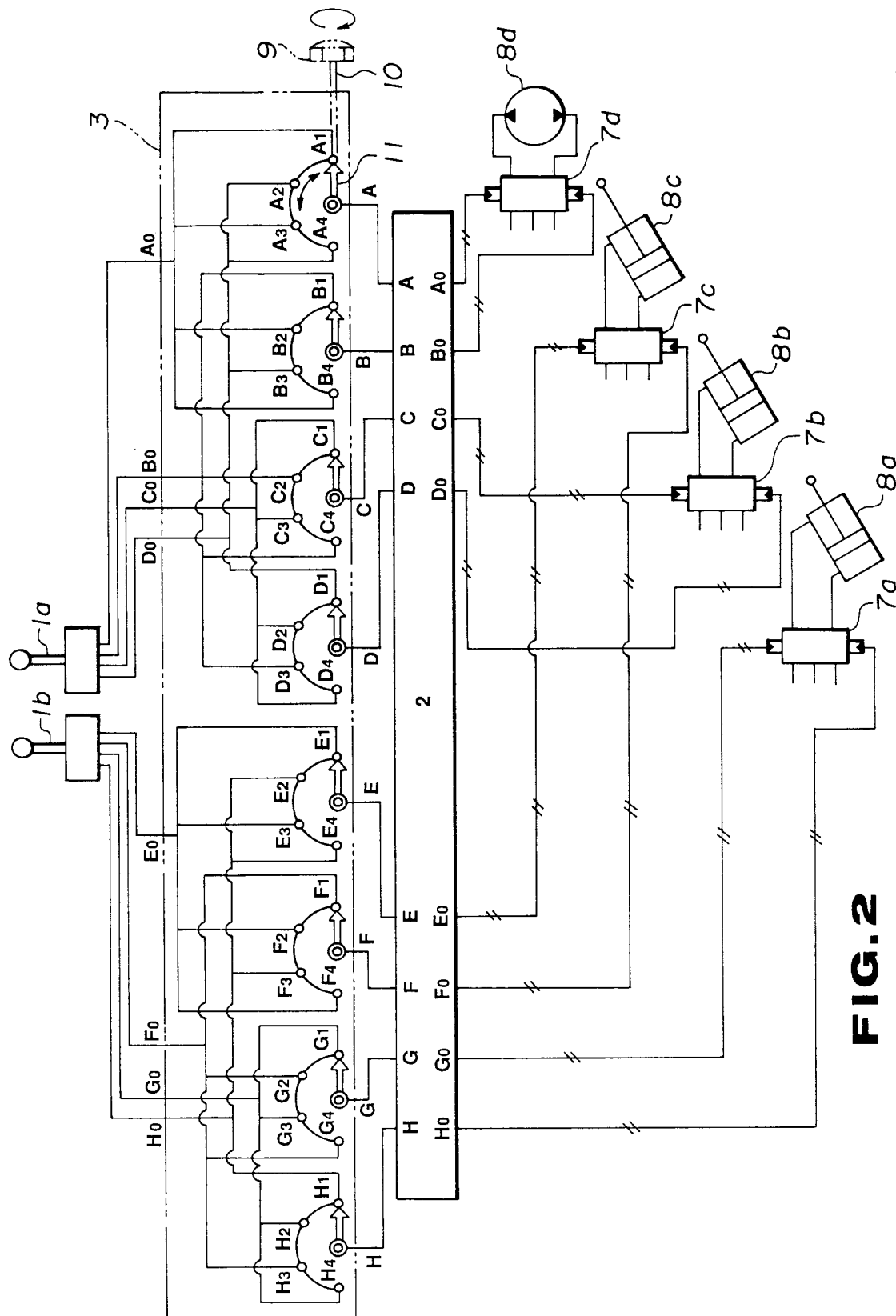


FIG. 1



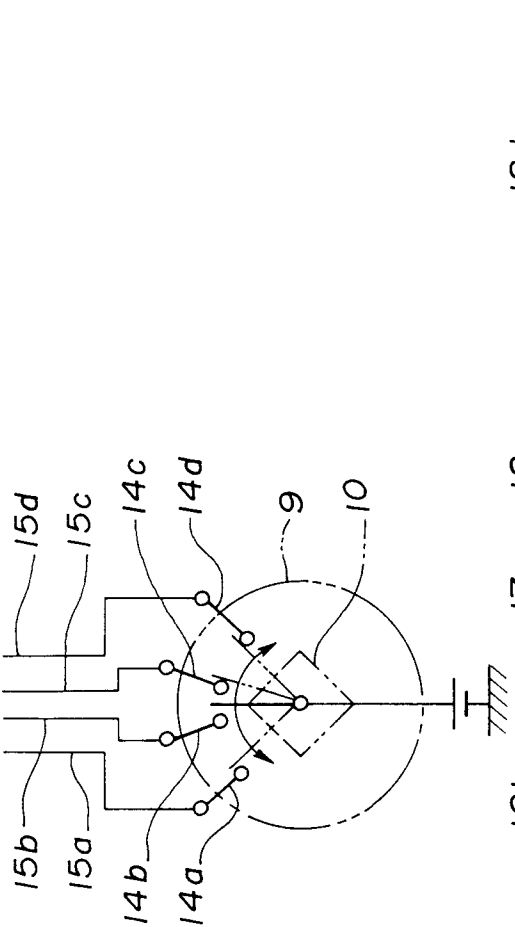


FIG. 3

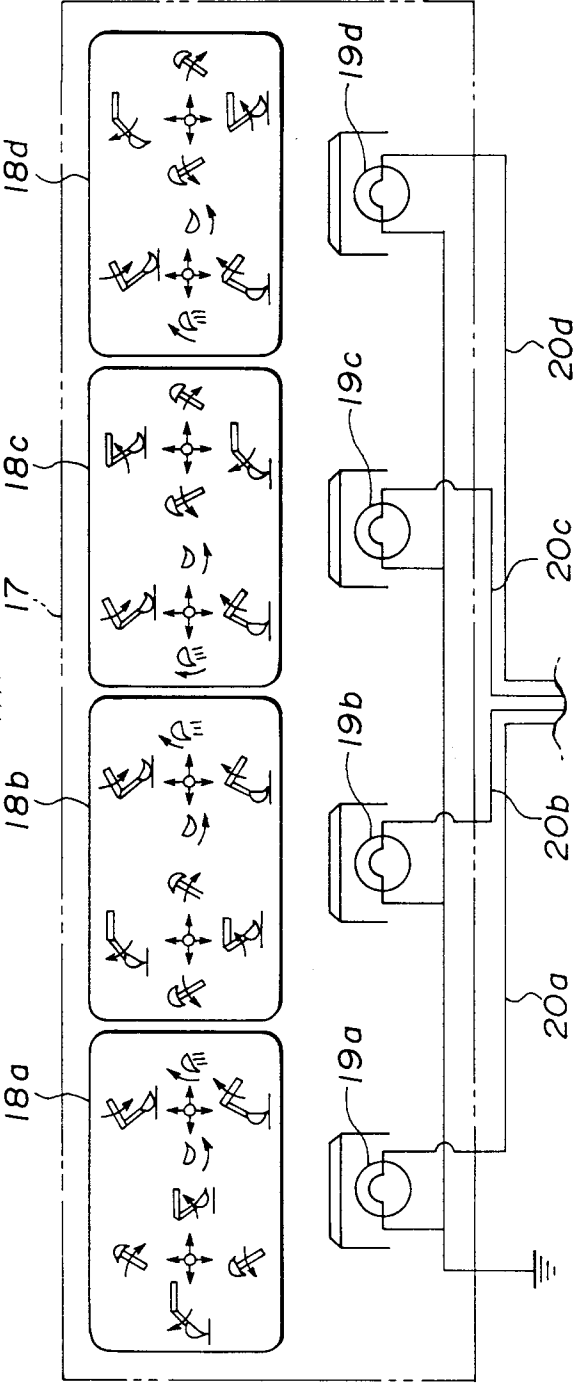


FIG. 4

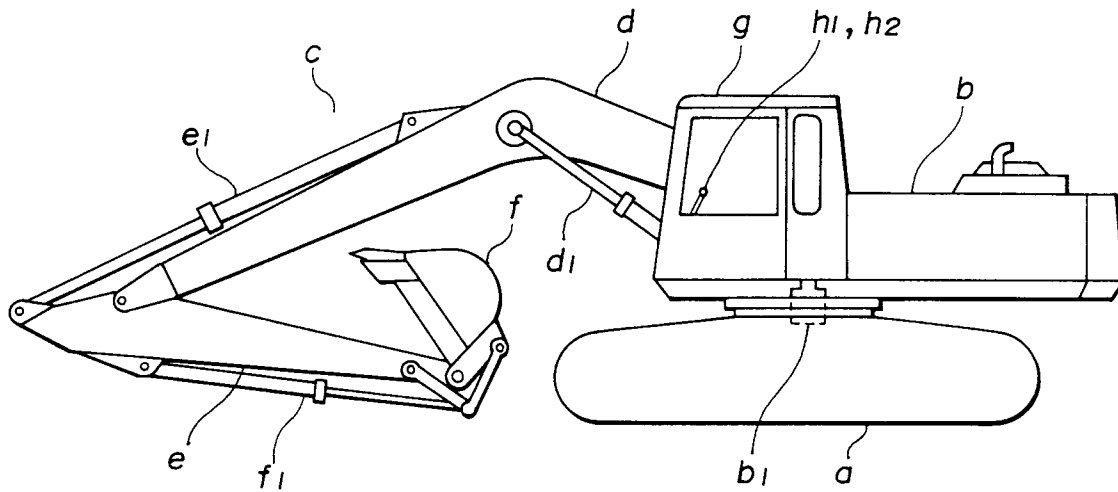


FIG. 5

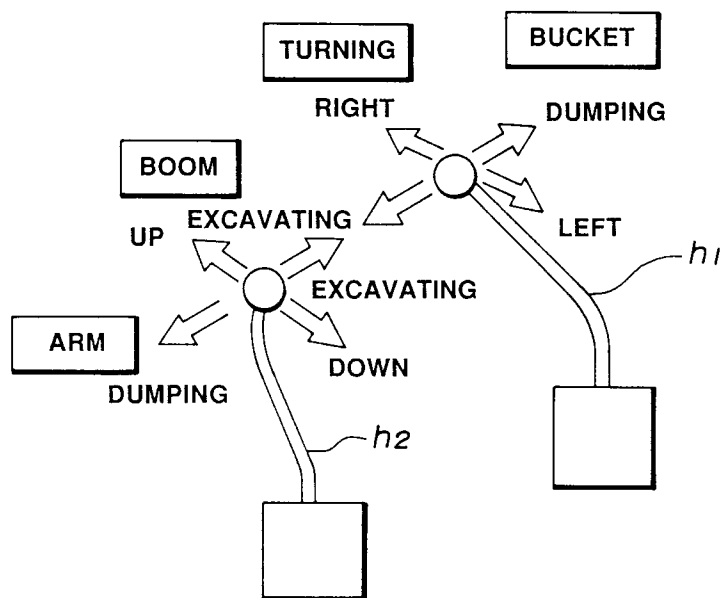


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00853

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		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC	E02F3/43, 9/20, 9/22, 9/26	
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 ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	JP, A, 61-31532 (Kubota, Ltd.), 14 February 1986 (14. 02. 86), (Family: none)	1 - 3
X	JP, U, 62-125168 (Yutani Juko K.K.), 8 August 1987 (08. 08. 87), (Family: none)	1 - 3
X	JP, U, 63-116565 (Seirei Kogyo K.K.), 27 July 1988 (27. 07. 88), (Family: none)	1 - 3
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "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 13, 1990 (13. 09. 90)	September 25, 1990 (25. 09. 90)	
International Searching Authority	Signature of Authorized Officer	
Japanese Patent Office		