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(54) **IMPROVED LOAD SENSING PUMP ARRANGEMENT FOR A HYDRAULIC CIRCUIT AND RELATED HYDRAULIC CIRCUIT ARRANGEMENT**

(57) Load sensing pump arrangement (2) for a hydraulic arrangement (1) for a work vehicle, comprising pump means (2') and a control module (2'') configured to regulate displacement and pressure provided by pump means (2) towards a supply line of the hydraulic arrangement (1), wherein the control module (2'') comprise a torque limiter (2a) and at least one control valve (2b', 2b'') controlling the torque limiter on the base of a

pilot signal coming from a pilot conduit (8) of the hydraulic arrangement (1), the control module (2'') further comprising an enabling valve (9) fluidly interposed between the pilot conduit (8) and a further conduit (8') spilling fluid at the outlet of the pump means (2') and configured to regulate the passage of fluid between pilot conduit (8) and further conduit (8') towards torque limiter (2a) and the least one control valve (2b', 2b'').

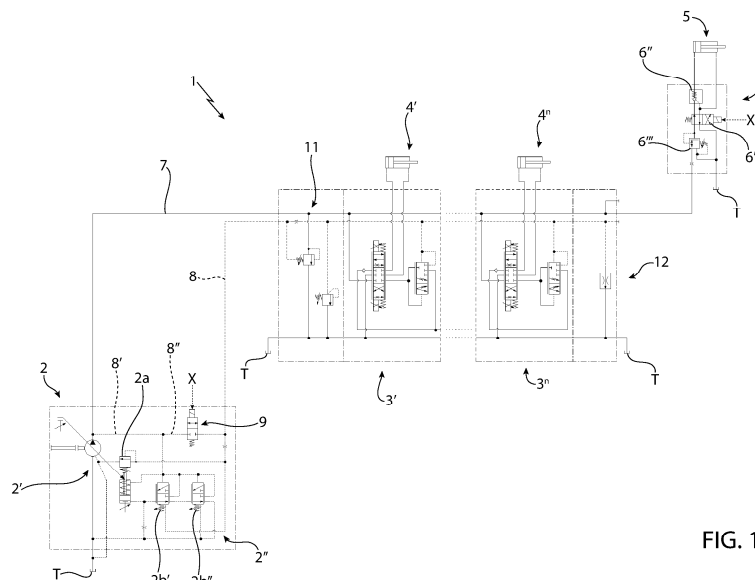


FIG. 1

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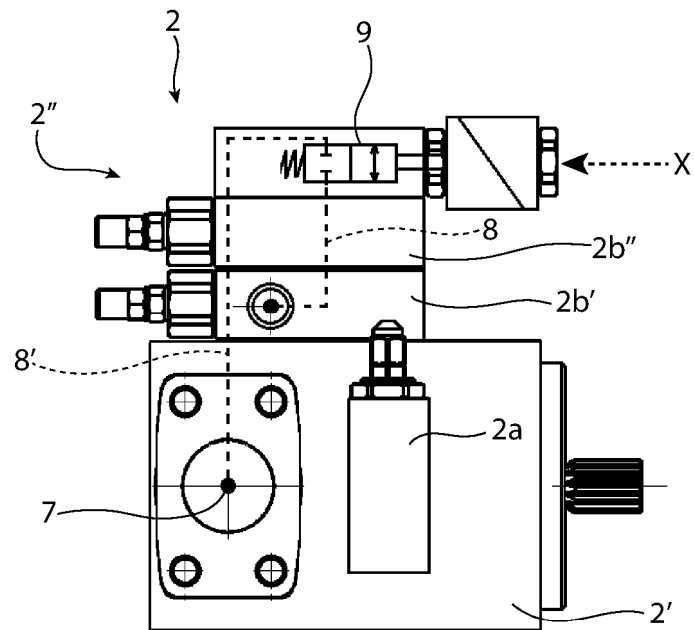


FIG. 2

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Description

TECHNICAL FIELD

[0001] The present invention concerns a load sensing pump arrangement for a work machine hydraulic circuit.

[0002] The present invention finds its preferred, although not exclusive, application in excavators. Reference will be made to this application by way of example below.

BACKGROUND OF THE INVENTION

[0003] Work vehicles such as earth moving machines or agricultural vehicles may be provided with so-called quick couplers..

[0004] Quick-couplers allow to attach or detach in an easy and quick manner an implement/working element via a locking arrangement. Such locking arrangement usually comprises a hydraulic cylinder that is controlled to keep opened or locked the locking arrangement thereby allowing substitution or maintaining connection of an implement/working element to the vehicle body. Further details about quick couplers are reported in ISO 13031 - Earth-moving machinery - Quick couplers

[0005] The hydraulic cylinder is controlled by a dedicated valve that is fluidly connected to a source of pressurized hydraulic fluid.

[0006] Usually, such quick coupler is provided at the end of a boom/arm assembly. Examples of vehicle provided with quick couplers are scrapers or excavators.

[0007] During the above-mentioned substitution of the implement/working element, there is further need to maintain the boom/arm assembly in a fixed position.

[0008] This request clearly imposes loads to the hydraulic circuit that needs to provide both pressure to the boom/arm assembly and to the valve dedicated to control the quick coupler cylinder.

[0009] To disconnect quick-coupler is needed to provide suitable pressure and flow, therefore, different solutions are known that foresees the use of hoses and connectors that increase costs, maintenance and reduces useful space on the vehicle.

[0010] Accordingly, the need is felt to allow control of a quick coupler control valve without increasing complexity, cost and encumbrance of existing systems.

[0011] An aim of the present invention is to satisfy the above-mentioned needs in a cost-effective and optimized manner.

SUMMARY OF THE INVENTION

[0012] The aforementioned aim is reached by a load sensing pump arrangement and a hydraulic circuit arrangement as claimed in the appended set of claims that are integral part of the present description.

BRIEF DESCRIPTION OF DRAWINGS

[0013] For a better understanding of the present invention, a preferred embodiment is described in the following, by way of a non-limiting example, with reference to the attached drawings wherein:

- Figure 1 is a schematic representation of a hydraulic arrangement comprising a pump arrangement according to the invention;
- Figure 2 is a schematic representation of a pump arrangement according to a first embodiment of the invention; and
- Figure 3 is a schematic representation of a pump arrangement according to a second embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Figure 1 discloses a hydraulic arrangement 1 for a work vehicle (not shown) such as an earth moving machine in particular an excavator.

[0015] Hydraulic arrangement 1 comprises essentially a load sensing pump arrangement 2 configured to provide pressurized fluid to different users of the work vehicle.

[0016] In detail, hydraulic arrangement 1 comprises a plurality of actuators 4', 4ⁿ (, 5 fluidly connected to the load sensing pump arrangement 2 via related valve modules 3', 3ⁿ, 6.

[0017] In detail, such actuators 4', 4ⁿ , 5 comprise hydraulic cylinders, e.g. double acting hydraulic cylinders as shown in the attached schematic figure, configured to operate a related element of the work vehicle.

[0018] In the disclosed arrangement, at least a first and a second actuator 4', 4ⁿ are shown such boom/arm assembly cylinders of the work vehicle.

[0019] In the disclosed arrangement, a third actuator 5 is a quick coupler cylinder, i.e. a cylinder configured to release or attach an operative device of the work vehicle, as discussed in the background section.

[0020] The load sensing pump arrangement 2 is fluidly connected to the valve modules 3', 3ⁿ, 6 via a supply conduit 7. In detail, the valve modules 3', 3ⁿ, 6 are configured in an open-center configuration thereby regulating the flow passage towards the respective actuator 4', 4ⁿ, 5 between the supply conduit 7 and a discharge T.

[0021] The load sensing pump arrangement 2 operates via a load sensing hydraulic signal spilled by a pilot conduit 8 fluidly connected to the valve modules 3', 3ⁿ controlling the first and second actuators 4', 4ⁿ, i.e. the actuators controlling the element to which the operative device can be selectively attached via the quick-coupler controlled by third actuator 5.

[0022] In detail, load sensing pump arrangement 2

comprises pump means 2' and a control module 2'' configured to control the operation of pump means 2' via load sensing hydraulic signal coming from pilot conduit 8.

[0023] In detail, the disclosed control module 2'' comprises a torque limiter 2a, a flow regulator 2b' and a load sensing regulator 2b''. Since the proposed hydraulic topology is one of the possible known in the art will not further disclosed in detail for sake of brevity.

[0024] In further detail, valve module 6 voted to control the third actuator 5 comprises a control valve 6' configured to regulate flow passage towards the third actuator 5.

[0025] In detail, control valve 6' is an electro-actuated valve and more in particular a two-position four ways valve. According to the disclosed hydraulic topology, control valve 6' is fluidly interposed between the two portions of the double acting cylinder 5, the supply line 7 and discharge T.

[0026] In further detail, control valve 6 is configured to assume a first position in which allows the passage of fluid from the supply line 7 to a first portion of the cylinder 5 and connects to discharge T a second portion and a second position opposite to the first one.

[0027] The valve module 6 may further comprise a check valve 6'' fluidly interposed downstream to control valve 6' and configured to allow passage of fluid to the first portion of the cylinder 5 only from supply line 7 towards this latter and avoiding passage from first portion to discharge T.

[0028] The valve module 6 may further comprise a safety valve 6''' fluidly interposed upstream to control valve 6' and configured to allow passage of fluid o discharge T if the pressure in supply conduit 7 exceeds a preset threshold.

[0029] Referring back to control module 2'' of the load sensing pump arrangement 2, it further comprises an enabling valve 9 configured to switch control module 2'' from a first configuration in which the torque limiter 2a is controlled by pilot conduit 8 via flow regulator 2b' and load sensing regulator 2b'' and a second configuration in which torque limiter imposes minimum displacement and maximum pressure to be provided by pump means 2.

[0030] In detail, the enabling valve 9 is fluidly interposed by pilot conduit 8 and a pump pilot conduit 8' spilled close downstream to outlet of pump means 2'.

[0031] In detail, enabling valve 9 is an electro-actuated valve and more preferably an ON-OFF valve. More in detail, in the disclosed hydraulic topology, the enabling valve 9 is fluidly interposed on a by-pass conduit 8'' fluidly connecting pilot conduit 8 and pump pilot conduit 8' thereby allowing or deny the passage of fluid between these latter conduits.

[0032] As disclosed, exemplarily, the proposed hydraulic topology of the hydraulic arrangement 1 may further comprise an inlet stage 11 upstream to valve modules 3', 3ⁿ and configured to allow discharge from

supply line 7 to discharge T if a preset pressure is reached in supply line 7.

[0033] Moreover, exemplarily, the proposed hydraulic topology of the hydraulic arrangement 1 may further comprise an outlet stage 12 downstream to valve modules 3', 3ⁿ and configured to allow discharge from pilot conduit 8 to discharge T in function of pressure in pilot conduit 8.

[0034] As shown in figures 2 and 3, different dispositions of enabling valve 9 may be foreseen.

[0035] As depicted, pump means 2' define the main body into which the torque limited, the flow regulator 2b' and the load sensing regulator 2b'' are connected . The flow regulator 2b' is configured to receive the pilot conduit 8.

[0036] Advantageously, the enabling valve 9 is carried by pump means 2' adjacent to flow regulator 2b' and the load sensing regulator 2b''.

[0037] In the embodiment of figure 2, the enabling valve 9 is fixedly carried by the load sensing regulator 2b'', in particular, placed parallelly with respect to the main axis of the pump means 2'; differently, in the embodiment of figure 3 the enabling valve 9 is carried by one between pump means 2', flow regulator 2b' and/or the load sensing regulator 2b'' and is placed transversely with respect to the main axis of pump means 2' adjacent to a terminal end of the flow regulator 2b' and the load sensing regulator 2b''.

[0038] The operation of the embodiment of the invention as described above is the following.

[0039] When needed, the user requests to unlock the quick coupler of the vehicle, e.g. for substituting the operative device. Accordingly, an electric control signal X is sent to the control valve 6 and to the enabling valve 9. In this manner, the pump pilot signal 8' is short-circuited on pilot signal 8 thereby maximizing the pressure of fluid within supply conduit 7 and allowing to move third actuator 5. When the electric control signal X is switched off, the hydraulic arrangement operates as usual.

[0040] In view of the foregoing, the advantages of a load sensing pump arrangement and a hydraulic circuit arrangement according to the invention are apparent.

[0041] The proposed hydraulic circuit allows to increase pressure in supply line thereby controlling the quick coupler actuator without varying the operation of the remaining actuators.

[0042] In particular, the above effect is reached without providing further valves in the vehicle but incorporating a valve in the pump arrangement itself.

[0043] Accordingly, space waste is reduced, such as costs. Indeed, there is no need of dedicated hose and connection since they are reduced to minimum or incorporated in pump means body 2'.

[0044] In detail, such reduction of components and hose length further reduces the possibilities of damages and of fault in the system.

[0045] Moreover, the proposed concept can be ap-

plied to different pump means arrangement with small modifications thereby being particularly versatile.

[0046] It is clear that modifications can be made to the described load sensing pump arrangement and the hydraulic circuit arrangement which do not extend beyond the scope of protection defined by the claims.

[0047] For example, number of actuators may vary such as the typology of vehicle. Moreover, the disclosed hydraulic topologies and components may be different.

Claims

1. Load sensing pump arrangement (2) for a hydraulic arrangement (1) for a work vehicle, said load sensing pump arrangement (2) comprising pump means (2') and a control module (2'') configured to regulate displacement and pressure provided by said pump means (2) towards a supply line of said hydraulic arrangement (1), wherein said control module (2'') comprise a torque limiter (2a) and at least one control valve (2b', 2b'') controlling the torque limiter on the base of a pilot signal coming from a pilot conduit (8) of said hydraulic arrangement (1), said control module (2'') further comprising an enabling valve (9) fluidly interposed between said pilot conduit (8) and a further conduit (8') spilling fluid at the outlet of said pump means (2') and configured to regulate the passage of fluid between said pilot conduit (8) and said further conduit (8') towards said torque limiter (2a) and said at least one control valve (2b', 2b'').
2. Load sensing pump arrangement according to claim 1, wherein said enabling valve (9), said torque limiter (2a) and said at least one control valve (2b', 2b'') are carried by said pump means (2').
3. Load sensing pump arrangement according to claim 2, wherein said enabling valve (9) is adjacent to said at least one control valve (2b', 2b'') parallelly with respect to a main axis of said pump means (2').
4. Load sensing pump arrangement according to claim 2, wherein said enabling valve (9) is adjacent to said at least one control valve (2b', 2b'') transversally with respect to a main axis of said pump means (2').
5. Load sensing pump arrangement according to any of the preceding claims, wherein said enabling valve (9) is an electro-actuated valve controlled by an electric control signal (X).
6. Load sensing pump arrangement according to any of the preceding claims, wherein said enabling

valve (9) is an ON-OFF valve.

7. Hydraulic arrangement (1) for operating a plurality of plurality of actuators (4', 4ⁿ, 5) of a work vehicle, said hydraulic arrangement comprising a supply conduit (7) and a pilot conduit (8) and a load sending pump arrangement (2) according to any of the preceding claims and configured to supply pressurized fluid to said conduit (7) in function of an hydraulic pilot signal provided by said pilot conduit (8).
8. Hydraulic arrangement according to claim 7, wherein said plurality of actuators (4', 4ⁿ, 5) are fluidly connected to said supply conduit (7) via valve modules (3', 3ⁿ, 6), said valve modules (3', 3ⁿ, 6) being open center valve modules.
9. Hydraulic arrangement according to claim 8, wherein said hydraulic pilot signal provided by said pilot conduit (8) is spilled by only some among said valve modules (3', 3ⁿ, 6).
10. Hydraulic arrangement according to claim 8 or 9, wherein one among said plurality of actuators (4', 4ⁿ, 5) is a quick coupler actuator, the related valve module (6) comprising an electro-actuated valve (6'), said electro-actuated valve (6').
11. Hydraulic arrangement according to claim 10 when claim 7 depends on claim 5, wherein said electro-actuated valve (6') and said enabling valve (9) are controlled by the same control signal (X).

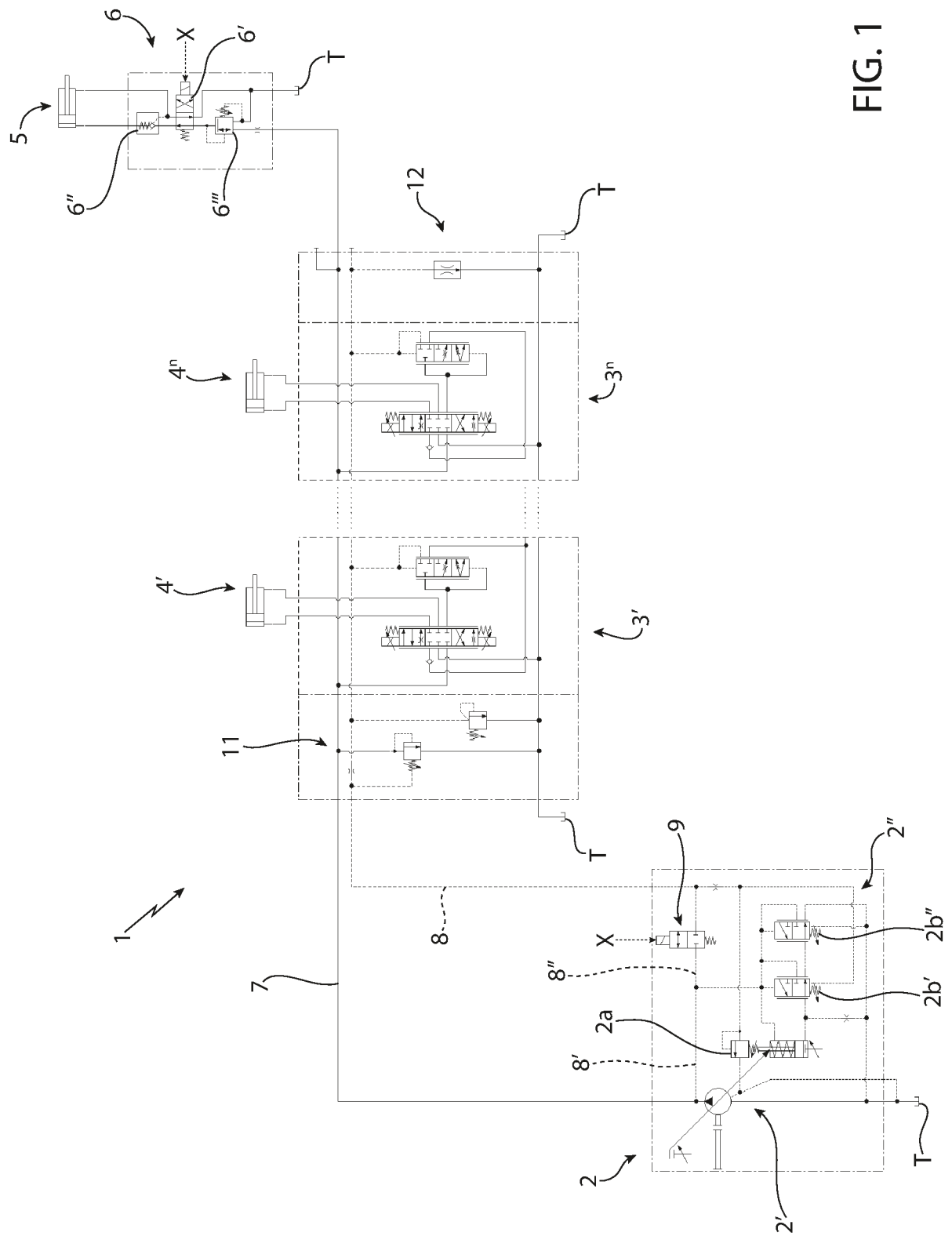


FIG. 1

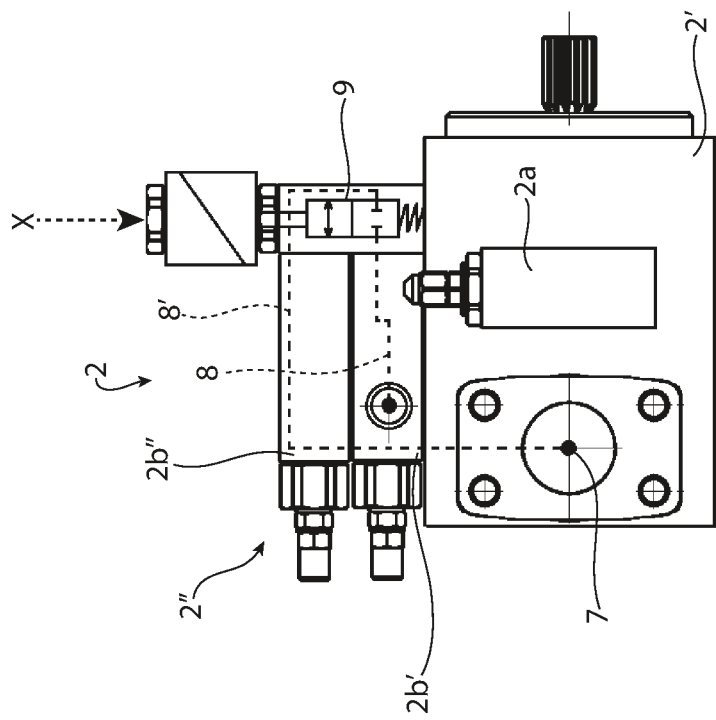


FIG. 3

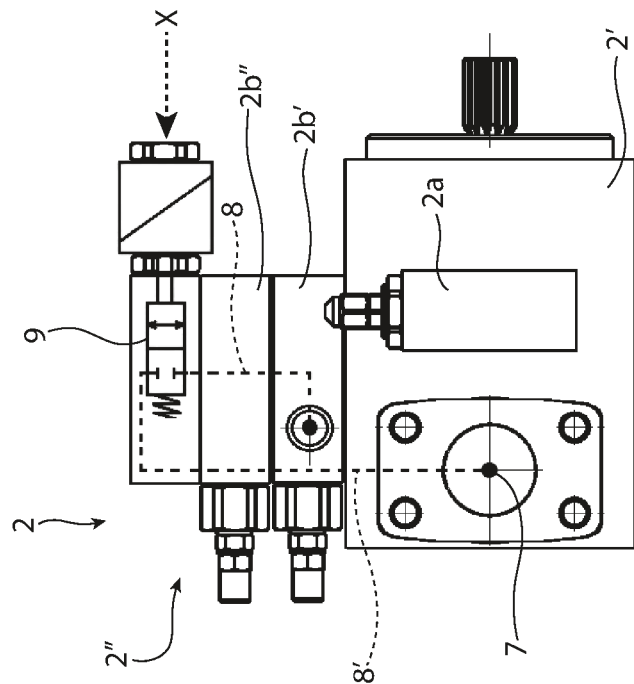


FIG. 2



EUROPEAN SEARCH REPORT

Application Number

EP 26 17 2250

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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			A01B
Place of search			Examiner
Munich			Bultot, Coralie
Date of completion of the search			
12 August 2026			
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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