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(54) **Oleadynamic circuit for the control of reciprocating pistons pump.**

(57) An open oleodynamic circuit with automatic sequence for the control of piston pumps, particularly of concrete pumps, wherein the stability of the hydraulic system is obtained in all working conditions and with any positioning of the cylinders, of the type comprising two pumping cylinders (1, 3), two cylinders (2, 4) for the control of a deviating valve, through which the pumping cylinders are alternately placed in communication with a delivery pipe and with a charging hopper, and hydraulic valves (5, 6) for controlling said cylinders.

In this circuit, said hydraulic valves (5, 6) are controlled by means of auxiliary hydraulic valves (7, 8) acting as relays, which are piloted directly by the flow feeding the oleodynamic cylinders (1, 2, 3, 4) operating the pump, and which are meant to operate only when the end-of-stroke position has been reached.

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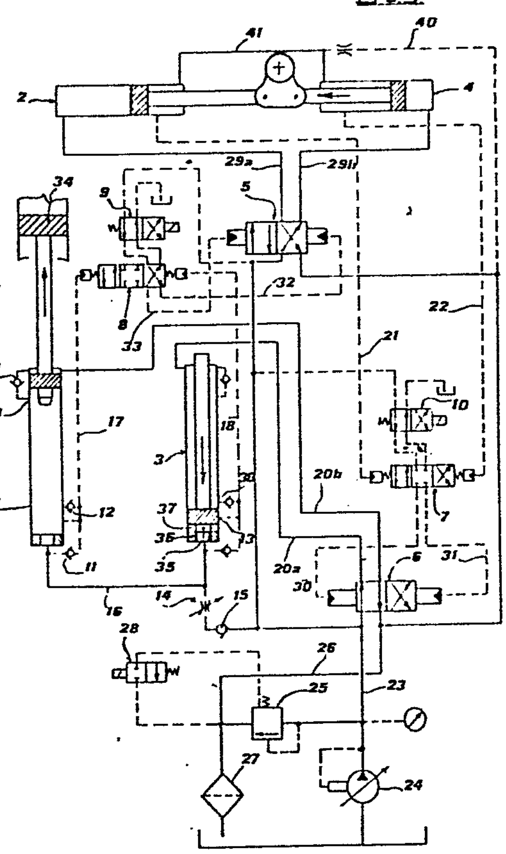
FIG 1



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"OLEODYNAMIC CIRCUIT FOR THE CONTROL OF RECIPROCATING PISTON PUMPS"

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The present invention concerns an open oleodynamic circuit with automatic sequence, having an indirect piloting system for the control of reciprocating piston pumps, particularly of concrete pumps, of the type comprising two cylinders for pumping the material and two cylinders for the control of a valve deviating said material in synchronism with the pumping cylinders.

For the control of concrete pump cylinders, the use of oleodynamic circuits with automatic sequence has been adopted for quite some time. There are known to be:

a) control systems by electric stops;

b) control systems by hydraulic stops;

c) composite electric-hydraulic systems;

d) time control systems;

e) control systems by means of single-acting piloted valves;

f) control systems wherein the pump operating cylinders perform the function of distributor.

All these systems are apt to provide the pump control oleodynamic circuit with an automatic sequence, without however reaching the degree of reliability required from machines operating on the building yard and in extremely hard and varied conditions, where the personnel in charge is often scarcely qualified and insensitive to the machine.

Experience has in fact proved that:

a) The control systems by electric stops, of various types, do not give sufficient guarantees as far as mechanical strength and resistance to oxidation of the contacts, taking into account the fact that they are generally fed by low-tension direct current. Furthermore, these systems require auxiliary instruments involving higher costs and, above all, not within reach of the personnel in charge.

b) The control systems with hydraulic stops require control members (cams, sliding support rods, and so on) involving high costs, which give rise to problems of adjustment and maintenance and complicate the oleodynamic circuit to the detriment of reliability.

c) The combined electric-hydraulic systems suffer from the already examined drawbacks, which are typical of single component systems.

d) The time control systems, wherein the cycle sequence signal depends on the time of passage of an oil flow through a gauged throttle, involve the drawback of having response times varying according to the flow pressure level and to temperature (depending on the viscosity), thereby causing timing problems in the operations between the valve cylinders and the pumping cylinders, which determine further wears of the sealing members or losses in volumetric efficiency.

e) The control systems by means of single-acting piloted valves, of the commercial type, have exceedingly long response times and intensify the water hammering phenomenon, not only, but they compromise the stability of the hydraulic which they control, as in the closing phase they pipe out of the hydraulic circuit a certain amount of oil. It also happens that, since the two valves are applied symmetrically on the two piloting branches of the distributing valve, one is apt to stop the outlet of oil, while the other allows the passage of the flow under pressure. On account of the oil escape, which is normally allowed for these standardized components, an uncontrolled movement of the main slider may then take place, causing the shifting of the working cycle. It should be pointed out that this type of drawback occurs only in particular oil pressure and temperature conditions, but it anyhow limits the stability. It is also possible that components apt to solve the aforespecified drawbacks may be conceived and produced, but this would still weigh negatively upon the economy of the machine and, above all, it would mean depending on a single supply source.

f) Finally, the control systems providing for the use of pump operating cylinders as distributors of the main feeding flow, are apt to solve well the sequence and stability problems, but only between the valve cylinder and the pumping cylinder and not viceversa, whereby it is always necessary to resort to an integrating system of the type of those cited in the previous points. This system hence requires non-standardized distribution components being, as such, costly and scarcely reliable. One should add, furthermore, the drawbacks typical of integrating systems.

Since all the oleodynamic circuits for piston pumps, known up to date, provide for a parallel connection (by-pass, or so-called slave circuit) between the two chambers on the piston side or on the rod side of the pumping cylinders, there is always need for a system to reintegrate the oil which from this circuit escapes to the exhaust. Whereby, it is necessary to resort to single-acting valves, positioned next to the stops of the pumping cylinder, so as to allow a small transfer of oil between the chamber which is fed directly and the slave circuit. This system solves well the problem of synchronism between the pumping cylinders, but it causes a slight reversal of motion when, for instance, the transfer occurs from the minor section to the major one, as the respective pressures tend to counterbalance each other.

The oleodynamic circuit according to the present invention proposes and allows to overcome all the heretofore specified drawbacks, which are typical of the already known solutions.

It is of the type comprising two pumping cylinders, two cylinders for the control of a deviating valve, through which the pumping cylinders are alternately placed in communication with a delivery pipe and with a charging hopper, and hydraulic valves for controlling the direction of movement of the pistons in said cylinders, and it is essentially characterized in that said hydraulic valves are controlled by means of auxiliary hydraulic valves, acting as relays forming part of said circuit, each of said auxiliary hydraulic valves operating as the two cylinders controlled by the other valve reach the wanted positions.

Further characteristics of the circuit according to the present invention are:

- that said hydraulic valves are all of the standardized type;

- that the pumping cylinders are provided with slowing-down means in correspondence of the return stroke stop;

- that, in correspondence of the return stroke stop, the piston of the pumping cylinders acts as distributor in respect of the signal taps;

- that the recovery of oil escape by the slave circuit is carried out continuously, during the pumping cycle, by means of a throttle with micrometric delivery adjustment.

The invention will now be described in detail, with reference to a particular embodiment thereof, illustrated in the accompanying drawings, in which:

Fig. 1 is a diagram of the oleodynamic circuit according to the invention, in a first working phase thereof;

Figs. 2 to 4 show the working phases of the same circuit, subsequent to that of figure 1;

Figs. 5 and 6 show the pumping cylinder-piston units of the circuit of figure 1, in two anomalous working conditions;

Fig. 7 shows the circuit of figure 1, in the inverted working phase which is occasionally required to remove obstacles to the pumping; and

Figs. 8 and 9 show the two working phases of a circuit like that according to the previous figures, integrated with elements allowing it to perform also the function of keeping the deviating valve close to and away from the cylinders during the pumping phase and, respectively, during the valve displacement phase.

With reference to figure 1, the oleodynamic circuit according to the invention comprises two hydraulic pumping cylinders 1 and 3, to which are connected the pistons 34 thrusting the material (concrete); two hydraulic cylinders 2 and 4 controlling the deviating valve, both connected to a handle; a two-position hydraulic valve 5, with floating slider for feeding the two valve cylinders 2 and 4; a two-position hydraulic valve 6, with floating slider for feeding the hydraulic pumping cylinders 1 and 3; a three-position auxiliary hydraulic valve 7, controlled by the flow under pressure determined by the position of the deviating valve and sent, through pipes 21 and 22, from the cylinders 2 and 4, said hydraulic valve 7 acting as relay for piloting the hydraulic valve 6; a three-position auxiliary hydraulic valve 8, controlled by the flow under pressure determined by the position of the hydraulic pumping cylinders and sent, through pipes 17 and 18, from the cylinders 1 and 3, said hydraulic valve 8 acting as relay for piloting the hydraulic valve 5; two solenoid valves 9 and 10 (or, where required, manually controlled valves), for remote controlling of the reversal of the pumping cycle into a suction cycle; a circuit feeding pump 24; a peak valve 25, with annexed discharging solenoid valve 28, for the control and protection of the oleodynamic circuit; a micrometric oil filter 27, preferably positioned on the return pipe; a single-acting valve 15 on the supercharging pipe of the slave circuit; and a micrometric capacity regulator 14, which is apt to guarantee the synchronism of the pumping cylinders and allows oil regeneration.

The operation of the circuit is now described in detail, in its four phases illustrated in figures 1 to 4 of the accompanying drawings:

In phase I (fig. 1), the pumping cylinder 1 has completed its outlet stroke slightly in advance in respect of the cylinder 3, which has performed its inlet stroke. The piston of the cylinder 1 thereby uncovers the hole 39, allowing the slave circuit (formed by the two chambers on the piston side of the cylinders 1 and 3 which are connected by the pipe 16) to drain to the exhaust, through the single-acting valve 19, the excess of oil absorbed during the stroke, while the piston of the cylinder 3, which is still moving forward, covers the hole 13 and uncovers the hole 38 which is connected to the single-acting valve 12. At the same time, the projection 35 enter the seat 36, causing the oil contained in the chamber 37 to escape into the pipe 16 creating an appropriate resistance, the value of which varies in function of the oil viscosity and of the piston speed, but is independent from the pressure which the system requires to overcome the resistance of the material to be pumped through the pistons 34. A pressure is established in the pipe 18, having a value equal to the sum of the pumping pressure plus the pressure deriving from the escape of oil from the chamber 37 to the pipe 16, while a fall of pressure takes place in the pipe 17, as the slave circuit is connected to the exhaust by way of the valve 19. Consequently, the slider of the hydraulic valve 8 - which was earlier in the central position, due to a pressure balance between pipes 17 and 18 and thanks to the action of the end springs - moves towards the pipe 17. Through the solenoid valve 9, the pipe 32 goes into pressure, while the pipe 33 discharges, causing a change of position of the slider of the hydraulic valve 5. The oil placed in circulation by the pump 24 flows into the pipe 29b (the absorption by the pipe 20a being now exhausted) and causes the displacement of the valve cylinder 4 and that of the valve cylinder 2, to which it is connected. This positively takes place, in any pressure conditions of the circuit, and even in pumping situations where pressures are close to zero, in that, at the end of the stroke, the cylinder always produces sufficient pressure to guarantee the piloting of the relay-hydraulicvalve 8.

In actual fact, even if there will be a slight oil escape through the hole 13, closed by the piston, said escape will never be such as to determine a fall of pressure on the pilot branch 18, in that this latter is connected to the pump 24 through the hole 38 and through the single-acting valve 12.

As soon as the valve cylinders will have moved from the end-of-stroke position (the cylinder 4 from the inlet position and the cylinder 2 from the outlet position), the pipe 21 will connect itself to exhaust like the pipe 22, creating the conditions whereby the slider of the hydraulic valve 7 moves to the center, causing the slider of the hydraulic valve 6 to remain in a steady closing position. The pumping cylinder 3, through the pipe 20a, remains connected to the pump, parallely to the pipe 29b, throughout the stroke length of the cylinders 4 and 2 controlling the deviating valve.

One should take in due consideration the phenomenon which characterizes the starting and stopping of the cylinders of a piston pump as that described, on account of the high working speeds. Especially the starting, easily creates an unbalance in pressure on the piloting pipes, upsetting the synchronism of movement of the various cylinders.

The heretofore described oleodynamic circuit allows to solve this problem by adopting the following expedients:

For the valve cylinders, a controlled drainage of the "by-pass" 41, connecting the two chambers on the rod side, is operated through a fixed throttle 40, such as to allow limiting -

in any working conditions - the difference in pressure Δ p between said chambers, the one discharging oil and the other absorbing it. It so happens that the pressure wave produced by the feeding of the cylinder 4 is trasmitted, through the pipe 41, also in the cylinder 2, so as to guarantee stability to the slider of the hydraulic valve 7, connected to said cylinders through the pipes 21 and 22.

For the pumping cylinders, two holes 13 and 38 are provided in correspondence of the end-of-stroke inlet position. The first hole more or less coincides with the center of the piston, which is apt to close the same; the second hole is spaced from the first by a distance such as to make sure that, during the return stroke of the piston, the first hole closes upon opening of the second hole. It ensues that the pressure wave produced in the slave circuit when the cylinders start off, equally affects both piloting pipes 17 and 18, on account of the fact that the hole 13 will be closed and the hole 38 will be protected by the single-acting valve 12. This is sufficient to guarantee stability to the slider of the hydraulic valve 8 in any working conditions, even in the presence of a possible slight oil escape from the piston (as already explained previously).

Always in connection with stability, it should be added that the hydraulic valves 7 and 8, designed to process the signals issued from the cylinders, are apt to guarantee stability to the slider of the respective main hydraulic valves 6 and 5, in any pressure conditions of the hydraulic circuit and in any intermediate position of the cylinder pistons. This means that the change of situation occurs only when each of the cylinders 1 to 4 has reached its end-of-stroke position.

We shall now consider the operating phase II, illustrated in figure 2:

The cylinder 4 of the deviating valve has reached the end-of-stroke outlet position. Simultaneously, a difference in pressure Δ p is established between the pipe 22 and the pipe 21, having a value which varies according to the resistance opposed by the deviating valve, and which is anyhow such that the relay-hydraulicvalve 7 moves from the central position, taken up during the stroke, to the end position. The pipe 31 goes into pressure, while the pipe 30 discharges, thereby causing the main hydraulic valve 6 to take up a new position. The oil placed in circulation by the pump flows into the pipe 20b, the absorption by the pipe 29b being now exhausted, and the pumping cylinders will thus start a new stroke. On starting, the slider of the relay-hydraulicvalve 8 moves from the outer position to the central position, holding in a steady position the hydraulic valve 5, which will keep the pipe 29b connected to the pump. It can easily be understood that, during the full stroke of the pumping cylinders, the hydraulic valve 8 will hold the central position, while the hydraulic valve 7 will hold the external position finally taken up or, at the most, in the event of the pressure in the system being very low, it will take up the central position.

At this point, phase III starts, as illustrated in figure 3.

As a result of the supercharging of the slave circuit, the cylinder 3 completes its stroke slightly in advance in respect of the cylinder 1 and, in this situation, all the piloting conditions already examined in phase I are reproduced. The relay-hydraulicvalve 8 moves from the central position to the outer position and, consequently, the hydraulic valve 5 changes position, causing the pipe 29a to go into pressure and the pipe 29b to discharge. The cylinder 2 starts its stroke, which causes the deviating valve to take up a new position. As soon as this stroke has started, the slider of the relay-hydraulicvalve 7 takes up the central position, keeping the hydraulic valve 6, which controls the pumping cylinders in a steady closed position. At the same time, the relay-hydraulicvalve 8 holds the final taken up position or, at the most, in the event of the pressure in the system being very low, it takes up the central position.

Phase IV, which is the last phase of the cycle, is illustrated in figure 4:

The cylinder 2, in completing its stroke, puts under pressure the pipe 21 producing, in any pressure conditions, a difference in pressure Δ p between the two branches 21 and 22, so that the hydraulic valve 7 moves from the central position (taken up during the intermediate part of the stroke) to the outer position. Consequently, the hydraulic valve 6 takes up a new position whereby the pump 24, having stopped feeding the cylinder 2, starts to feed the cylinder 3 through the pipe 20a. The starting-off of cylinder 3 reproduces all the conditions already illustrated in figure 1, whereby the slider of the relay-hydraulicvalve 8 moves from the last external position taken up, to the central position, guaranteeing stability to the hydraulic valve 5 which controls the cylinders of the deviating valve.

At the end of phase IV, the situation already analysed in figure 1 will arise again and the pumping cycle, intended as time interval between a specific position of a pumping cylinder and the following position, will be completed.

An oleodynamic circuit as that described guarantees for each cylinder movement to take place only if the previous movement has been accomplished; it operates at a regular rate and keeps the synchronism in each situation; as well as being realized with standardized components (cylinders excluded), which have the merit to be easily found at limited costs. Furthermore, it works with an automatic sequence of the various phases and it can thus be stopped and started again without any preferential positions. If, for any special reasons (which are obviously not analysed herein), the pumping cylinders should miss the synchronism, due to excess or want of oil in the slave circuit, it is not necessary to resort to expedients or supplementary operations, as the circuit self-synchronizes.

To be convinced of this, it will be sufficient to consider, for example, the case in which an excess of oil is present in the slave circuit, as illustrated in figure 5: the cylinder 3 ends its outlet stroke somewhat in advance in respect of the cylinder 1. Since the sequence signal is produced at the end of the inlet stroke, the excess of oil is eliminated through the single-acting valve 19 and the cylinders return at once in synchronism.

Whereas, if there should be lack of oil in the slave circuit, as shown in figure 6, things proceed as follows: the cylinder 1 ends its inlet stroke in advance in respect of the outgoing cylinder 3, and produces the sequence signal; the cylinder 3 in turn performs its inlet stroke and the cylinder 1 its outlet stroke, and so on. The two pumping cylinders will gradually perform longer and longer strokes as, in the slave circuit, a predetermined amount of oil continually flows through the capacity regulator 14, up to reaching the full stroke.

In both cases, therefore, the circuit is apt to overcome the temporary unbalances and starts to work again regularly.

In concrete pumps, it is fairly often required to change over from the delivery cycle to the suction cycle, when plugs of material blocking the flow are formed inside the piping.

These situations are mostly solved by resorting to a temporary backflow, that is, by returning the concrete from the piping towards the charging hopper, thereby disintegrating that part of material which had caused the plugging up.

With the circuit according to the present invention, this operation is carried out by acting on the solenoid valves 9 and 10, exciting them for the length of time required to remove the obstacle.

Figure 7 shows a phase of the suction cycle referring to a previous situation, as that of figure 4.

If, at any time of the pumping cycle, the solenoids of the valves 9 and 10 are put undertension, the situation on the hydraulic valve 7 changes and, accordingly, the pipe 31 passes from the exhaust condition to the pressure condition, and the opposite occurs to the pipe 30; the hydraulic valve 6 changes position, causing the pipe 20b to go into pressure and the pipe 20a to discharge, the pumping cylinders 1 and 3 reversing at once their direction of movement; nothing changes on instead the hydraulic valve 8 which, finding itself with a closed center, does not interfere on the situation of the hydraulic valve 5 which controls the deviating valve. When the cylinder 1 completes its stroke, it causes the hydraulic valve 8 to take up a new position, which will cause the switching of the deviating valve. In the event that the excitation of the solenoid valves 9 and 10 should coincide with the situation of figure 3, one would obtain a prompt reversal of the deviating valve, while the pumping cylinders would instead remain at a standstill up to completion of the stroke of the cylinders controlling the valve. The situations already analysed in figures 1 to 4 would in any case reproduce themselves, whereby the automatic sequence control would anyhow be guaranteed.

Concrete pumps of the type with reciprocating pistons normally perform two functions: pumping and switching of the valve, as seen so far.

In particular applications, where a constant adherence between the sealing parts, even in the presence of wears, has to be guaranteed, a third function can be provided to complete the first two, namely that allowing to bring the deviating valve adherent to the pumping cylinders, when these latter are working, and to keep it instead slightly apart (it may even be enough to simply eliminate the coupling force) when having to move from one cylinder to the other.

Without specifically discussing herein the advantages obtained with the third function, we shall simply point out how the circuit according to the present invention is apt to accomplish this task if it is integrated with a few additional elements.

One should consider figure 8, which illustrates a phase of the cycle wherein the pumping cylinders have ended their stroke. Through the hole 38, the cylinder 3 puts simultaneously under pressure the pipes 18 and 43, while the slave circuit is already at the exhaust by way of the single-acting valve 19. The flow under pressure simultaneously affects the pipes 44 and 45, which connect the opposite ends of the slider of the hydraulic valve 46. However, since the flow entering the pipe 44 has to cross the throttle 50, and since it is furthermore connected to the pipe 16, which is at this moment positioned in exhaust, there will no doubt be a difference in pressure Δ p between the pipes 44 and 45, such as to overcome the opposing force of the positioning spring provided on the hydraulic valve 46. As a result, also the pipe 47 will be put under pressure, in parallel with the pipes 18 and 43, while the pipe 48 will be affected by an induced pressure (in that it is closed) as a result of which, owing to the compressibility of the oil and to the elasticity of the means, the piston of the cylinder 49 will move to a slight extent from right to left, causing the desired separation between the valve and the pumping cylinders.

This situation will last throughout the length of movement of the deviating valve, that is, up to when a new sequence signal appears.

Figure 9 illustrates the phase which follows the one heretofore described; in this latter, the cylinder of the valve 4 has performed its stroke and created the conditions for the starting of the pumping cylinder 1.

At this point, the pipe 20b goes into pressure simultaneously with the slave circuit of the pumping cylinders, whereupon also the pipes 44 and 45 have the same pressure. The positioning spring of the hydraulic valve 46 acts so as to drain the pipe 45 into the pipe 44 through the throttle 50, whereby the pipe 48 goes into pressure and the pipe 47 discharges. The cylinder 49 then moves from left to right, so performing the pulling function (forced drawing of the valve close to the pumping cylinder).

It should be underlined that the cylinder 49, when working in the pulling sense (T), has no stroke limitation, which means that it can recover with time the slack produced by wear, whereas when working in the parting sense (S), it has stroke limitations, in that the possible stroke is that deriving from the yielding of the seals on the piston and from the compressibility of the hydraulic fluid. Furthermore, the amount of oil required for this function is low comparatively to that placed in circulation in the hydraulic system, and namely such as not to cause perceptible delays in the piloting system.

CLAIMS

1) Open oleodynamic circuit with automatic sequence, having an indirect piloting system for the control of reciprocating piston pumps, of the type comprising two pumping cylinders, two cylinders for the control of a deviating valve, through which the pumping cylinders are alternately placed in communication with a delivery pipe and with a charging hopper, and hydraulic valves for controlling the direction of movement of the pistons in said cylinders, characterized in that said hydraulic valves are controlled by means of auxiliary hydraulic valves, acting as relays forming part of said circuit, each of said auxiliary hydraulic valves operating as the two cylinders controlled by the other valve reach the wanted positions.

2) An oleodynamic circuit as in claim 1), wherein said auxiliary hydraulic valves are apt to keep the piloting active and to preserve it once they have operated the same.

3) An oleodynamic circuit as in claims 1) and 2), wherein the pumping cylinders are provided with slowing-down means in correspondence of the return stroke stop.

4) An oleodynamic circuit as in claims 1) to 3), wherein the pumping cylinders comprise two signal taps, to obtain stability of the system when they start off.

5) An oleodynamic circuit as in claims 1) to 4), wherein each of the pistons of the pumping cylinders performs the function of distributor in respect of the signal taps, at the end of the return stroke.

6) An oleodynamic circuit as in claims 1) to 5), comprising a micrometric flow regulator, designed to supercharge a slave circuit.

7) An oleodynamic circuit as in claims 1) to 6), wherein the cylinders of the deviating valve are connected on their rod side

by a parallel circuit (by-pass), which is in turn connected to the exhaust by means of a fixed throttle.

8) An oleodynamic circuit as in claims 1) to 7), comprising two solenoid valves to remote control the concrete intake operation.

9) An oleodynamic circuit as in claims 1) to 8), obtained with standardized components.

10) An oleodynamic circuit as in claims 1) to 9), wherein the signals produced by the pumping cylinders are used to perform a supplementary function, whereby the deviating valve is caused to adhere to or, in turn, to stay apart from said pumping cylinders.

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FIG.1 0167635

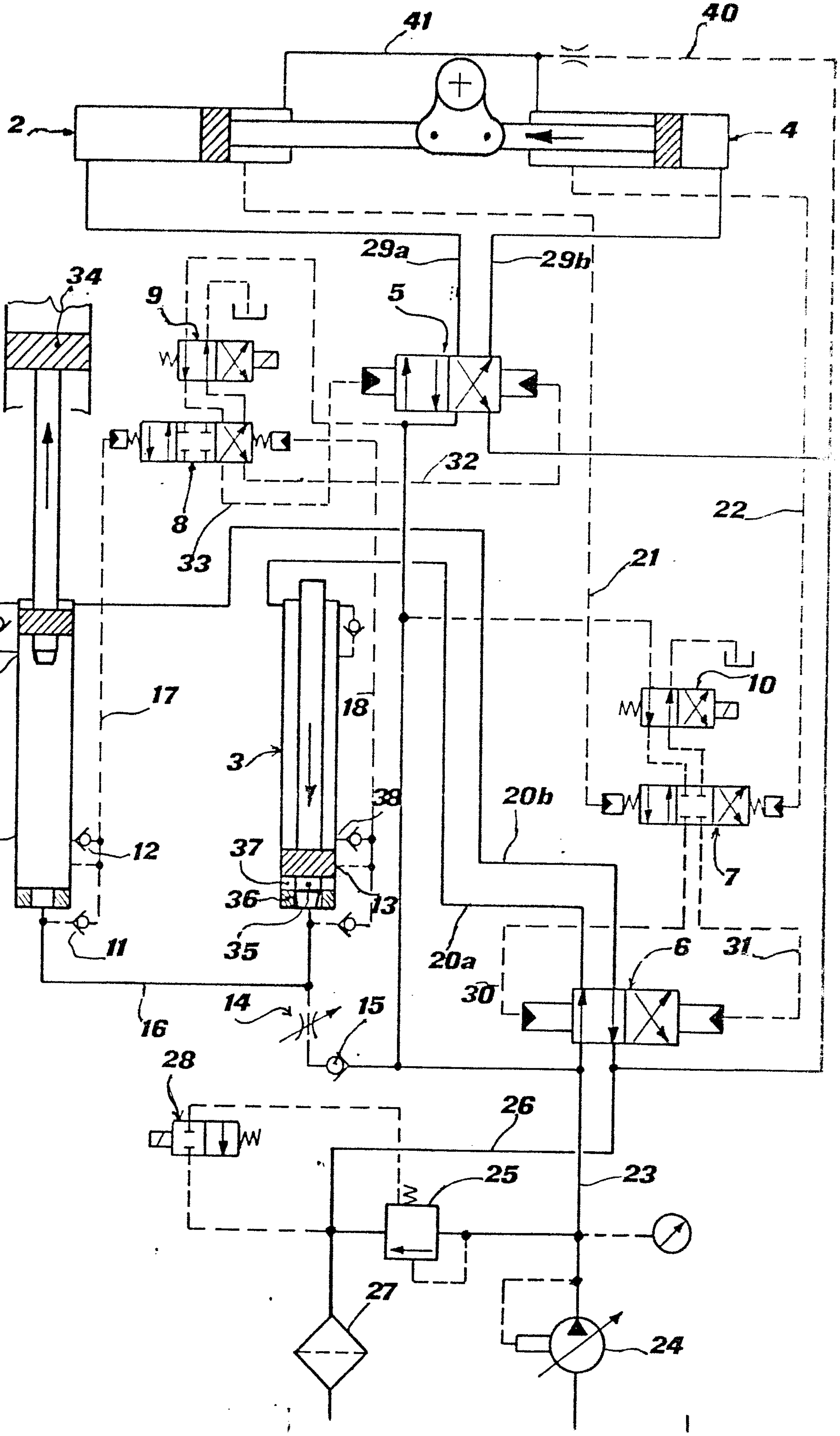

FIG. 2

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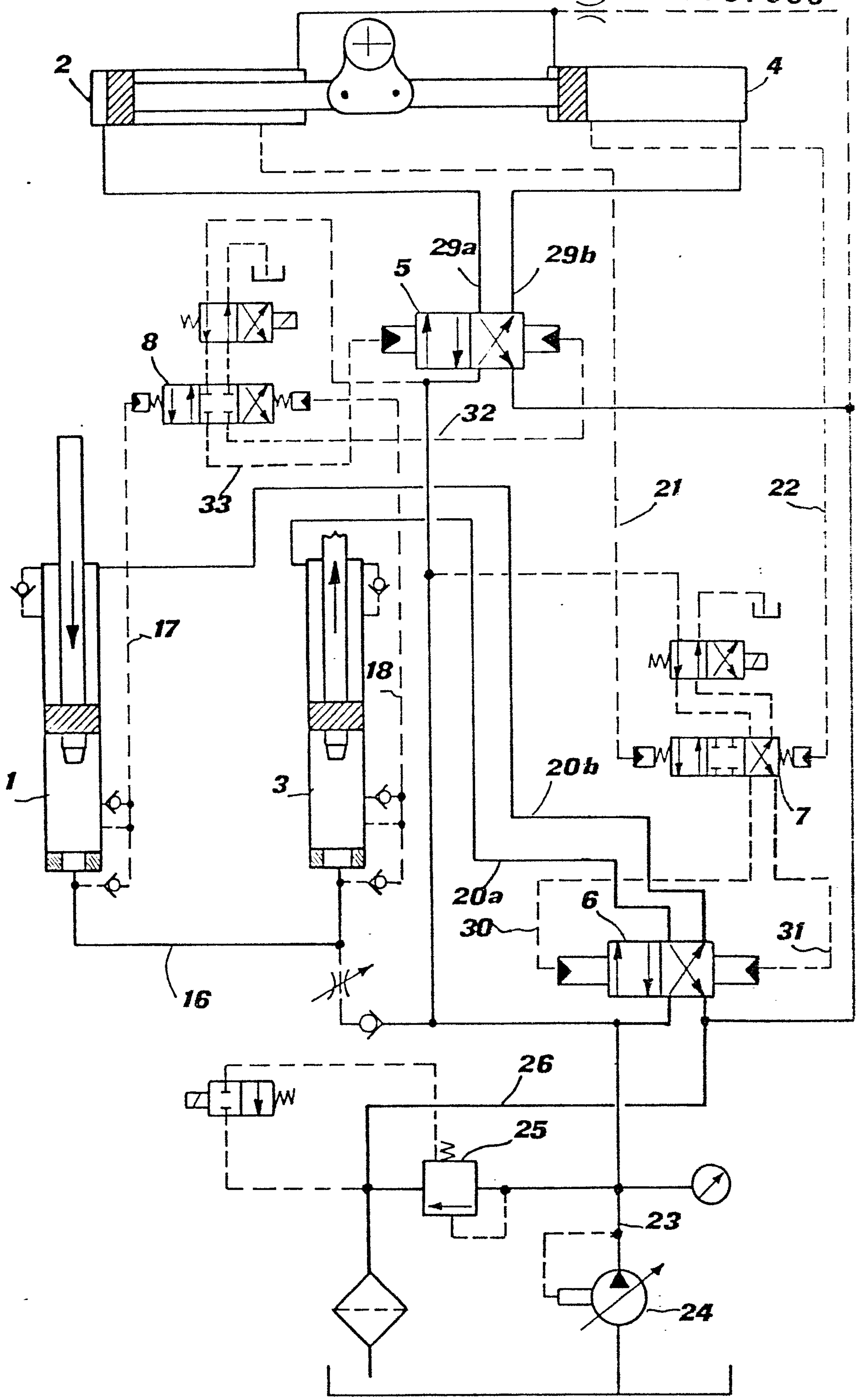

FIG. 3

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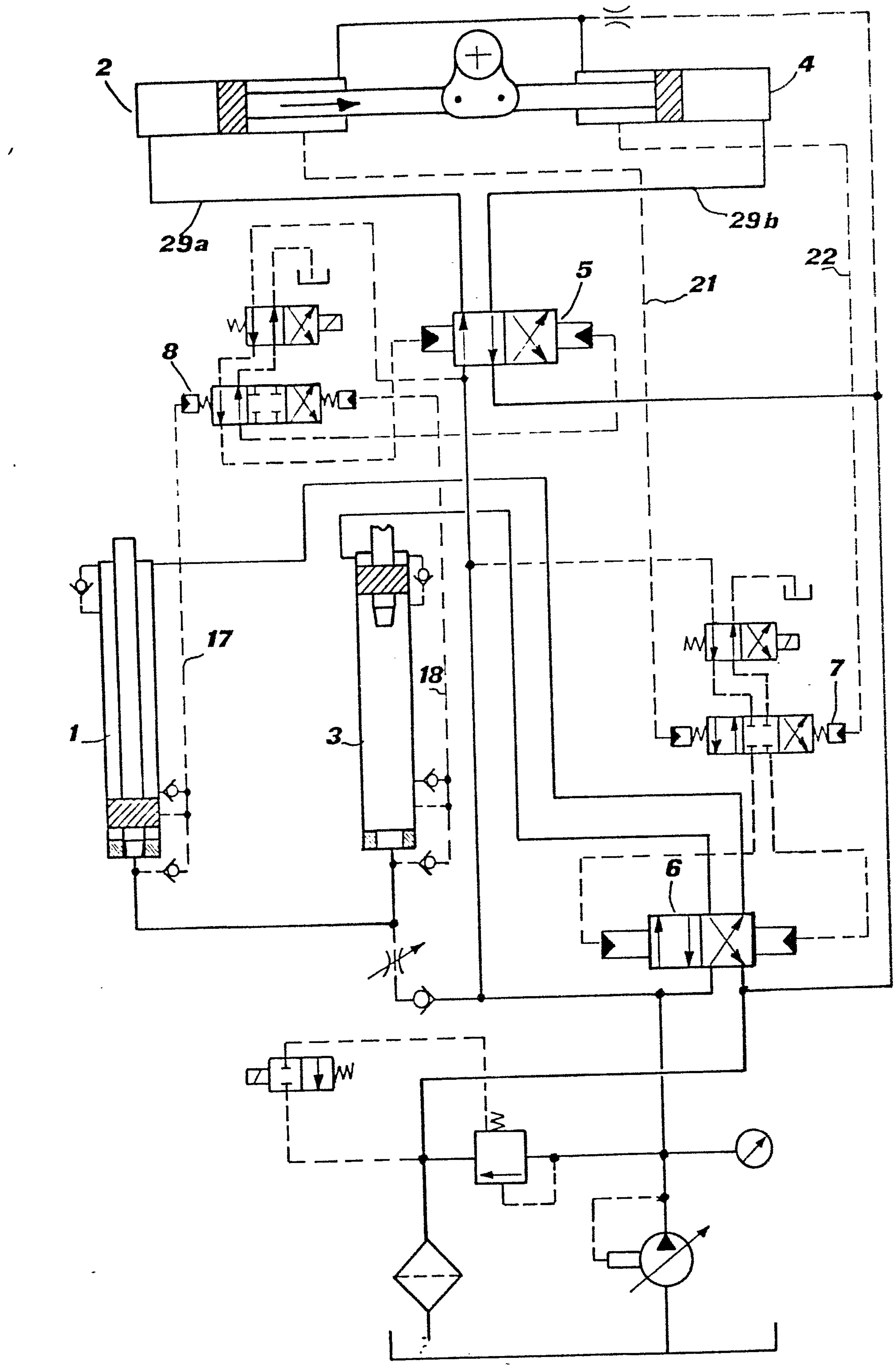

FIG. 4

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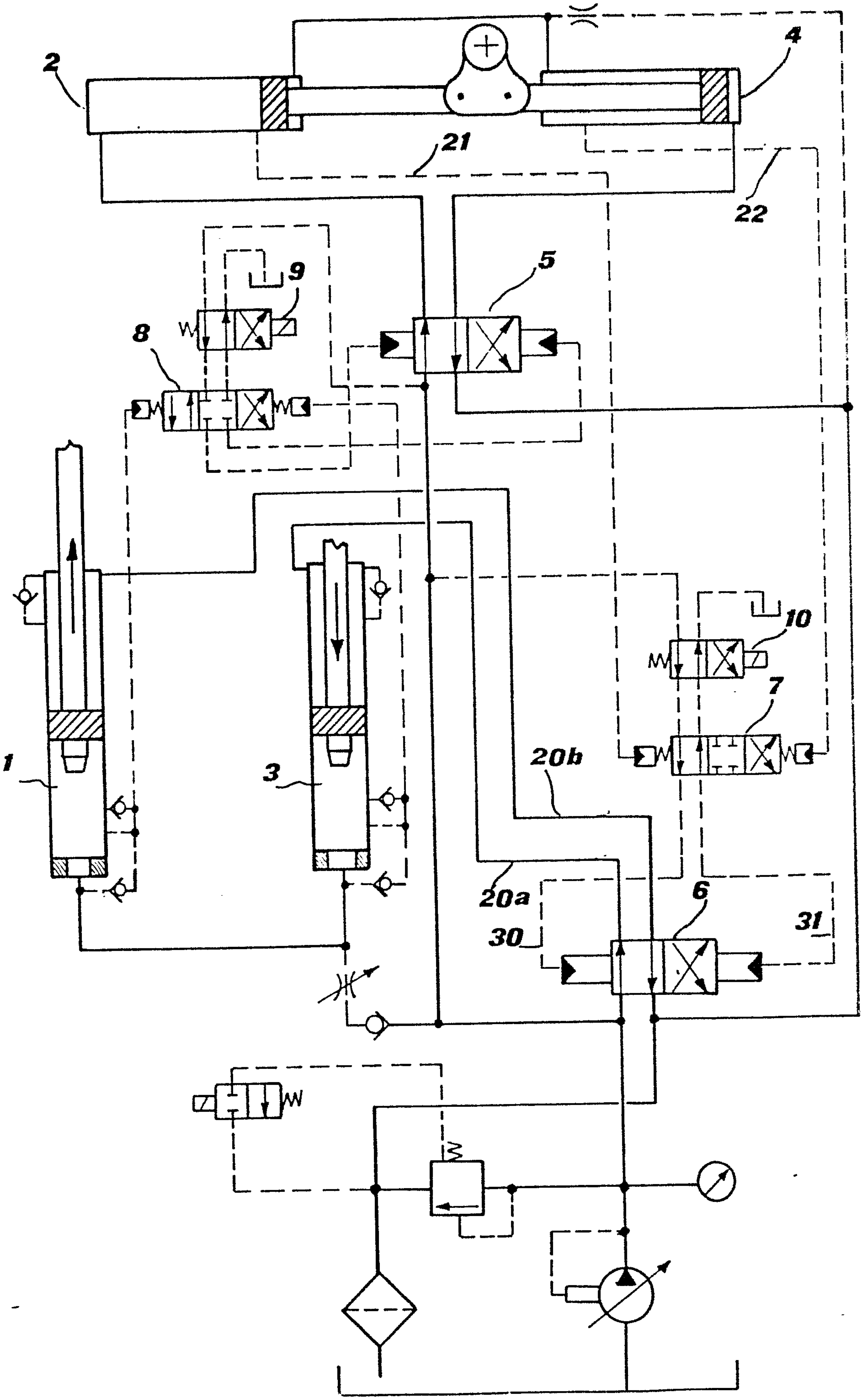

FIG.5

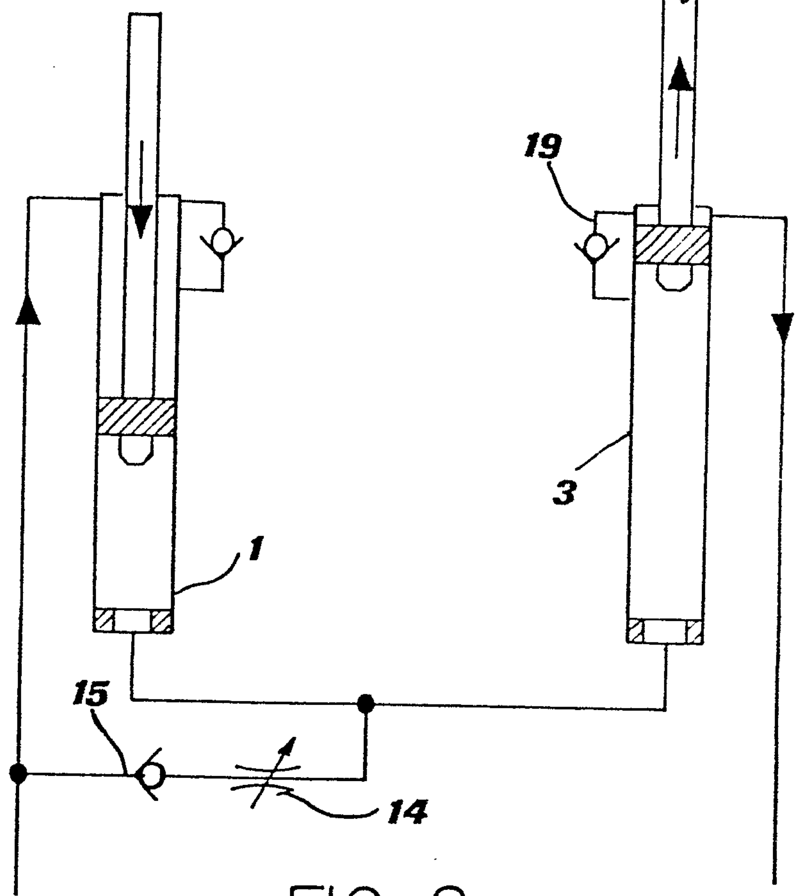

FIG.6

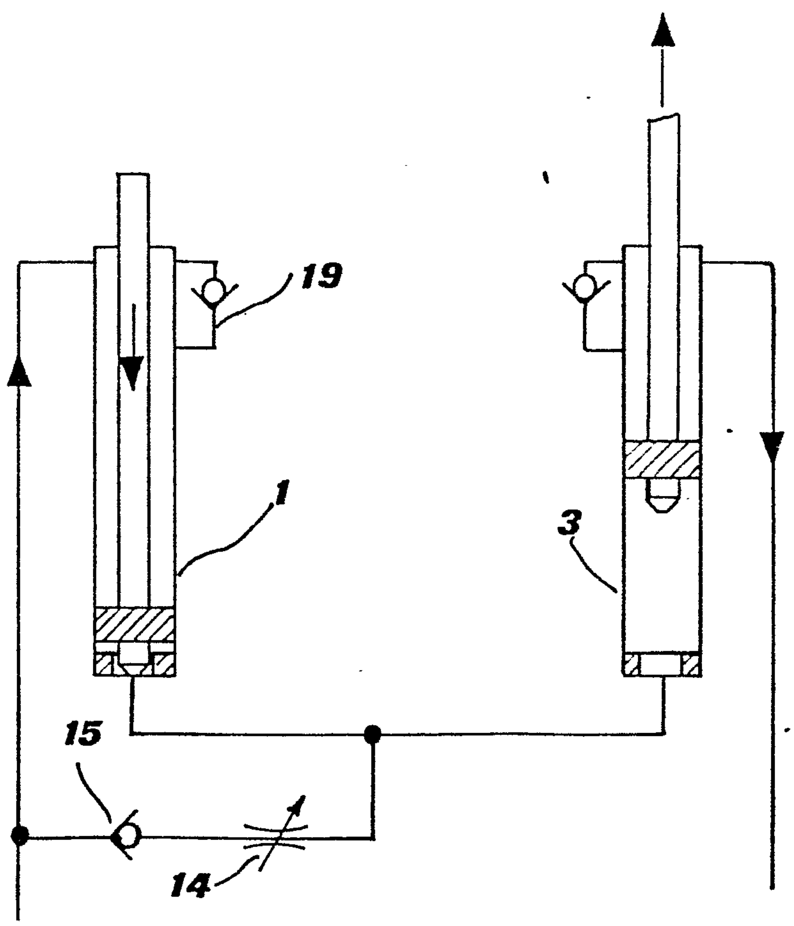

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FIG. 7

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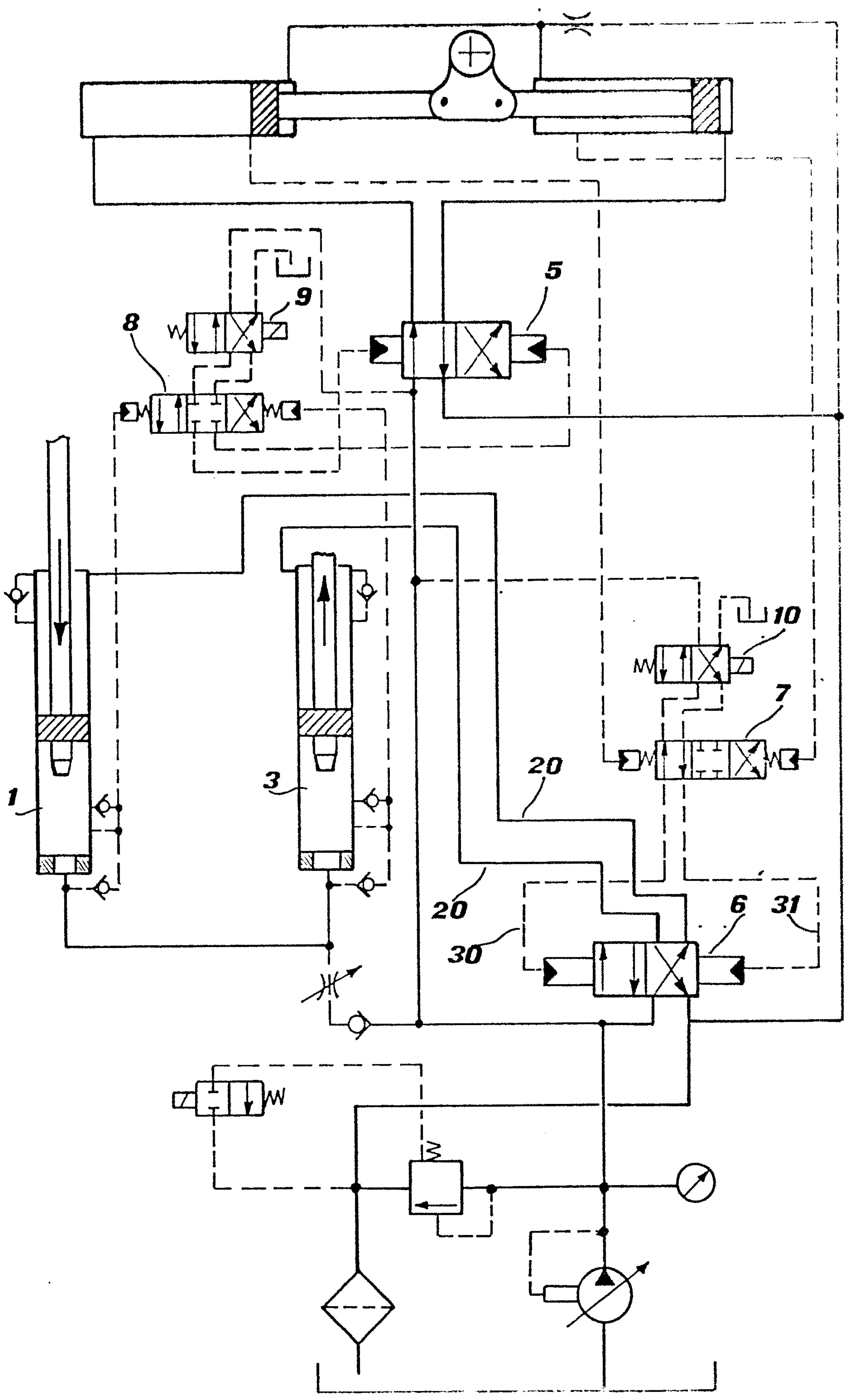

FIG. 8

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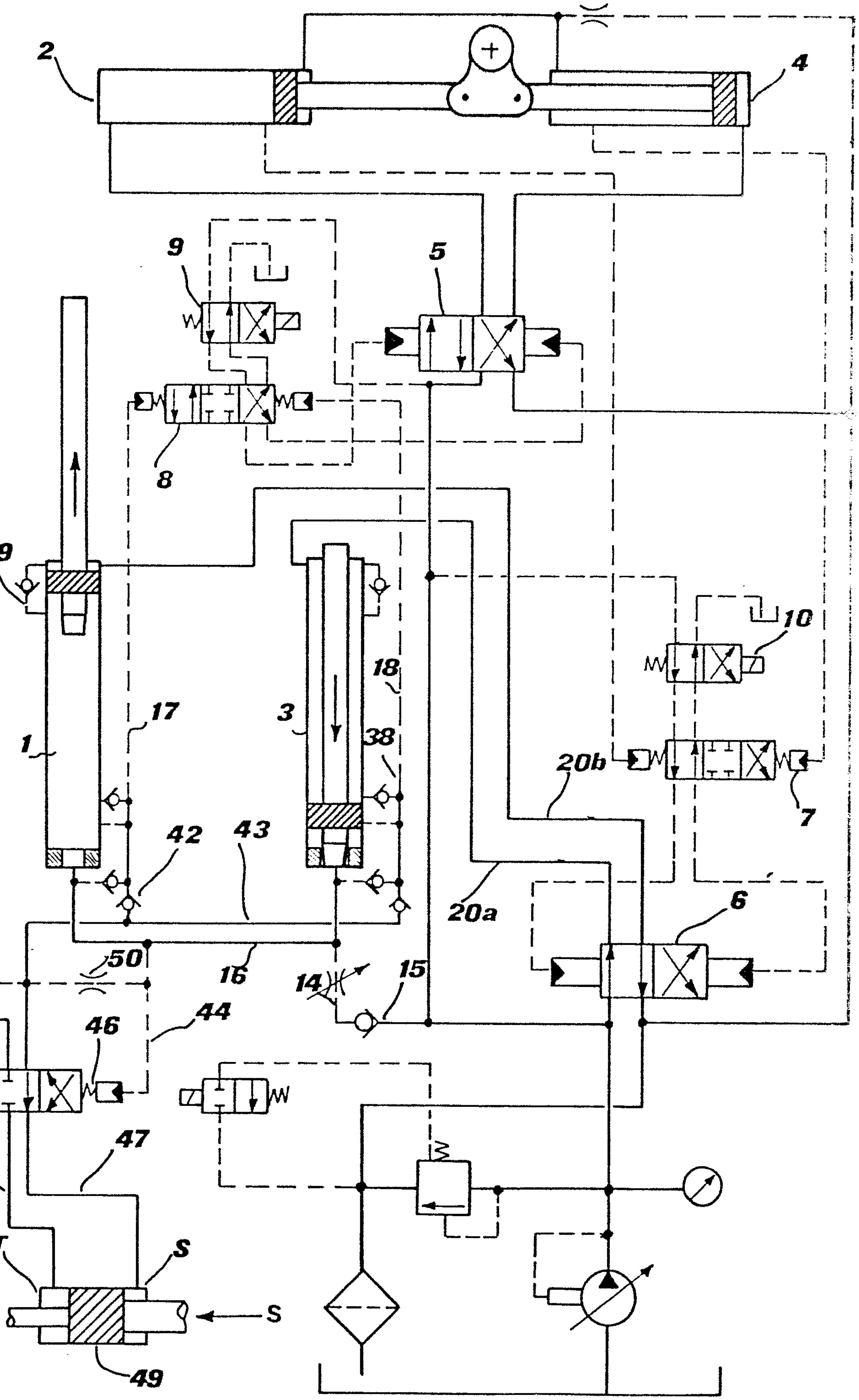

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FIG. 9

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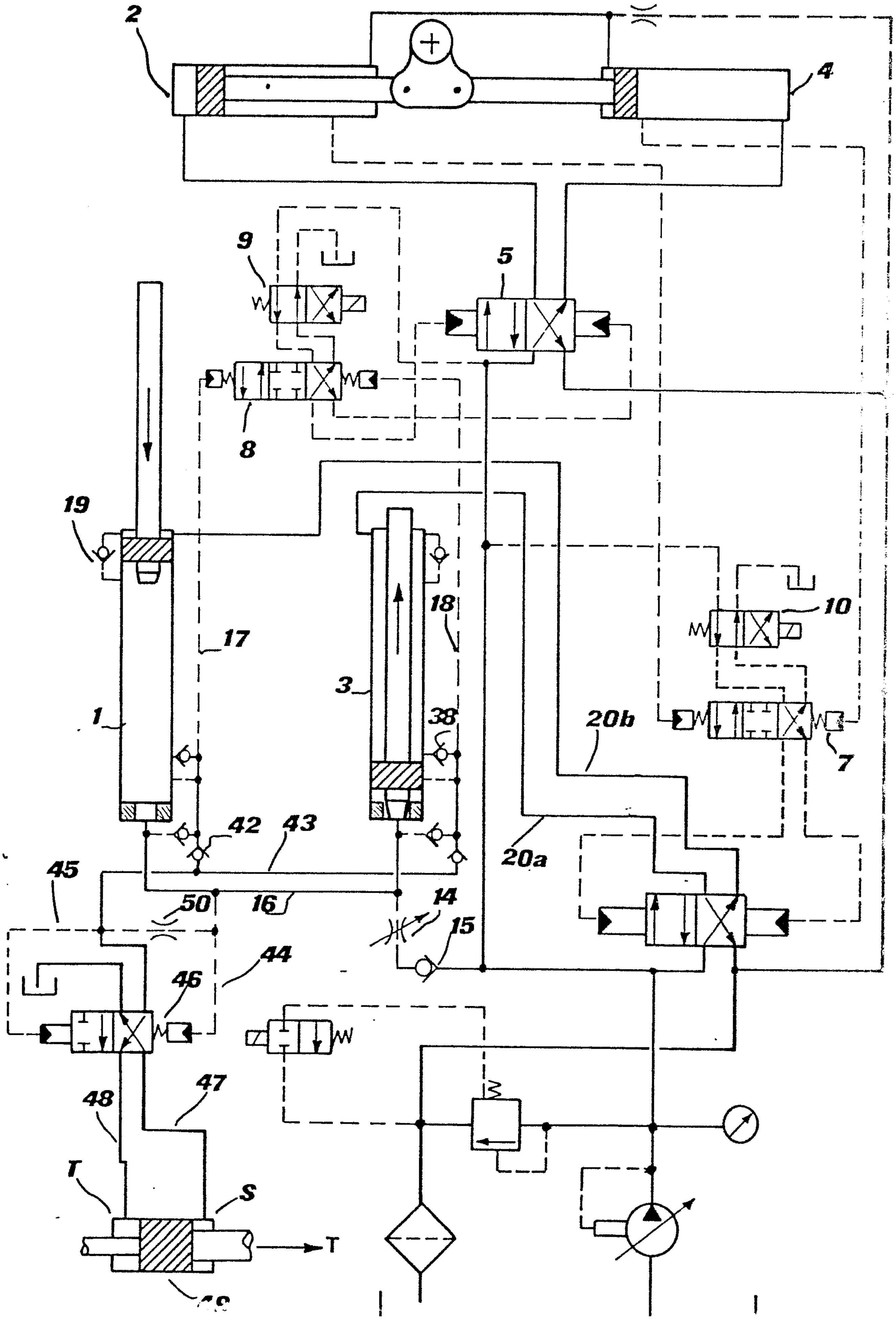

European Patent Office

EUROPEAN SEARCH REPORT

0167635
Application number

EP 84 10 4810

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
X	US-A-3 327 641 (KLOSTERMAN) * Column 5, line 60 - column 7, line 51; column 8, line 66; column 1, line 29; figures 1-3,4,5,5A *	1,6,8, 9	F 04 B 9/10 F 04 B 7/02 F 04 B 15/02 F 01 L 25/06
Y		2-5	
A		10	

Y	LU-A- 56 224 (JAEGER MACHINE CO.) * Claims; page 6, line 33 - page 7, line 23; page 7, line 39 - page 9, line 40; figures 1,2 *	2	
			TECHNICAL FIELDS SEARCHED (Int Cl 4)
A		1,9	
	---		F 04 B F 01 L F 03 C
Y	FR-A-2 291 374 (HYDRAULICS LTD.) * Page 3, line 31 - page 4, line 16; figure 1 *	3-5	

A	EP-A-0 027 654 (SCHLECHT) * Whole document, especially page 6, paragraph 3; figure 2 *	1,7	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19-09-1985	VON ARX H.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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P : intermediate document

T : theory or principle underlying the invention
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D : document cited in the application
L : document cited for other reasons

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EUROPEAN SEARCH REPORT

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Application number

EP 84 10 4810

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
A	DE-A-2 731 122 (HAUSHERR) * Whole document, especially page 13, paragraph 1 * -----	1,8	

TECHNICAL FIELDS SEARCHED (Int Cl 4)

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Place of search	Date of completion of the search	Examiner
THE HAGUE	19-09-1985	VON ARX H.P.

CATEGORY OF CITED DOCUMENTS

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