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(54) **DISTRIBUTOR AND OLEODYNAMIC BRAKING SYSTEM OF AN AGRICULTURAL OR FORESTRY VEHICLE**

(57) Hydraulic distributor, in particular of an agricultural or forestry machine or other mobile industrial means, having an inlet (I) connectable to a pressurized oil delivery (P); a first outlet (U1) connectable to a first user (TB); a second outlet (U2) connectable to a second user (EF); a first gap (L1) connectable to a storage unit (A); a second gap (L2) connectable to a signal (LS);

wherein, the distributor (1) has a first valve (V1) which is configured to selectively put in fluidic communication the inlet (I) with the second outlet (U2) and/or the storage unit (A); wherein the inlet (I1) and the first outlet (U1) are always in fluid communication by means of a first conduit (4).

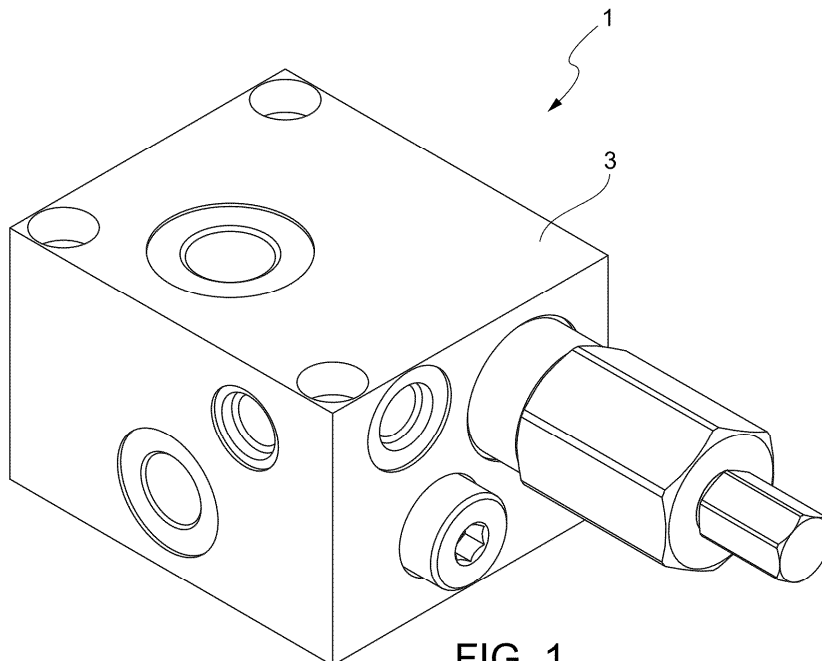


FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102024000025029 filed on November 7, 2024, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE ART

[0002] The present invention relates to a distributor and a hydraulic system, in particular for agricultural, forestry or other mobile industrial means.

PRIOR ART

[0003] It is known to feed, in particular on board an agricultural machine, one or more users with the same delivery of pressurized fluid. It is also known to selectively convey the excess flow rate of the delivery from one user, referred to as the main user, to a further user, referred to as the secondary user. Generally, on board an agricultural or forestry machine, the incoming oil flow rate is generated by fixed displacement hydraulic pumps that are dimensioned so as to be able to ensure the necessary pressure even under the most extreme conditions of use. Therefore, during operation moments of excess oil flow rate are created.

[0004] The distributors and systems of known type have the disadvantage of being subject to fluctuations in the inlet flow rate, as a function of the flow rate of the inlet delivery. In other words, the known distributors and systems do not guarantee delivery pressure stability.

DISCLOSURE OF THE INVENTION

[0005] Aim of the present invention is to provide a distributor and a hydraulic system of an improved type.

[0006] According to the present invention a distributor and a hydraulic system are provided as recited in the appended claims.

[0007] The dependent claims define particular embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] In the following, an embodiment of the invention is described for a better understanding thereof by way of nonlimiting example and with reference to the accompanying drawings, wherein:

- Figure 1 is a schematic view, with some parts removed for the sake of clarity, of a distributor according to the present invention;
- Figure 2 shows is a diagram, simplified and with some parts removed for the sake of clarity, of a system according to the present invention;

- Figure 3 shows a variant of the diagram of Figure 2;
- Figure 4 shows a further variant of the diagram of Figure 2;
- Figures 5 to 7 are diagrams of respective different variants of a distributor according to the present invention.

EMBODIMENTS OF THE INVENTION

[0009] In Figure 1, reference numeral 1 is used for a hydraulic distributor, in particular for an agricultural or forestry machine (of known type and not shown).

[0010] The distributor 1 is a component of a hydraulic system 2. Figure 2 shows the diagram of an embodiment of the hydraulic system 2 of an agricultural or forestry machine comprising a distributor 1 according to the present invention.

[0011] In particular, the hydraulic system 2 comprises a pressurized oil delivery P, a discharge T and the distributor 1 which is configured, as will be better shown below, to send pressurized oil to: a main user TB, a secondary user EF; and a storage unit A. Preferably the secondary user EF is open-centre.

[0012] In particular, the distributor 1 has: an inlet I connectable (in a known and schematically shown manner) to the delivery P; a main outlet U1 connectable (in a known and schematically shown manner) to the main user TB; and a secondary outlet U2 connectable to the secondary user EF. The distributor 1 has: a main gap L1 connectable (in a known and schematically shown manner) to the storage unit A, as will be better shown below; a signal gap L2 connectable (in a known and schematically shown manner) to a signal LS; a measurement gap L3 connectable (in a known and schematically shown manner) to a pressure gauge GA. Advantageously, the pressure gauge GA checks the oil pressure inside the storage unit A.

[0013] The distributor 1 comprises a body 3 inside which chambers and conduits for the passage of oil and the housing of valves are made, as will be shown.

[0014] According to what is shown in Figure 2, the inlet I is directly connected, through the body 3, with the main outlet U1. In particular, the body 3 of the distributor 1 has a delivery conduit 4 that directly connects the inlet I with the main outlet U1. In this way, advantageously, the pressurized oil is fed directly from the delivery P to the main user TB.

[0015] The body 3 of the distributor 1 also has a conduit 5. The delivery conduit 4 and the conduit 5 are in fluid communication with each other at a node N1. The conduit 5 puts in communication the secondary user EF with the delivery conduit 4. The distributor 1 further comprises a main valve V1 which is interposed along the conduit 5, as will be better shown below.

[0016] The distributor 1 has a conduit 6 which connects the main valve V1 with the storage unit A. The distributor 1 comprises a recharging valve V2 interposed along the conduit 6 between the main valve V1 and the storage unit

A. The recharging valve V2 comprises an actuator D3 which is driven by the pressurized oil of the storage unit A.

[0017] The distributor 1 has a conduit 7, which connects the storage unit A with the main valve V1. The conduit 7 comprises a one-way valve V4 that allows the flow of pressurized oil only from the storage unit A towards the pilot valve V1.

[0018] The distributor 1 has a conduit 8 which connects the delivery conduit 4 with an actuator D1 of the main valve V1.

[0019] The distributor 1 has a conduit 9 which connects the recharging valve V2 with the signal LS.

[0020] The distributor 1 comprises a shuttle valve V3 interposed along the conduit 9.

[0021] The distributor 1 has a conduit 10 which connects a further actuator D2 of the pilot valve V1 with the shuttle valve V3.

[0022] The actuators D1 and D2 of the pilot valve V1 are opposed to each other, and together with the force of an elastic element M1, which acts in the same direction as D2, act so that the pilot valve V1 is moved in one direction or in the opposite direction, depending on the resulting force given by the pressures acting instantaneously on both actuators D1 and D2. In particular, the actuator D1 is driven by the oil pressure along the delivery conduit 4 (perceived through the conduit 8).

[0023] The pilot valve V1 communicates with the secondary user EF, the recharging valve V2, the delivery conduit 4 and the storage unit A.

[0024] The pilot valve V1 is configured to be arranged in the following positions:

- boost position S1;
- closing position S2;
- recharging position S3;
- excess position S4.

[0025] In the boost position S1 the connection with: the secondary user EF is closed; the recharging valve V2 is closed; the delivery conduit 4 is open; the storage unit A is open. In the boost position S1, the passage of pressurized oil is allowed from the storage unit A to the delivery conduit 4.

[0026] Advantageously, when the oil flow rate of the delivery P is not sufficient to feed the main user TB, the pilot valve V1 is brought to the boost position S1 so as to feed the main user TB with an extra flow of pressurized oil from the storage unit A. Advantageously, the presence of the one-way valve V4 along the conduit 7 and the main pilot valve V1 prevents pressurized oil from returning to the storage unit A directly from the feed of the delivery P.

[0027] In the closing position S2 the connection with: the secondary user EF is closed; the recharging valve V2 is closed; the delivery conduit 4 is closed; the storage unit A is closed. In the closing position S2, the pressurized oil is sent directly and completely from the inlet I1 to the main outlet U1 and does not pass through the pilot valve V1.

[0028] In the recharging position S3 the connection

with: the secondary user EF is closed; the recharging valve V2 is open; the delivery conduit 4 is open, the storage unit A is closed. In the recharging position S3, the pressurized oil is sent to the main user TB and allows the passage of excess oil towards the recharging valve V2 and which, when necessary, lets the flow pass to the storage unit A.

[0029] In the excess position S4 the connection with: the secondary user EF is open; the recharging valve V2 is open; the delivery conduit 4 is open; the storage unit A is closed. In the excess position S4, the pressurized oil feeds all the users in parallel, TB, EF, storage valve V2.

[0030] The recharging valve V2 communicates with: the signal LS, the storage unit A, the pilot valve V1, the discharge T. The recharging valve V2 has a one-way valve V5 that allows the flow of the pressurized oil only towards the storage unit A.

[0031] The recharging valve V2 is configured to be arranged in the following positions:

- accumulator recharging position S5;
- closed position S6;

[0032] In the accumulator recharging position S5, the pressurized oil coming from the pilot valve V1, through the conduit 6, is sent to the storage unit A. The return of pressurized oil is prevented by the one-way valve V5. Further, the conduit 6 is put in communication with the conduit 9 to send the signal LS to the actuator D2 of the main valve V1 through the shuttle valve V3. In addition, the discharge connection of the recharging valve V2 is closed.

[0033] In the closed position S6, the recharging valve V2 closes the conduit 6, not allowing the recharging of the storage unit A; and connects the feed line of the one-way valve V5 to discharge; connects the conduit 9 to discharge to reset the signal LS to the actuator D2 of the main valve V1 through the shuttle valve V3.

[0034] In use, the pressurized oil coming from the delivery P is directed to the main user TB through the conduit 4. Then, the oil of the delivery P is always directly sent to the main user TB. The delivery conduit 4 is connected to the pilot valve V1 and, depending on the position assumed by the pilot valve V1, different functions are performed.

[0035] When the pilot valve V1 is in the boost position S1, the connection with the recharging valve V2 is closed, the connection with the secondary user EF is closed whereas the connection with the main user TB is open and the connection with the storage unit A is open. In this configuration, oil flow from the storage unit A to the main user TB is made possible. In case the pressurized oil of the delivery P is not enough to feed the main user TB, by moving the pilot valve V1 to the boost position S1 it is possible to add to the oil flow of the delivery P an extra flow coming from the storage unit A. Advantageously, the presence of the one-way valve V4 prevents oil from being sent directly from the delivery P to the storage unit A.

[0036] When the main valve V1 is in the closing position S2, all paths are closed. This position is an intermediate position between the boost position S1 and the recharging position S3.

[0037] When the pilot valve V1 is in the recharging position S3, the connection with the recharging valve V2 is open, the connection with the secondary user EF is closed, the connection with the delivery conduit 4 is open, and the connection with the storage unit A is closed. In this position it is possible to send pressurized oil coming from the delivery P to the recharging valve V2. Advantageously, in the main valve V1 the connection with the recharging valve V2 is open only when: the connection with the storage unit A is closed, the connection with the secondary user EF is closed as there is not enough oil to feed both the recharging valve V2 and the secondary user EF.

[0038] When the pilot valve V1 is in the excess position S4, the connection with the storage unit A is closed whereas the connections with the recharging valve V2, the secondary user EF and the delivery conduit 4 are open. In this configuration, the oil of the delivery P is used to feed the main user TB, the secondary user EF and recharge the storage unit A.

[0039] Advantageously, in the main valve V1 the connection with the recharging valve V2 is open only when: the connection with the storage unit A is closed, the connection with the secondary user EF is open since there is enough oil to feed both the recharging valve V2 and the secondary user EF. Advantageously, the recharging valve V2 provides, via the conduit 9, a pilot signal which is used to operate the shuttle valve V3 and, consequently, to drive the actuator D2 of the pilot valve V1. Advantageously, the actuators D1 and D2 of the pilot valve V1 are configured to limit the flow rate to the secondary user EF in order to generate a sufficient pressure of the oil to be sent to the recharging valve V2 and, consequently, to the storage unit A.

[0040] A variant of the system 2 of the type described above is indicated in Figure 3 with 102. The system 102 comprises all the components described above for the system 2, which maintain the same numbering and are not repeated for the sake of brevity. In addition, the system 102 comprises, in addition to what has already been described: a delivery signal LSP, in order to allow the operation of the distributor 101 in the event that the feed pump is of the variable displacement load sensing type, in this case also the user connected to EF will be of the load sensing type and with a closed-centre.

[0041] Similarly, a variant of the distributor 1 described above is indicated in Figure 3 with 101. The distributor 101 comprises all the components described above for the distributor 1, which maintain the same numbering and are not repeated for the sake of brevity. In addition, the distributor 101 has: a supplementary inlet U4 connectable (in a known manner and schematically shown) to the signal delivery LSP, and a conduit 11 which connect the supplementary signal gap L4 with the conduit 10.

[0042] In use, the system 102 operates in a manner similar to that described above for the system 2. In addition, the system 102 allows to feed from the conduit 10 between the actuator D2 of the pilot valve V1 and the shuttle valve V3 with pressurized oil by means of the signal delivery LSP.

[0043] A variant of the system 2 of the type described above is indicated in Figure 4 with 202. The system 202 comprises all the components described above for the system 2, which maintain the same numbering and are not repeated for the sake of brevity. Similarly, a variant of the distributor 1 described above is indicated with 201. The distributor 201 comprises all the components described above for the distributor 1, which maintain the same numbering and are not repeated for the sake of brevity. The distributor 201 also has: a supplementary gap L4 connectable (in a known and schematically shown way) to a supplementary storage unit A2; and a supplementary outlet U5 connectable to a supplementary user CP. The distributor 201 further comprises: a conduit 12 which connects the supplementary storage unit A2 with the supplementary user C2, a valve V6 installed along the conduit 12. The valve V6 is in communication with the supplementary storage unit A2, the supplementary user CP and the discharge T. The valve V6 is configured to be arranged in the following positions:

- feed position S8;
- discharge position S9.

[0044] In the feed position S8 the connection with: the supplementary storage unit A2 is open; the supplementary user CP is open; the discharge T is closed.

[0045] In the discharge position S9 the connection with: the supplementary storage unit A2 is closed; the supplementary user CP is open; the discharge T is open.

[0046] The valve V6 comprises an actuator D4 which is driven by the pressure of the oil sent to the supplementary user CP; in other words, the actuator D4 is driven by the pressure of the oil exiting the valve V6 towards the supplementary user CP.

[0047] The distributor 201 also has a conduit 13 that puts in communication the conduit 6 with the conduit 12, between the supplementary storage unit A2 and the valve V6. The distributor 210 further comprises a one-way valve V7 installed along the conduit 6 between the storage unit A and the connection point with the conduit 13. In this way, the one-way valve V7 allows the flow of pressurized oil from the supplementary storage unit A2 towards the storage unit A.

[0048] In use, the system 202 operates in a manner similar to that described above for the system 2. In addition, the system 202 allows to feed a supplementary user CP with a second pressure line. In this way, it is possible to apply a supplementary storage unit A2 to the distributor 201 dedicated to an external supplementary user CP. Advantageously, the presence of the one-way valve V7 prevents the storage unit A from being discharged from

the supplementary user CP.

[0049] Advantageously, the valve V6 is a pressure reducer that is configured to feed the supplementary user CP with a constant pressure.

[0050] Figures 5 to 7 schematically show different embodiments of a distributor that can be used in a system according to the present invention and without the internal connection of the inlet I and the main outlet U1. In other words, according to what is shown in Figures 5 to 7, the connection between the delivery P and the main user TB is made outside the distributor itself (in a known and not shown manner, for example by means of a dedicated connection).

[0051] Figure 5 shows the diagram of a distributor 301 that can be used in a system 2 as shown in Figure 2. In Figure 5 the components in common with the distributor 2 maintain the same numbering and are to be considered included therein without repeating them for the sake of brevity. The operation of the distributor 301 is similar to that already described above.

[0052] Figure 6 shows the diagram of a distributor 401 that can be used in a system 102 as shown in Figure 3. In Figure 6, the components in common with the distributor 101 maintain the same numbering and are to be considered included therein, without repeating them for the sake of brevity.

[0053] Figure 7 shows the diagram of a distributor 501 that can be used in a system 202 as shown in Figure 4. In Figure 7 the components in common with the distributor 501 maintain the same numbering and are to be considered included therein, without repeating them for the sake of brevity.

Claims

1. Hydraulic distributor, in particular of an agricultural or forestry machine or other mobile industrial means, having an inlet (I) connectable to a pressurized oil delivery (P) and to a priority user (TB); a second outlet (U2) connectable to a second user (EF); a first gap (L1) connectable to a storage unit (A); a second gap (L2) connectable to a first pressure signal (LS) from the primary user (TB); wherein, the distributor comprises a first valve (V1), selectively movable between at least:

- a first position (S1) in which the inlet (I) is in communication with the first gap (L1) and the second gap (U2) is closed; and
- a second position (S4) in which the second gap (U2) is connected to the inlet (I) and the first gap (L1) is closed;

wherein the distributor is **characterized in that** the first valve (V1) is moved:

- in the first configuration (S1) by an elastic

element (M1) and by a first actuator (D2) fed by the oil pressure to the second gap (L2); and,
- in the second position (S4) by a second actuator (D1) fed by the oil pressure to the inlet (I).

2. Distributor according to claim 1, wherein the first valve (V1) has a conduit (6) connectable to a second recharging valve (V2), which is configured to feed the storage unit (A) during use; wherein, the first valve (V1) is movable into a third position (S3), which is interposed between said first position (S1) and second position (S4); wherein:

- in the first position (S1) the communication with the conduit (6) is closed;
- in the third position (S3) the first valve (V1) puts in communication the pressurized oil at the inlet (I) with said conduit (6) and closes both the first gap (L1) and the second gap (U2);
- in the second position (S4) the conduit (6) communicates with the inlet (I);

wherein the first actuator (D2) is fed by a pressure signal that is the greater between the first pressure signal (LS) from the priority user (TB) and a second pressure signal from the second valve (V2).

3. Distributor according to claim 2, and comprising a body (3) inside which the first valve (V1), the second valve (V2) and a third valve (V3) are made, which is configured to generate, in use, a pressure signal corresponding to the maximum pressure between said first signal (LS) and second signal; wherein the second valve (V2) is configured to recharge the storage unit (A) which is connected, in use, to the first gap (L1).
4. Distributor according to claim 3 and having a second conduit (7), which connects the first valve (V1) with the storage unit (A); wherein, the distributor comprises a fourth unidirectional valve (V4), which is installed along said second conduit (7) and allows the oil to flow only from the storage unit (A) towards the first valve (V1).
5. Distributor according to any one of the preceding claims, wherein the pressurized oil delivery (P) and the primary user (TB) communicate with each other through the body (3) of the distributor itself; wherein, the body (3) of the distributor has the inlet (I), a third outlet (U1), and a third conduit (4), which directly connects the inlet (I) and the third outlet (U1) to each other.
6. Distributor according to any one of claims 3 to 5, wherein the second user (EF) is open-centre.
7. Distributor according to any one of claims 3 to 5,

wherein the second user (EF) is closed-centre and the pressurized oil delivery (P) has a variable flow rate.

8. Distributor according to any one of claims 3 to 7, wherein the second valve (V2) is configured to feed one or more further storage units (A2). 5
9. Distributor according to claim 2, wherein the primary user (TB) is a trailer brake valve. 10
10. Hydraulic system, in particular of an agricultural or forestry machine or other mobile industrial means, comprising a hydraulic distributor as claimed in any of the preceding claims. 15

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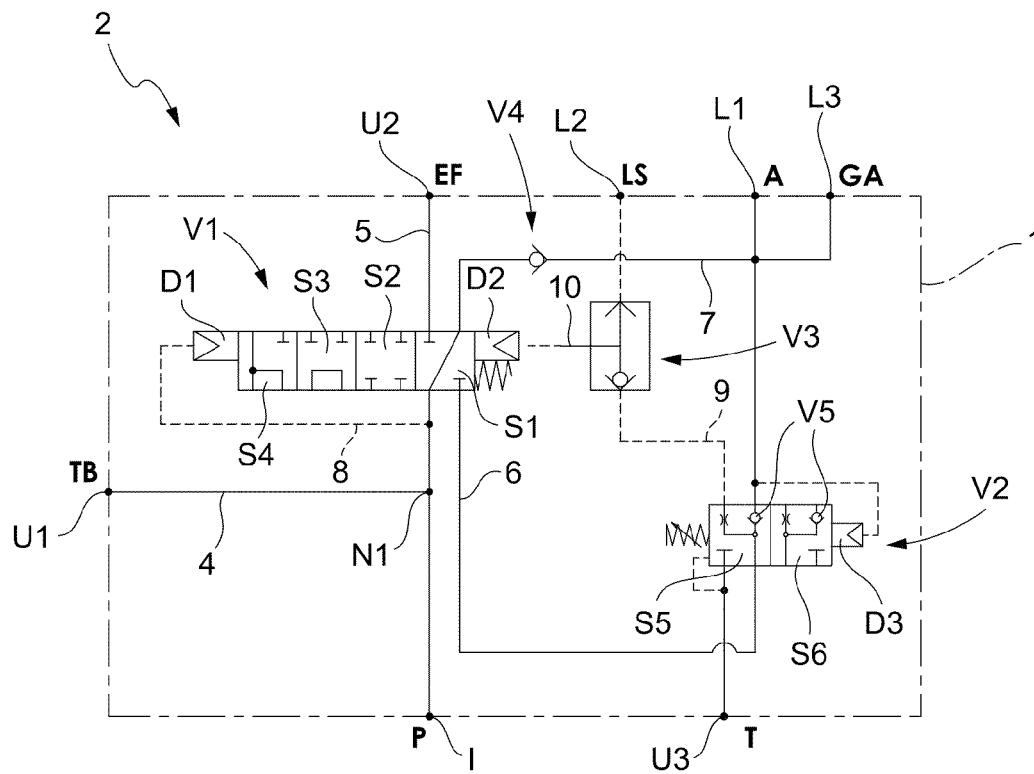
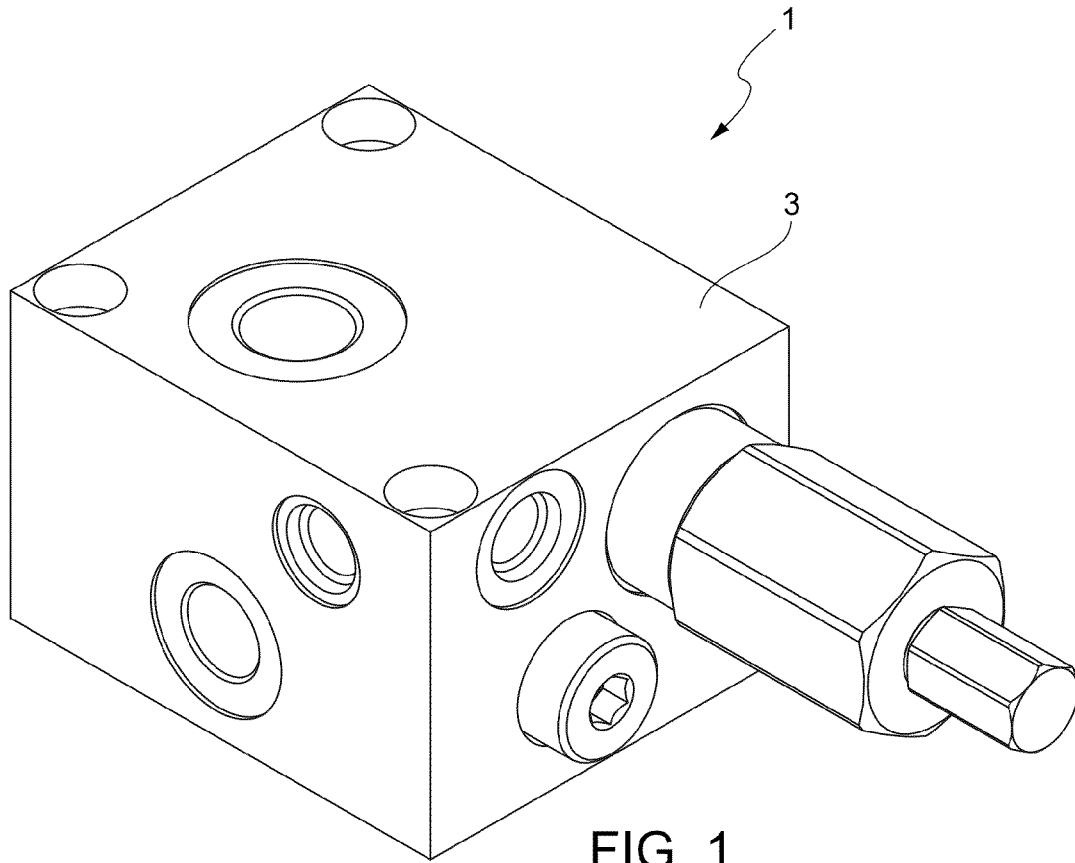
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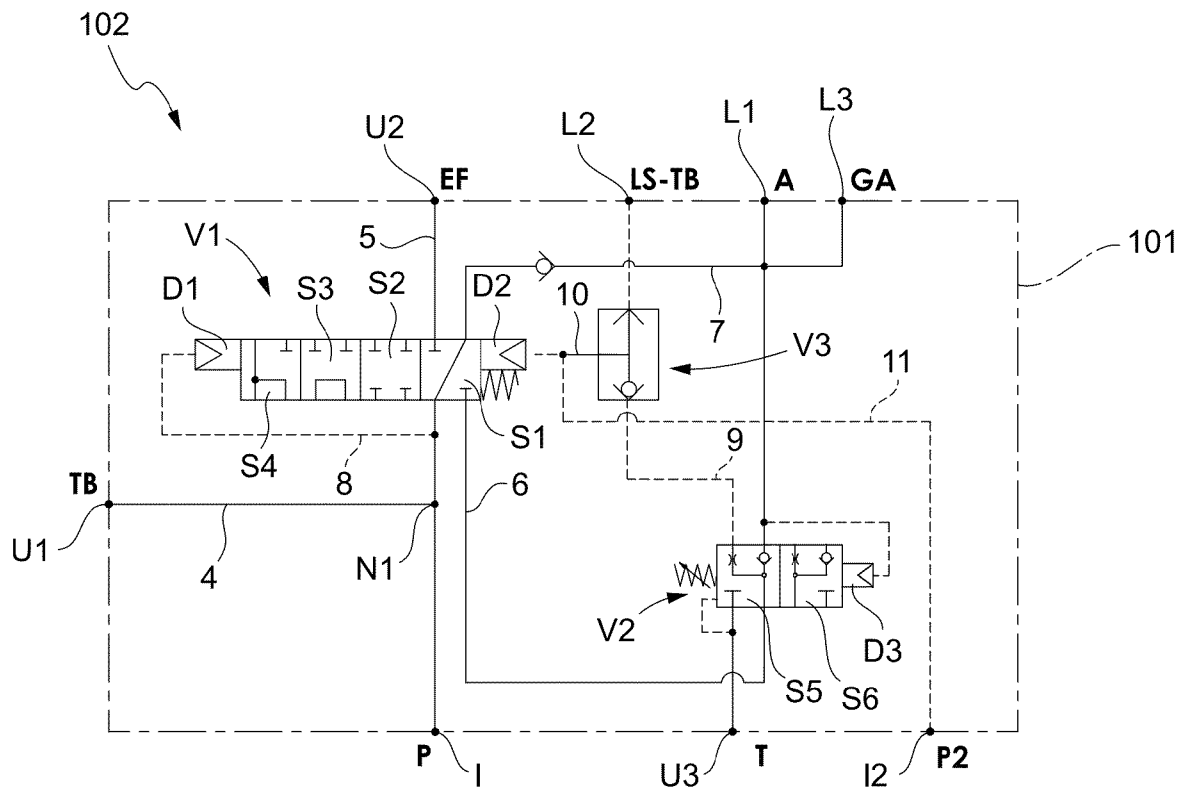


FIG. 3

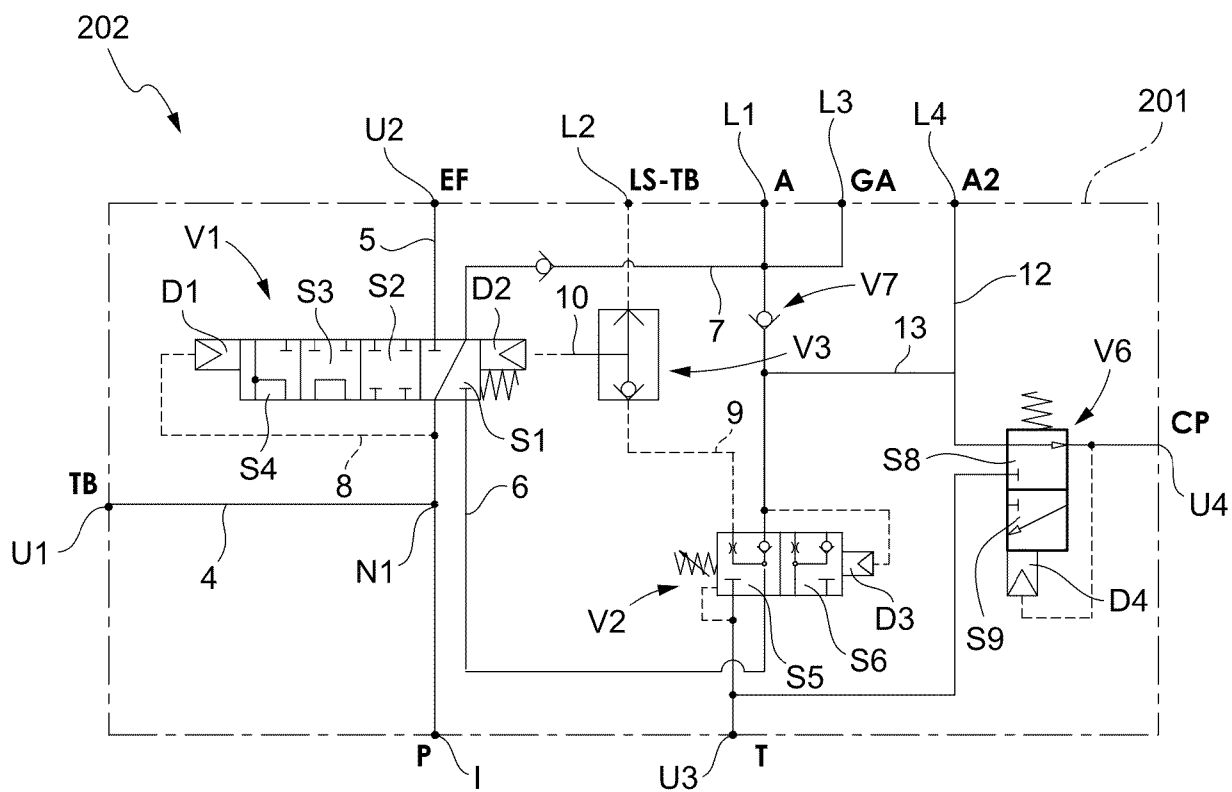


FIG. 4

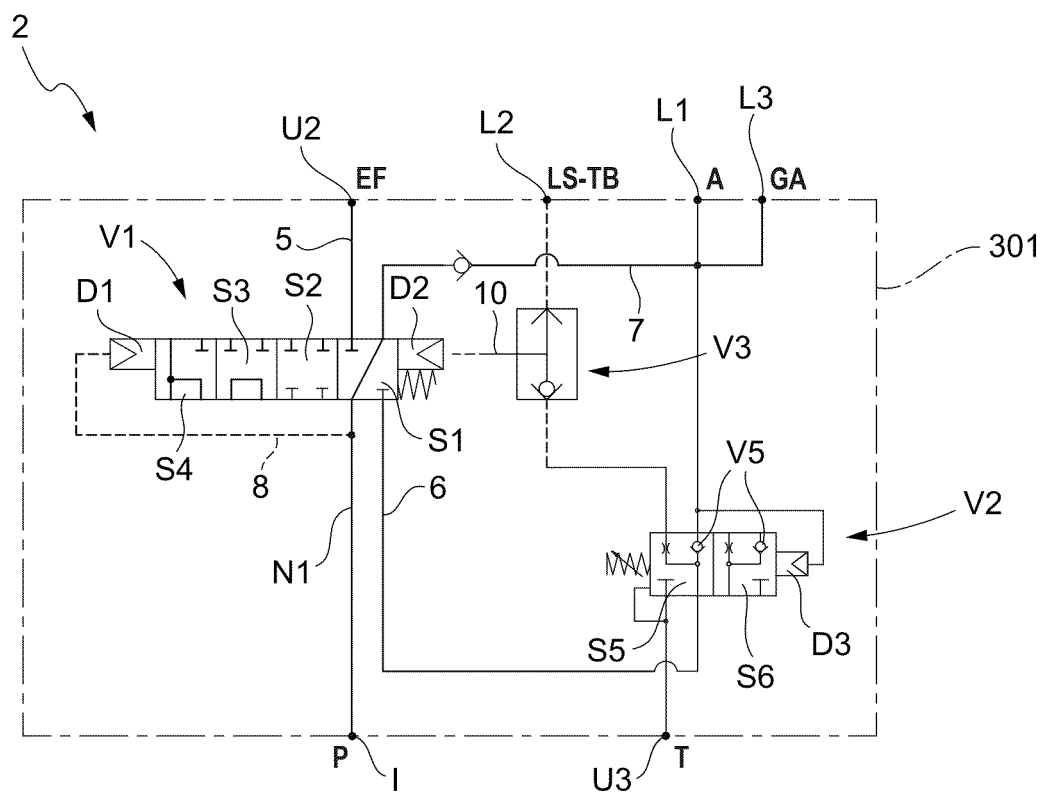


FIG. 5

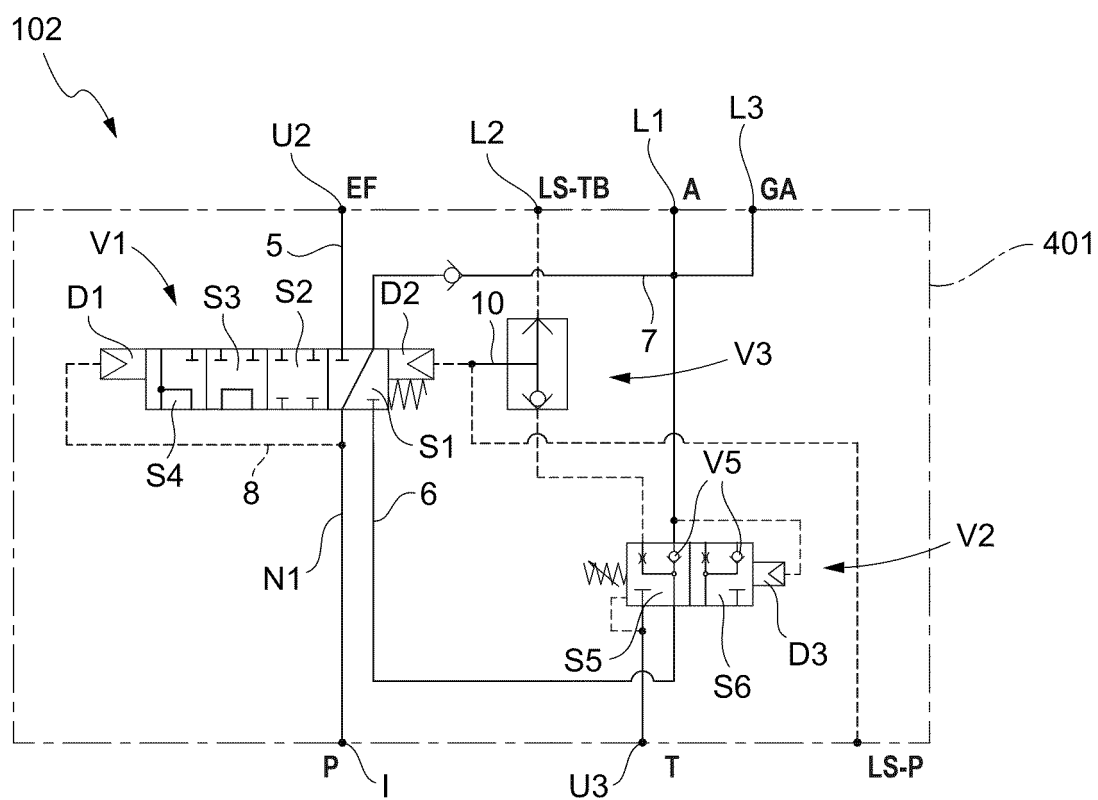


FIG. 6

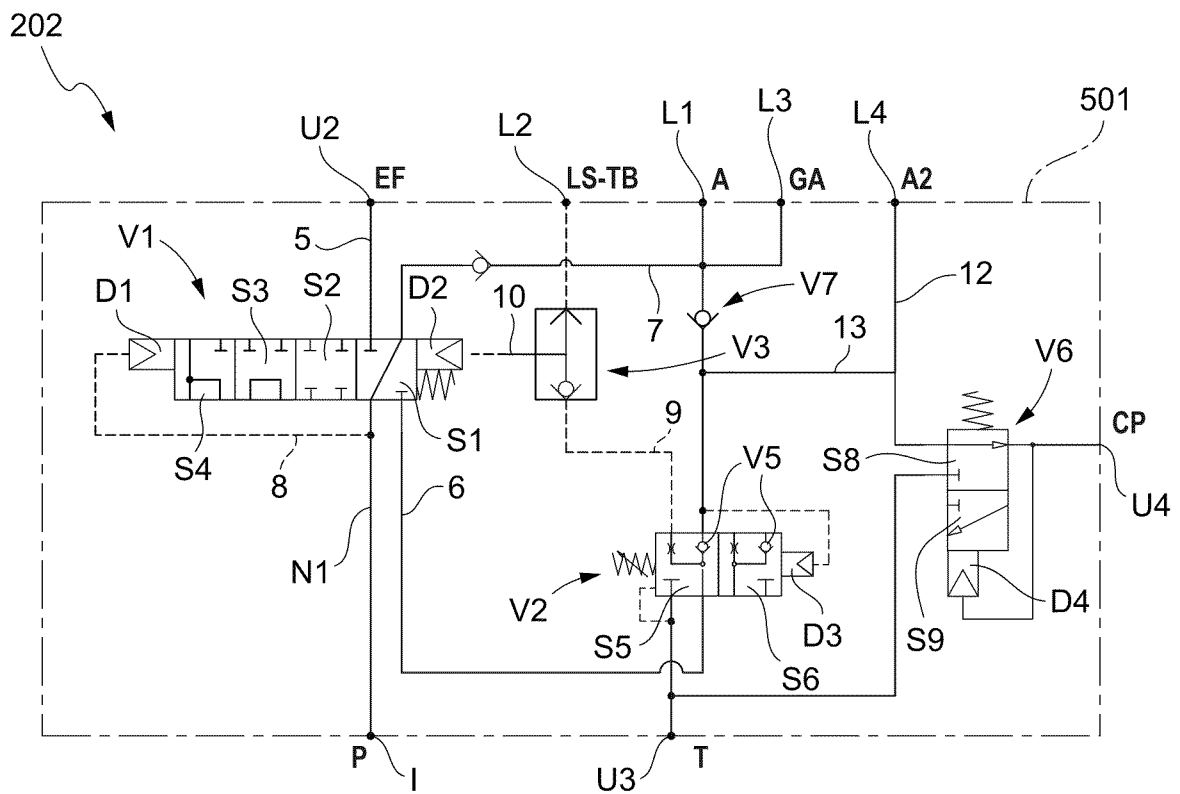


FIG. 7



EUROPEAN SEARCH REPORT

Application Number

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Place of search		Date of completion of the search	Examiner
Munich		26 February 2026	Bindreiff, Romain
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