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(54) **METHOD AND SYSTEM FOR AUTOMATICALLY MONITORING A HYDRAULIC CIRCUIT FOR LIFTS, GOODS LIFTS AND THE LIKE, EQUIPPED WITH INHERENT SAFETY MECHANISM**

(57) A method for monitoring a hydraulic circuit (1) operating in a system for the movement of lifts or goods lifts comprising at least one cabin (101) and at least two electrically-controlled hydraulic valves (14, 16) operating in series. The method comprises providing at least one position sensing device near at least one stopping plane of the cabin (101), providing at least one control device (41,42) associated with each of the two hydraulic valves (14, 16) arranged in series. The method further comprises receiving the signals detected by the control devices (41, 42) and after receiving a signal generated by the position sensing device, activating a comparative analysis of the signals coming from said control devices (41, 42) associated with each of the valves (14, 16). The comparative analysis provides for comparing the values of the signals detected by the control devices (41,42) and, in the case in which at least one of the aforementioned detected signals identifies an open status of the relative regulating valve, generating a system failure status report.

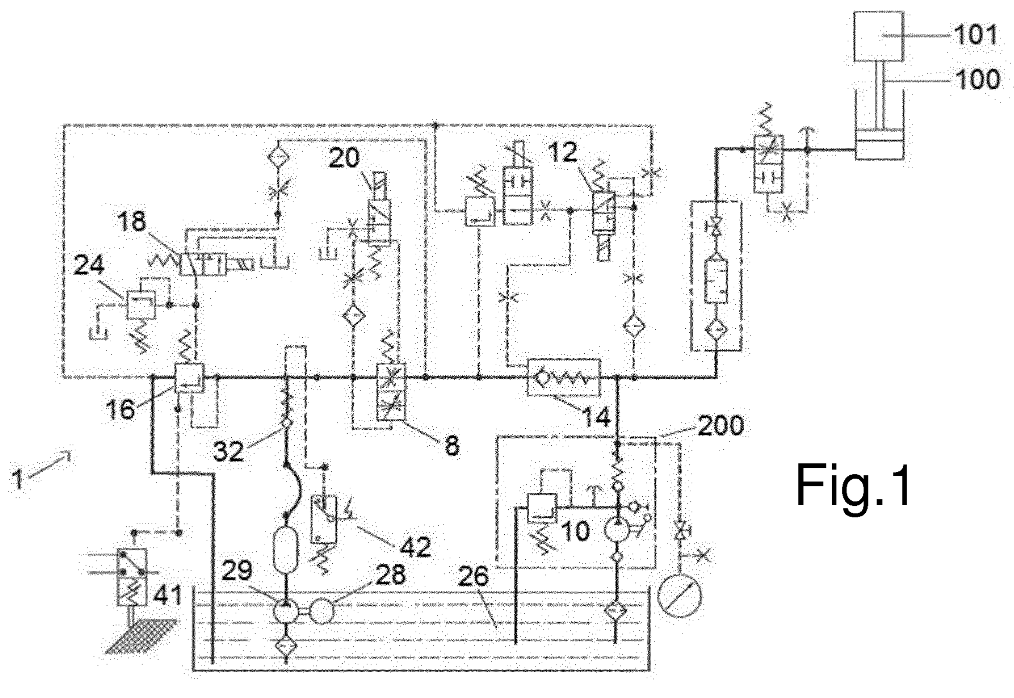

Fig.1

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Description

[0001] The present invention relates to a method for automatically monitoring a hydraulic circuit equipped with inherent safety mechanism.

[0002] The present invention also relates to a system for the movement of lifts or goods lifts or the like, implementing a method for automatically monitoring a hydraulic circuit equipped with inherent safety mechanism. In the sector of lifts, goods lifts and the like, the type of system used to move the cabin is chosen in relation to the specific intended use, as well as to the performance required of the same.

[0003] With specific reference to hydraulic systems, one important aspect relates to the safety of the system. Systems are therefore generally provided with special devices, such as for example electric valves or sensors which, in the case of engine failure, allow the movement of the cabin to be stopped. In systems in which the operating fluid involves the actuators themselves, both in the ascent and descent of the cabin, the oil flow rate generally regards at least two valves arranged in series.

[0004] In such context, wishing to achieve the required safety of the system and prevent, in the case of failure of one of the valves present, an unintentional descent of the cabin due to gravity, specific and independent members are used, which add to the design and production costs of the system.

[0005] The German patent DE 10 2015 111303 A1 discloses the process of monitoring the pressure of the hydraulic circuit of a lift with the use of two valves in parallel, so as to store energy in an accumulator and use it in the event of a mains power failure. In the solution described in WO 2017/013709 detection devices are instead provided, which are used only when the lift has the doors open with the cabin moving, with a sensor able to detect whether the differential value is outside a predefined range. The purpose of the present invention is to overcome the drawbacks and limitations of the safety systems complained of above.

[0006] More in particular, the purpose of the present invention is to provide a monitoring method which improves the safety of the hydraulic systems used in lifts, goods lifts and the like, which has safety elements arranged in series.

[0007] A further purpose of the present invention is to provide a monitoring system which allows systematic checks of the functioning of the control elements.

[0008] A further purpose of the present invention is to provide a monitoring method which is automated and coordinated with the movement actuation devices of the system to which it is applied, so as to ensure a high level of operating over time.

[0009] A no less important purpose of the invention is to provide a monitoring method which is simple to implement and such as to be easily and inexpensively manufactured.

[0010] These and other purposes are achieved by the automatic monitoring method according to the independent claim.

[0011] The invention will be described below with reference to several examples, provided by way of non-limiting examples and illustrated in the appended drawings. These drawings illustrate different aspects and embodiments of the present invention and where appropriate similar reference numerals illustrate similar structures, components and /or elements in different drawings.

- Figure 1 shows an exemplary diagram of a hydraulic circuit for the implementation of a first embodiment of the monitoring method according to the present invention;
- Figure 2 shows an exemplary diagram of the hydraulic circuit in figure 1, for the implementation of a second embodiment of the monitoring method according to the present invention;
- Figure 3 shows an exemplary diagram of the hydraulic circuit in figure 1, for the implementation of a third embodiment of the monitoring method according to the present invention;
- Figure 4 shows an exemplary diagram of a variant of the circuit in figure 1 implementing the first embodiment of the monitoring method according to the present invention;
- Figure 5 shows a diagram of the circuit in figure 4, implementing the second embodiment of the monitoring method according to the present invention; and
- Figure 6 shows a diagram of the circuit in figure 4, implementing the third embodiment of the monitoring method according to the present invention.

[0012] With reference to the appended drawings, reference numeral 1 globally denotes a hydraulic circuit for lifts, goods lifts or the like, configured to move at least one cabin 101 by moving a piston 100.

[0013] In a possible preferred embodiment, as shown in figures 1 to 3, the circuit 1 comprises a flow regulator valve 8, a magnetic descent valve 12 which pilots a non-return valve 14 and a magnetic starter valve 18 which pilots a pressure relief valve 16 indicated as "VB".

[0014] The circuit further comprises a tank 26, a motor 28, a pump 29, a magnetic levelling valve 20, a flow valve 32 and a pilot valve 24, indicated as "VS".

[0015] Preferably the magnetic starter valve 18 also indicated as "VMP" is electrically controlled so as to keep the pressure relief valve 16 supported, i.e. closed, in the absence of an electric control.

[0016] More in particular, during the ascent phase said VMP valve 18 is not electrically controlled, so as to remain closed and support the pressure relief valve 16, preferably up to reaching a pressure value which is set on the pilot valve 24. This way it is possible to create the pressure needed for the ascent of the cabin 101 of the system.

[0017] During the descent phase, wishing to keep the pressure relief valve 16 open, it is activated by sending an electric signal to the VMP valve 18; this way the pressure relief valve 16 is not supported, thereby allowing the opening of the same and the consequent descent of the cabin 101 of the system. According to a similar method, the magnetic descent valve 12 receives an electric signal so as to pilot the opening of the non-return valve 14.

[0018] Preferably, the hydraulic circuit has the non-return 14 (indicated as "VRP") and pressure relief 16 (VB) valves arranged in series; while the first is a real and actual non-return valve, suitable to keep the cabin 101 stationary at the floor, the second has a safety function and is appropriately supported by the starter valve 18, in the manner previously described.

[0019] Preferably the two valves VRP and VB must be in the closed position when the cabin 101 is stationary at the floor.

[0020] During the descent phase of the cabin 101, the valves VRP and VB are brought into the open position so as to allow the outflow of the fluid contained in the circuit towards the tank 26.

[0021] Said conditions are achieved by means of a specific command on the control panel which electrically powers respectively, the descent valve 12 (VMD) which pilots the non-return valve 14 (VRP), and the starter valve 18 (VMP) which pilots the pressure relief valve 16 (VB). A construction variant of the hydraulic circuit 1 described above, implementing the monitoring method according to the present invention, is shown in figures 4 to 6, wherein the circuit 1 further comprises a stepper-motor 31 suitable to govern the flow regulator valve 8.

[0022] The hydraulic circuit 1 preferably presents, in all the embodiments shown in figures 1 to 6, an auxiliary circuit 200 designed for emergency manoeuvres in ascent of the cabin 101, comprising a manual pump and a second pressure relief valve 10.

[0023] According to both embodiments of the hydraulic circuit 1, a system with inherent safety is realised.

[0024] The hydraulic circuit 1 is further configured to implement an automatic monitoring method. This method is suitable to control the correct functioning of at least two electrically-controlled hydraulic valves operating in series present in said circuit, and to restore safe conditions of the system should malfunction of any elements of the system, appropriately identified in a design phase of said monitoring system, be detected.

[0025] According to the automatic monitoring method of the present invention, the provision of at least one position sensing device (not shown in the drawings) in proximity of at least one stopping plane of the cabin 101 is envisaged.

[0026] Preferably, said electrically-controlled hydraulic valves operating in series comprise check valves and/or regulator valves.

[0027] In a preferred embodiment, said at least two hydraulic valves comprise a non-return valve 14 and a pressure relief valve 16.

[0028] In a first preferred embodiment, the monitoring method according to the present invention can be implemented in a continuous manner and comprises providing at least one control device (41, 42), associated with each of the two valves (14, 16) operating in series.

[0029] The method comprises receiving the signals detected by the control devices (41, 42) associated with each valve (14, 16) operating in series and, after receiving a signal generated by said at least one position sensing device, activating a comparative analysis of the signals coming from said control devices (41, 42) associated with each of the valves (14, 16).

[0030] Preferably, said activation of a comparative analysis comprises the steps of comparing the values of said signals detected by the control devices (41, 42) and, in the event in which at least one of said signals detected identifies an open status of the relative valve (14, 16), generating a system failure status report.

[0031] Preferably, following a failure status report, the system is automatically put into an out of service mode.

[0032] Preferably, the monitoring method comprises interrupting the movement of the cabin 101, following a failure status report resulting from said comparative analysis of the signals.

[0033] Advantageously, according to said monitoring method it is possible to verify, at the moment in which the cabin 101 is stationary at the floor, if the valves (14, 16) operating in series are closed or not.

[0034] Preferably said control devices consist of detectors and/or sensors. Preferably said control devices comprise one or more electromechanical sensors 41, configured to verify the closed and/or open position of the valves (14, 16) operating in series.

[0035] Preferably, said control devices comprise at least one hydraulic electro sensor 42 configured to verify the closed and/or open position of one of said valves (14, 16) operating in series.

[0036] Preferably, said at least one sensing device is positioned below the level of said stopping plane.

[0037] Preferably, said at least one sensing device is placed at a distance between 5 mm and 550 mm from the cabin stopping plane 101.

[0038] Even more preferably, said at least one sensing device is placed at a distance between 20 mm and 30 mm from the cabin stopping plane 101. According to a first preferred embodiment of the automatic, continuous monitoring method according to the present invention, as shown in figures 1 and 4, the position of the pressure relief valve 16 is verified by means of an electromechanical sensor 41. Preferably, according to said embodiment, the position of the non-return valve 14 is verified by means of an electrohydraulic sensor 42.

[0039] According to a second preferred embodiment of the automatic continuous monitoring method according to the present invention, as shown in figures 2 and 5, the position of the pressure relief valve 16 is verified by means of an electromechanical sensor 41. Preferably, according to said embodiment, the position of the non-return valve 14 is also verified by means of an electromechanical sensor 41.

[0040] According to a third preferred embodiment of the automatic continuous monitoring method according to the present invention, as shown in figures 3 and 6, the position of the pressure relief valve 16 is verified by means of two electromechanical sensors 41. Preferably, according to said embodiment, the position of the non-return valve 14 is also verified by means of two electromechanical sensors 41.

[0041] The continuous automatic monitoring method described above can be implemented on further possible layouts of hydraulic systems on condition that they have at least two electrically-controlled hydraulic valves operating in series.

[0042] Further embodiments are possible by appropriately configuring both the combinations of the control devices and hydraulic valves operating in series for which the correct position must be verified, and the number of said devices which need to be used to achieve the desired level of safety of the system.

[0043] In a second preferred embodiment, the monitoring method according to the present invention can be implemented in a programmed manner, scheduling the periodic performance of a specific test, which if passed ensures the integrity and proper functioning of the at least two electrically-controlled hydraulic valves operating in series, and therefore of the system overall.

[0044] Also according to said possible alternative embodiment, the automatic monitoring method comprises providing at least one position sensing device (not shown in the drawings) in the proximity of at least one stopping plane of the cabin 101.

[0045] Preferably, said at least one position sensing device is positioned below the level of said stopping plane.

[0046] According to such method, the automatic monitoring method of the present invention envisages two separate steps.

[0047] In a first test step, hereinafter referred to as F1, the control panel energises the starter valve 18 for a time t_1, predetermined during the design phase, and verifies that the cabin 101 does not intercept the position sensing device placed below the stopping plane. If the cabin 101 is not intercepted by said device, the test is considered as passed. In the case in which, instead, the cabin 101 is intercepted by the sensing device, the test is not considered passed and the device sends a signal to the control panel (not shown in the drawings) which de-energises the starter valve 18 and places the system in out of service status.

[0048] In the case in which the F1 step is passed, a second test step is performed, identified hereinafter as F2.

[0049] In said second step F2, the control panel energises the descent valve 12 for a time t_2, predetermined during the design phase, and verifies that the cabin 101 is not intercepted by the position sensing device positioned below the stopping plane. If said device does not intercept the cabin 101, the test is considered as passed. In the case in which, instead, the cabin 101 is intercepted by the sensing device, the test is not considered passed and said device sends a signal to the control panel which de-energises the descent valve 12 and places the system in out of service status. Preferably, said at least one sensing device is placed at a distance between 5 mm and 550 mm from the cabin stopping plane 101.

[0050] Even more preferably, said at least one sensing device is placed at a distance between 20 mm and 30 mm from the cabin stopping plane 101. Preferably the opening time t_1 is more than 0.1 second and less than 60 seconds.

[0051] Preferably the opening time t_2 is more than 0.1 second and less than 60 seconds.

[0052] In a preferred configuration, the opening time t_1 is more than 1 second and less than 10 seconds.

[0053] In a preferred configuration, the opening time t_2 is more than 1 second and less than 10 seconds.

[0054] Preferably, the test described above is performed regularly according to a time interval, between one test and the next, of more than 1 minute. The performance of said first step F1 and second step F2 can advantageously be actuated according to any desired sequence, on condition that both steps are completed, whenever the test is performed. Such scheduled automatic monitoring method can be conveniently implemented in pre-existing hydraulic circuits, allowing a significant increase in the safety of said circuits and at the same time limiting costs. Despite the invention having been described above with particular reference to several preferred embodiments, made solely by way of non-limiting examples, numerous modifications and variants will appear evident to a person skilled in the art in the light of the above description. The present invention therefore sets out to embrace all the modifications and variants which fall within the sphere and scope of the following claims.

Claims

1. Method for the automatic monitoring of a hydraulic circuit (1) operating in a system for the movement of lifts or goods lifts comprising at least one cabin (101) and at least two electrically controlled hydraulic valves (14, 16) arranged in series, said method comprising:

- providing at least one position sensing device near at least one stopping plane of said at least one cabin (101);
- providing at least one control device (41,42) associated with each of said at least two electrically controlled hydraulic valves (14, 16) arranged in series;
- receiving the signals detected by the control devices (41,42) associated with each valve (14,

16);

- after receiving a signal generated by said at least one position sensing device, activating a comparative analysis of the signals coming from said control devices (41,42);

wherein said activation of a comparative analysis comprises the steps of:

- comparing the values of said signals detected by the control devices (41,42);
- in the case in which at least one of the aforementioned detected signals identifies an open status of the relative valve (14, 16), generating a system failure status report.

2. Method according to claim 1, comprising interrupting the movement of the cabin (101), following a failure status report resulting from said comparative analysis of the signals.

3. Method according to claim 1, wherein said at least two electrically controlled hydraulic valves arranged in series comprise a non-return valve (14) and a pressure relief valve (16).

4. Method according to claim 1, wherein said control devices comprise at least one electromechanical sensor (41) configured to verify the closed and/or open position of one of said electrically controlled hydraulic valves (14, 16) arranged in series.

5. Method according to claim 1, wherein said control devices comprise at least one hydraulic electro sensor (42) configured to verify the closed and/or open position of one of said electrically controlled hydraulic valves (14, 16) arranged in series.

6. Method according to any one of the preceding claims wherein the position of the pressure relief valve (16) is verified by an electromechanical sensor (41) and the position of the non-return valve (14) is verified by a hydraulic electro sensor (42).

7. Method according to any one of claims 1 to 5, wherein the position of the pressure relief valve (16) is verified by two electromechanical sensors (41) and the position of the non-return valve (14) is verified by two electromechanical sensors (41).

8. Method according to any one of the preceding claims wherein said at least one position sensing device is positioned below the level of the cabin stopping plane (101).

9. Method according to any one of the preceding claims wherein said at least one position sensing device is placed at a distance between 5 mm and 550 mm from the cabin stopping plane (101).

10. Method for the automatic monitoring of a hydraulic circuit (1) operating in a system for the movement of lifts or goods lifts comprising at least one cabin (101) and at least two electrically controlled hydraulic valves (14, 16) arranged in series, said method comprising:

- providing at least one position sensing device near at least one stopping plane of said at least one cabin (101);
- providing a control panel configured to send an electrical signal to at least one starter valve (18) and to a descent valve (12), receiving a signal from at least one position sensing device, comparing said signals;
- conducting a first test phase F1 wherein the control panel excites the starter valve (18), which controls a pressure relief valve (16) for a time t_1 and detects a signal from the position sensing device, said first test phase being passed if the cabin (101) is not intercepted by the position sensing device;
- if the first test phase F1 is passed, conducting e a second test phase F2 in which the control panel excites a descent valve (12), which controls a non-return valve (14) for a time t_2 and detects a signal from the position sensing device, said second test phase F2 being passed if the cabin (101) is not intercepted by the detection device; and wherein

when at least one of said first and said second test phases is not passed, the control panel de-energises the starter valve (18) and/or the descent valve (12) and generates a system failure status report.

11. System for the movement of lifts or goods lifts comprising:

- at least one cabin (101) moved by means of a hydraulic circuit (1) having at least two electrically controlled hydraulic valves (14, 16) arranged in series;
- one or more flow regulating valves (8), of descent (12), non-return (14), pressure-relief (16) and a magnetic starter valve (18) electrically controlled during the descent phase of the cabin (101) so as to allow the opening thereof;
- at least one position sensing device near at least one stopping plane of said at least one cabin (101);
- at least one control device (41,42) associated with each of said at least two electrically controlled hydraulic valves (14, 16) arranged in series
- a control system operatively connected to said hydraulic circuit (1) implementing a method for

automatic monitoring of the hydraulic circuit (1), according to claims 1 or 10.

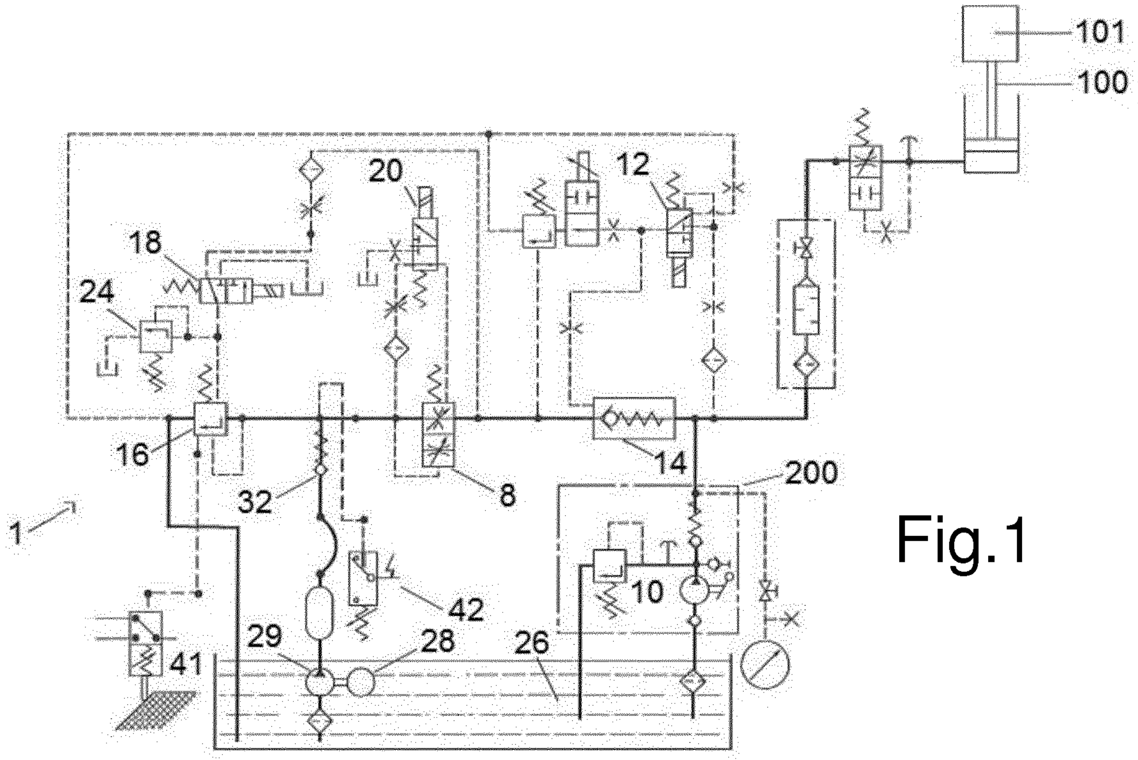
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Fig.1

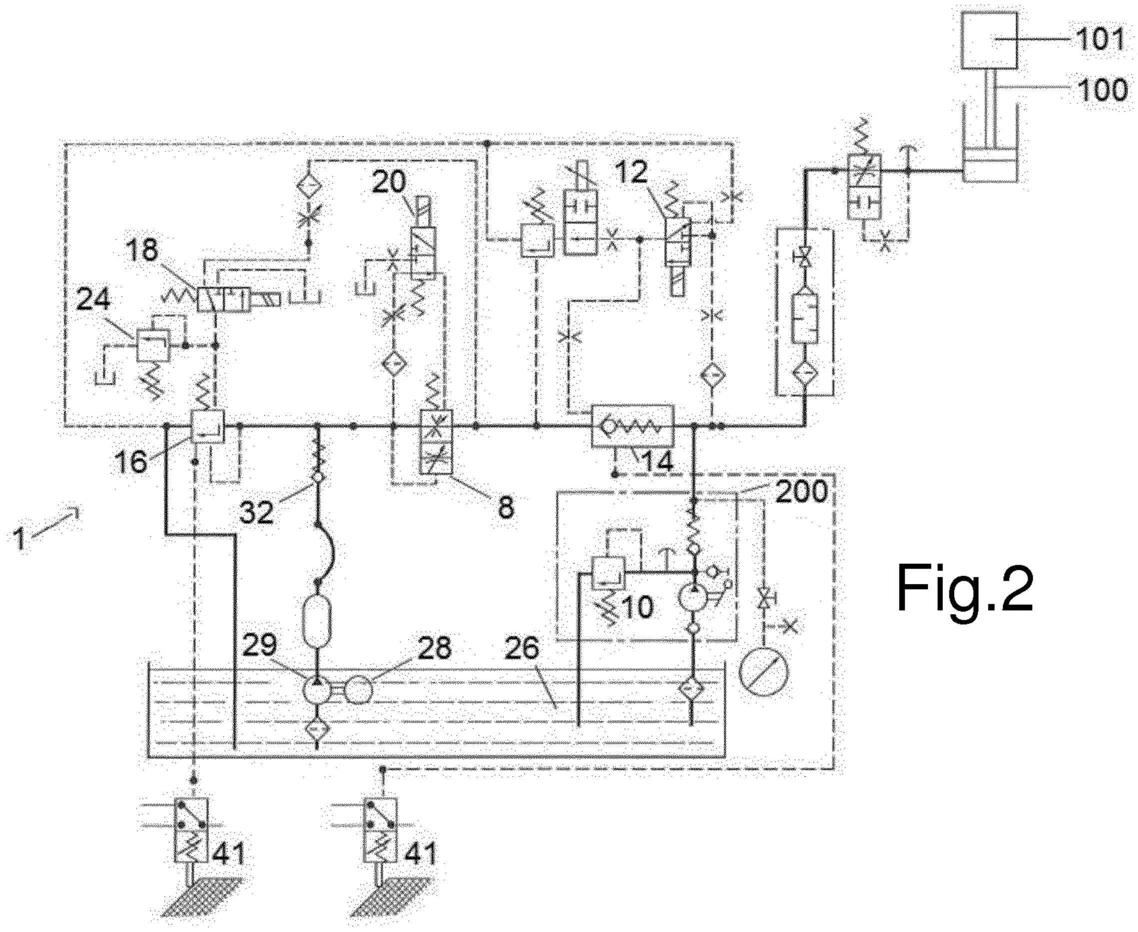
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Fig.2

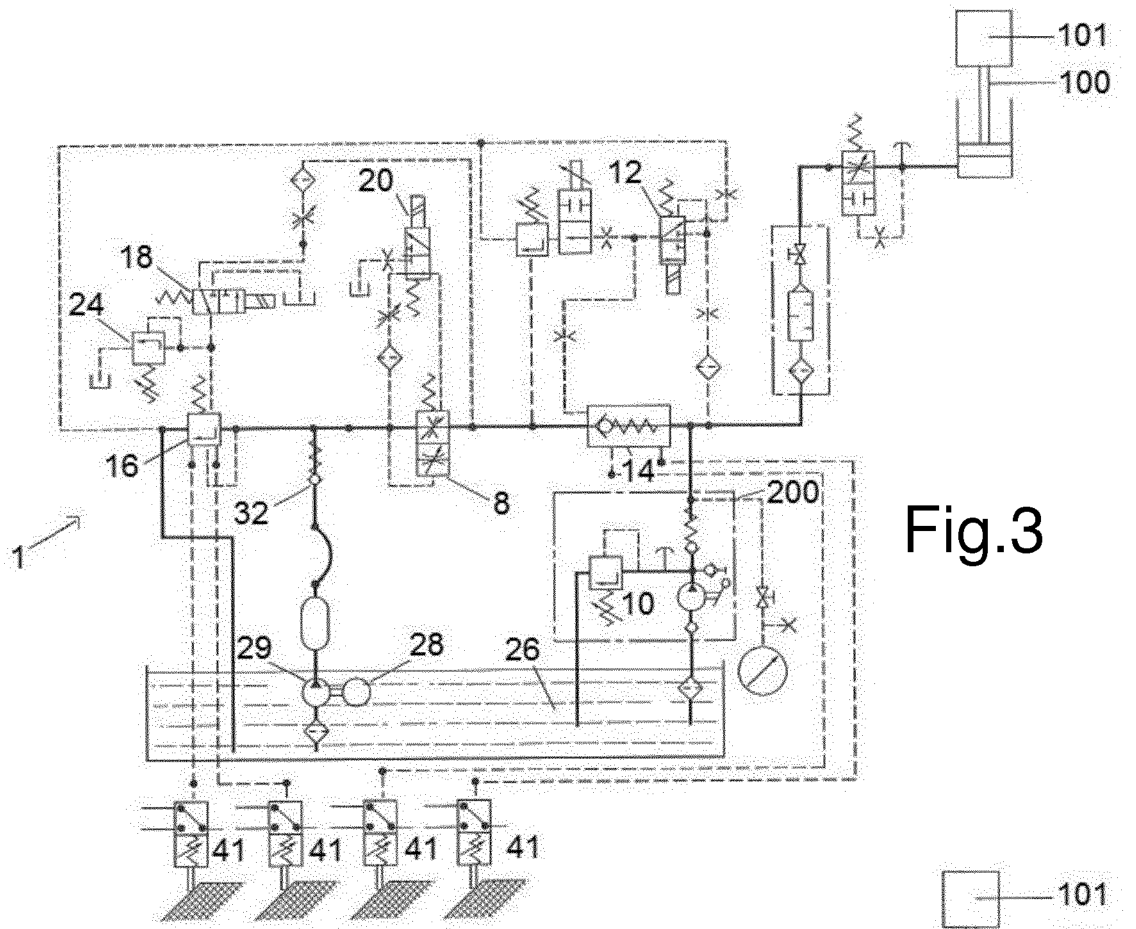
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Fig.3

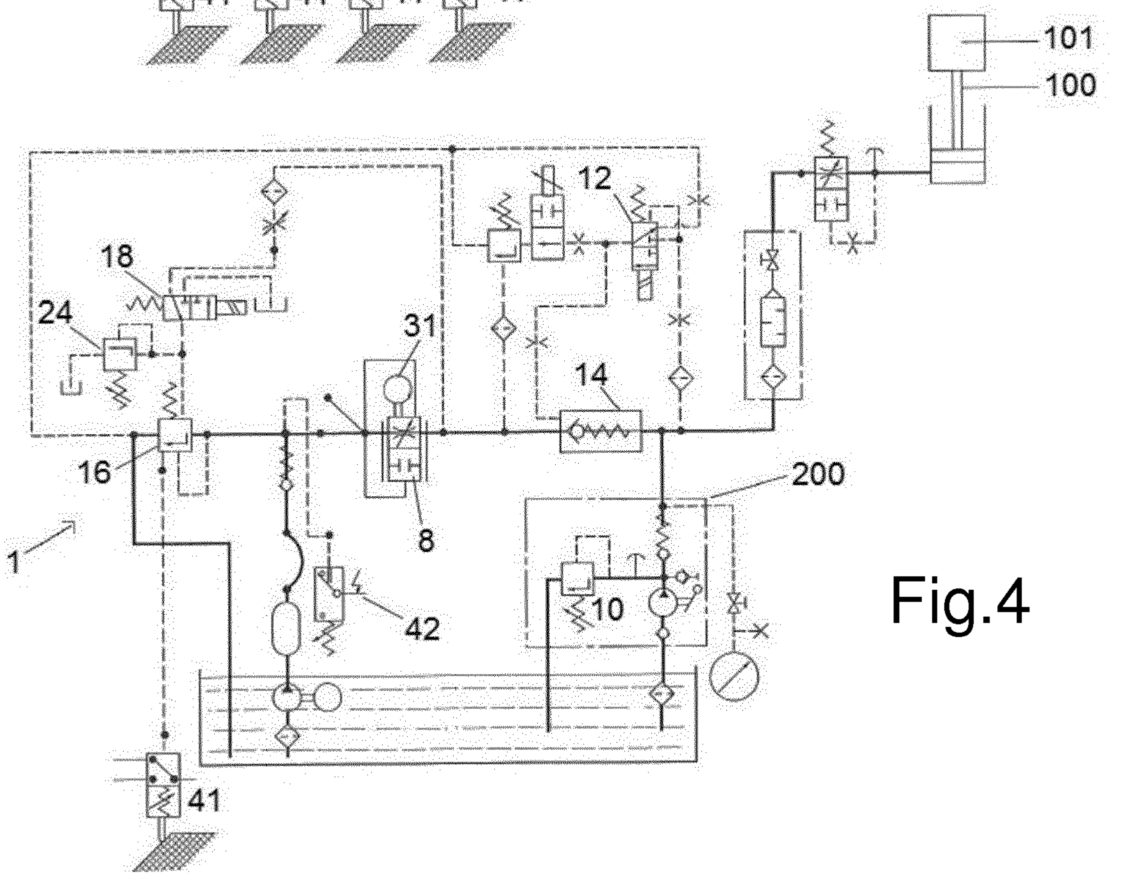
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Fig.4

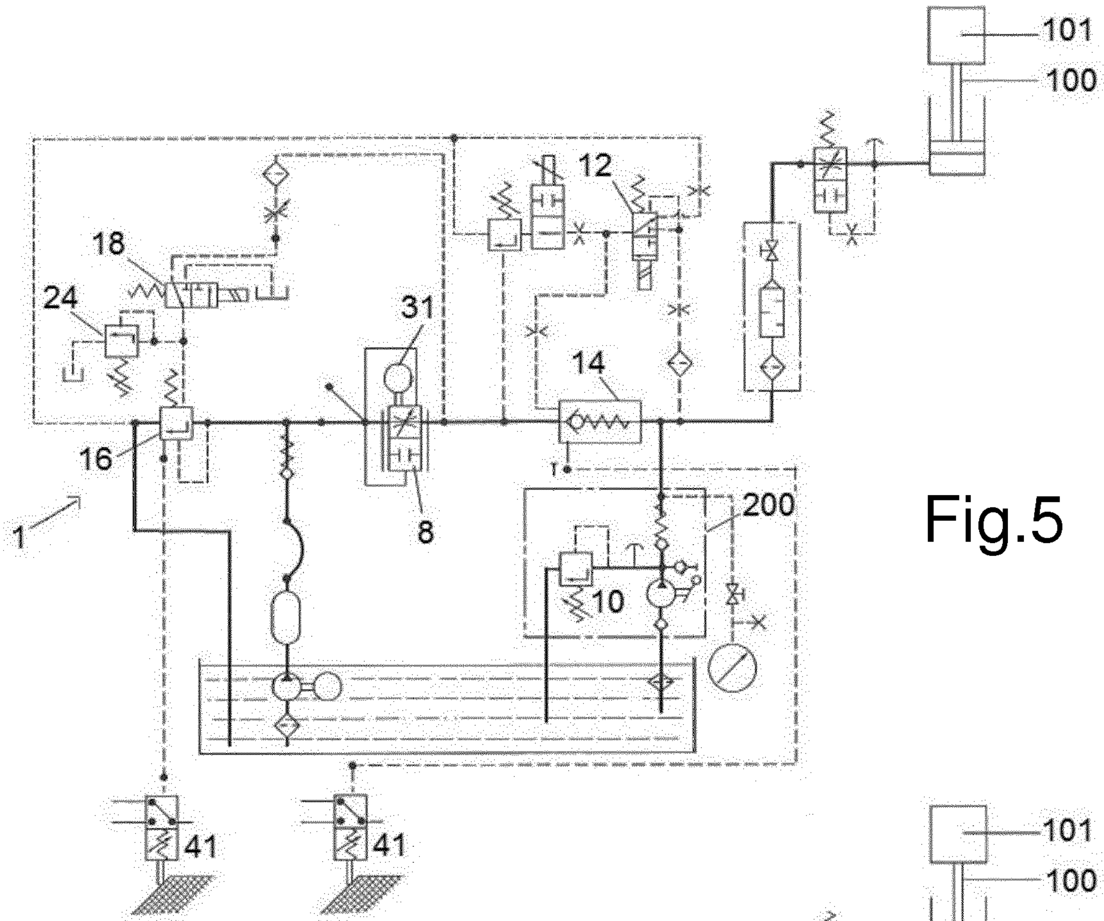
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Fig.5

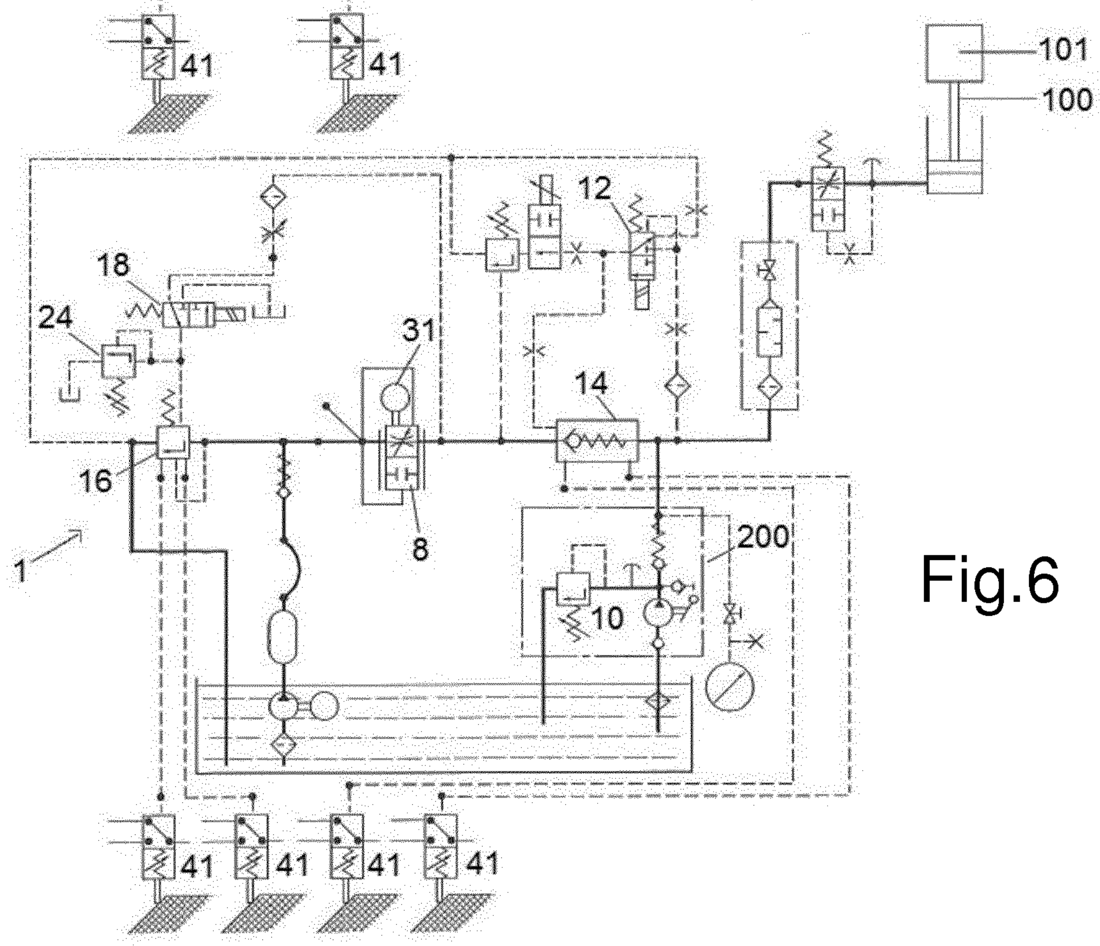
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Fig.6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 02 0565

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	18 March 2020	Lohse, Georg

CATEGORY OF CITED DOCUMENTS

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