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(72) Inventors:
• **Arbeithuber, Peter**
4484 Kronstorf (AT)
• **Haider, Franz**
4443 Maria Neustift (AT)
• **Huber, Karl**
4100 Ottensheim (AT)

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(74) Representative: **CNH Industrial IP Department**
Patent Department,
Leon Claeysstraat 3A
8210 Zedelgem (BE)

(71) Applicant: **CNH Industrial Italia S.p.A.**
10135 Torino (IT)

(54) **HYDRAULIC OIL SUCTION AND FILTERING ARRANGEMENT FOR A WORK VEHICLE**

(57) Suction and filtering hydraulic arrangement (1) for feeding hydraulic pumps assemblies (2, 3) of a work vehicle, comprising at least an auxiliary pump assembly (2) and at least one hydraulic circuit pump (3), both pumps (2, 3) comprising an inlet fluidly connected to a source (4) of oil and a filter module (5) fluidly interposed

between each of said pumps (2, 3) and said source (4), this latter being an oil transmission tank of the work vehicle, wherein the arrangement (1) comprises air discharge means (13) configured to accumulate air from filter module (5) and to allow the suction of such air from the at least one pump (3).

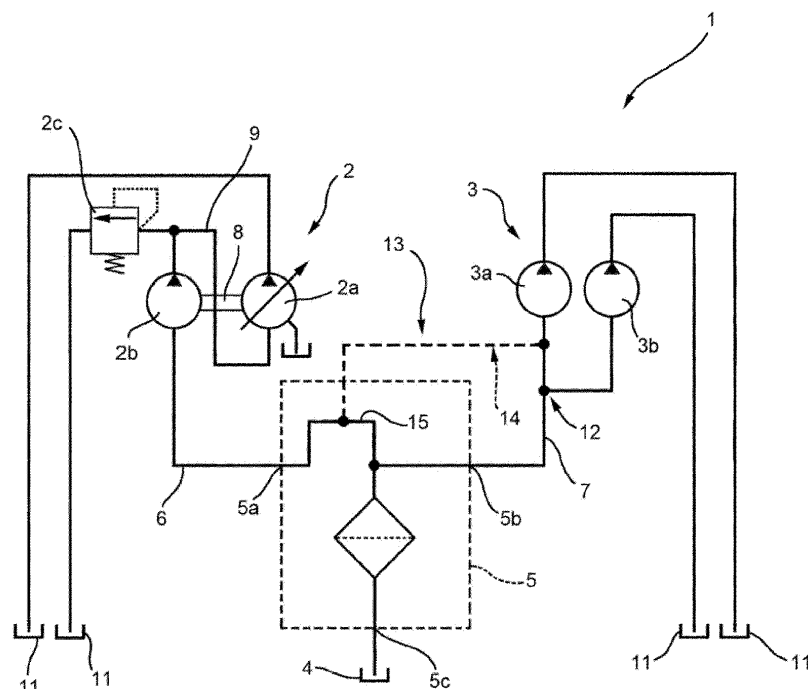


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention concerns a hydraulic arrangement for a work vehicle, in particular an improved hydraulic oil suction and filtering arrangement for a work vehicle.

BACKGROUND OF THE INVENTION

[0002] Work vehicles such as agricultural vehicles or construction equipment vehicles are provided with a plurality of hydraulic circuits for actuating different utilities of the vehicle.

[0003] In particular, such plurality of hydraulic circuits uses a common source of oil which is usually the oil from oil transmission tank of the vehicle which is therefore suctioned and filtered before flowing into the aforementioned hydraulic circuits.

[0004] Making reference to figure 1, it is disclosed a known prior art suction and filtering hydraulic arrangement 1' for providing oil to a plurality of utility hydraulic circuits. Such suction and filtering hydraulic arrangement 1' is configured to provide filtered oil to an auxiliary pump assembly 2', i.e. a pump voted to feed an auxiliary devices hydraulic arrangement (not shown) of the vehicle and a plurality of hydraulic circuits 3' voted in particular to managing the hydraulic devices linked to motion of the vehicle, e.g. a transmission pump 3a' and a steering pump 3b' for feeding respectively a transmission and a steering hydraulic arrangements (not shown).

[0005] As depicted, auxiliary pump assembly 2' comprises, as known, an auxiliary pump 2' a carried by a known charge pump 2b' and it is provided with a relief valve 2c' for safety reason.

[0006] Both auxiliary pump assembly 2' and hydraulic circuits 3' suck oil from a source 4' of oil with the hydraulic interposition of a filter 5' configured to filter oil from impurities. Indeed source 4' of oil is transmission oil tank and therefore contain impurities due to gearing operation and/or degradation of oil due to the high temperature of the transmission during its operation.

[0007] Oil filtered by filter 5' and suctioned by pumps assemblies 2', 3' is then, when passed through the related circuit, discharged to respective discharges 6', being each fluidly connected to oil transmission tank.

[0008] It has to be noticed that oil in transmission tank is, as said before, dirtied and mixed so that an emulsion of dirty oil is usually present in such tank. Consequently, it may happen that air passes through filter 5' and flows towards pump assemblies 2' and 3'.

[0009] However, motion voted pump assemblies 3', i.e. transmission pump and steering pump 3a', 3b', are not deeply influenced by air suction and oil usually returns to transmission/mechanical elements which operation is not influenced by presence of air into the oil. Conversely, auxiliary pump 2a' is deeply affected by the presence of

air into oil.

[0010] Moreover, auxiliary pump assembly 2' is not used continuously as other pump assembly 3' and, accordingly, air tends to accumulate in conduits connecting auxiliary pump assembly 2' with filter 5' during rest operation of auxiliary pump assembly 2'.

[0011] Consequently, by passing into auxiliary pump assembly 2', such air creates noise problems and may also lead to other malfunctioning of this latter.

[0012] Therefore, the need is felt to avoid the accumulation of air towards auxiliary pump assembly 2' of a hydraulic oil suction and filtering arrangement 1' for a work vehicle.

[0013] An aim of the present invention is to satisfy the above mentioned needs.

SUMMARY OF THE INVENTION

[0014] The aforementioned aim is reached by a hydraulic oil suction and filtering arrangement as claimed in the appended set of claims.

BRIEF DESCRIPTION OF DRAWINGS

[0015] 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 hydraulic circuit of hydraulic oil suction and filtering arrangement as known in the prior art; and
- Figure 2 is a schematic hydraulic circuit of hydraulic oil suction and filtering arrangement according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Figure 2 discloses a hydraulic oil suction and filtering arrangement 1 for providing oil to a plurality of utility hydraulic circuits according to the invention.

[0017] In the described embodiment, hydraulic oil suction and filtering arrangement 1 is configured to provide filtered oil to an auxiliary pump assembly 2, i.e. a pump voted to feed an auxiliary devices hydraulic arrangement (not shown) of the vehicle and to a plurality of hydraulic circuit pumps 3 voted in particular to managing the hydraulic devices linked to motion of the vehicle, e.g. a transmission pump 3a and a steering pump 3b for feeding respectively a transmission and a steering hydraulic arrangements (not shown).

[0018] According to the exemplarily embodiment, auxiliary pump assembly 2 may comprise a proper auxiliary pump 2a carried by a known charge pump 2b and it is provided with a security valve 2c for safety reason.

[0019] Both auxiliary pump assembly 2 and hydraulic circuit pumps 3 suck oil from a source 4 of oil with the

hydraulic interposition of a filter module 5 configured to filter oil from impurities. Filter module 5 may of any typology and therefore it is not disclosed for sake of brevity.

[0020] In particular, filter module 5 comprises a first opening 5a fluidly connected to auxiliary pump assembly 2 by a conduit 6, a second opening 5b fluidly connected to hydraulic circuit pumps 3 by a related conduit 7 and a third opening 5c fluidly connected to the aforementioned source 4. More in detail, source 4 is the tank of a transmission of the work vehicle.

[0021] In greater particular, according to the proposed embodiment, an input of charge pump 2b is fluidly connected to first opening 5 via conduit 6 and an output of charge pump 2b is fluidly hydraulically via a conduit 9 to an input of auxiliary pump 2a. Furthermore, charge pump 2b is operatively connected to auxiliary pump 2a via a mechanical link 8. An output of auxiliary pump 2a is fluidly connected to discharge 11. Advantageously, discharge 11 is again the tank of the transmission oil.

[0022] Preferably, auxiliary pump 2a is a variable displacement pump and may be controlled electronically or hydraulically to provide the requested hydraulic load to auxiliary devices of the work vehicle.

[0023] Security valve 2c preferably comprises a relief valve having an output fluidly connected to conduit 9 and an output connected to discharge 11, i.e. oil transmission tank. Relief valve 11 is configured to allow to connect conduit 9 to discharge if pressure inside this latter overcome a preset maximum pressure.

[0024] In the described embodiment, second opening 5b is fluidly connected to hydraulic circuit pumps 3. Each of such pumps 3a, 3b comprises respectively an inlet fluidly connected to second opening 5b and an outlet fluidly connected to discharge 11, i.e. oil transmission tank.

[0025] In particular, second opening 5b is fluidly connected to a hydraulic junction 12 configured to divide fluid to the aforementioned inlets of pumps 3a,3b. In particular, hydraulic junction 12 may be, as the described embodiment, a hydraulic knot.

[0026] According to the invention, hydraulic oil suction and filtering arrangement 1 comprises air discharge means 13 configured to allow the accumulation of air into a dedicated space and to allow its suction by hydraulic circuits pumps 3 so as to avoid its suction by auxiliary pump assembly 2.

[0027] According to the described embodiment, air discharge means 13 comprise a discharge conduit 14 fluidly connecting filter module 5 and hydraulic junction 12. Furthermore, such discharge conduit 14 is fluidly connected to an accumulation portion 15 of at least part of conduit 6. In particular, in the described embodiment accumulation portion 15 is realized in conduit 6 and has an extremity joining the connection between conduits 6 and 7.

[0028] Advantageously accumulation portion 15 is a top portion of filter module 5, i.e. a portion higher with respect to first and second openings 5a, 5b which therefore is a syphon for air with respect to discharge conduit

14.

[0029] The operation of the above described suction and filtering hydraulic arrangement 1 according to the invention is the following.

[0030] Standard operation of the arrangement 1 includes a substantial continuous suction of oil from pumps 3 while auxiliary pump assembly 2 operates discontinuously. Accordingly, air which comes from filter module 5 tends to accumulate into accumulation portion 15 due to its upper position with respect to remaining portion of conduits 6, 7.

[0031] Accordingly, since operation of pumps 3 is almost continuous, any air accumulation due to inoperative status of auxiliary pump assembly is sucked directly by pumps 3 which are substantially unaffected by air.

[0032] When auxiliary pump assembly 2 is operative, air cannot accumulate into filter module 5 and therefore the sucked oil is almost of good quality for the operation of auxiliary pump assembly 2.

[0033] In view of the foregoing, the advantages of a suction and filtering hydraulic arrangement 1 according to the invention are apparent.

[0034] The air discharge means 13 allows to accumulate deliberately air into a zone by which air can be sucked by pumps 3 thereby avoiding its suction from auxiliary pump assembly 2. Accordingly, noise of such assembly is sensibly reduced.

[0035] Furthermore, the layout of such auxiliary pump assembly 2 could also be simplified; indeed, without the great presence of air of prior art arrangements, it is possible to have a simplified pump assembly 2 i.e. not to use charge pump 2b (embodiment not shown), thereby increasing economies and having a more compact layout.

[0036] The use of a discharge conduit 14 fluidly connected to an accumulation portion 15 works such as a syphon, allowing the accumulation of air in a predetermined zone and its suction predominantly by pumps 3. Such embodiment of air discharge means 13 is economic and does not need to change the global layout/encumbrance of arrangement 1.

[0037] It is clear that modifications can be made to the described suction and filtering hydraulic arrangement 1 which do not extend beyond the scope of protection defined by the claims.

[0038] For example, number or typologies of pump assemblies 2, 3 may be varied according to the typology and power of the work vehicle.

[0039] Furthermore, accumulation portion 15 may be positioned differently with respect to the described position into conduit 6.

[0040] Further, hydraulic junction 12 may be of any typology or, even, a passive or active controlled valve.

55 Claims

1. Work vehicle comprising an oil transmission tank for a transmission of said vehicle and a suction and fil-

tering hydraulic arrangement (1) for feeding hydraulic pumps assemblies (2, 3) of a work vehicle, said arrangement (1) comprising:

- at least an auxiliary pump assembly (2) comprising an inlet fluidly connected to a source (4) of oil, 5
- at least one hydraulic circuit pump (3) comprising an inlet fluidly connected to a source (4) of oil, 10
- a filter module (5) fluidly interposed between said auxiliary pump assembly (2) and said source (4) and between said at least one hydraulic circuit pump (3) and said source (4);

wherein said source (4) is the oil transmission tank of said work vehicle and 15
 wherein said arrangement (1) comprises air discharge means (13) configured to accumulate air from filter module (5) and to allow the suction of such air from said at least one hydraulic circuit pump (3). 20

2. Arrangement according to claim 1, wherein said air discharge means (13) comprise a discharge conduit (14) fluidly connecting said filter module (5) to said at least one hydraulic circuit pump (3). 25
3. Arrangement according to claim 2, wherein said air discharge means (13) comprise an accumulation portion (15) configured to trap the air into said filter module (5), said accumulator portion (15) being fluidly connected by said discharge conduit (14) to said at least one hydraulic circuit pump (3). 30
4. Arrangement according to claim 3, wherein said auxiliary pump unit (2) is fluidly connected to said filter module (5) by a conduit (6), said accumulator conduit portion (15) being part of said filter module (5) and at least part of said conduit (6). 35
5. Arrangement according to claim 2 to 4, wherein said at least one hydraulic circuit pump (3) comprises at least two hydraulic circuit pumps (3a, 3b), whose inlets are fluidly connected to a hydraulic junction (12) which is fluidly connected to said filter module (5), said discharge conduit (14) fluidly connecting said filter module (5) with said hydraulic junction (12). 40 45
6. Arrangement according to claim 3 to 5, wherein said filter module (5) comprises a first opening (5a) fluidly connected to said auxiliary assembly pump (2) and a second opening (5b) fluidly connected to said at least one hydraulic circuit pump (3), accumulation portion (15) being placed in a top portion of said filter module (5) which is higher with respect to said first and second openings (5a, 5b) so that air is trapped in such accumulation portion (15) by a syphon effect. 50 55
7. Arrangement according to any of the preceding

claims, wherein said pump assembly (2) comprises a charge pump (2b) and an auxiliary pump (2a), said charge pump (2b) being fluidly and mechanically connected to said auxiliary pump.

8. Arrangement according to claim 7, wherein said auxiliary pump (2a) is a variable displacement pump.
9. Arrangement according to claim 7 or 8, wherein said auxiliary pump assembly (2) comprises a safety valve (2c) configured to fluidly connect to discharge said auxiliary pump assembly (2) if a pressure value of oil in said auxiliary pump assembly (2) reaches a preset value.

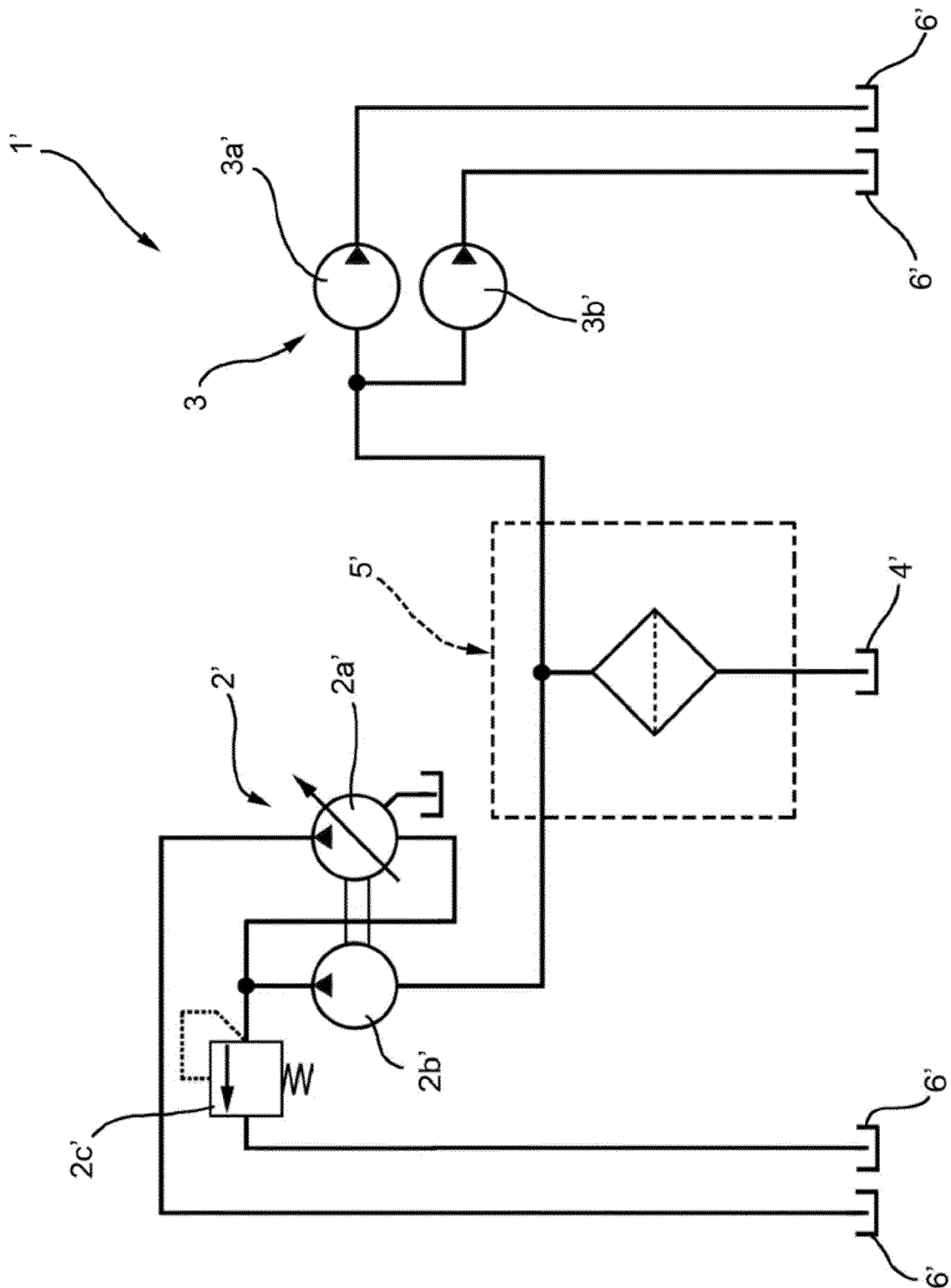
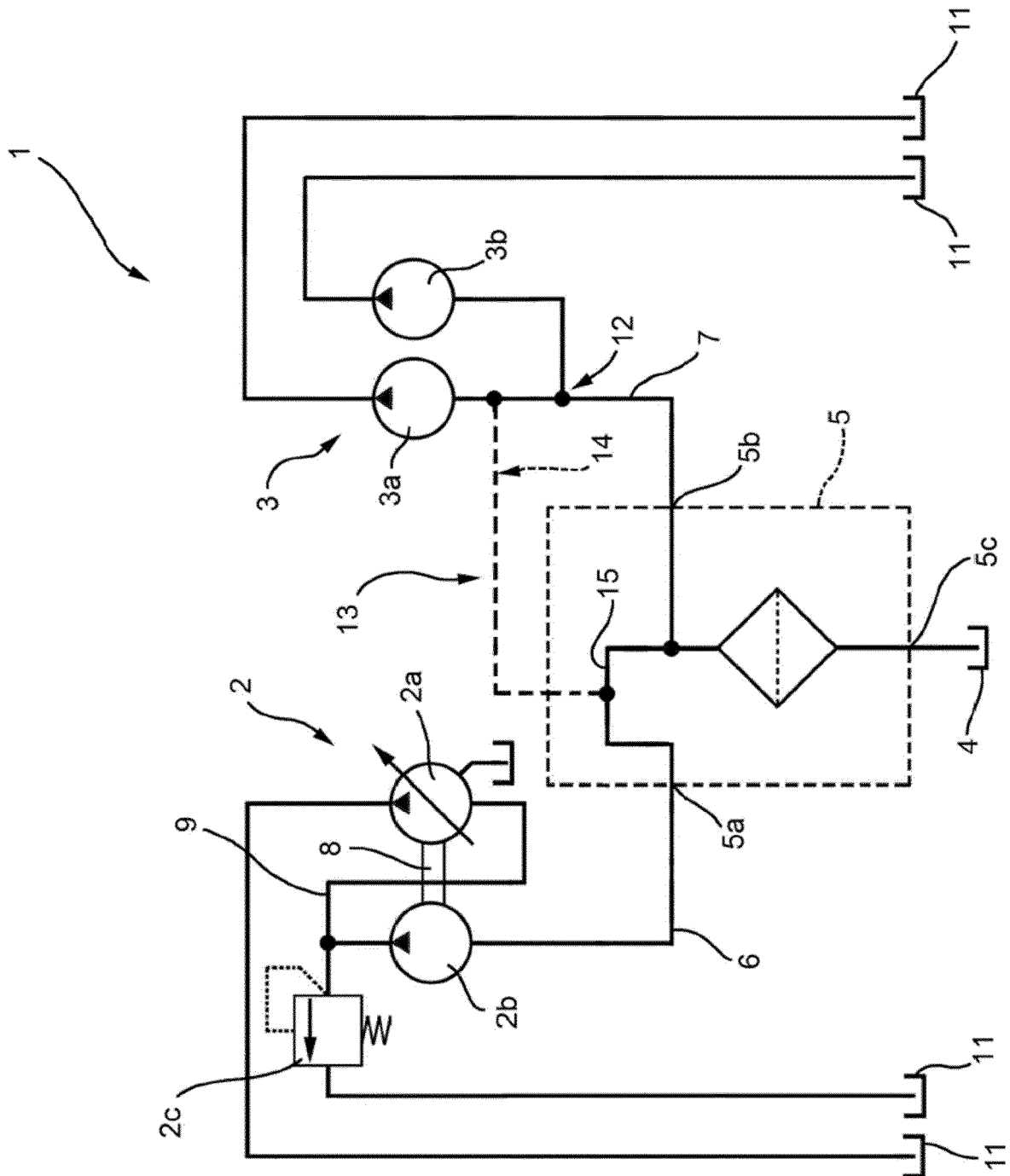


FIG. 1 Prior Art

FIG. 2





EUROPEAN SEARCH REPORT

 Application Number
 EP 20 16 7511

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EPO FORM 1503 03.82 (P04C01)

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A	US 2007/163817 A1 (OHASHI RYOTA [JP] ET AL) 19 July 2007 (2007-07-19) * abstract *paragraphs 127-128, 285; figures *	1-9	INV. F04B23/02 F04B23/04 F04B53/06 F04B53/20
A	US 2008/164115 A1 (GRETHEL MARCO [DE]) 10 July 2008 (2008-07-10) * abstract *paragraph 15; figures *	1-9	
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A	US 2017/307065 A1 (BUCHMANN RENÉ [DE] ET AL) 26 October 2017 (2017-10-26) * abstract *; claims; figures *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 June 2020	Examiner Pinna, Stefano
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 16 7511

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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