(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 517 008 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.03.2025 Bulletin 2025/10

(21) Application number: **24193641.8**

(22) Date of filing: **08.08.2024**

(51) International Patent Classification (IPC):
E02F 3/36 *(2006.01)* ***E02F 9/00*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E02F 9/006; E02F 3/3681

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **28.08.2023 IT 202300017649**

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(54) **IMPROVED SWIVEL JOINT ASSEMBLY FOR A WORK VEHICLE AND RELATED HYDRAULIC ARRANGEMENT**

(57) Swivel joint assembly (1) for a work vehicle provided with a chassis movable on ground and a main body rotatably carried by chassis about a vertical axis (A), the swivel joint assembly (1) comprising a stator portion (2) configured to be carried by one between the chassis and the main body and a rotor portion (3) configured to be carried by the other between the chassis and the main body, rotor portion (3) being housed in a fluid tight manner and rotatably free carried about axis (A) by stator portion (2),

rotor portion (3) comprising at least a pair of input conduits (4', 4'') fluidly connectable to pump means carried by other between the chassis and the main body and stator portion (2) comprising a plurality of output conduits (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 51, 51) fluidly connectable to operative elements of work vehicle, wherein swivel joint assembly (1) comprises valve means (7) carried transversally to axis (A) by said rotor portion (3) and configured to regulate the fluid flow between said input conduits (4', 4'') and at least a pair among the plurality of output conduits (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 51, 51).

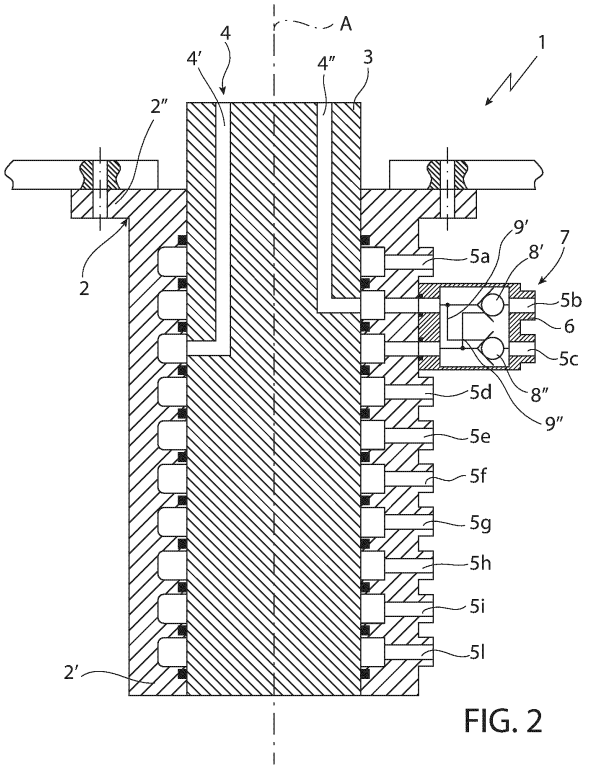

FIG. 2

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Description

TECHNICAL FIELD

[0001] The present invention concerns a swivel joint assembly for a work vehicle.

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

BACKGROUND OF THE INVENTION

[0003] Swivel joint assemblies are widely known and used as shown in publication EP3546659 A1.

[0004] As known, a swivel joint is used for allowing hydraulic and/or electric passage between hydraulic/-electric system of a work vehicle comprising a chassis, movable on ground, and a main body that is rotatably carried about the chassis.

[0005] The hydraulic flows within the swivel joint are regulated by dedicated flow control valves that are carried by the chassis or by the main body, i.e. downstream or upstream with respect to the flow direction, in an upper position of the swivel joint.

[0006] One of such valves is the anti-drift valve that is voted to avoid drift of operative cylinders of the work vehicle, i.e. unwanted movement thereof. Commonly, such valves are placed on the operative cylinders themselves.

[0007] However, it is clear that such flow control valves reduces the space claim on operative cylinders and needs dedicated piping to connect this latter to the required openings on the swivel joint, e.g. for pilot lines.

[0008] Therefore, the need is felt to reduce the overall complexity and encumbrance of existing hydraulic arrangement comprising known swivel joint assemblies, while maintaining their functionalities.

[0009] An aim of the present invention is to satisfy the above mentioned needs in a cost-effective and optimized manner.

SUMMARY OF THE INVENTION

[0010] The aforementioned aim is reached by a swivel joint assembly, a hydraulic arrangement and a work vehicle as claimed in the appended set of claims.

BRIEF DESCRIPTION OF DRAWINGS

[0011] 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 lateral schematic view of a swivel joint assembly according to the invention;
- Figure 2 is a cross-sectional schematic view of the swivel joint assembly of figure 1 ; and
- Figures 3 and 4 are cross-sectional schematic view as in Figure 2 with addition of lines indicating fluid flows in different operational conditions.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The attached figures disclose a swivel joint assembly 1 for use on a work vehicle (not shown) such as an earthmoving machine, e.g. an excavator. The work vehicle comprises, as known, a chassis movable on ground, e.g. by crawlers, and a main body carried in a rotatable manner about a rotational, vertical, axis A with respect to chassis.

[0013] The work vehicle further comprises a hydraulic arrangement provided with the aforementioned swivel joint assembly 1, pump means (not shown) configured to provide pressurized fluid and actuators configured to receive the pressurized fluid derived from pump means to control related utilities of the work vehicles as described below.

[0014] In particular, the aforementioned hydraulic arrangement may comprise the following elements for controlling different utilizes of the work vehicle:

- At least a pair of hydraulic motors (not shown) such as a left or a right one for controlling movement of the work vehicle;
- At least a first and a second actuator cylinder (not shown), the first actuator cylinder is configured to control the operation of an operable element such as a bucket/dozer of the work vehicle and the second actuator cylinder, as disclosed in EP3546659 A1, being configured to vary the width of the chassis, e.g. varying the distance between crawlers thereof.

[0015] The swivel joint assembly 1 is configured to manage fluid flow coming to pump means towards the aforementioned different utilities.

[0016] In detail, swivel joint assembly 1 comprises a stator portion 2 carried by one between the chassis or the main body of the work vehicle and a rotor portion 3 housed within the housing 2 and carried by the other between the chassis or the main body.

[0017] In detail, in the shown embodiment, the stator portion 2 comprises a body 2' that is fixedly carried by flanges 2'' to the chassis of the work vehicle and the rotor portion 3 is fixedly carried by the main body of the work vehicle.

[0018] The body 2' houses the rotor portion 3 in a rotatably free manner along a vertical axis A in a fluid tight manner, as per se known and not further described into details.

[0019] In the discloses embodiment, the rotor portion 3 is fluidly connected to pump means via input conduits 4 while the body 2' of housing 2 if fluidly connected to the utilities via output conduits 5.

[0020] In greater detail, the rotor portion 3 defines a pair of conduits 4', 4'' configured to define two different high pressure fluid inputs towards the output conduits 5.

[0021] Output conduits 5 are a plurality and may be provided according to the specific typology and number of utilities of the hydraulic arrangement of the work vehicle.

[0022] In the disclosed embodiment, such output conduits 5 comprises:

- A first output conduit 5a for a pilot line, e.g. for controlling the variation of hydraulic motor displacement;
- A second and a third output conduits 5b, 5c for controlling the first actuator cylinder;
- A fourth, a fifth, a sixth and a seventh output conduits 5d, 5g, 5h, 5i for controlling the hydraulic motors;
- An eight output conduit 5l towards a drain; and
- A ninth and a tenth conduits 5e, 5f for controlling the second actuator cylinder.

[0023] In the described embodiment, the first and second conduits 4', 4'' are fluidly separated one with respect to the other and are respectively fluidly connected to a pair of different output conduits. In the disclosed embodiment, such output conduits are the second conduit 5b and the first conduit 5c.

[0024] According to the invention, the swivel joint assembly 1 comprises valve means 7 carried laterally with respect to axis A by the rotor portion 3 and configured to manage the fluid coming from input conduits 4', 4" towards a pair conduits among the output conduits 5. Such valve means 7 are controlled hydraulically on the base of an input signal spilled from input conduits 4', 4'' themselves.

[0025] In detail, the rotor portion 3 defines a housing 6 that houses valve means 7. In particular, housing 6 is housed transversally, better perpendicularly, with respect to vertical axis A.

[0026] More preferably, housing 6 can be selectively fixed, e.g. by threaded elements, to the lateral surface of the rotor 3, or realized monolithic, i.e. as one body, with the body 2.

[0027] Advantageously, the valve means 7 are an anti-drift valve and therefore comprises a pair of check valves 8', 8" fluidly interposed in the flow towards the second and third outputs 5b, 5c respectively and a pair of cross-pilot lines 9', 9" each configured to allow opening of the opposite check valve in function of the pressure of fluid flowing in the respective conduit.

[0028] The operation of the embodiment of the invention as described above is the following.

[0029] In general, in function of the pressure signal in the designated output conduit, the valve means 7 control the passage of pressurized fluid from the pair conduits 4', 4'' to the selected pair of output conduits 5. Therefore different designs can be foreseen according to the vehicle specific need.

[0030] In a preferred use described above, as per the operations disclosed in EP3546659 A1 that is incorporated by reference, the work vehicle may control the dozer up or down via sending fluid to one between the second and third outlets 5b, 5c. In detail, when there is need to lift dozer up (via first hydraulic actuator), as shown in figure 3, fluid is sent towards the second outlet 5b passing through first check valve 8' and allowing via first cross-pilot line 9' to allow fluid to return from the third outlet 5c. Conversely, when there is need to lift dozer down as shown in figure 4, fluid is sent towards the third outlet 5c passing through second check valve 8" and allowing via first cross-pilot line 9'' to allow fluid to return from the second outlet 5b.

[0031] In view of the foregoing, the advantages of a swivel joint assembly 1 and related hydraulic arrangement and work vehicle according to the invention are apparent.

[0032] Thanks to provision of valve means transversally with respect to the rotor portion, it is possible avoid waste of space in the neighborhood of the operative cylinders.

[0033] Furthermore, it is easier to assemble the operative cylinder, thereby reducing costs.

[0034] Moreover, since valve means are selectively removable by the rotor portion, it is possible to easily substitute or change position to the valve means, if needed.

[0035] Furthermore, since the valve means are directly carried by the rotor portion, the use of hoses is reduced and consequently the possibilities of damages or it is avoided the use of protection means for such valves, thereby further reducing encumbrance and costs.

[0036] In addition to the above, the manufacturing of the work vehicle is less complex since there is less need of hoses and their fluid connection to the respective elements, thereby reducing the manufacturing time and costs.

[0037] Moreover, in the peculiar use linked to the system of EP3546659 A1, the valve means allows to provide the related functionality without varying the proposed system but simply substituting and providing the valve means coupled to the correct outputs outside the lateral surface of the rotor.

[0038] It is clear that modifications can be made to the described swivel joint assembly 1 and related hydraulic arrangement and work vehicle which do not extend beyond the scope of protection defined by the claims.

[0039] For example, even if a preferred configuration is disclosed, clearly the proposed valve means 7 can be coupled to the rotor portion of the swivel joint to allow control of other operative system of the vehicle.

[0040] Clearly, different hydraulic topology or typology of valve means may be used to achieve different operative profiles.

[0041] Furthermore, as said, different work vehicle may use the proposed swivel joint assembly that may have different shapes with respect to the disclosed one.

Claims

1. Swivel joint assembly (1) for a work vehicle provided with a chassis movable on ground and a main body rotatably carried by said chassis about a vertical axis (A), said swivel joint assembly (1) comprising a stator portion (2) configured to be carried by one between the chassis and the main body and a rotor portion (3) configured to be carried by the other between the chassis and the main body, said rotor portion (3) being housed in a fluid tight manner and rotatably free carried about said axis (A) by said stator portion (2),
said rotor portion (3) comprising at least a pair of input conduits (4', 4'') fluidly connectable to pump means carried by said other between the chassis and the main body and said stator portion (2) comprising a plurality of output conduits (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5l) fluidly connectable to operative elements of said work vehicle, wherein said swivel joint assembly (1) comprises valve means (7) carried by said rotor portion (3) transversally with respect to said axis (A) and configured to regulate the fluid flow between said input conduits (4', 4'') and at least a pair among said plurality of output conduits (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5l).

2. Swivel joint assembly according to claim 1, wherein said valve means (7) are hydraulic controlled by a hydraulic pressure signal derived by said input conduits (4', 4'') themselves.

3. Swivel joint assembly according to claim 1 or 2, further comprising a housing (6) carried by the rotor portion (3), said housing (6) housing said valve means (7).

4. Swivel joint assembly according to claim 3, wherein said housing (6) is fixedly carried by said rotor portion (3) in a selectively removable manner.

5. Swivel joint assembly according to claim 3 or 4, wherein said housing (6) is carried externally from said rotor portion (3).

6. Swivel joint assembly according to any of the preceding claims, wherein said hydraulic arrangement comprises:

    • At least one hydraulic motor for controlling movement of the work vehicle;
    • A first and a second actuator cylinder, the first configured to control the operation of an operable element of the work vehicle and the second configured to control the width of said chassis, said output conduits comprising:

        o A first output conduit (5a) for a pilot line;
        o A second and a third output conduits (5b, 5c) fluidly connectable to said first actuator cylinder;
        o A fourth, a fifth, a sixth and a seventh output conduits (5d, 5g, 5h, 5i) fluidly connectable to said hydraulic motors;
        o An eight output conduit (5l) fluidly connectable towards a drain; and
        o A ninth and a tenth conduits (5e, 5f) fluidly connectable to said second actuator cylinder.

7. Swivel joint assembly according to claim 6, wherein said valve means (7) are fluidly interposed between said first and second inputs (4', 4'') and said second and third output conduits (5b, 5c).

8. Swivel joint assembly according to claim 7, wherein said valve means (7) comprises respective check valves (8', 8'') fluidly interposed towards the second and third outputs (5b, 5c) and a pair of cross-pilot lines (9', 9'') each configured to allow opening of the opposite check valve (8', 8'') in function of the pressure of fluid flowing in the respective conduit.

9. Hydraulic arrangement for a work vehicle comprising a chassis movable on ground, a main body rotatably carried about a vertical axis (A) with respect to said chassis, said hydraulic arrangement comprising pump means for providing pressurized fluid, at least a pair of actuator cylinders and at least one hydraulic motor and a swivel joint assembly (1) according to any of the preceding claims for distributing said pressurized fluid coming from said pump means towards said at least a pair of actuator cylinders and at least one hydraulic motor.

10. Work vehicle comprising a chassis movable on ground, a main body rotatably carried about a vertical axis (A) with respect to said chassis and a hydraulic arrangement according to claim 9.

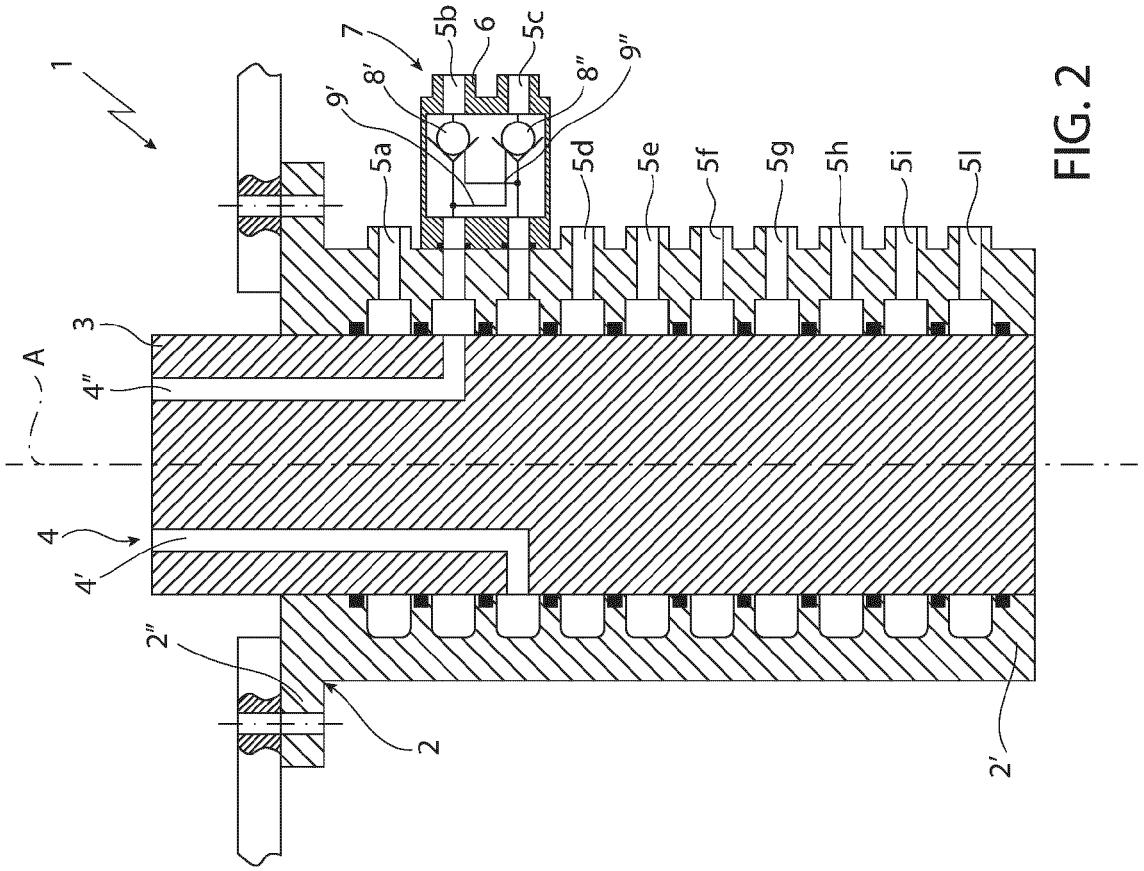
1
7
5b
6
5c
9'
8'
8"
9"
5a
5d
5e
5f
5g
5h
5i
5l
3
A
4"
4
4'
2"
2
2'

FIG. 2

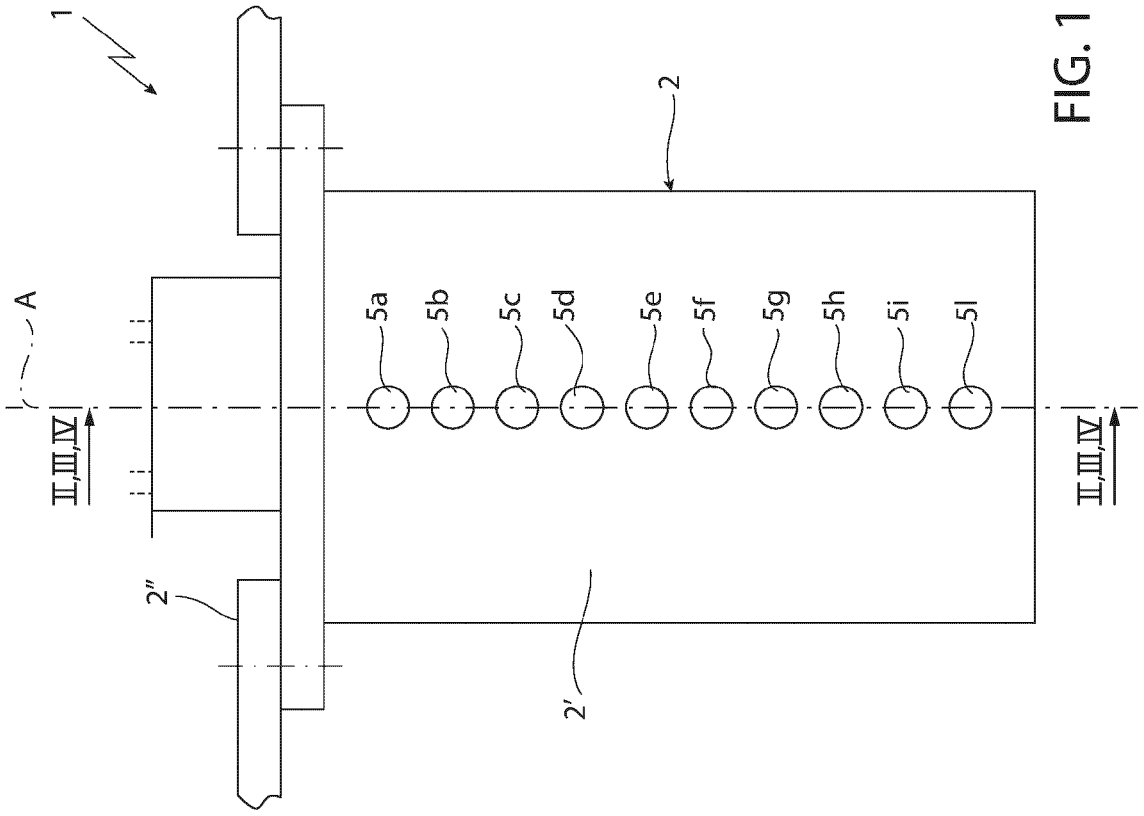
1
2
A
5a
5b
5c
5d
5e
5f
5g
5h
5i
5l
II,III,IV
II,III,IV
2"
2'

FIG. 1

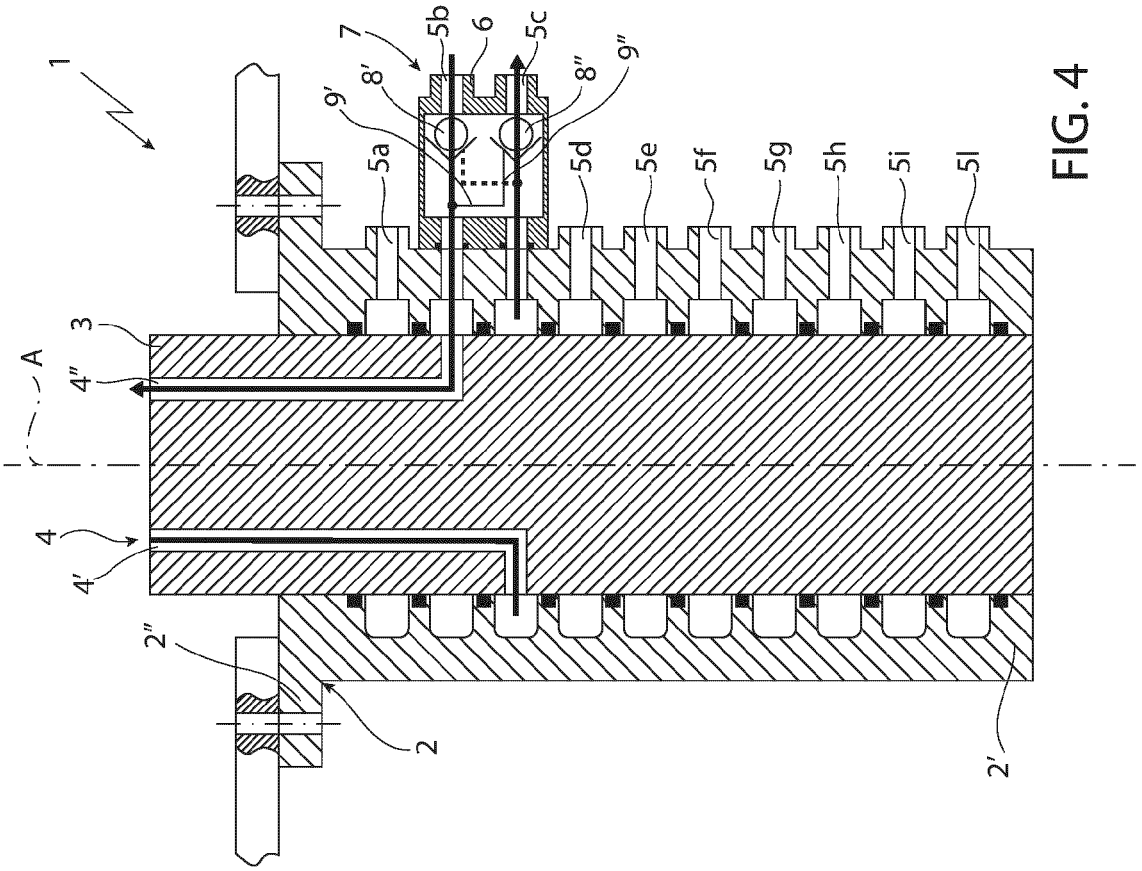
1
7
5b
6
5c
9'
8'
8"
9"
5a
5d
5e
5f
5g
5h
5i
5l
3
A
4"
4
4'
2"
2
2'

FIG. 4

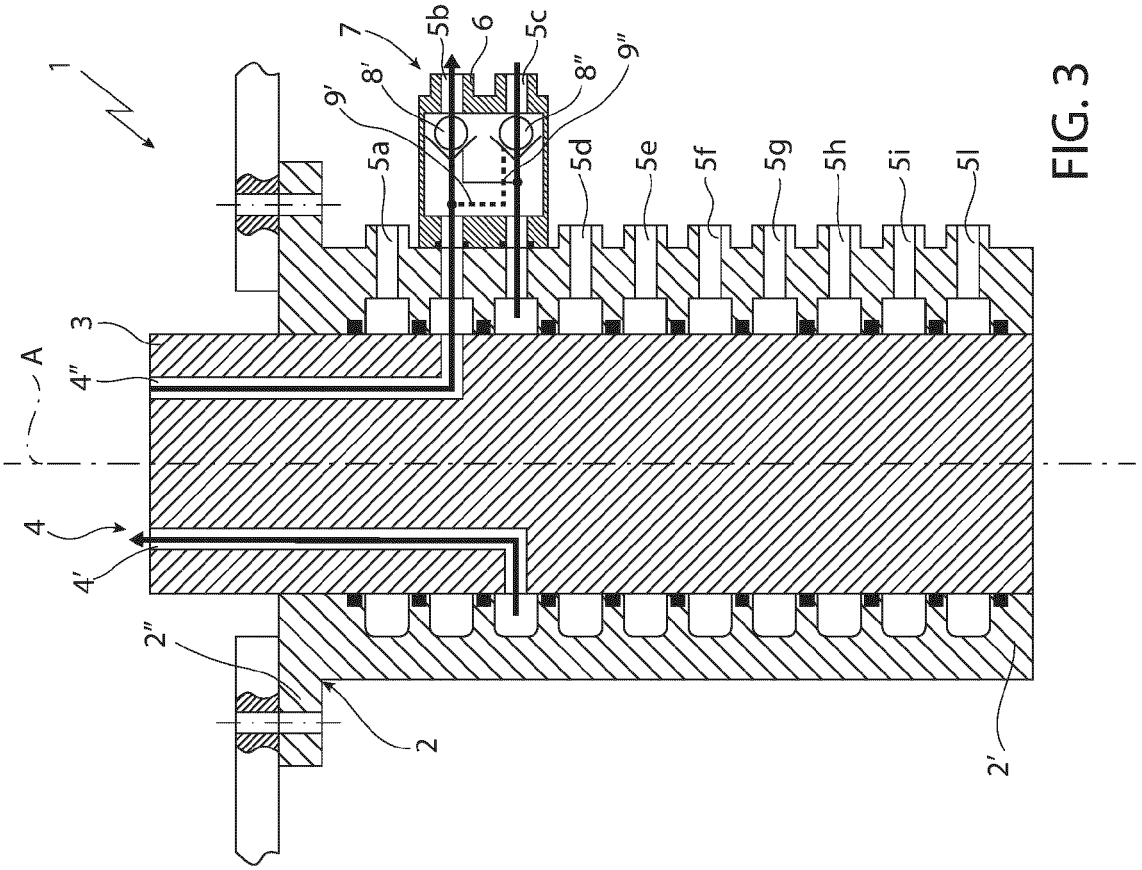
1
7
5b
6
5c
9'
8'
8"
9"
5a
5d
5e
5f
5g
5h
5i
5l
3
A
4"
4
4'
2"
2
2'

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 3641

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 282 363 A (OGAWA KAZUNORI [JP] ET AL) 1 February 1994 (1994-02-01)	1	INV. E02F3/36
A	* column 3, lines 10-23; figures 1,6,10 * * column 5, line 40 - column 6, line 16 *	2-10	E02F9/00
A	US 2017/045171 A1 (CHIOCCOLA FRANCESCO [IT]) 16 February 2017 (2017-02-16) * paragraphs [0003], [0033], [0039], [0044], [0045]; figures 1-3,8 *	1-10	
A	JP H11 94159 A (KUBOTA KK) 9 April 1999 (1999-04-09) * paragraphs [0032] - [0037]; figures 1-3,6 *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 November 2024	Luta, Dragos

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- EP 3546659 A1 **[0003] [0014] [0030] [0037]**