(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 785 312 A1

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

(43) Date of publication:
23.07.1997 Bulletin 1997/30

(21) Application number: **95932957.4**

(22) Date of filing: **03.10.1995**

(51) Int. Cl.[6]: **E02F 9/22**, E02F 3/40, F15B 21/12

(86) International application number:
PCT/JP95/02010

(87) International publication number:
WO 96/11306 (18.04.1996 Gazette 1996/17)

(84) Designated Contracting States:
BE DE GB IT

(30) Priority: **05.10.1994 JP 264433/94**

(71) Applicant: **KOMATSU LTD.**
Minato-ku Tokyo 107 (JP)

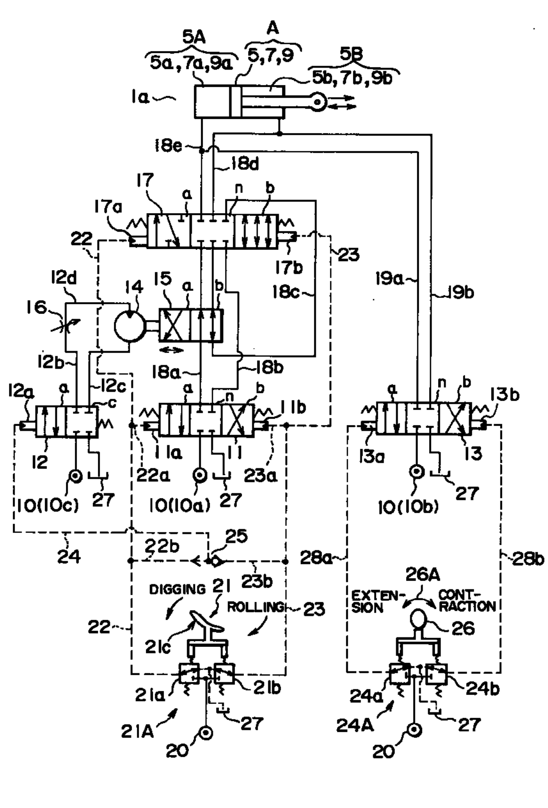
(72) Inventor: **TOMITA, Shinji**
Hirakata-shi Osaka 573 (JP)

(74) Representative: **Meissner, Peter E., Dipl.-Ing. et al**
Meissner & Meissner,
Patentanwaltsbüro,
Hohenzollerndamm 89
14199 Berlin (DE)

(54) VIBRATING DEVICE FOR AN OPERATING MACHINE FOR A HYDRAULIC SHOVEL

(57) The present invention relates to an operating machine vibrating device for a hydraulic excavator which can effectively perform vibrating operation such as digging work and rolling work, etc. To this end, the vibrating device comprises a rotary vibrating valve (15) for continuously switching pressure oil from a hydraulic source (10) for discharging, and a vibration mode switching valve (17) having two positions, a position where switched discharge oil is continuously discharged in one direction, and a position where the oil is alternately switched for discharging, wherein the discharge oil from the vibration mode switching valve (17) is supplied to either operating machine actuators (5, 7, 9) or a vibrating actuator (30) so as to vibrate the operating machine (1a).

FIG. 2



EP 0 785 312 A1

Description

TECHNICAL FIELD

The present invention relates to an operating machine vibrating device for a hydraulic excavator, and more particularly to a vibrating device which facilitates vibration mode switching of an operating machine during digging work or rolling work.

BACKGROUND ART

Hitherto, vibrating devices for a hydraulic vibratory pile driver have been comprised of a gripping device 102 for vertically vibrating the hydraulic vibratory pile driver, as shown in Fig. 16. When a directional control valve 107 is switched, pressure oil, which is controlled by a flow rate control valve 105 to a predetermined flow rate, in a vibrating pressure oil supplying section 109 flows into a hydraulic motor 103 through a pipe 110 so as to rotate the hydraulic motor 103 at a predetermined number of rotations (for example, Japanese Unexamined Patent Publication No. 57-40025). And, by switching a directional control valve 106, pressure oil from a pressure oil supplying section 108 flows into a cylinder 100 through a pipe 111 and a vibration switching valve 104. At the time of the inflow, the vibration switching valve 104 operates at the number of vibrations corresponding to the number of rotations of the hydraulic motor 103, so that the pressure oil alternately flows in from inlet ports 100a and 100b by the switching of the vibration switching valve 104 so as to vertically move a piston 101, and vibrate the gripping device 102.

In addition, an operating machine vibrating device for a hydraulic excavator has been known which comprises a switching means for instructing a vibration mode, and a means for intermittently supplying pressure oil to an operating machine driving actuator when the vibration mode is instructed (for example, Japanese Unexamined Utility Model Publication No. 62-60658).

However, the vibrating device for the hydraulic vibratory pile driver only vibrates and controls the piston 102 vertically. In addition, the operating machine vibrating device controls the raising amplitude and lowering amplitude of an operating machine cylinder constant. Therefore, these prior arts, in the case of rolling vibration work of uneven ground where ground compaction positions vary, encounters a problem in that lost striking is generated, and sufficient vibrations are not provided.

By the way, the hydraulic excavator is commonly used for road building and the like. In the case of soft soil, during digging work, the work is performed by a compound operation of a bucket and an arm. On the other hand, in the case of hard soil, digging work is performed after the bucket, and the arm or a boom have been vibrated to loosen the soil. In addition, during rolling work, soil scattered on the road is compacted by the bucket.

These works can be performed by providing constant vibrations to the boom, the arm, and the bucket of the operating machine in the case of flat ground. However, an inclined ground or uneven ground suffers from a problem in that sufficient vibration cannot be provided, similar to the above-described vibrating device. In addition, when the operating machine is vibrated to perform the operations, vibrations are generated throughout the operating machine. However, vibrations particularly from the boom are transmitted throughout an upper turning body, whereby ride quality deteriorates. Moreover, there arises a problem in that the operating machine cracks due to vibrations.

Accordingly, an operating machine vibrating device for a hydraulic excavator capable of performing civil engineering works corresponding to various soils and topography is required.

DISCLOSURE OF THE INVENTION

The present invention has been made to solve the problems of the known arts, and its object is to provide an operating machine vibrating device for a hydraulic excavator for efficiently performing vibration operations, such as digging work, and rolling work, etc. in civil engineering works corresponding to various soils and topography.

According to the present invention, there is provided an operating machine vibrating device for a hydraulic excavator including an actuator driving hydraulic source, a plurality of operating machine actuators and/or a vibrating actuator driven by pressure oil from the hydraulic source, and an operating machine having a boom, an arm, and a bucket, and vibrating the operating machine by at least one of the operating machine actuators or by the vibrating actuator,

the vibrating device comprising: a rotary vibrating valve for continuously switching pressure oil from the hydraulic source for discharging; and a vibration mode switching valve having two positions, a position where discharge oil switched by the rotary vibrating valve being continuously discharged in one direction, and a position where the oil being alternately switched for discharging,

wherein discharge oil from the vibration mode switching valve is supplied either to the operating machine actuators or the vibrating actuator.

In addition, the vibrating device may comprise:

a first directional control valve for switching pressure oil from the hydraulic source, and supplying the oil to the vibrating actuator through the rotary vibrating valve and the vibration mode switching valve;

a pipe for connecting the hydraulic source to each of the operating machine actuators; and

a second directional control valve disposed on the pipe for switching lubrication to at least one of the operating machine actuators by a pilot valve.

Further, the vibrating device may comprise:

a first directional control valve for switching pressure oil from the hydraulic source, and supplying the oil to at least one of the operating machine actuators through the rotary vibrating valve and the vibration mode switching valve;
a pipe for connecting the hydraulic source to at least another one of the operating machine actuators; and
a second directional control valve disposed on the pipe for switching lubrication to the at least another one of the actuators by a pilot valve.

At least one of the operating machine actuators switched and controlled by the first directional control valve may be used as a bucket actuator. And, the first directional control valve may be switched by a signal from a vibration mode switching operation section.

Still further, the vibrating device may comprise:

a hydraulic motor for driving the rotary vibrating valve;
a hydraulic motor ON/OFF switching valve for controlling supply of pressure oil from the hydraulic source; and
a flow rate control valve for controlling a flow rate from the hydraulic motor ON/OFF switching valve,
wherein the hydraulic motor is rotated by the controlled flow rate from the flow rate control valve, and a vibration frequency of the rotary vibrating valve is controlled in accordance with the number of rotations of the hydraulic motor.

The operating machine actuator switched by the second directional control valve for lubrication may be a boom actuator,

an inflow side of an accumulator switching valve may be connected to the pipe formed between the second directional control valve and the boom actuator, and an accumulator may be connected to a discharge side of the accumulator switching valve, wherein the second directional control valve and the accumulator switching valve are switched by a pilot pressure signal from the pilot valve, or by an electric signal from an electric vibration mode switching operation section.

Furthermore, the vibrating device may comprise pressure switches for detecting pressures of the operating machine actuators, wherein pressure oil is supplied to the vibrating actuator based on the detected pressure when at least one of the operating machine actuators is in the driving condition.

By such a construction, a rolling mode for reciprocally vibrating pistons of the operating machine actuators or the vibrating actuator, a digging mode for vibrating the pistons in one direction can be arbitrarily selected, whereby, in the case of hard soil of a civil engineering work, etc. among various operations of the hydraulic excavator, digging work is facilitated because one of the bucket, the arm, and the boom is vibrated to loosen soil. In addition, compaction is facilitated even in the inclined ground or uneven ground, whereby rolling work is facilitated. Moreover, even if the position of the ground lowers during vibrating operation, the operation is performed in the digging mode for vibrating in one direction, thereby preventing lost striking. In this way, vibrations corresponding to various soils and topography can be provided, resulting in improved workability.

In addition, vibrations generated in the operating machine actuators are retarded by the accumulator, so that stability and reliability of the hydraulic excavator are improved. Further, by detecting pressures of the operating machine actuators, the vibrating actuator is conjointly automatically vibrated during driving of the operating machine actuators, so that workability is improved.

BRIEF DESCRIPTION OF DRAWINGS

Figs. 1A and 1B are drawings of a hydraulic excavator to which an operating machine vibrating device according to the present invention is applied, in which Fig. 1A is a side elevational view during rolling work, and Fig. 1B is a side elevational view during digging work;
Fig. 2 is a hydraulic circuit diagram of an operating machine vibrating device according to a first embodiment of the present invention;
Fig. 3 is an illustration of cross sections of a rotary vibrating valve and a vibration mode switching valve in a neutral condition according to the first embodiment;
Figs. 4A and 4B are drawings each showing when an actuator is contracted in a rolling mode according to the first embodiment, in which Fig. 4A is an illustration of cross sections of the rotary vibrating valve and the vibration mode switching valve, and Fig. 4B is a hydraulic circuit diagram;
Figs. 5A and 5B are drawings each showing when the actuator is extended in a rolling mode according to the first embodiment, in which Fig. 5A is an illustration of cross sections of the rotary vibrating valve and the vibration mode switching valve, and Fig. 5B is a hydraulic circuit diagram;
Figs. 6A and 6B are drawings each showing a suspending condition of the digging mode according to the first embodiment, in which Fig. 6A is an illustration of cross sections of the rotary vibrating valve and the vibration mode switching valve, and Fig. 6B is a hydraulic circuit diagram;
Figs. 7A and 7B are drawings each showing an operating state in the digging mode according to the first embodiment, in which Fig. 7A is an illustration of cross sections of the rotary vibrating valve and the vibration mode switching valve, and Fig. 7B is a hydraulic circuit diagram;
Figs. 8A, 8B, and 8C are drawings each showing a case where the vibration mode switching valve of

Fig. 6B is provided with a restrictor, in which Fig. 8A is an illustration of cross sections of the rotary vibrating valve and the vibration mode switching valve, Fig. 8B shows details of a section P of Fig. 8A, and Fig. 8C is a hydraulic circuit diagram;

Figs. 9A, 9B and 9C are drawings each showing an operating machine vibrating device according to a second embodiment of the present invention, in which Fig. 9A is a main part side elevational view of the operating machine, Fig. 9B is a hydraulic circuit diagram of a vibrating actuator, and Fig. 9C is a hydraulic circuit diagram of an operating machine actuator;

Fig. 10 is a hydraulic circuit diagram of an operating machine vibrating device according to a third embodiment of the present invention;

Fig. 11 is a hydraulic circuit diagram of an operating machine vibrating device according to a fourth embodiment of the present invention;

Fig. 12 is a hydraulic circuit diagram of an operating machine vibrating device according to a fifth embodiment of the present invention;

Fig. 13 is a hydraulic circuit diagram of an operating machine vibrating device according to a sixth embodiment of the present invention;

Fig. 14 is a hydraulic circuit diagram of an operating machine vibrating device according to a seventh embodiment of the present invention;

Fig. 15 is a hydraulic circuit diagram of an operating machine vibrating device according to a eighth embodiment of the present invention; and

Fig. 16 is an illustration of a conventional operating machine vibrating device.

BEST MODE FOR CARRYING OUT THE INVENTION

The preferred embodiments of an operating machine vibrating device for a hydraulic excavator according to the present invention will be described in detail with reference to the attached drawings.

Figs. 1A and 1B illustrate a hydraulic excavator 1 to which the present invention is applied. A lower running body 2 is driven by a non-illustrated running motor so as to be capable of running. An upper turning body 3, which is driven by a turning motor so as to be turnable, is provided on the lower running body 2, and an operating machine 1a is mounted to the upper turning body 3. The operating machine 1a comprises a boom 4; an arm 6; a bucket 8; a plurality of hydraulic actuators 5, 7, and 9; a tilt lever 9h; and a link 9j.

The boom 4, which is driven by a boom actuator 5 so as to be vertically swingable, has the arm 6 secured to the tip thereof. The arm 6 is driven by an arm actuator 7 so as to be vertically swingable, and has the bucket 8 secured to the tip thereof. In addition, one end of a bucket actuator 9 is coupled to one end of the tilt lever 9h, the other end of the tilt lever 9h is coupled to the arm 6, and the tilt lever 9h is coupled to the bucket 8 through the bucket link 9j, whereby the bucket 8 is driven by the bucket actuator 9 so as to be rotatable.

As described above, reciprocating vibrations or one-direction vibrations of at least one piston among the pistons of the operating machine actuators 5, 7, and 9 allow digging work while loosening soil, or rolling work while compacting soil. Hereinafter, when at least one actuator among the actuators 5, 7, and 9 is pointed, it is referred to as an actuator A.

Next, a first embodiment of the present invention will be described in detail.

Referring to Fig. 2, an actuator driving hydraulic source 10 (10a) (hereinafter, referred to as a hydraulic source 10a) is connected to a first directional control valve 11. The first directional control valve 11 is connected to a rotary vibrating valve 15 by means of pipes 18a, and 18b, and a vibration mode switching valve 17 is provided downstream of the rotary vibrating valve 15. The vibration mode switching valve 17 is connected to each of the bottom oil chambers 5a, 7a, 9a of the actuator A by means of a pipe 18e. In addition, the vibration mode switching valve 17 is connected to each of the head oil chambers 5b, 7b, 9b of the actuator A by means of a pipe 18d. Hereinafter, when at least one bottom oil chamber among the bottom oil chambers 5a, 7a, 9a, and at least one head oil chamber among the head oil chambers 5b, 7b, 9b are pointed, they are referred to as a bottom oil chamber 5A and as a head oil chamber 5B. Incidentally, although a description will be given by illustrating one hydraulic control system with respect to the actuator A, the actuators 5, 7, and 9 for the operating machine can be individually operated and controlled. This example will be described in a seventh embodiment.

A second directional control valve 13 connected to the hydraulic source 10 (10b) (hereinafter, referred to as a hydraulic source 10b) is connected to a pipe 18e through a pipe 19a, and connected to a pipe 18d through a pipe 19b. A hydraulic motor ON/OFF switching valve 12 (hereinafter, referred to as a motor switching valve 12) connected to a hydraulic source 10 (10c) (hereinafter, referred to as a hydraulic source 10c) is connected to a flow rate control valve 16 by means of a pipe 12b. A hydraulic motor 14 connected to the flow rate control valve 16 allows the rotary vibrating valve 15 to be rotatable. Numeral 12c denotes a return pipe. Incidentally, although the hydraulic source 10 is illustrated and described as hydraulic sources 10a, 10b, and 10c to make it understandable, one or a plurality of hydraulic sources 10 are used, as needed.

A pilot operation circuit of this embodiment will be described. A pilot hydraulic source 20, and an operating member 21c of a vibration mode switching operation section 21 are connected to a pilot valve 21A (21a, 21b). The pilot valve 21a are connected to an operation section 11a of the first directional control valve 11 through a pilot pipe 22 and a branch pipe 22a. The pilot valve 21b is connected to an operation section 11b of the first directional control valve 11 through a pilot pipe 23 and a branch pipe 23a.

Two pilot pipes 22, 23 are connected to operation sections 17a, 17b of the vibration mode switching valve 17, respectively. A shuttle valve 25 provided between branch pipes 22b, 23b of the two pilot pipes 22, 23 is connected to an operation section 12a of the motor switching valve 12 by means of a pilot pipe 24.

A pilot valve 24A (24a, 24b) included in an operating lever 26 is connected to a pilot hydraulic source 20. A pilot pipe 28a from the pilot valve 24a is connected to an operation section 13a of the second directional control valve 13. In addition, a pilot pipe 28b from the pilot valve 24b is connected to an operation section 13b of the second directional control valve 13. Numeral 27 denotes a tank.

Referring to Fig. 3, a drive shaft 14a of the hydraulic motor 14 is joined to a rotor 15h of the rotary vibrating valve 15 by means of a spline 14b. A plurality of passage holes 15a to 15d (see Fig. 4A, Fig. 5A) are formed in the outer periphery of the rotor 15h. This drawing shows a condition where a pilot pressure does not act on the first directional control valve 11 and the vibration mode switching valve 17, and a spool 17g of the vibration mode switching valve 17 is on a neutral position. When the spool 17g is on the neutral position, the passages 17i, 17j, and 17k and the passages 17d, 17e, and 17f are closed. The first directional control valve 11 is connected to a passage 15a of the rotary vibrating valve 15 by means of the pipe 18a. Since the hydraulic motor 14 is not driven, the actuator A is suspended.

Figs. 4A and 4B show a driving condition of the hydraulic motor 14. The rotary vibrating valve 15 is on a position b. At this time, the pilot pressure acts on the operation sections 17b and 11b, whereby both of the vibration mode switching valve 17 and the first directional control valve 11 are switched to the position b. When on the position b, the passage 15a is in communication with the passage 15b. The passage 15b is in communication with the passages 17j, 17e of the vibration mode switching valve 17. The passage 17e is connected to the head oil chamber 5B through the pipe 18d. The pipe 18e connected to the bottom oil chamber 5A is sequentially in communication with the passages 17d, 17i, 17c, 17k, 17f, and connected to the tank 27 through the pipe 18a.

Figs. 5A and 5B show when the rotary vibrating valve 15 is on a position a. The rotary vibrating valve 15 is connected to the bottom oil chamber 5A through the passages 15a, 15d, 17i, 17d and the pipe 18e in sequence. The head oil chamber 5B is connected to the tank 27 through the pipe 18d, the passages 17e, 17j, 17k, 17f, and the passage 18a.

Figs. 6A and 6B show when the rotary vibrating valve 15 is on a position a. Even if both of the first directional control valve 11 and the rotary vibrating valve 15 are switched to the position a, the passages 15a and 15b of the rotary vibrating valve 15 are not in communication with the passages 17e to 17f of the vibration mode switching valve 17.

Figs. 7A and 7B show when the rotary vibrating valve 15 is on a position b. Both of the first directional control valve 11 and the vibration mode switching valve 17 are switched to a position a, whereby the rotary vibrating valve 15 is connected to the bottom oil chamber 5A through the passages 15a, 15d, 17i, 17d, and the pipe 18e in sequence. The head oil chamber 5B is connected to the tank 27 through the pipe 18d, the passages 17e and 17f, and the passage 18b in sequence.

An operation of the first embodiment constructed as described above will be described.

According to the construction of Fig. 2, when the operating machine 1a is vibrated to perform a digging mode operation, both of the first directional control valve 11 and the vibration mode switching valve 17 are switched to the position a by operating the operating member 21c of the vibration mode switching operation section 21 to a digging side. In addition, the motor switching valve 12 is also switched to the position a, so that pressure oil from the hydraulic source 10C flows into the hydraulic motor 14 through the flow rate control valve 16, and the hydraulic motor 14 starts to rotate. The number of rotations of the hydraulic motor 14 is increased and decreased with the opening degree of the flow rate control valve 16, and can be controlled by a control means (not shown).

The rotary vibrating valve 15 is continuously alternately switched to the position a and the position b at a number of vibrations corresponding to the number of rotations of the hydraulic motor 14. Therefore, the pressure oil from the hydraulic source 10a is intermittently discharged from the rotary vibrating valve 15 via the position a of the first directional control valve 11 through the pipe 18a, and intermittently supplied to the bottom oil chamber 5A of the actuator A via the position a of the vibration mode switching valve 17 through the pipe 18e. On the other hand, oil of the head oil chamber 5B is drained to the tank 27 via the pipes 18d, 18b.

Accordingly, the actuator A generates vibrations in one direction, and provides vibrations to soil of a firm ground, whereby digging can be facilitated.

On the other hand, when the operating machine 1a is vibrated to perform a rolling mode operation, both of the first directional control valve 11 and the vibration mode switching valve 17 are switched to the position b by operating the operating member 21c of the vibration mode switching operation section 21 to the rolling side. The motor switching valve 12 is also switched to the position a, so that the hydraulic motor 14 starts to rotate due to pressure oil from the hydraulic source 10a in the same manner as described above. The rotary vibrating valve 15 is alternately switched to the position a and the position b at a number of vibrations corresponding to the number of rotations of the hydraulic motor 14, and is operated continuously.

In a state where the rotary vibrating valve 15 is alternately continuously operated to the position a and the position b, the vibration mode switching valve 17 has three ports at the position b, whereby the pressure oil from the hydraulic source 10a is continuously switched to pressure oil supplied to the head oil chamber 5B via the pipes 18b, 18c, 18d, and pressure oil supplied to the bottom oil chamber 5A via the pipes 18b, 18c, 18e so as to be lubricated. By this switch-lubrication, each of the pistons of the actuator A generate vibrations due to reciprocating, so that it becomes possible to easily perform rolling such that soil is vibrated and compacted.

In addition, by operating the operating lever 26 in the direction of arrow 26A so as to be placed in the extension side or the contraction side of the actuator A, the pressure oil from the pilot hydraulic source 20 acts from the pilot valve 24a or 24b to the operation section 13a or 13b of the second directional control valve 13, whereby the second directional control valve 13 is switched from the neutral position n to the position a or the position b, so that the actuator A can be driven by the pressure oil discharged from the second directional control valve 13. That is, a normal driving with the actuator A is made possible by operating the operating lever 26.

Therefore, by operating the vibration mode switching operation section 21 to the digging side or the rolling side, the actuator A can be vibrated in the digging mode or the rolling mode. In addition, the actuator A is extended and contracted by the operating lever 26, so that a normal operation can be performed by the hydraulic excavator with the actuator A.

Details on the rolling mode operation will be described. Referring to Fig. 4A, as described above, the hydraulic motor 14 is in a driving condition and the passages 15a and 15b are in communication, so that the pressure oil from the hydraulic source 10a flows into the head oil chamber 5B via the passages 15b, 17i, 17e, and the pipe 18d to contract the actuator A. Sequentially, by the rotation of the hydraulic motor 14, the rotary vibrating valve 15 is switched from the position b to the position a, as shown in Fig. 5A, so that the pressure oil from the hydraulic source 10a flows into the bottom oil chamber 5A via the passages 15a, 15d, 17a, 17d, and the pipe 18e to extend the actuator A. Therefore, the rotary vibrating valve 15 is alternately switched to the position a and the position b, whereby the actuator A repeats extension and contraction (reciprocating) to generate rolling mode vibrations.

Details on the digging mode operation will be described. Referring to Fig. 6A, as described above, the rotary vibrating valve 15 is on the position a, so that the pressure oil from the hydraulic source 10a is blocked by the vibration mode switching valve 17. Therefore, it is a condition where the pressure oil does not flow into the actuator A, e.g., suspending condition of the digging mode. When the rotary vibrating valve 15 is switched from this condition to the position b, the pressure oil from the hydraulic source 10a flows into the bottom oil chamber 5A via the passages 15a, 15d, 17i, 17d, and the pipe 18e to extend the actuator A. Therefore, the rotary vibrating valve 15 is alternately switched to the position a and the position b, whereby the actuator A is extended (one direction), so that digging mode vibrations can be generated.

Figs. 8A, 8b, and 8C show a case where the spool 17g of the vibration mode switching valve 17 is provided with a restrictor 17h. The bottom oil chamber 5A is connected to the tank 27 through the pipe 18e, the passages 17d, 15c, 17k, the restrictor 17h, the passages 17e, 17f, and the pipe 18b in sequence.

By such a construction, when the actuator A is in the suspending condition, the pressure oil flows into the passage 17k, the restrictor 17h, the passages 17e, 17f, the pipe 18b and the bottom oil chamber 5A so as to be blocked, but a part of the pressure oil is drained from the passage 18b to the tank 27 through the restrictor 17h. This drain reduces the oil pressure in the bottom oil chamber 5A, etc., and an external load (for example, a load applied to the bucket 8 during vibration digging) applied to the actuator A contracts the actuator A, so that overextension of the actuator A can be corrected.

Next, a second embodiment of the present invention will be described. Referring to Figs. 9A, 9B, and 9C, the operating machine 1a comprises a vibrating actuator 30 in place of the bucket link 9j shown in Fig. 1A. The vibrating actuator 30 is connected to the vibration mode switching valve 17, and the actuator A is used for driving the hydraulic excavator 1 in the normal operation. By such a construction, digging and rolling works can be performed by the actuator A while providing vibrations by the vibrating actuator 30. In this embodiment, although one end of the vibrating actuator 30 is coupled to the tilt lever 9h, and the other end is coupled to the bucket 8, the coupling positions are not restricted.

A third embodiment of the present invention will be described. In this embodiment, electric type is employed with respect to the hydraulic type of the first embodiment.

Referring to Fig. 10, a first electromagnetic directional control valve 32 for controlling a flow rate of the pressure oil from a hydraulic source 31a is connected to a rotary vibrating valve 35 and an electromagnetic vibration mode switching valve 36 through a pipe 41a, and connected to the electromagnetic vibration mode switching valve 36 through a pipe 41b. The pressure oil from the electromagnetic vibration mode switching valve 36 flows into the bottom oil chamber 5A through a pipe 41e, and the head oil chamber 5B through a pipe 41d. A second electromagnetic directional control valve 33 for controlling a flow rate of the pressure oil from a hydraulic source 31b is connected to the pipe 41e through a pipe 42a, and connected to the pipe 41d through a pipe 42b.

An electric circuit will be described. A digging mode switch 45a and a rolling mode switch 45b of an electric vibration mode switching operation section 45, a lever tilt angle sensor 38 for detecting an operating angle of an electric lever 37, and an electric motor operating box 39 are connected to a controller 40 in such a manner that they can input a signal, respectively. When the digging mode switch 45a is turned on, signals are outputted to an operation section 32a of the first electromagnetic directional control valve 32, and an operation section 36a of the electromagnetic vibration mode switching valve 36 through the controller 40. In addition, when the rolling mode switch 45b is turned on, signals are outputted to an operation section 32b of the first electromagnetic directional control valve 32, and to an operation section 36b of the electromagnetic vibration mode switching valve 36 through the controller 40.

When the electric lever 37 is placed in the actuator extension side shown by an arrow, a signal is outputted to an operation section 33a of the second electromagnetic directional control valve 33 through the controller 40. On the other hand, when the electric lever 37 is placed in the actuator contraction side, a signal is outputted to an operation section 33b of the second electromagnetic directional control valve 33 through the controller 40. Signals output from vibration frequency control operating means 39a and 39b of the electric motor operating box 39 control the number of rotations of an electric motor 34 through the controller 40. The rotary vibrating valve 35 is coupled to the electric motor 34.

By such a construction, when the operating machine 1a is vibrated to perform a digging mode operation, the digging mode switch 45a is turned on to operate the vibration frequency control operating means 39a or 39b, whereby the rotary vibrating valve 35 is alternately continuously switched to the position a and the position b at a number of vibrations corresponding to the number of rotations of the electric motor 34. Responsive to this switching, pressure oil from the hydraulic source 31a is intermittently discharged from the rotary vibrating valve 35 through the position a of the first electromagnetic directional control valve 32 and the pipe 41a. The discharge oil is intermittently supplied to the bottom oil chamber 5A via the position a of the electromagnetic vibration mode switching valve 36 through the pipe 41e. At this time, oil of the head oil chamber 5B is drained to a tank 41 passing through the pipes 41d and 41b, whereby the actuator A can generate vibrations in one direction, so that soil of the firm ground is vibrated to facilitate digging.

In addition, when the operating machine 1a is vibrated to perform a rolling mode operation, the digging mode switch 45b is turned on to operate the vibration frequency control operating means 39a or 39b, whereby the rotary vibrating valve 35 is alternately switched to the position a and the position b, so that the pressure oil from the hydraulic source 31a is intermittently discharged from the rotary vibrating valve 35 via the position b of the first electromagnetic directional control valve 32 through the pipe 41b. Since the electromagnetic vibration mode switching valve 36 has three ports at the position b, the pressure oil from the hydraulic source 31a is continuously switched to pressure oil supplied form the pipes 41b, 41c, and 41d to the head oil chamber 5B, or pressure oil supplied to the bottom oil chamber 5A from the pipes 41b, 41c, and 41e, whereby the piston of the actuator A generates reciprocating vibrations, so that easy rolling work can be performed in the same manner as the above-described embodiment.

Further, by operating the electric lever 37 in the actuator extension side, a signal is outputted from the controller 40 to the operation section 33a of the second electromagnetic directional control valve 33 in accordance with the signal from the lever tilt angle sensor 38. On the other hand, when the electric lever 37 is operated in the actuator contraction side, a signal is outputted to the operation section 33b, whereby the second electromagnetic directional control valve 33 is switched from the neutral position n to the position a, or the position b, so that discharging pressure oil is supplied to the bottom oil chamber 5A through the pipes 42a and 41e, or supplied to the head oil chamber 5B through the pipes 42b and 41d. Therefore, by placing the electric lever 37 in the extension side or the contraction side, the actuator A is driven to perform normal operations such as digging and the like.

Then, a fourth embodiment of the present invention will be described. This embodiment is an example in which a vibrating actuator and the operating machine actuator A are individually included, while generation of vibrations and the normal operations can be performed by the actuator A in the third embodiment.

Referring to Fig. 11, the electromagnetic vibration mode switching valve 36 is connected to a bottom oil chamber 30a of the vibrating actuator 30 by means of the pipe 41e, and connected to a head oil chamber 30b of the vibrating actuator 30 by means of the pipe 41d. The vibrating actuator 30 is disposed in the same manner as shown in Fig. 9A. The second electromagnetic directional control valve 33 is connected to the bottom oil chamber 5A of the actuator A by means of the pipe 42a, and connected to the head oil chamber 5B by means of the pipe 42b.

By such a construction, by driving the actuator A while providing vibrations by the vibrating actuator 30, digging, or rolling work can be performed.

A fifth embodiment of the present invention will be described. This embodiment is an example in which an accumulator is provided in serial to a hydraulic circuit of the boom actuator with respect to Fig. 9C of the second embodiment.

Referring to Fig. 12, the second directional control valve 13 connected to the hydraulic source 10b is connected to the bottom oil chamber 5a of the boom actuator 5 by means of the pipe 19a, and connected to the head oil chamber 5b of the boom actuator 5 by means of the pipe 19b, respectively. A branch pipe 19c connected to the pipe 19b connects an accumulator switching valve 29. A restrictor 29b and an accumulator 29c are provided downstream of the accumulator switching valve 29 in serial. An operation section 29a of the accumulator switching valve 29 is connected to the shuttle valve 25 by means of the branch pipe 24a.

By such a construction, when pressure fluctuation occurs in the pipe 19b connected to the head oil chamber 5b, oil in the head oil chamber 5b flows into the accumulator 29c, and vibrating energy is absorbed by a damping action due to spring action of the accumulator 29c and collapse of the restrictor 29b, whereby vibrations of the boom actuator 5 are retarded. Incidentally, the accumulator switching valve 29, the restrictor 29b, and the accumulator 29c may be provided in serial to the pipe 19a so as to retard vibrations due to the pressure fluctuation in the bottom oil chamber 5a.

A sixth embodiment of the present invention will be described. This embodiment is an example in which an accumulator is provided in serial to a hydraulic circuit of the boom actuator with respect to Fig. 11 of the fourth embodiment.

Referring to Fig. 13, the second electromagnetic directional control valve 33 connected to the hydraulic source 31b is connected to the bottom oil chamber 5a of the boom actuator 5 by means of the pipe 42a, and connected to the head oil chamber 5b of the boom actuator 5 by means of the pipe 42b. Similar to the serial provision of Fig. 12, an accumulator switching valve 43, a restrictor 43b and an accumulator 43c are provided in serial to a branch pipe 42c connected to the pipe 42b. To an operation section 43a of the accumulator switching valve 43, a signal of the digging mode switch 45a, or the rolling mode switch 45b is inputted by the controller 40.

By such a construction, when pressure fluctuation occurs in the pipe 42b connected to the head oil chamber 5b, oil in the head oil chamber 5b flows into the accumulator 43c, and vibrating energy is absorbed by the same action as the fifth embodiment, so that vibrations of the boom actuator 5 are retarded. In addition, the accumulator switching valve 43, the restrictor 43b, and the accumulator 43c may be provided in serial to the pipe 42a.

A seventh embodiment of the present invention will be described. This embodiment is an example in which the actuator A is individually controlled and the vibrating actuator is included with respect to the first embodiment.

Referring to Fig. 14, a boom directional control valve 13c connected to the hydraulic source 10b is connected to the bottom oil chamber 5a of the boom actuator 5 by means of a pipe 18e1, and connected to the head oil chamber 5 by means of a pipe 18d1. A pressure detection pipe 53a connected to the pipe 18d1 is connected to a pressure switch 53. In addition, an arm directional control valve 13d connected to the hydraulic source 10b is connected to the bottom oil chamber 7a of the arm actuator 7 by means of a pipe 18e2, and connected to the head oil chamber 7b by means of the pipe 18d. A pressure detection pipe 54a connected to a pipe 18d2 connects a pressure switch 54.

Further, a bucket directional control valve 13e connected to the hydraulic source 10b is connected to the bottom oil chamber 9a of the bucket actuator 9 by means of a pipe 18e3, and connected to the head oil chamber 9b by means of a pipe 18d3. A pressure detection pipe 55a connected to the pipe 18e3 is connected to a pressure switch 55. Incidentally, each of the boom, arm and bucket directional control valves 13c, 13d, and 13e are the same components as the second directional control valve 13 shown in Fig. 2.

Signals from the pressure switches 53, 54, and 55 are inputted to a controller 60, and signals corresponding to the signals are outputted to a solenoid operated proportional switching valve 61 from the controller 60. The solenoid operated proportional switching valve 61 connected to a hydraulic source 56 is connected to an operation section 62a of a vibrating directional control valve 62 via a pilot pipe 61a and a branch pipe 61b. In addition, the pilot pipe 61a is connected to the operation section 12a of the motor switching valve 12 through a branch pipe 61c, and connected to a vibration mode switching valve 63. Incidentally, the hydraulic motor 14, the rotary vibrating valve 15, and the vibration mode switching valve 17, etc. are provided in each of the actuators 5, 7 and 9.

By such a construction, the pressure switches 53, 54, and 55 detect a boom lowering pressure of the boom actuator 5, a digging pressure of the arm actuator 7, and a tilt pressure of the bucket actuator 9. When generation of a driving pressure in at least one of the actuator A is detected, all of the vibrating directional control valve 62, the motor switching valve 12, and the vibration mode switching valve 63 are switched to the position a, whereby pressure oil is automatically supplied to the bottom oil chamber 30a of the vibrating actuator 30, so that digging vibrations in one direction can be caused. Therefore, the vibrating actuator 30 automatically generates vibrations during each operation with the operating machine 1a, so that workability is improved.

Then, an eighth embodiment of the present invention will be described. This embodiment is an example in which the electric control of the third embodiment is applied to the seventh embodiment (see Fig. 14) of the hydraulic type for individually controlling the actuator A and the vibrating actuator.

Referring to Fig. 15, each of boom, arm and bucket electromagnetic directional control valves 33-1, 33-2, and 33-3 (the same components as the second electromagnetic directional control valve 33) are connected to each of the bottom oil chambers 5a, 7a, and 9a through pipes 41e1, 41e2, and 41e3, respectively. In addition, each of the electromagnetic directional control valves 33-1, 33-2, and 33-3 are connected to each of the head oil chambers 5b, 7b, and 9b through pipes 41d1, 41d2, and 41d3, respectively.

Further, the pressure detection pipes 53a, 54a, and 55a connected to the pipes 41d1, 41d2, and 41d3, respectively, are connected to the pressure switches 53, 54, and 55, respectively. The controller 60 connected to the pressure switches 53, 54, and 55 are connected to a vibrating electromagnetic directional control valve 81, an electromagnetic vibration mode switching valve 82 and the electric motor 34. Incidentally, the rotary vibrating valve 15, and the electromagnetic vibration mode switching valve 36, etc. are provided in each of the actuators 5, 7 and 9.

By such a construction, the pressure switches 53, 54, and 55 detect a boom lowering pressure of the boom actuator 5, a digging pressure of the arm actuator 7, and a tilt pressure of the bucket actuator 9. By the detection, when at least one driving pressure generation is inputted to the controller 60, the vibrating electromagnetic directional control valve 81 is switched from a close position c to an open position a, and the electromagnetic vibration mode switching valve 82 is switched from the close position c to the open position a. By the switching, the pressure oil from the hydraulic source 31a is automatically supplied to the vibrating actuator 30 so as to cause digging vibrations.

INDUSTRIAL APPLICABILITY

The present invention is useful as an operating machine vibrating device for a hydraulic excavator in which a rolling mode or a digging mode of an operating machine is arbitrarily selected to facilitate digging work and rolling work, so that workability can be improved. In addition, even if the ground position lowers during vibrating operations, lost striking is prevented, so that safety is improved. Further, vibrations can be retarded by the accumulator, so that good ride quality can be provided. The vibrating actuator is conjointly automatically vibrated during driving of the operating machine actuators, so that workability is improved.

Claims

1. An operating machine vibrating device for a hydraulic excavator including an actuator driving hydraulic source, a plurality of operating machine actuators and/or a vibrating actuator driven by pressure oil from the hydraulic source, and an operating machine having a boom, an arm, and a bucket, and vibrating the operating machine by at least one of the operating machine actuators or by the vibrating actuator,

   said vibrating device comprising: a rotary vibrating valve (15) for continuously switching pressure oil from said hydraulic source (10) for discharging; and a vibration mode switching valve (17) having two positions, a position where discharge oil switched by said rotary vibrating valve (15) being continuously discharged in one direction, and a position where said oil being alternately switched for discharging,

   wherein discharge oil from said vibration mode switching valve (17) is supplied either to said operating machine actuators (5, 7, 9) or said vibrating actuator (30).

2. An operating machine vibrating device for a hydraulic excavator according to claim 1, further comprising:

   a first directional control valve (11) for switching pressure oil from said hydraulic source (10), and supplying said oil to said vibrating actuator (30) through said rotary vibrating valve (15) and said vibration mode switching valve (17);

   a pipe for connecting said hydraulic source (10) to each of said operating machine actuators (5, 7, 9); and

   a second directional control valve (13) disposed on said pipe for switching lubrication to at least one of said operating machine actuators (5, 7, 9) by a pilot valve (24A).

3. An operating machine vibrating device for a hydraulic excavator according to claim 1, further comprising:

   a first directional control valve (11) for switching pressure oil from said hydraulic source (10), and supplying said oil to at least one of said operating machine actuators (5, 7, 9) through said rotary vibrating valve (15) and said vibration mode switching valve (17);

   a pipe for connecting said hydraulic source (10) to at least another one of said operating machine actuators (5, 7, 9); and

   a second directional control valve (13) disposed on said pipe for switching lubrication to said at least another one of said actuators by a pilot valve (24A).

4. An operating machine vibrating device for a hydraulic excavator according to claim 3, wherein at least one of said operating machine actuators (5, 7, 9) switched and controlled by said first directional control valve (11) is a bucket actuator (9).

5. An operating machine vibrating device for a hydraulic excavator according to any one of claims 2 to 4, wherein said first directional control valve (11) is switched by a signal from a vibration mode switching operation section (21).

6. An operating machine vibrating device for a hydraulic excavator according to any one of claims 2 to 4, further comprising:

   a hydraulic motor (14) for driving said rotary vibrating valve (15);

   a hydraulic motor ON/OFF switching valve (12) for controlling supply of pressure oil from said hydraulic source (10); and

   a flow rate control valve (16) for controlling a flow rate from said hydraulic motor ON/OFF switching valve (12),

   wherein said hydraulic motor (14) is rotated by the controlled flow rate from said flow rate control valve (16), and a vibration frequency of said rotary vibrating valve (15) is controlled in accordance with the number of rotations of said hydraulic motor (14).

7. An operating machine vibrating device for a hydraulic excavator according to claim 2 or 3, wherein said operating machine actuator switched by said second directional control valve (13) for lubrication is a boom actuator (5),

wherein an inflow side of an accumulator switching valve (29) is connected to said pipe formed between said second directional control valve (13) and said boom actuator (5), and an accumulator (29c) is connected to a discharge side of said accumulator switching valve (29), and

wherein said second directional control valve (13) and said accumulator switching valve (29) are switched by a pilot pressure signal from said pilot valve (24A), or by an electric signal from an electric vibration mode switching operation section (45).

8. An operating machine vibrating device for a hydraulic excavator according to claim 2 or 3, further comprising pressure switches (53, 54, 55) for detecting pressures of said operating machine actuators (5, 7, 9),

wherein pressure oil is supplied to said vibrating actuator (30) based on the detected pressure when at least one of said operating machine actuators (5, 7, 9) is in the driving condition.

FIG. 1A

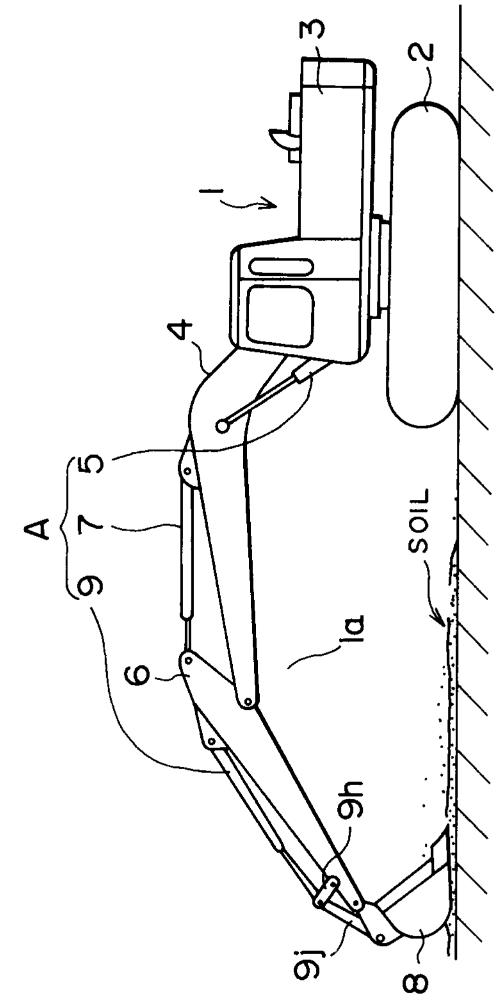


FIG. 1B

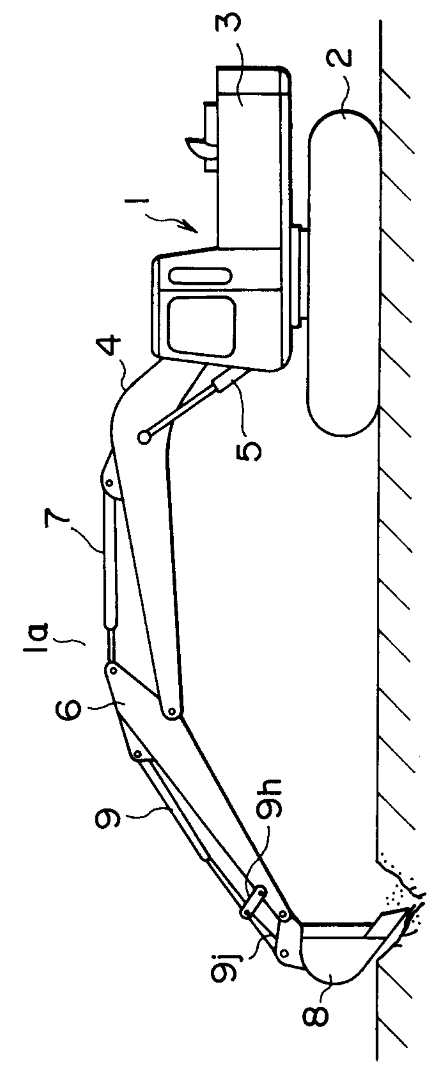
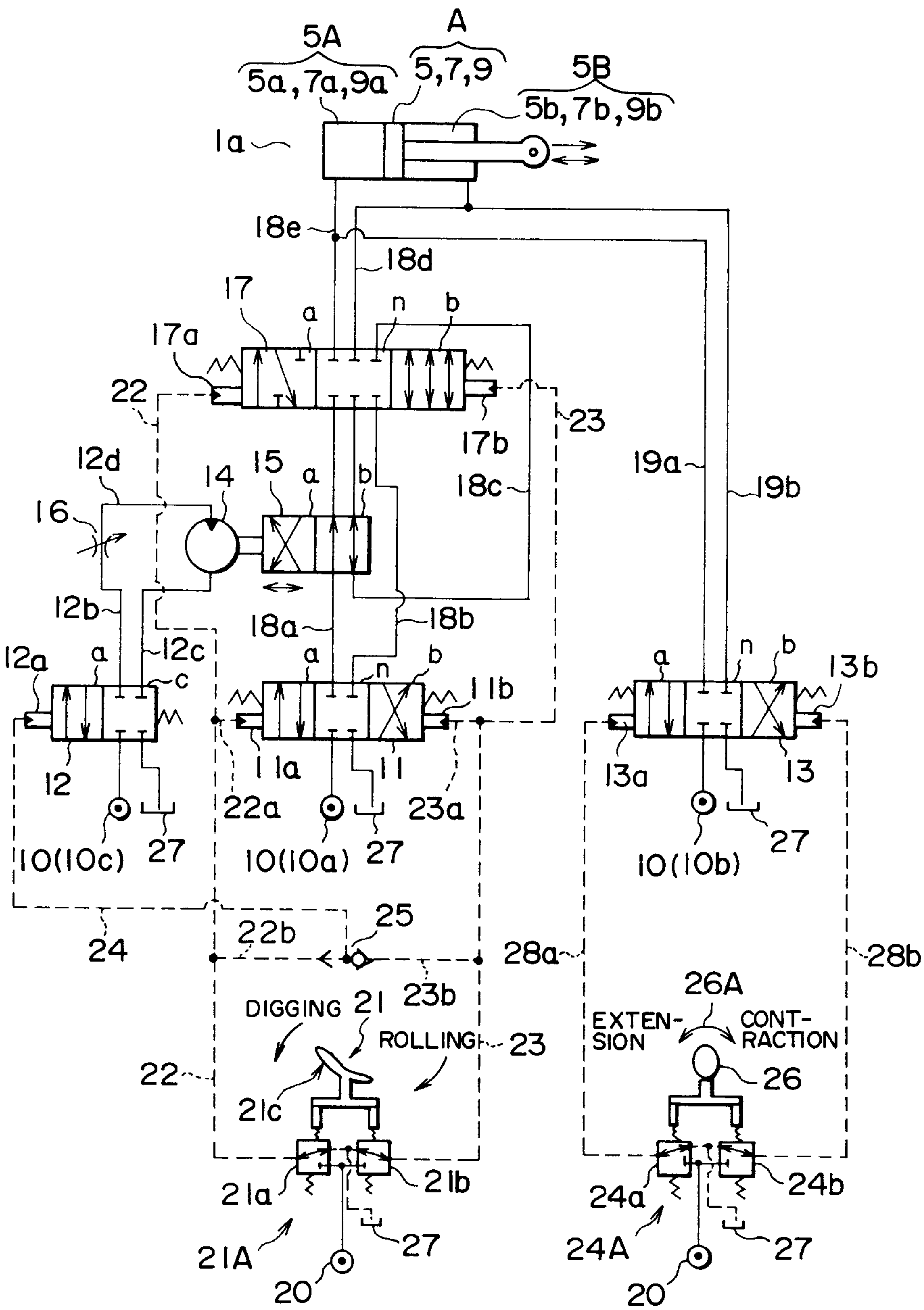


FIG. 2



5A
A
5a,7a,9a
5,7,9
5B
5b,7b,9b
1a
18e
18d
17
a
n
b
17a
22
23
17b
12d
14
15
a
b
16
19a
18c
19b
12b
18a
18b
12a
a
12c
c
a
n
b
11b
a
n
b
13b
12
11a
11
13a
13
22a
23a
10(10c)
27
10(10a)
27
10(10b)
27
24
22b
25
28a
28b
23b
26A
DIGGING
21
ROLLING
23
EXTEN-
SION
CONT-
RACTION
22
26
21c
21a
21b
24a
24b
21A
27
24A
27
20
20

FIG. 3

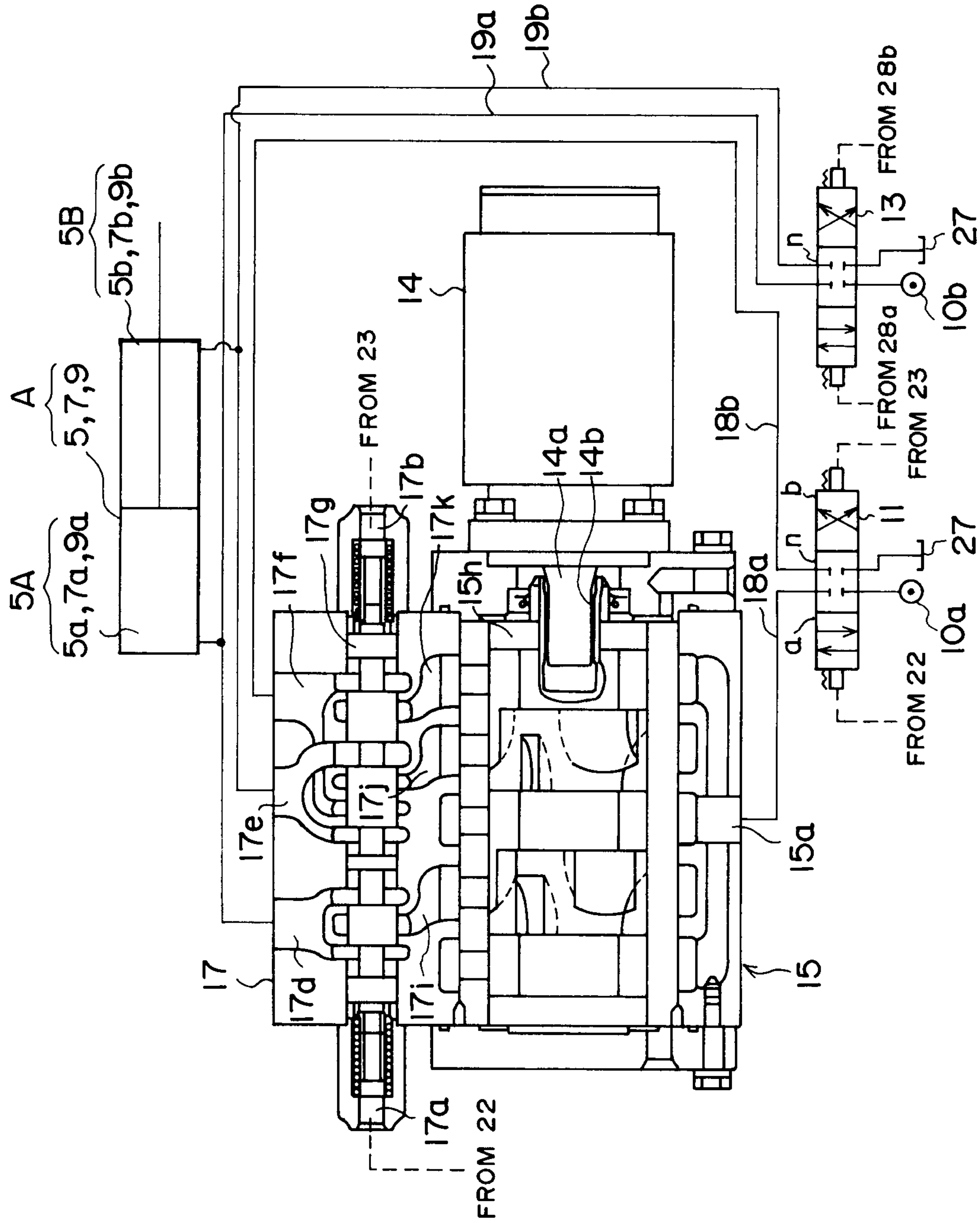

5A
5a,7a,9a
A
5,7,9
5B
5b,7b,9b
19a
19b
14
14a
14b
17
17a
17b
17d
17e
17f
17g
17i
17j
17k
15h
15
15a
18a
18b
FROM 22
FROM 23
FROM 22
FROM 23
FROM 28a
FROM 23
FROM 28b
a
n
b
11
10a
27
n
13
10b
27

FIG. 4B

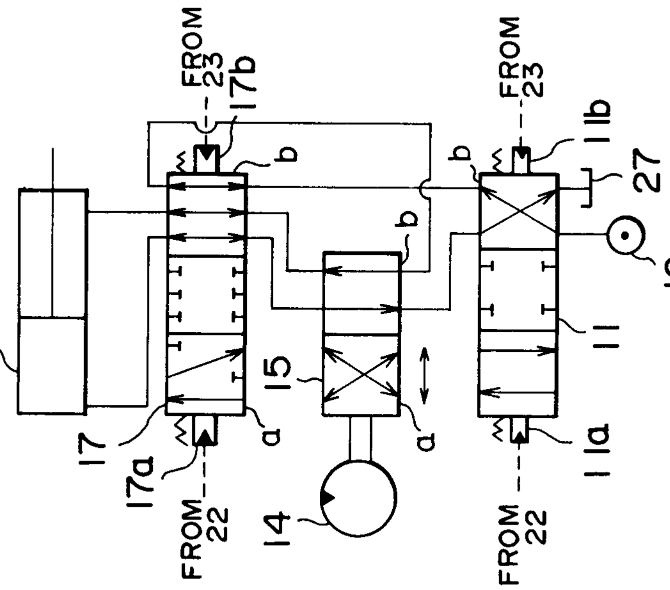
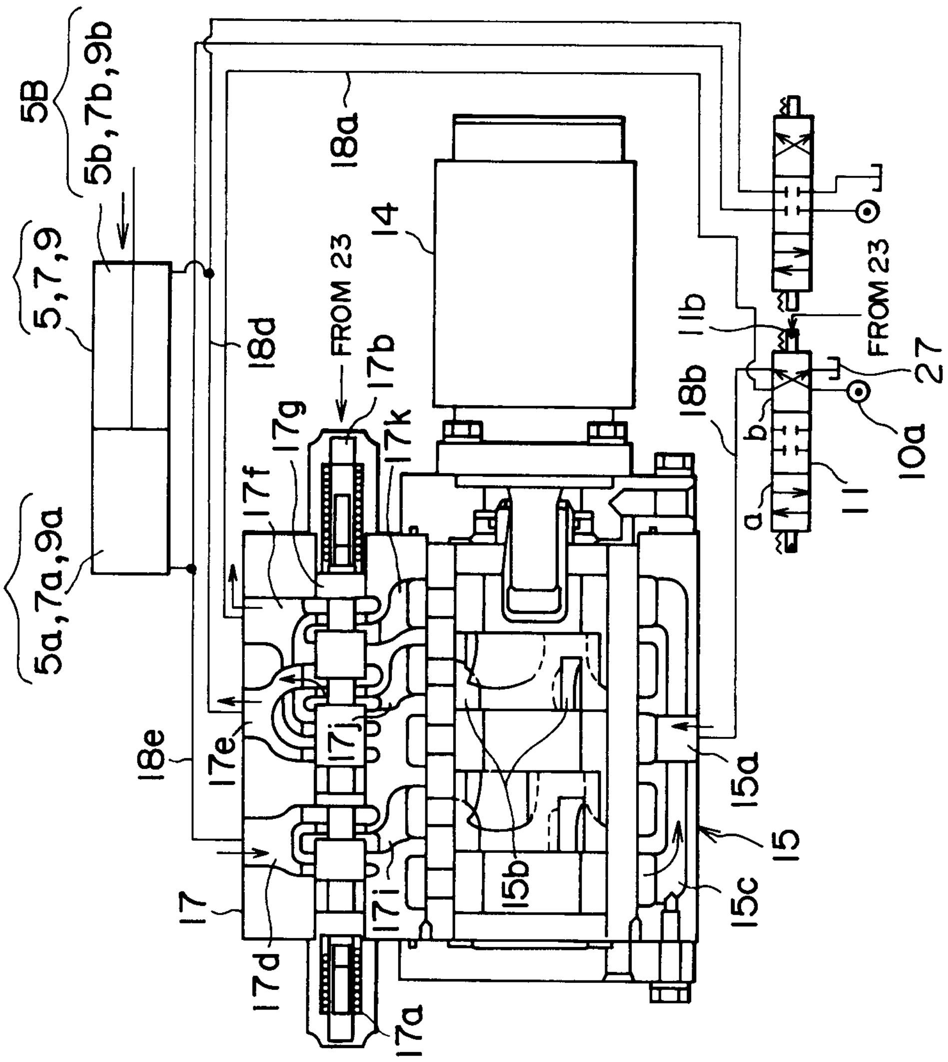

A
5,7,9
FROM 23
17b
b
FROM 23
11b
27
b
b
10a
11
15
17
17a
a
a
FROM 22
14
11a
FROM 22

FIG. 4A


5B
5b,7b,9b
A
5,7,9
5A
5a,7a,9a
18a
14
18d
FROM 23
17b
17g
17k
17f
FROM 23
11b
27
18b
b
10a
11
a
18e
17e
17j
15a
15
15b
15c
17
17d
17i
17a

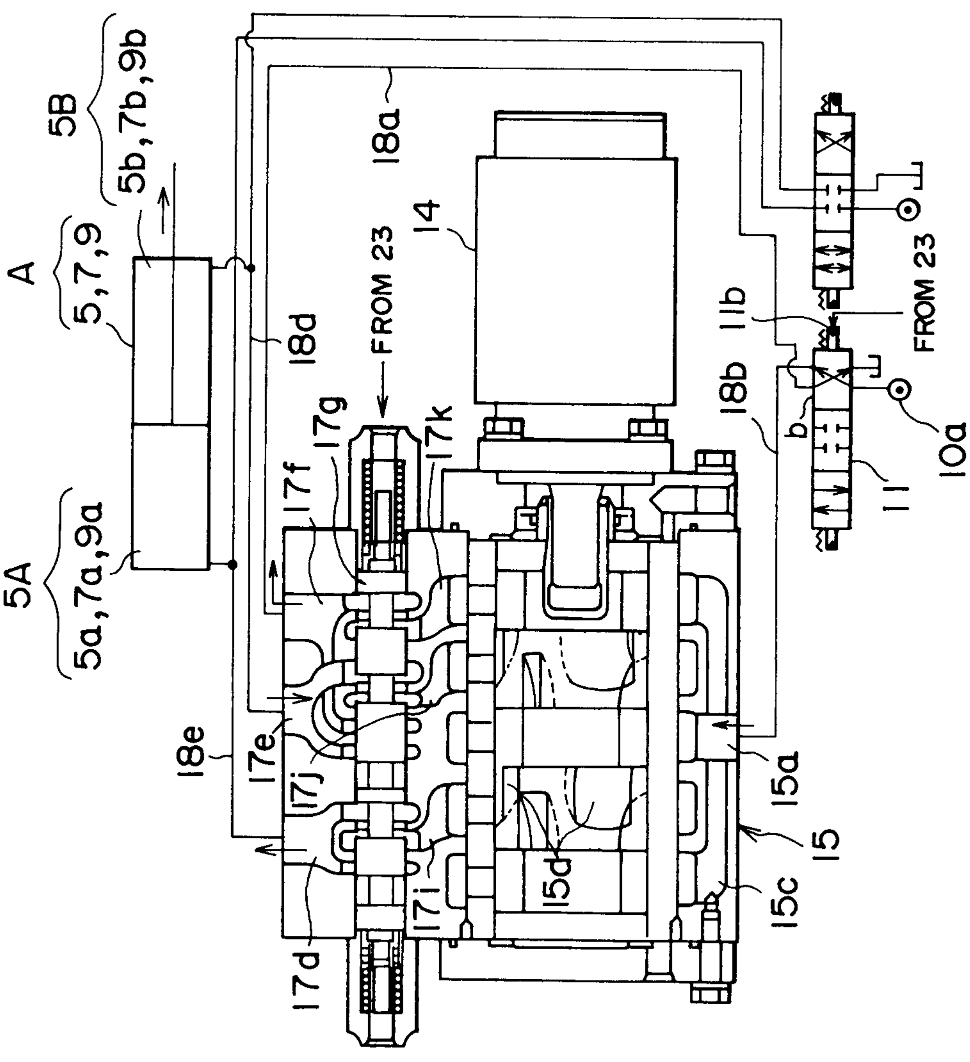

5A
5a,7a,9a
A
5,7,9
5B
5b,7b,9b
18a
18b
18d
18e
14
FROM 23
17d
17e
17f
17g
17i
17j
17k
15
15a
15c
15d
11
11b
10a
b
FROM 23

FIG. 5A

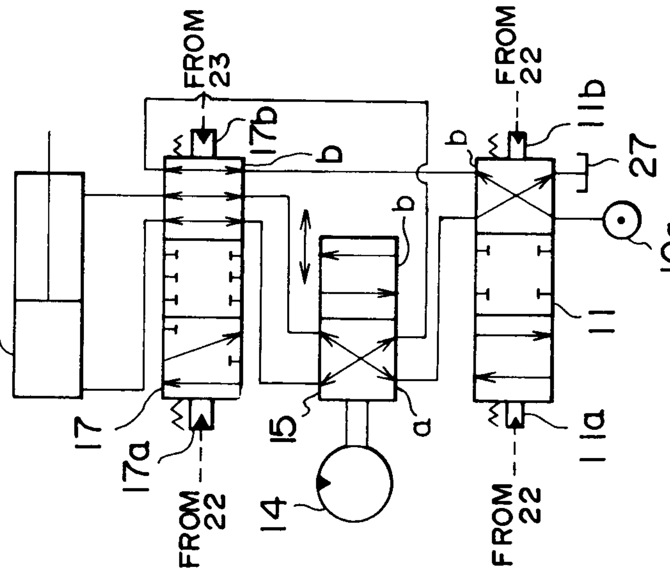

A
5,7,9
FROM 23
FROM 22
17
17a
17b
b
15
a
b
14
11
11a
11b
27
10a

FIG. 5B

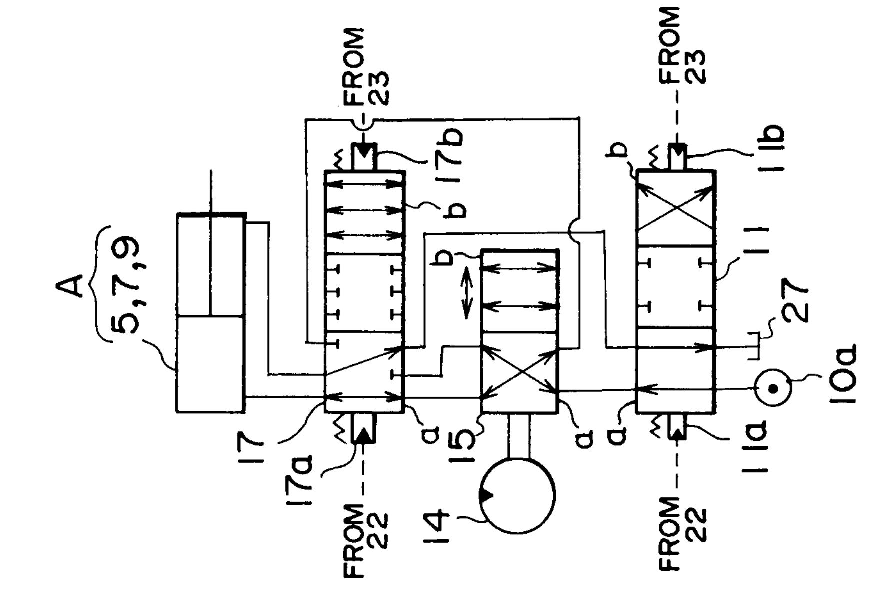

A
5,7,9
FROM 23
17b
b
17
17a
FROM 22
a
15
14
FROM 23
11b
11
27
10a
11a
FROM 22

FIG. 6B

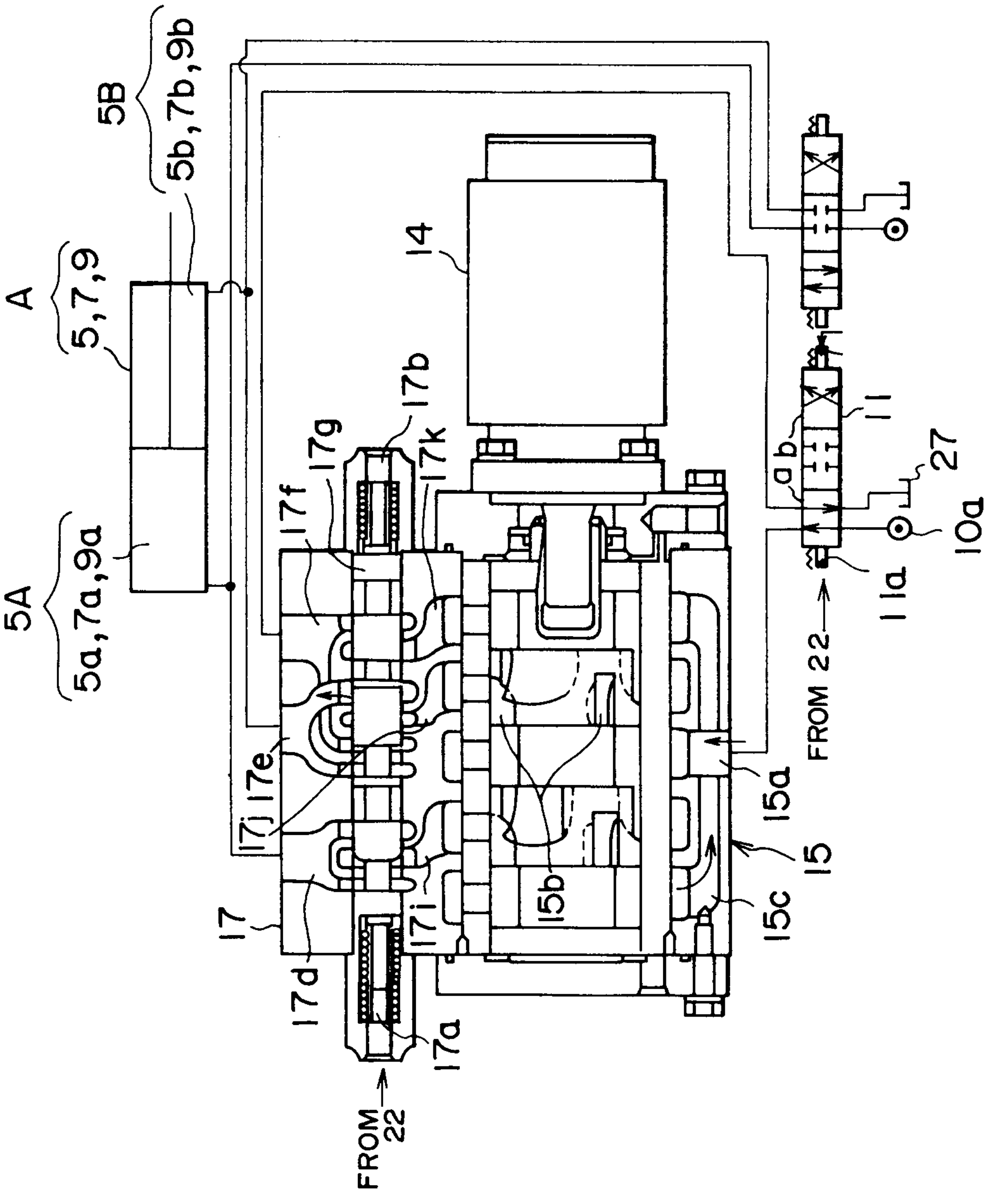

5A
5a,7a,9a
A
5,7,9
5B
5b,7b,9b
14
17b
17g
17k
17f
17e
17j
17
17d
17i
17a
FROM 22
15b
15a
15c
15
FROM 22
11a
10a
27
11
a b

FIG. 6A

FIG. 7B

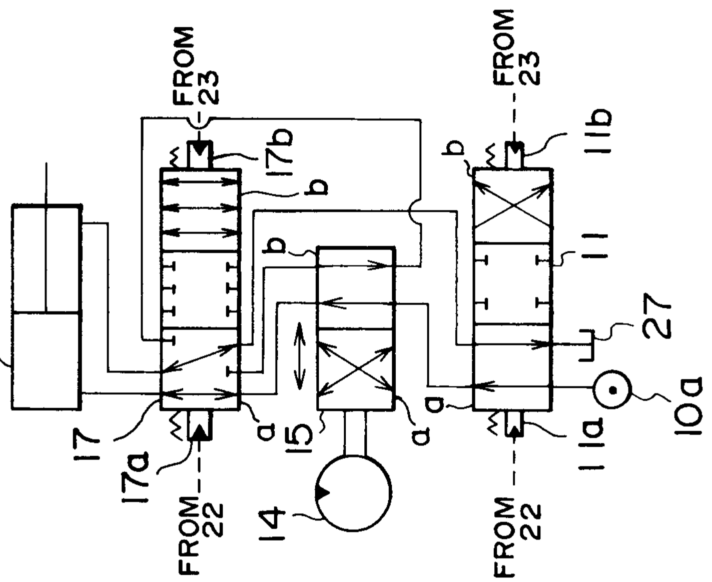

A
5,7,9
FROM 23
17b
b
17
17a
FROM 22
a
15
14
11
11a
11b
27
10a

FIG. 7A

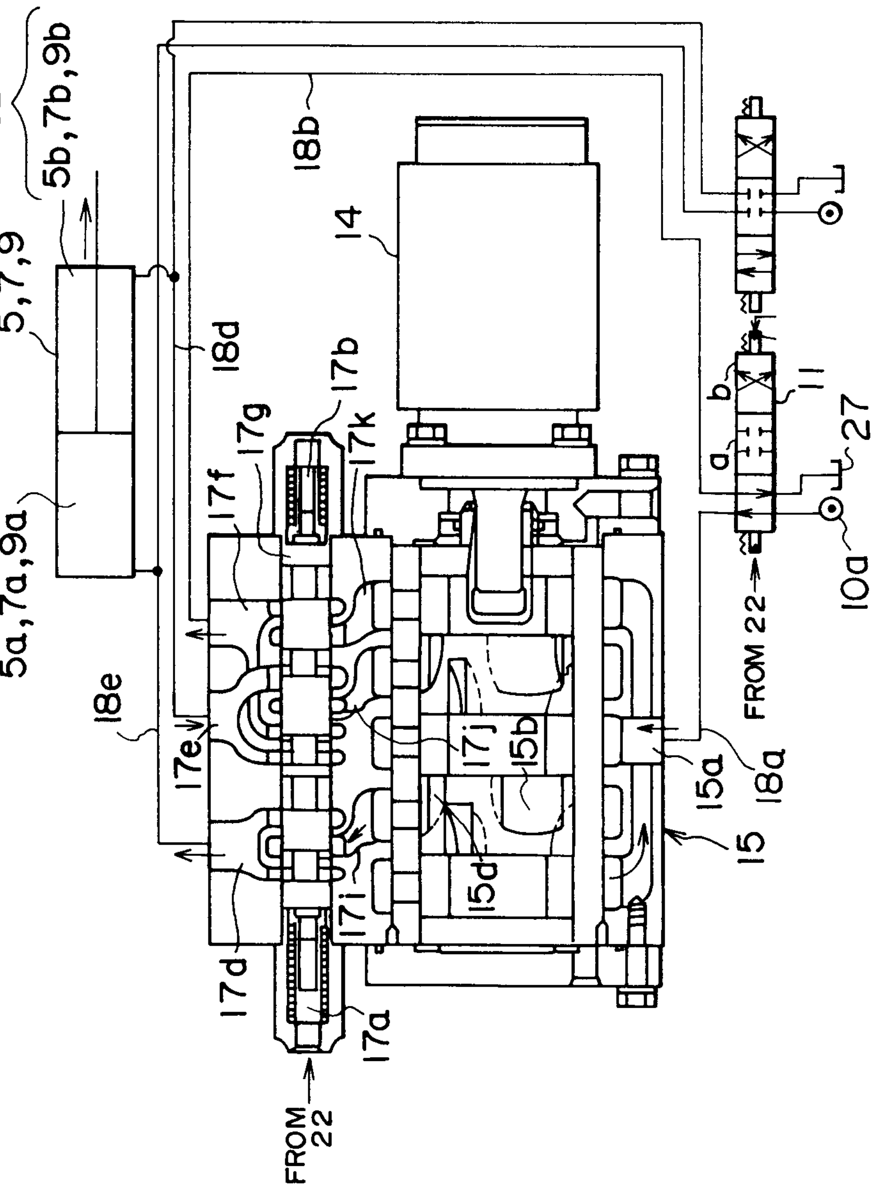

5A
5a,7a,9a
A
5,7,9
5B
5b,7b,9b
18b
18d
18e
14
17b
17g
17f
17k
17e
17j
15b
15d
17i
17d
17a
FROM 22
15a
18a
15
11
27
a
b
FROM 22
10a

FIG.8A

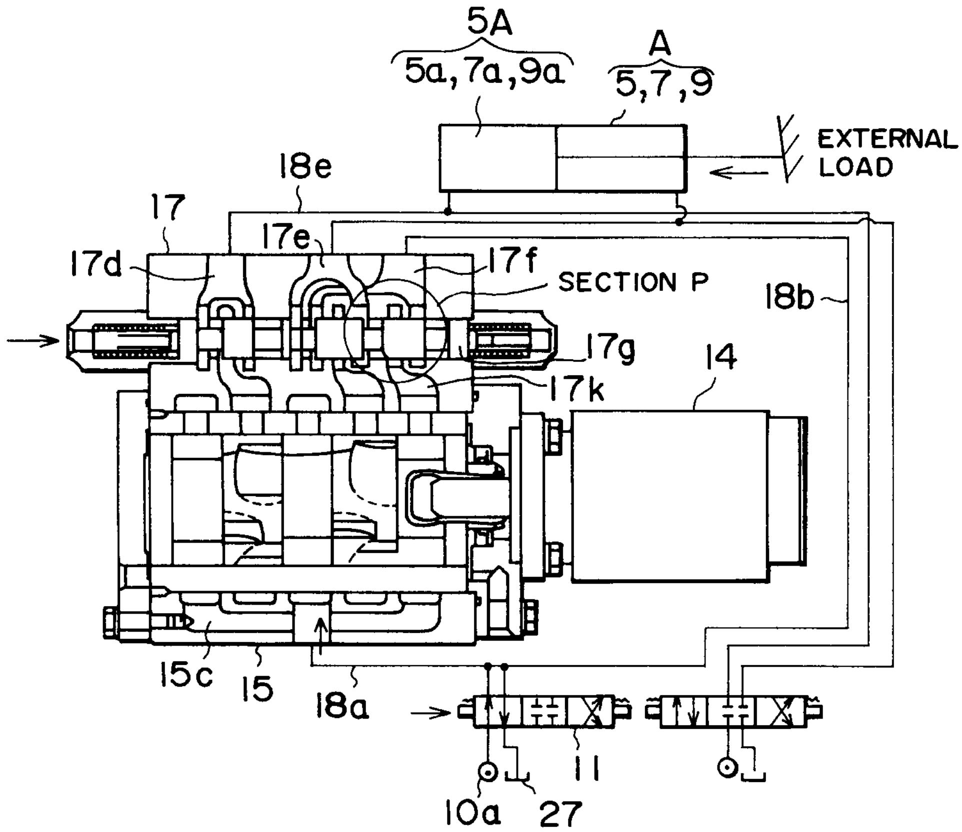


FIG.8B

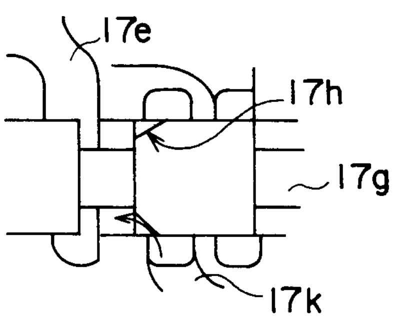


FIG.8C

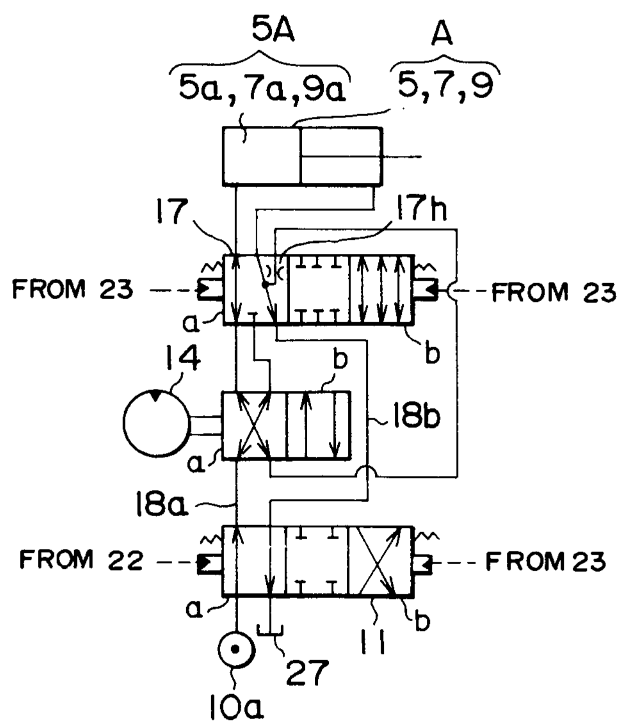


FIG.9A

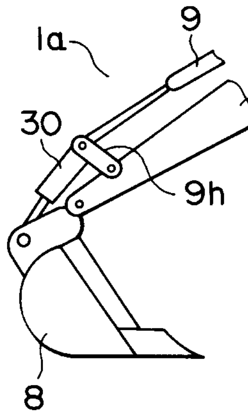


FIG.9B

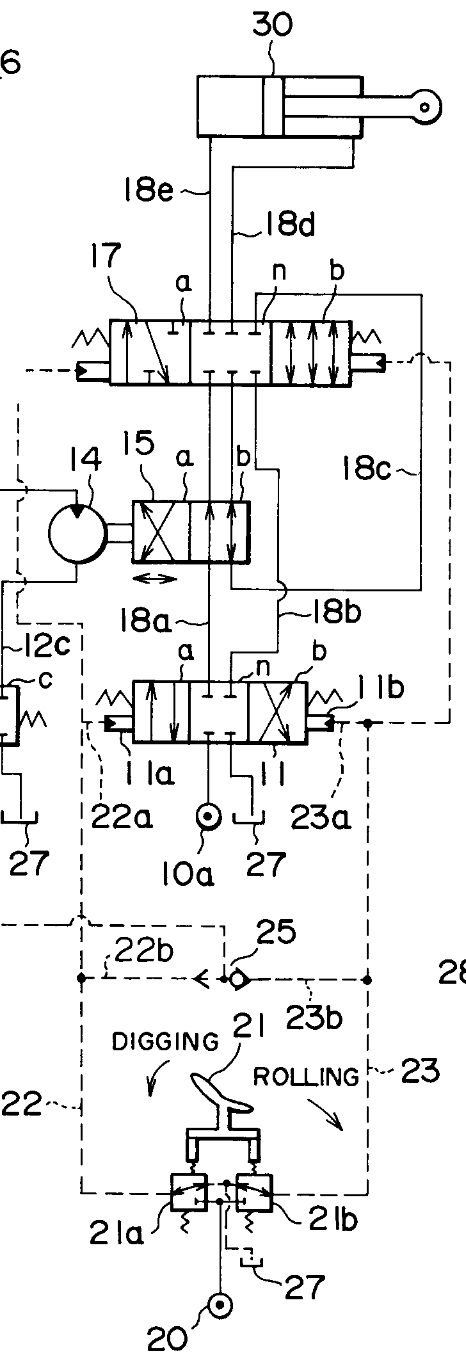


FIG.9C

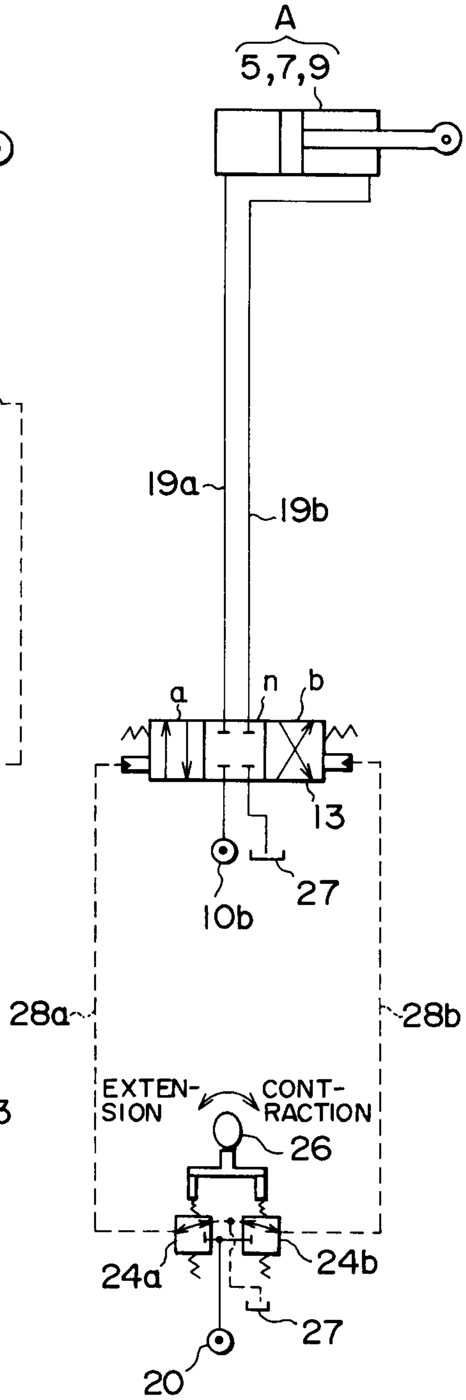


FIG. 10

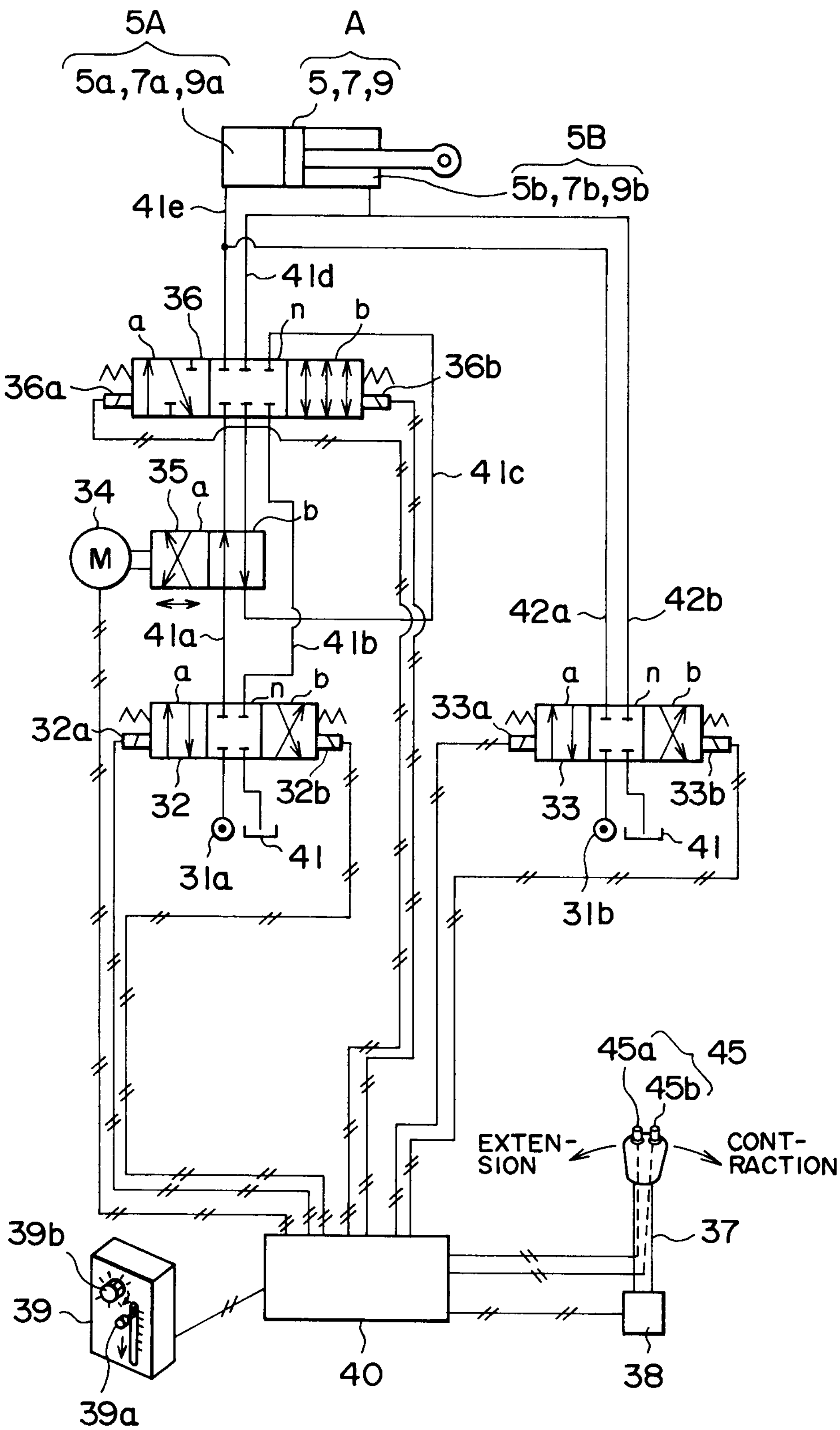

5A
A
5a,7a,9a
5,7,9
5B
5b,7b,9b
41e
41d
36
a
n
b
36a
36b
41c
34
35
M
41a
41b
42a
42b
32a
32
32b
31a
41
33a
33
33b
31b
45a
45
45b
EXTEN-
SION
CONT-
RACTION
37
39b
39
39a
40
38

FIG. 11

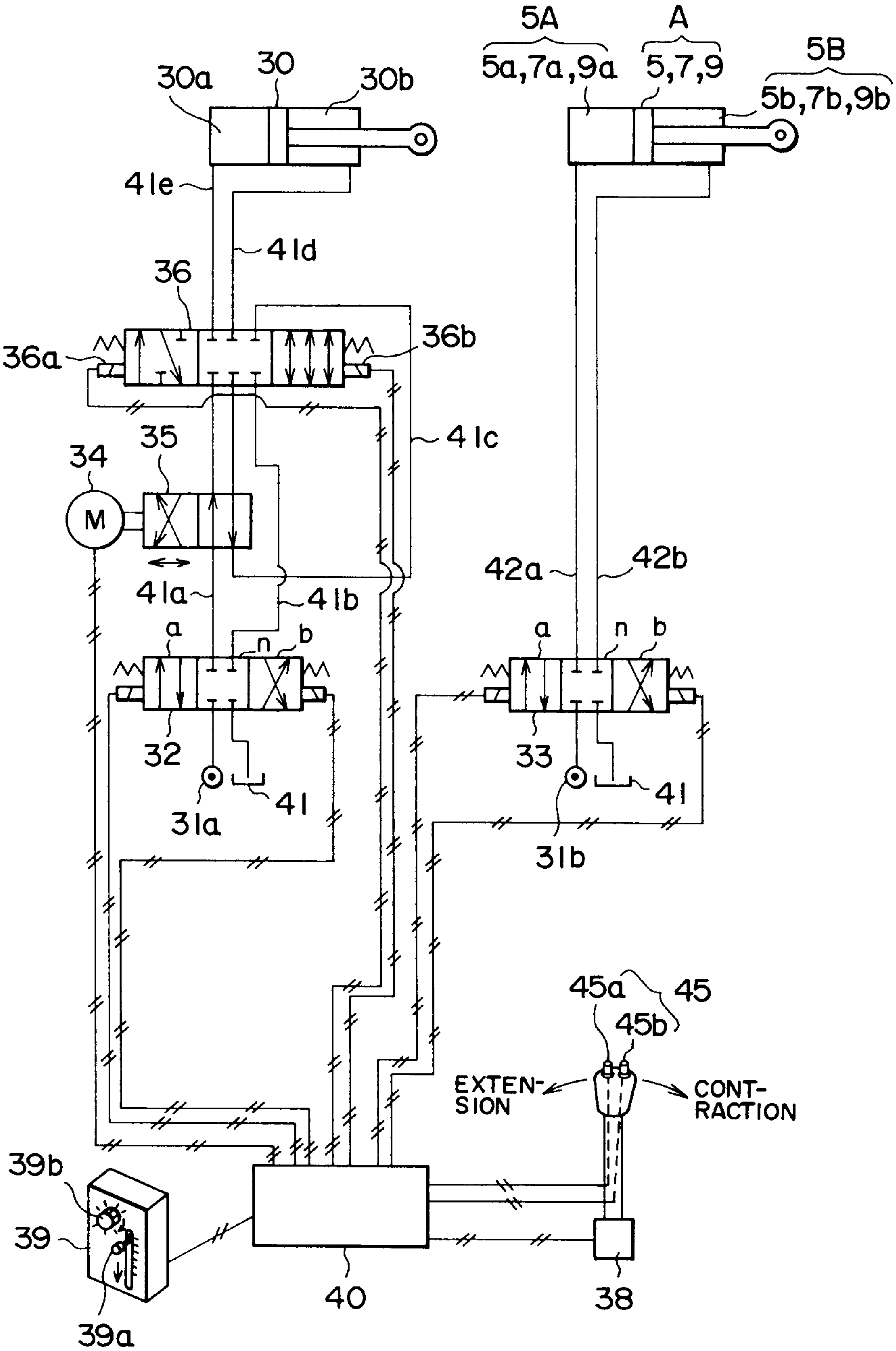

5A
5a,7a,9a
A
5,7,9
5B
5b,7b,9b
30a
30
30b
41e
41d
36
36a
36b
41c
35
34
M
41a
41b
42a
42b
a
n
b
32
33
31a
41
31b
45a
45
45b
EXTEN-
SION
CONT-
RACTION
39b
39
39a
40
38

FIG. 12

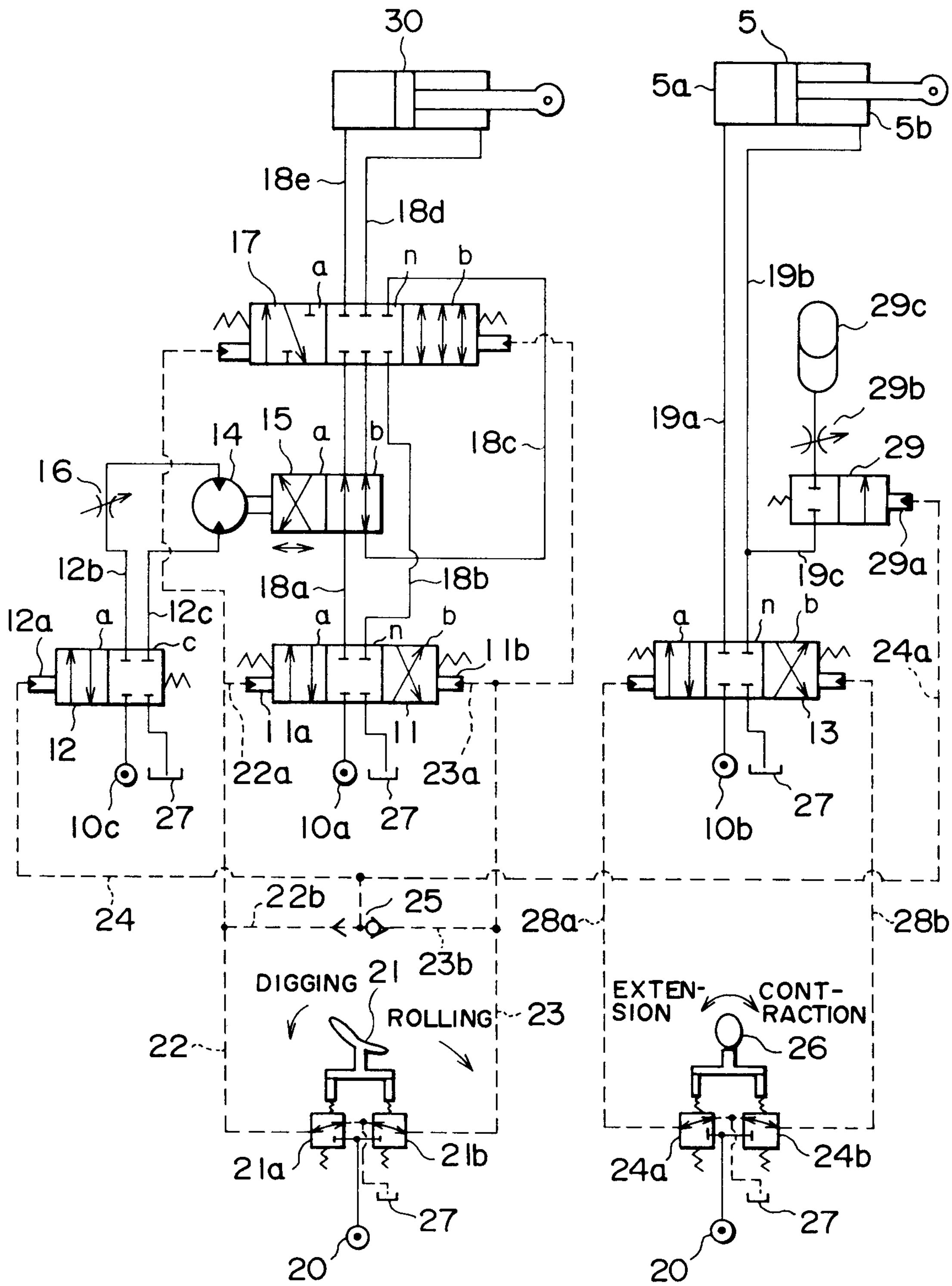

30
5
5a
5b
18e
18d
17
a
n
b
19b
29c
29b
19a
14
15
16
18c
29
29a
12b
19c
18b
18a
12a
12c
c
11b
24a
12
11a
11
13
22a
23a
10c
27
10a
10b
24
22b
25
28a
28b
23b
DIGGING
21
EXTEN-SION
CONT-RACTION
ROLLING
23
22
26
21a
21b
24a
24b
20

FIG. 13

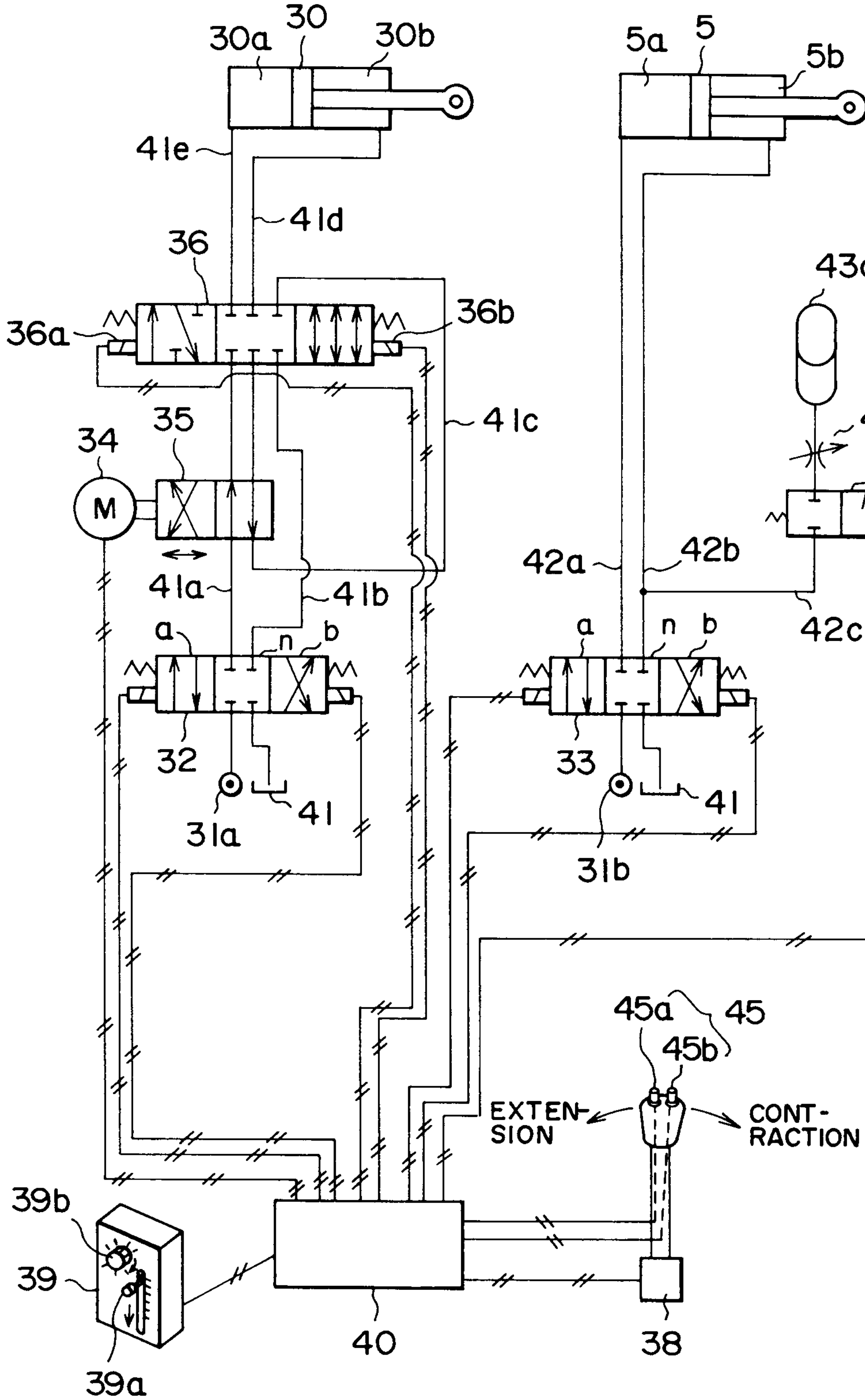

30a
30
30b
5a
5
5b
41e
41d
36
43c
36a
36b
41c
43b
35
43
34
M
41a
41b
42a
42b
43a
42c
a
n
b
32
33
31a
41
31b
41
45a
45
45b
EXTEN-SION
CONT-RACTION
39b
39
39a
40
38

FIG. 14

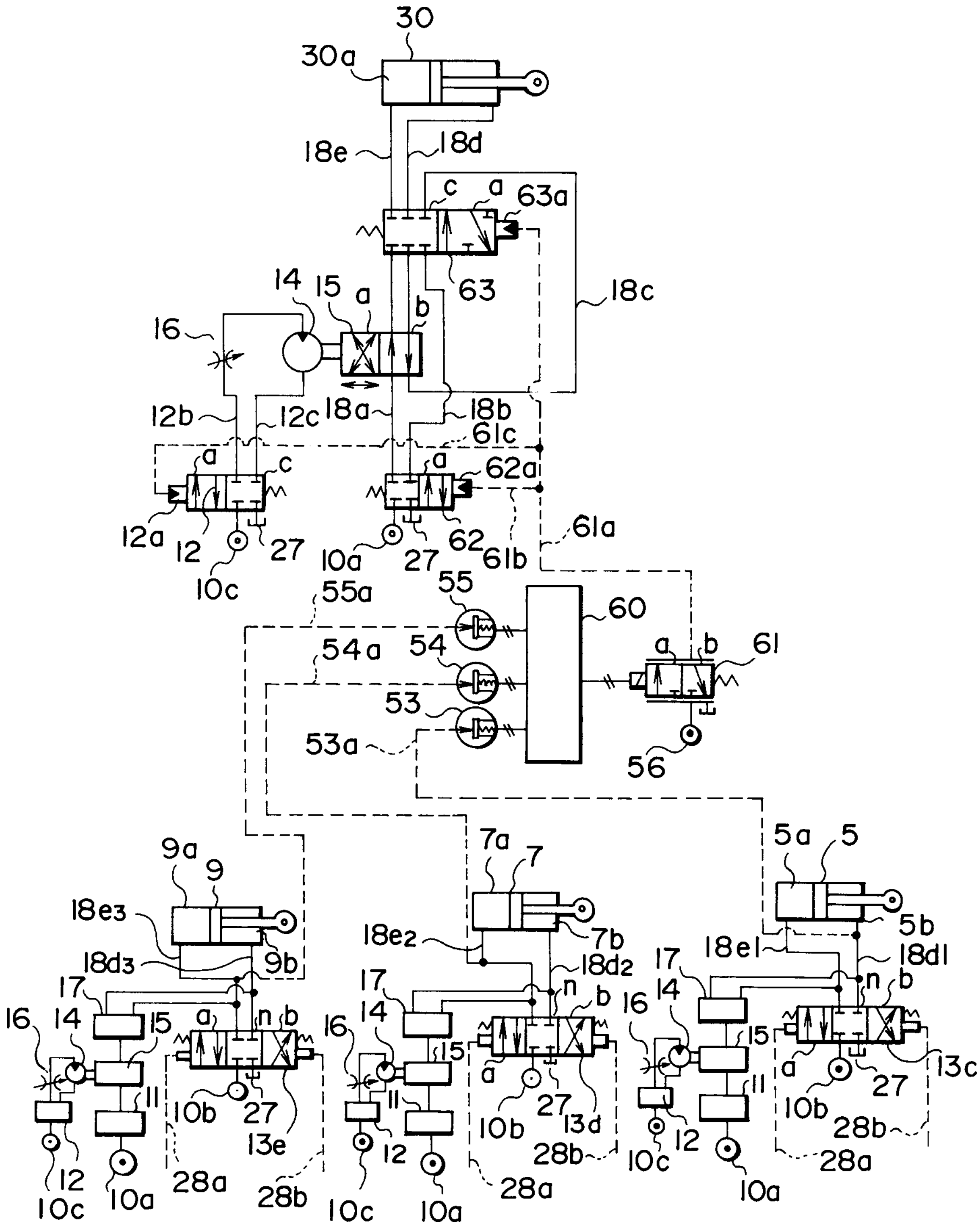

30
30a
18e
18d
c
a
63a
63
18c
14
15
a
b
16
12b
12c
18a
18b
61c
a
c
a
62a
12a
12
10c
27
10a
27
62
61b
61a
55a
55
60
54a
54
a
b
61
53
53a
56
9a
9
7a
7
5a
5
18e3
9b
18e2
7b
5b
18d3
18d2
18e1
18d1
17
16
14
15
a
n
b
10b
27
13e
12
10c
10a
28a
28b
17
14
15
n
b
11
a
10b
27
13d
28b
28a
12
10c
10a
16
14
17
n
b
15
11
a
10b
27
13c
28b
28a
12
10c
10a

FIG. 15

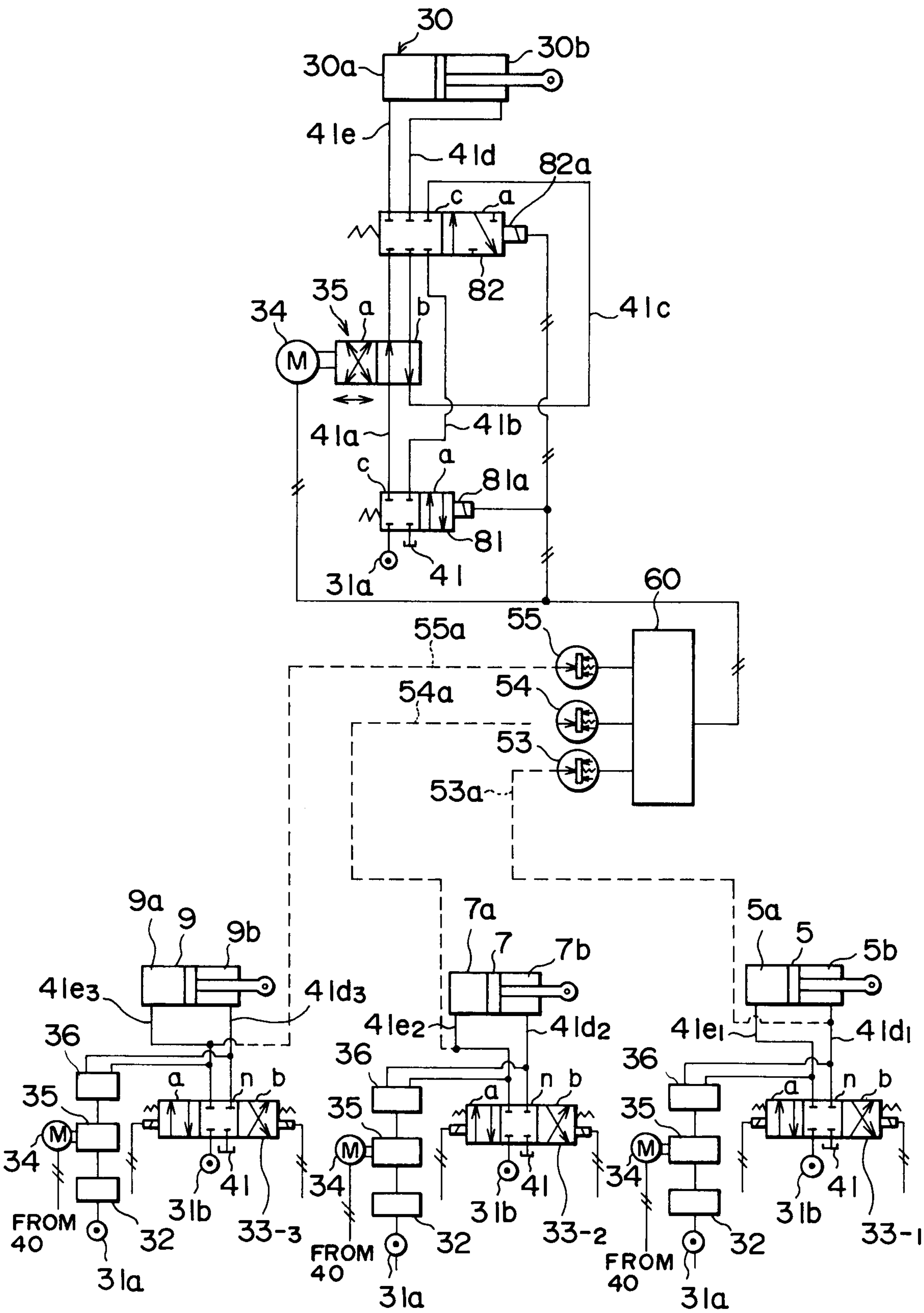
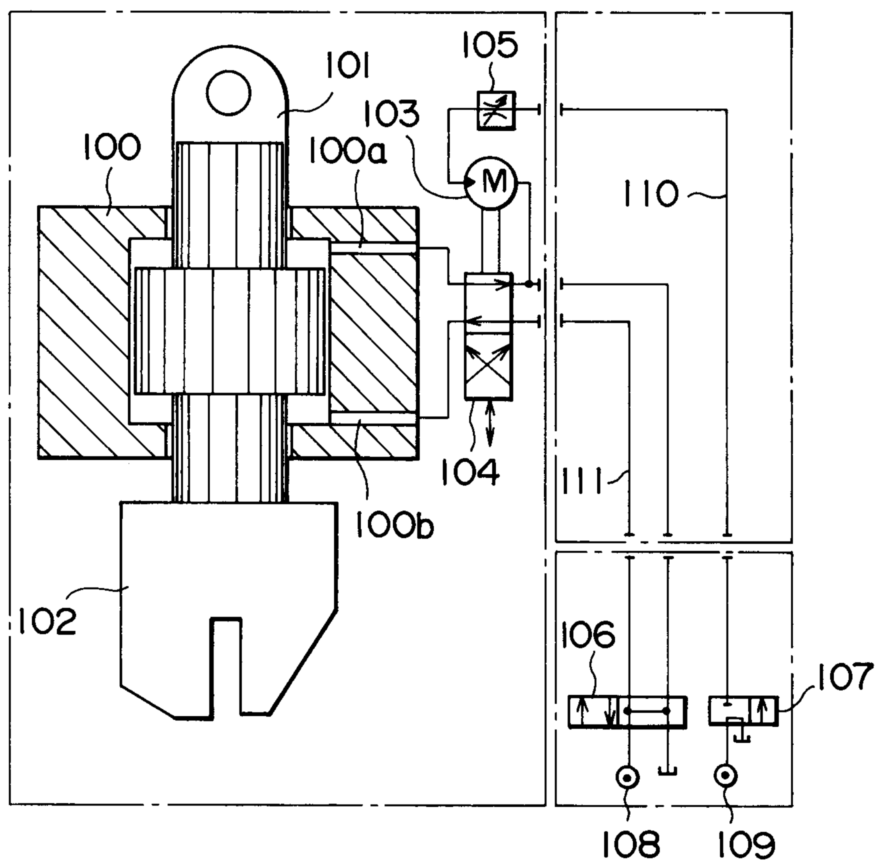

30
30a
30b
41e
41d
82a
c
a
82
35
34
M
a
b
41c
41a
41b
c
a
81a
81
31a
41
60
55a
55
54a
54
53
53a
9a
9
9b
41e3
41d3
36
35
34
M
a
n
b
41
31b
33-3
FROM 40
32
31a
7a
7
7b
41e2
41d2
36
35
34
M
a
n
b
41
31b
33-2
FROM 40
32
31a
5a
5
5b
41e1
41d1
36
35
34
M
a
n
b
41
31b
33-1
FROM 40
32
31a

FIG.16
PRIOR ART



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP95/02010

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl[6] E02F9/22, E02F3/40, F15B21/12

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. Cl[6] E02F9/22, E02F3/40, F15B21/12

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

Jitsuyo Shinan Koho 1926 - 1995
Kokai Jitsuyo Shinan Koho 1971 - 1995

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, 7-139522, A (Teijin Seiki Co., Ltd.), May 30, 1995 (30. 05. 95)	1-5
A	Microfilm of the specification and drawings annexed to the written application of Japanese Utility Model Application No. 164767/1987 (Laid-open No. 69903/1989) (Sanyo Kiki K.K.), May 10, 1989 (10. 05. 89)	1, 2, 3
A	JP, 7-158616, A (Teijin Seiki Co., Ltd.), June 20, 1995 (20. 06. 95)	1-5

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

* 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 when the document is taken alone
"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

Date of the actual completion of the international search	Date of mailing of the international search report
December 6, 1995 (06. 12. 95)	December 26, 1995 (26. 12. 95)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)