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(54) **PUMPING APPARATUS**

PUMPVORRICHTUNG

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EP 3 550 145 B1

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Description

[0001] The present invention relates to a pumping apparatus. It can be used to drive loads, typically in trucks or tipper trucks.

[0002] The use of a plurality of volumetric gear pumps is known, which are used to drive corresponding loads independently of each other.

[0003] Pumping apparatus are disclosed in GB882248 and EP2154372.

[0004] The object of the present invention is to propose a pumping apparatus equipped with multiple pumping sections which makes it possible to reverse the direction of rotation in a simple way (without opening the pumping apparatus, but simply by modifying the fluid connections from the outside). A further object of the present invention is to implement measures that allow minimising the risk of error during the reversal of the direction of rotation.

[0005] The defined technical task and the specified aims are substantially achieved by a pumping apparatus comprising the technical characteristics set forth in one or more of the appended claims.

[0006] Further characteristics and advantages of the present invention will become more apparent from the following indicative and therefore nonlimiting description of a pumping apparatus as illustrated in the appended drawings, in which:

- figures 1 and 2 show sectional views of an apparatus according to the present invention in a first operating configuration, these two sections being conducted through parallel sectional planes which are slightly spaced from one another;
- figure 3 shows a functional diagram of the apparatus in the configuration of figures 1 and 2;
- figures 4 and 5 show a sectional view of the apparatus of figures 1 and 2 in a second operating configuration, these two sections being conducted through parallel sectional planes which are slightly spaced from one another;
- figure 6 shows a functional diagram of the apparatus in the configuration of figures 4 and 5;
- figures 7 and 8 show views of the apparatus of figure 1;
- figures 9 and 10 show further details of the apparatus according to the present invention;
- figures 11 and 12 show a further constructive solution of a pumping apparatus according to the present invention, as an alternative to the apparatus in figures 1-8.

[0007] In the appended figures of the drawings, reference number 10 denotes a pumping apparatus.

[0008] The pumping apparatus 10 comprises a first reversible volumetric gear pump 1. In turn, the first pump 1 comprises:

- a first pair 11 of toothed wheels (meshing with each

other);

- a first housing compartment 12 for housing the first pair 11 of toothed wheels.

[0009] The apparatus 10 also comprises a second reversible volumetric gear pump 2. In turn, the second volumetric pump 2 comprises:

- a second pair 21 of toothed wheels (meshing with each other);
- a second housing compartment 22 for housing the second pair 21 of wheels.

[0010] The first and second pumps 1, 2 can also be defined as the first and second sections of the same pumping apparatus 10.

[0011] The first volumetric pump 1 draws in rotation the second volumetric pump 2, or vice versa.

[0012] In this regard, a joint can be present which couples a toothed wheel of the first pair 11 (or an element integral therewith) with a toothed wheel of the second pair 21 (or an element integral therewith). The first and second pumps 1, 2 are advantageously alongside each other. Advantageously, a wheel of the first pair 11 is coaxial with a wheel of the second pair 21.

[0013] There is therefore a single motor which drives both the first and the second pumps 1, 2. The first pump 1 is operatively interposed between a drive shaft connectable to the motor and the second pump 2. The motor is suitably electrical or thermal.

[0014] The apparatus 10 further comprises a first channel 13 that places in fluid connection a first zone 121 of the first compartment 12 and a first zone 221 of the second compartment 22.

[0015] The apparatus 10 further comprises a second channel 23 that places in fluid connection a second zone 122 of the first compartment 12 and a second zone 222 of the second compartment 22.

[0016] The apparatus 10 further comprises means 3 for opening/closing the first and second channels 13, 23.

[0017] The apparatus 10 further comprises a first, a second, a third and a fourth openings 14, 15, 24, 25 intended to allow the fluid communication of the pumping apparatus 10 with the outside.

[0018] Appropriately the apparatus 10 comprises an outer casing 4. Preferably such casing 4 is made of metallic material.

[0019] The first, second, third and fourth openings 14, 15, 24, 25 are fashioned on the casing 4.

[0020] Preferably the first and third openings 14, 24 are fashioned on a first face 41 of the casing 4. The second and fourth opening 15, 25 are instead fashioned on a second face 42 of the casing 4. The second face 42 and the first face 41 are fashioned in separate areas of the casing 4. In particular, the second face 42 is opposite the first face 41 (see for example figures 7 and 8).

[0021] The first and second openings 14, 15 allow direct access to the first and second zones 121, 122 of the

first compartment 12.

[0022] In turn, in the solution of figures 1-10, the third and fourth openings 24, 25 allow direct access to an intermediate position of the first and second channels 13, 23.

[0023] Instead, in the solution of figures 11 and 12, the third and fourth openings 24, 25 respectively allow access to the first and second zones 221, 222 of the second compartment 22.

[0024] The apparatus 10 can assume at least a first and a second operating configurations. They correspond to distinct modes of operation associated with the reversibility of the first and second pumps 1, 2. In the second operating configuration the rotation direction of the first and of the second pair 11, 21 of wheels is opposite to that assumed in the first operating configuration.

[0025] Figures 1, 2, 3, 7, 8 exemplify the first configuration. In this case, the first zone 121 of the first compartment 12 and the first zone 221 of the second compartment 22 define a suction respectively of the first and second pumps 1, 2, while the second zone 122 of the first compartment 12 and the second zone 222 of the second compartment 22 respectively define a delivery of the first and second pumps 1, 2. Still in the first configuration, the means 3 for opening/closing the first and second channels 13, 23 block the second channel 23. In this way they prevent the fluid communication between the second zone 122 of the first compartment 12 and the second zone 222 of the second compartment 22. The means 3 for opening/closing in the first configuration, however, allow the fluid communication of the first zone 121 of the first compartment 12 and the first zone 221 of the second compartment 22 through the first channel 13.

[0026] Still in the first configuration:

- the first opening 14 is crossed by the inflowing operating fluid and directed towards the first zone 121 of the first compartment 11 and the first zone 221 of the second compartment 12;
- the second opening 15 is crossed by the outflowing operating fluid coming from the second zone 122 of the first compartment 11 (and outflowing from the apparatus 1);
- the third opening 24 is blocked;
- the fourth opening 25 is crossed by the outflowing fluid coming from the second zone 222 of the second compartment 12.

[0027] Figures 4,5 and 6 exemplify the second operating configuration. In this configuration, the second zone 122 of the first compartment 12 and the second zone 222 of the second compartment 22 respectively define a suction of the first and second pumps 1, 2, while the first zone 121 of the first compartment 12 and the second zone 221 of the second compartment 22 respectively define a delivery of the first and second pumps 1, 2.

[0028] In the second configuration, the means 3 for opening/closing the first and second channels 13, 23

block the first channel 13, thereby preventing communication between the first zone 121 of the first compartment 11 and the first zone 221 of the second compartment 22. Furthermore, in the second configuration they allow the fluid communication between the second zone 122 of the first compartment 12 and the second zone 222 of the second compartment 22 through the second channel 23.

[0029] In the second configuration:

- the first opening 14 is crossed by the outflowing operating fluid coming from the first zone 121 of the first compartment 12;
- the second opening 15 is crossed by the inflowing operating fluid directed towards the second zone 122 of the first compartment 12 and the second zone 222 of the second compartment 12;
- the third opening 24 is crossed by the outflowing fluid coming from the first zone 221 of the second compartment 12;
- the fourth opening 25 is blocked.

[0030] In the second configuration, the fourth opening 25 is blocked.

[0031] In both the first and second configuration there is a single inlet of the operating fluid in the apparatus 10: it is the first opening 14 in the first configuration and the second opening 15 in the second configuration. Having a single suction zone is particularly convenient.

[0032] In addition, in both the first and second configuration there are at least two independent outlets of the operating fluid from the apparatus 10: for example, in the first configuration they are the second and the fourth opening 15, 25. They thus make it possible to deliver to two loads which are separate, and in an independent manner.

[0033] The apparatus 1 advantageously comprises a first hole 51 which connects the first channel 13 and the outside of the casing 4.

[0034] The means 3 for opening and closing the first and second channels 13, 23 comprise a first and a second stoppers 31, 32.

[0035] They are applicable to the casing 4 and fittable in the first hole 51. They are applicable to the first hole 51 as an alternative to one another. The first stopper 31, if applied to the first hole 51, allows the passage of fluid between the first and second compartments 12, 22 through the first channel 13. Instead, the second stopper 32, if applied to the first hole 51, prevents the passage of fluid between the first and the second compartments 12, 22 through the first channel 13.

[0036] The second stopper 32 can comprise a pair of gaskets. If applied to the first hole 51, the second stopper 32 blocks the first channel 13, preventing the passage of fluid. In this case, the first channel 13 is blocked by a portion of the second stopper 32 interposed between the pair of gaskets (which therefore contribute to a sealing action).

[0037] In an alternative solution, this pair of gaskets

could be absent. In this case the seal would be defined by the metal walls of the second stopper 32 (and would therefore be purely mechanical).

[0038] The apparatus 1 also comprises a second hole 52 which connects the second channel 23 and the outside of the casing 4.

[0039] The first and second stoppers 31, 32 can also be fitted into the second hole 52. In the first configuration, the second stopper 32 is fitted into the second hole 52 and the first stopper 31 is fitted into the first hole 51. In this case, the second stopper 32 can prevent the fluid connection between the first and second compartments 12, 22 through the second channel 23. The first stopper 31 instead allows the connection between the first and second compartments 12, 22 through the first channel 13. In the second configuration, the second stopper 32 is fitted into the first hole 51 and the first stopper 31 is fitted into the second hole 52. In this case, the second stopper 32 prevents the fluid connection between the first and second compartments 12, 22 through the first channel 13 while the first stopper 31 allows the fluid connection between the first and second compartments 12, 22 through the second channel 23.

[0040] In the solution exemplified in figures 1-10, the first hole 51 extends between the first channel 13 and the third opening 24 while the second hole 52 extends between the second channel 23 and the fourth opening 25.

[0041] The second stopper 32 is suitable for penetrating further into the apparatus 10 (or better inside the casing 4) with respect to the first stopper 31. In this way (unlike the first stopper 31), it can reach and block the first or the second channel 13, 23.

[0042] In the solution exemplified in figures 1-10 the second stopper 32 comprises:

- a first and a second longitudinal end 321, 322;
- a lateral wall 323 which connects the first and second ends 321, 322;
- an internal cavity 324 in communication with the outside at the first end 321 and at a zone of the lateral wall 323.

[0043] In the first configuration the cavity 324 is crossed by the fluid present along the second channel 23 and coming from the second pump 2 (thus allowing the crossing of the fourth opening 25).

[0044] In the second configuration the cavity 324 is crossed by the fluid present along the first channel 13 and coming from the second pump 2 (thus allowing the crossing of the third opening 24).

[0045] This arrangement is absent in the solution of figures 11 and 12, wherein the outflow of the fluid processed by the second pump 2 does not cross the second stopper 32, but crosses a different channel. In fact, in this case the first and second holes 51, 52 are separate and independent with respect to the third and fourth openings 24, 25. With reference to the solution of figure 11 (which

is in the first operating configuration), the outflow of fluid continues to take place through the fourth opening 25 which, however, does not provide for the transit through the stopper 32. In the case wherein the solution of figure 11 was in the second operating configuration, the fourth opening 25 would be stopped while the third opening 24 would allow the outflow of the fluid processed by the second pump 2.

[0046] In the solution of Figure 11, a third stopper 33 different from the first and second stoppers 31, 32 is used to block one among the third and the fourth openings 24, 25 (the other remaining open for the outflow of the fluid coming from the delivery of the second pump 2). In this case, even if the second stopper 32 is not internally crossed by the fluid, the first and second stoppers 31, 32, however, exert the function of allowing or not allowing the passage through the first or the second channel 13, 23. For completeness, it should be noted that advantageously the third stopper 33 is not fittable in the first and second holes 51, 52 intended for the first and second stoppers 31, 32. This is to minimise the risk of accidental errors by users when reversing the motion of the apparatus (which could compromise proper operation). In addition, the operating principle of the schematic solution of figures 3 and 6 is also valid for the solution of figures 11 and 12.

[0047] With reference to any of the solutions exemplified in the appended drawings, regardless of the first or second configuration, an inlet of the operating fluid into the apparatus 10 coincides with an inlet of operating fluid into the first pump 1.

[0048] In addition, regardless of the first or second configuration, the delivery of the first and second pumps 1, 2 are not mutually communicating. Therefore, an independent delivery of various loads is possible. In addition, regardless of the first or second configuration, the delivery of the first and second pumps 1, 2 are located side by side (or otherwise formed along a same side of the casing 4).

[0049] Advantageously, the pumping apparatus 1 comprises a lubrication path 90 of bushings 94 supporting one or more support shafts of the first and/or second pair of toothed wheels 11, 21 (see figures 9 and 10). The lubrication path 90 draws the fluid from the first and/or from the second compartment 12, 22 and conveys it in an environment 93 downstream of the bushings 94 and at least partially delimited by an oil seal. This environment 93 must be at low pressure in order to avoid the breakage of the oil seal separating it from the outside. In fact, the outside will typically have atmospheric pressure. Advantageously, the apparatus 1 comprises a canalisation 91 that connects the first and second holes 51, 52 and which is in communication with such environment (through a section 92). Suitably, such canalisation 91 connects a bottom of the first hole 51 and a bottom of the second hole 52. These measures make it possible to ensure that such an environment has the suction pressure of the operating fluid (and therefore low pressure). In this way, the

breakage of the oil seal is avoided.

[0050] The present invention achieves important advantages.

[0051] Firstly, it allows reversing the direction of rotation in a simple way, without opening the pump, but acting only on the connections accessible from the outside (the channels that connect to the openings 14, 15, 24, 25). Another important advantage is the minimal risk of error associated with the inversion operations of the direction of rotation.

[0052] Furthermore, all the details can be replaced with other technically-equivalent elements. In practice, all the materials used, as well as the dimensions, can be any according to requirements.

Claims

1. A pumping apparatus comprising:

i) a first reversible volumetric gear pump (1) comprising:

- a first pair (11) of toothed wheels;
- a first housing compartment (12) for housing the first pair (11) of toothed wheels;

ii) a second reversible volumetric gear pump (2) comprising:

- a second pair (21) of toothed wheels; the first volumetric pump (1) drawing in rotation the second volumetric pump (2);
- a second housing compartment (22) for housing the second pair (21) of wheels;

characterised in that it comprises:

* a first channel (13) that places in fluid connection a first zone (121) of the first compartment (12) and a first zone (221) of the second compartment (22);

* a second channel (23) that places in fluid connection a second zone (122) of the first compartment (12) and a second zone (222) of the second compartment (22);

* means (3) for opening/closing the first and the second channel (13, 23);

* an outer casing (4) comprising a first, a second, a third and a fourth opening (14, 15, 24, 25) intended to allow the fluid communication of the pumping apparatus (10) with the outside;

* means used to block the third and fourth openings (24, 25);

in a first operating configuration: said first zone (121) of the first compartment (12) and said first zone (221) of the second compartment (22) defining a suction

of the first and of the second pump (1, 2), respectively, said second zone (122) of the first compartment (12) and said second zone (222) of the second compartment (22) defining a delivery of the first and of the second pump (1, 2), respectively, said means (3) for opening/closing the first and the second channel (13, 23) blocking the second channel (23) and allowing the fluid communication of the first zone (121) of the first compartment (12) and of the first zone (221) of the second compartment (22) through the first channel (13); the first opening (14) being crossed by the inflowing operating fluid directed towards the first zone (121) of the first compartment (12) and to the first zone (221) of the second compartment (22); the second opening (15) being crossed by the outflowing operating fluid coming from the second zone (122) of the first compartment (12), the third opening (24) being blocked, the fourth opening (25) being crossed by the outflowing fluid coming from the second zone (222) of the second pump (2);

in a second operating configuration: said second zone (122) of the first compartment (12) and said second zone (222) of the second compartment (22) defining a suction of the first and of the second pump (1, 2), respectively, said first zone (121) of the first compartment (12) and said first zone (221) of the second compartment (22) defining a delivery of the first and of the second pump (1, 2), respectively, said means (3) for opening/closing the first and second channel (13, 23) blocking the first channel (13) and allowing the fluid communication between the second zone (122) of the first compartment (12) and the second zone (222) of the second compartment (22) through the second channel (23); the first opening (14) being crossed by the outflowing operating fluid coming from the first zone (121) of the first compartment (12), the second opening (15) being crossed by the inflowing fluid directed towards the second zone (122) of the first compartment (12) and towards the second zone (222) of the second compartment (22); the third opening (24) being crossed by the outflowing fluid coming from the first zone (221) of the second compartment (2); the fourth opening (25) being blocked;

in the second operating configuration the rotation direction of the first and of the second pair (11, 21) of wheels being opposite to that assumed in the first operating configuration.

2. The apparatus according to claim 1, **characterised in that** it comprises a first hole (51) that connects the first channel (13) and the outside of the casing (4), the means (3) for opening and closing the first and the second channel (13, 23) comprising a first and a second stopper (31, 32) applicable to the casing (4) and fittable in said first hole (51); the first stopper (31), if applied to the first hole (51), allowing the

passage of fluid between the first and the second compartment (12, 22) through the first channel (13), the second stopper (32), if applied to the first hole (51), preventing the passage of fluid through the first channel (13).

3. The apparatus according to claim 2, **characterised in that** it comprises a second hole (52) that connects the second channel (23) and the outside of the casing (4); the first and the second stopper (31, 32) being fittable also in the second hole (52); in the first configuration the second stopper (32) being fitted in the second hole (52) for stopping the passage of fluid between the first and the second compartment (12, 22) through the second channel (23) and the first stopper (31) being fitted in the first hole (51); in the second configuration the second stopper (32) being fitted in the first hole (51), the first stopper (31) being fitted in the second hole (52) allowing the passage of fluid between the first and the second compartment (12, 22) through the second channel (23).
4. The apparatus according to claim 3, **characterised in that** the first and the second hole (51, 52) are separate and independent with respect to the third and the fourth opening (24, 25).
5. The apparatus according to claim 3, **characterised in that** the first hole (51) extends between the first channel (13) and the third opening (24); the second hole (52) extending between the second channel (23) and the fourth opening (25).
6. The apparatus according to any one of claims 2 to 5, **characterised in that** the second stopper (32) is suitable for penetrating further into the apparatus (10) than the first stopper (31).
7. The apparatus according to any one of claims 2 to 6, **characterised in that** the second stopper (32) comprises:
 - a first and a second longitudinal end (321, 322);
 - a lateral wall (323) which connects the first and the second end (321, 322);
 - an internal cavity (324) in communication with the outside at the first end (321) and at a zone of the lateral wall (323);
 in the first configuration said cavity (324) being crossed by the fluid present along the second channel (23) and coming from the second pump (2) allowing the crossing of the fourth opening (25); in the second configuration said cavity (324) being crossed by the fluid present along the first channel (13) and coming from the second pump (2) allowing the crossing of the third opening (24).

8. The apparatus according to any one of the preceding claims, **characterised in that** the first and the third opening (14, 24) are fashioned on a first face (41) of said casing (4); the second and the fourth opening (15, 25) being fashioned on a second face (42) of said casing (4), the second face (42) being opposite the first face (41).
9. The apparatus according to any one of the preceding claims, **characterised in that** both in the first and in the second configuration an inlet of the operating fluid into the apparatus (10) coincides with an inlet of operating fluid into the first pump (1).
10. The apparatus according to any one of the preceding claims, **characterised in that** both in the first and in the second configuration the delivery of the first and the second pump (1, 2) are not mutually communicating and are located alongside each other.

Patentansprüche

1. Pumpvorrichtung, umfassend:

i) eine erste reversible volumetrische Zahnrادpumpe (1), umfassend:

- ein erstes Paar (11) von Zahnrädern;
- eine erste Gehäuseunterteilung (12) zur Aufnahme des ersten Paares (11) von Zahnrädern;

ii) eine zweite reversible volumetrische Zahnrادpumpe (2), umfassend:

- ein zweites Paar (21) von Zahnrädern; wobei die erste Volumenpumpe (1) die zweite Volumenpumpe (2) in Rotation versetzt;
- eine zweite Gehäuseunterteilung (22) zur Aufnahme des zweiten Paares (21) von Rädern;

dadurch gekennzeichnet, dass sie umfasst:

- * einen ersten Kanal (13), der eine erste Zone (121) der ersten Unterteilung (12) und eine erste Zone (221) der zweiten Unterteilung (22) in Fluidverbindung bringt;
- * einen zweiten Kanal (23), der eine zweite Zone (122) der ersten Unterteilung (12) und eine zweite Zone (222) der zweiten Unterteilung (22) in Fluidverbindung bringt;
- * Mittel (3) zum Öffnen/Schließen des ersten und des zweiten Kanals (13, 23);
- * ein Außengehäuse (4) umfassend eine erste, eine zweite, eine dritte und eine vierte Öffnung (14, 15, 24, 25), die bestimmt ist, die Fluidkom-

munikation der Pumpvorrichtung (10) mit der Außenseite zu ermöglichen;

* Mittel zum Blockieren der dritten und vierten Öffnung (24, 25);

in einer ersten Betriebskonfiguration: wobei die erste Zone (121) der ersten Unterteilung (12) und die erste Zone (221) der zweiten Unterteilung (22) eine Absaugung jeweils der ersten und der zweiten Pumpe (1, 2) definieren, wobei die zweite Zone (122) der ersten Unterteilung (12) und die zweite Zone (222) der zweiten Unterteilung (22) jeweils eine Abgabe der ersten und der zweiten Pumpe (1, 2) definieren, wobei die Mittel (3) zum Öffnen/Schließen des ersten und des zweiten Kanals (13, 23) den zweiten Kanal (23) blockieren und die Fluidkommunikation von der ersten Zone (121) der ersten Unterteilung (12) und von der ersten Zone (221) der zweiten Unterteilung (22) durch den ersten Kanal (13) ermöglichen; wobei die erste Öffnung (14) von dem einströmenden Betriebsfluid durchquert wird, das auf die erste Zone (121) der ersten Unterteilung (12) und auf die erste Zone (221) der zweiten Unterteilung (22) gerichtet ist; wobei die zweite Öffnung (15) von dem ausströmenden Betriebsfluid, das aus der zweiten Zone (122) der ersten Unterteilung (12) kommt, durchquert wird, wobei die dritte Öffnung (24) blockiert wird, wobei die vierte Öffnung (25) von dem ausströmenden Fluid, das aus der zweiten Zone (222) der zweiten Pumpe (2) kommt, durchquert wird;

in einer zweiten Betriebskonfiguration: wobei die zweite Zone (122) der ersten Unterteilung (12) und die zweite Zone (222) der zweiten Unterteilung (22) eine Absaugung jeweils der ersten und der zweiten Pumpe (1, 2) definieren, wobei die erste Zone (121) der ersten Unterteilung (12) und die zweite Zone (221) der zweiten Unterteilung (22) jeweils eine Abgabe der ersten und der zweiten Pumpe (1, 2) definieren, wobei die Mittel (3) zum Öffnen/Schließen des ersten und des zweiten Kanals (13, 23) den ersten Kanal (13) blockieren und die Fluidkommunikation zwischen der zweiten Zone (122) der ersten Unterteilung (12) und der zweiten Zone (222) der zweiten Unterteilung (22) durch den zweiten Kanal (23) ermöglichen; wobei die erste Öffnung (14) von dem ausströmenden Betriebsfluid, das von der ersten Zone (121) der ersten Unterteilung (12) kommt, durchquert wird, wobei die zweite Öffnung (15) von dem einströmenden Betriebsfluid durchquert wird, das auf die zweite Zone (122) der ersten Unterteilung (12) und auf die zweite Zone (222) der zweiten Unterteilung (22) gerichtet ist; wobei die dritte Öffnung (24) von dem ausströmenden Fluid, das aus der ersten Zone (221) der zweiten Unterteilung (2) kommt, durchquert wird; wobei die vierte Öffnung (25) blockiert ist;

in der zweiten Betriebskonfiguration ist die Drehrichtung des ersten und des zweiten Paares (11, 21) von

Rädern entgegengesetzt zu der, die in der ersten Betriebskonfiguration angenommenen worden ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** sie ein erstes Loch (51) umfasst, das den ersten Kanal (13) und die Außenseite des Gehäuses (4) verbindet, wobei die Mittel (3) zum Öffnen und Schließen des ersten und des zweiten Kanals (13, 23) einen ersten und einen zweiten Stopfen (31, 32) umfassen, die auf das Gehäuse (4) anwendbar sind und in das erste Loch (51) eingepasst werden können; wobei der erste Stopfen (31), wenn er auf das erste Loch (51) angewandt ist, den Durchgang von Fluid zwischen der ersten und der zweiten Unterteilung (12, 22) durch den ersten Kanal (13) ermöglicht, wobei der zweite Stopfen (32), wenn er auf das erste Loch (51) angewandt ist, den Durchgang von Fluid durch den ersten Kanal (13) verhindert.
3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** sie ein zweites Loch (52) umfasst, das den zweiten Kanal (23) und die Außenseite des Gehäuses (4) verbindet; wobei der erste und der zweite Stopfen (31, 32) auch in das zweite Loch (52) eingepasst werden können; wobei der zweite Stopfen (32) in der ersten Konfiguration in das zweite Loch (52) eingepasst ist, um den Durchgang von Fluid zwischen der ersten und der zweiten Unterteilung (12, 22) durch den zweiten Kanal (23) zu stoppen und wobei der erste Stopfen (31) in das erste Loch (51) eingepasst ist; wobei der zweite Stopfen (32) in der zweiten Konfiguration in das erste Loch (51) eingepasst ist, wobei der erste Stopfen (31) in das zweite Loch (52) eingepasst ist, um den Durchgang von Fluid zwischen der ersten und der zweiten Unterteilung (12, 22) durch den zweiten Kanal (23) zu ermöglichen.
4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** das erste und das zweite Loch (51, 52) in Bezug auf die dritte und die vierte Öffnung (24, 25) getrennt und unabhängig sind.
5. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** sich das erste Loch (51) zwischen dem ersten Kanal (13) und der dritten Öffnung (24) erstreckt; wobei das zweite Loch (52) sich zwischen dem zweiten Kanal (23) und der vierten Öffnung (25) erstreckt.
6. Vorrichtung nach einem der Ansprüche 2 bis 5, **dadurch gekennzeichnet, dass** der zweite Stopfen (32) geeignet ist, in die Vorrichtung (10) tiefer als der erste Stopfen (31) einzudringen.
7. Vorrichtung nach einem der Ansprüche 2 bis 6, **dadurch gekennzeichnet, dass** der zweite Stopfen (32) umfasst:

- ein erstes und ein zweites Längsende (321, 322);
- eine Seitenwand (323), die das erste und das zweite Ende (321, 322) verbindet;
- einen inneren Hohlraum (324), der am ersten Ende (321) und in einer Zone der Seitenwand (323) mit der Außenseite in Kommunikation steht;

wobei der Hohlraum (324) in der ersten Konfiguration von dem entlang des zweiten Kanals (23) vorhandenen und aus der zweiten Pumpe (2) kommenden Fluid durchquert ist, wodurch das Durchqueren der vierten Öffnung (25) ermöglicht wird;

wobei der Hohlraum (324) in der zweiten Konfiguration von dem entlang des ersten Kanals (13) vorhandenen und aus der zweiten Pumpe (2) kommenden Fluid durchquert ist, wodurch das Durchqueren der dritten Öffnung (24) ermöglicht wird.

8. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die erste und die dritte Öffnung (14, 24) auf einer ersten Seite (41) des Gehäuses (4) ausgebildet sind; wobei die zweite und die vierte Öffnung (15, 25) auf einer zweiten Seite (42) des Gehäuses (4) ausgebildet sind, wobei die zweite Seite (42) der ersten Seite (41) gegenüberliegt.
9. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sowohl in der ersten als auch in der zweiten Konfiguration ein Einlass des Betriebsfluids in die Vorrichtung (10) mit einem Einlass des Betriebsfluids in die erste Pumpe (1) zusammenfällt.
10. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sowohl in der ersten als auch in der zweiten Konfiguration die Abgabe der ersten und der zweiten Pumpe (1, 2) nicht miteinander kommunizieren und nebeneinander angeordnet sind.

Revendications

1. Appareil de pompage comprenant :

- i) une première pompe volumétrique (1) réversible à engrenages comprenant :
 - une première paire (11) de roues dentées ;
 - un premier compartiment de logement (12) servant à loger la première paire (11) de roues dentées ;
- ii) une deuxième pompe volumétrique (2) réversible à engrenages comprenant :

- une deuxième paire (21) de roues dentées ; la première pompe volumétrique (1) entraînant en rotation la deuxième pompe volumétrique (2) ;
- un deuxième compartiment de logement (22) servant à loger la deuxième paire (21) de roues ;

caractérisé en ce qu'il comprend :

- * un premier canal (13) mettant en raccordement fluide une première zone (121) du premier compartiment (12) et une première zone (221) du second compartiment (22) ;
- * un second canal (23) mettant en raccordement fluide une seconde zone (122) du premier compartiment (12) et une seconde zone (222) du second compartiment (22) ;
- * des moyens (3) servant à ouvrir/fermer le premier et le deuxième canal (13, 23) ;
- * une enveloppe extérieure (4) comprenant une première, une deuxième, une troisième et une quatrième ouverture (14, 15, 24, 25) prévues pour permettre la communication fluide de l'appareil de pompage (10) avec l'extérieur ;
- * des moyens utilisés pour bloquer les troisième et quatrième ouvertures (24, 25) ;

dans une première configuration de fonctionnement : ladite première zone (121) du premier compartiment (12) et ladite première zone (221) du second compartiment (22) définissant une aspiration, respectivement, de la première et de la seconde pompe (1, 2), ladite seconde zone (122) du premier compartiment (12) et ladite seconde zone (222) du second compartiment (22) définissant un refoulement, respectivement, de la première et de la seconde pompe (1, 2), lesdits moyens (3) d'ouverture/fermeture du premier et du second canal (13, 23) bloquant le second canal (23) et permettant la communication fluide de la première zone (121) du premier compartiment (12) et de la première zone (221) du deuxième compartiment (22) à travers le premier canal (13) ; la première ouverture (14) étant traversée par le fluide de service entrant dirigé vers la première zone (121) du premier compartiment (12) et vers la première zone (221) du deuxième compartiment (22) ; la deuxième ouverture (15) étant traversée par le fluide de service sortant provenant de la deuxième zone (122) du premier compartiment (12), la troisième ouverture (24) étant bloquée, la quatrième ouverture (25) étant traversée par le fluide sortant provenant de la deuxième zone (222) de la deuxième pompe (2) ;

dans une deuxième configuration de fonctionnement : ladite seconde zone (122) du premier compartiment (12) et ladite seconde zone (222) du second compartiment (22) définissant une aspi-

- ration, respectivement, de la première et de la deuxième pompe (1, 2), ladite première zone (121) du premier compartiment (12) et ladite première zone (221) du second compartiment (22) définissant un refoulement, respectivement, de la première et de la deuxième pompe (1, 2), lesdits moyens (3) d'ouverture/fermeture du premier et du second canal (13, 23) bloquant le premier canal (13) et permettant la communication fluide entre la seconde zone (122) du premier compartiment (12) et la seconde zone (222) du second compartiment (22) à travers le second canal (23) ; la première ouverture (14) étant traversée par le fluide de service sortant provenant de la première zone (121) du premier compartiment (12), la deuxième ouverture (15) étant traversée par le fluide entrant dirigé vers la deuxième zone (122) du premier compartiment (12) et vers la deuxième zone (222) du deuxième compartiment (22) ; la troisième ouverture (24) étant traversée par le fluide sortant provenant de la première zone (221) du deuxième compartiment (2) ; la quatrième ouverture (25) étant bloquée ; dans la deuxième configuration de fonctionnement, le sens de rotation de la première et de la deuxième paire (11, 21) de roues étant opposé à celui adopté dans la première configuration de fonctionnement.
2. Appareil selon la revendication 1, **caractérisé en ce qu'il** comprend un premier orifice (51) reliant le premier canal (13) et l'extérieur de l'enveloppe (4), les moyens (3) d'ouverture et de fermeture du premier et du second canal (13, 23) comprenant un premier et un second bouchon (31, 32) applicables à l'enveloppe (4) et pouvant être montés dans ledit premier orifice (51) ; le premier bouchon (31), s'il est appliqué sur le premier orifice (51), permettant le passage du fluide entre le premier et le second compartiment (12, 22) à travers le premier canal (13), le second bouchon (32), s'il est appliqué sur le premier orifice (51), empêchant le passage du fluide à travers le premier canal (13).
3. Appareil selon la revendication 2, **caractérisé en ce qu'il** comprend un deuxième orifice (52) reliant le deuxième canal (23) et l'extérieur de l'enveloppe (4) ; le premier et le deuxième bouchon (31, 32) pouvant aussi être montés dans le deuxième orifice (52) ; dans la première configuration, le deuxième bouchon (32) étant monté dans le deuxième orifice (52) pour arrêter le passage du fluide entre le premier et le deuxième compartiment (12, 22) à travers le deuxième canal (23) et le premier bouchon (31) étant monté dans le premier orifice (51) ; dans la seconde configuration, le second bouchon (32) étant monté dans le premier orifice (51), le premier bouchon (31) étant monté dans le second orifice (52) permettant le passage du fluide entre le premier et le second compartiment (12, 22) à travers le second canal (23).
4. Appareil selon la revendication 3, **caractérisé en ce que** le premier et le deuxième orifice (51, 52) sont séparés et indépendants par rapport à la troisième et à la quatrième ouverture (24, 25).
5. Appareil selon la revendication 3, **caractérisé en ce que** le premier orifice (51) se prolonge entre le premier canal (13) et la troisième ouverture (24) ; le deuxième orifice (52) se prolongeant entre le deuxième canal (23) et la quatrième ouverture (25).
6. Appareil selon l'une quelconque des revendications 2 à 5, **caractérisé en ce que** le deuxième bouchon (32) est adapté pour pénétrer plus loin dans l'appareil (10) que le premier bouchon (31).
7. Appareil selon l'une quelconque des revendications 2 à 6, **caractérisé en ce que** le second bouchon (32) comprend :
- une première et une deuxième extrémité longitudinale (321, 322) ;
 - une paroi latérale (323) reliant la première et la deuxième extrémité (321, 322) ;
 - une cavité interne (324) en communication avec l'extérieur en correspondance de la première extrémité (321) et en correspondance d'une zone de la paroi latérale (323) ;
- dans la première configuration, ladite cavité (324) étant traversée par le fluide présent le long du deuxième canal (23) et provenant de la deuxième pompe (2) permettant le passage de la quatrième ouverture (25) ; dans la deuxième configuration, ladite cavité (324) étant traversée par le fluide présent le long du premier canal (13) et provenant de la deuxième pompe (2) permettant le passage de la troisième ouverture (24).
8. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la première et la troisième ouverture (14, 24) sont façonnées sur une première face (41) de ladite enveloppe (4) ; la deuxième et la quatrième ouverture (15, 25) étant façonnées sur une deuxième face (42) de ladite enveloppe (4), la deuxième face (42) étant opposée à la première face (41).
9. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, dans la première et dans la deuxième configuration, une entrée de fluide de service dans l'appareil (10) coïncide avec une entrée de fluide de service dans la première pompe (1).
10. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, dans la première et dans la seconde configuration, les refoule-

ments de la première et de la seconde pompe (1, 2)
ne communiquent pas mutuellement et sont situés
l'un à côté de l'autre.

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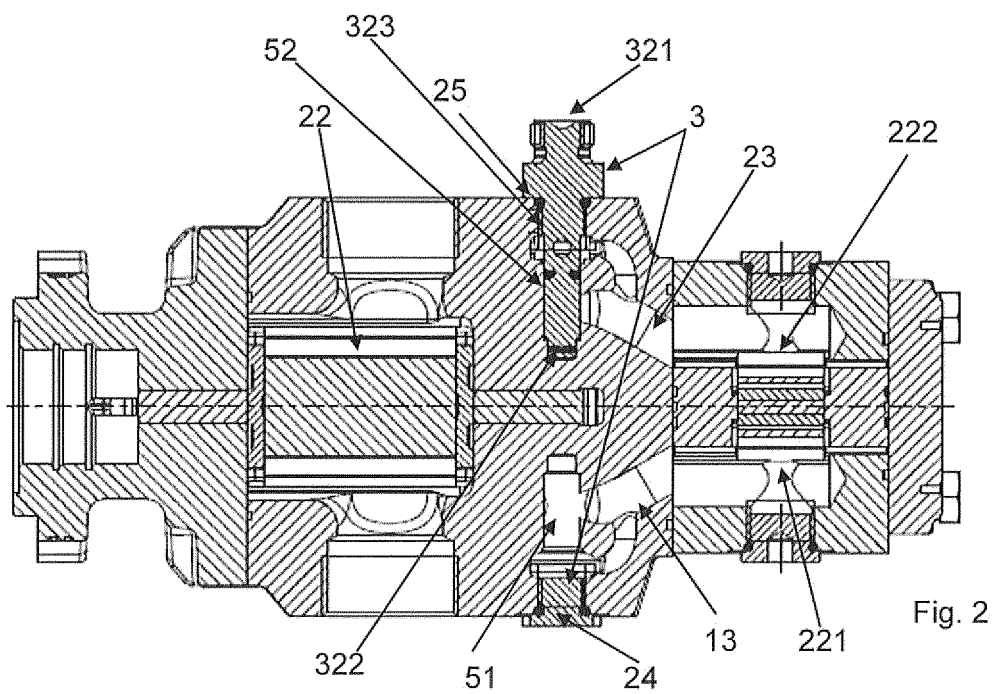
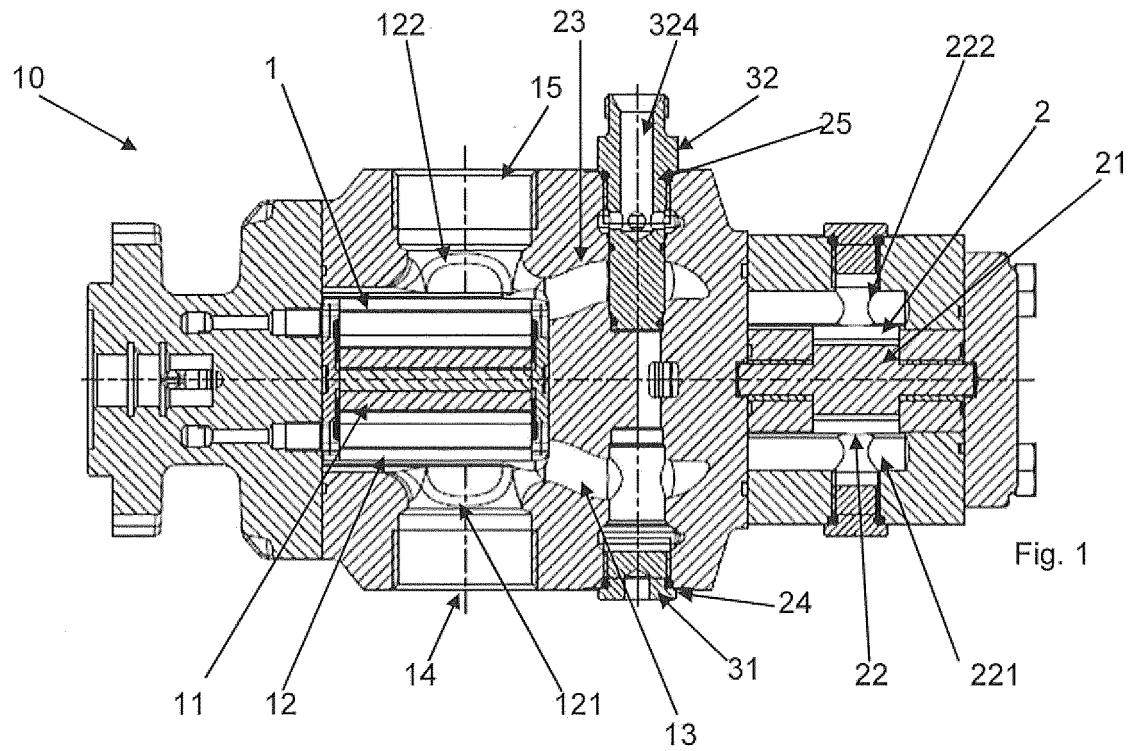
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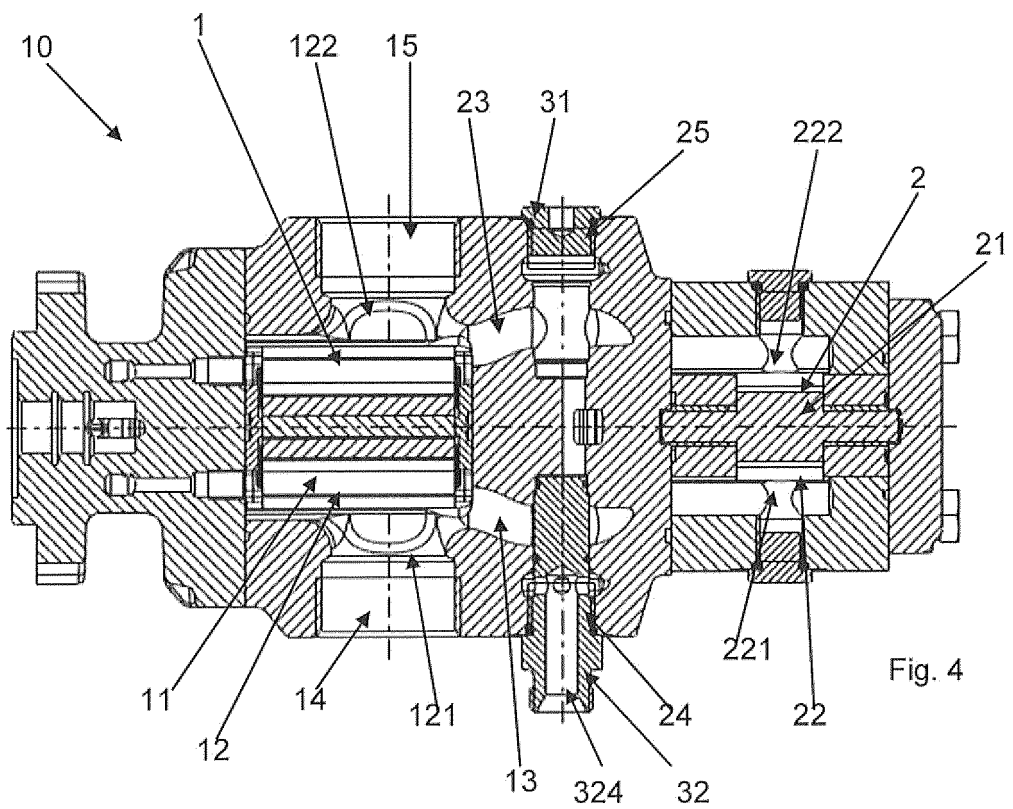
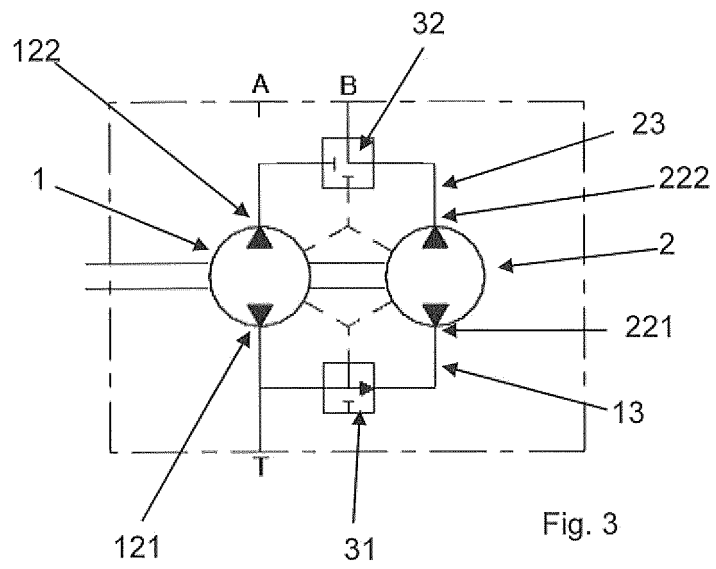
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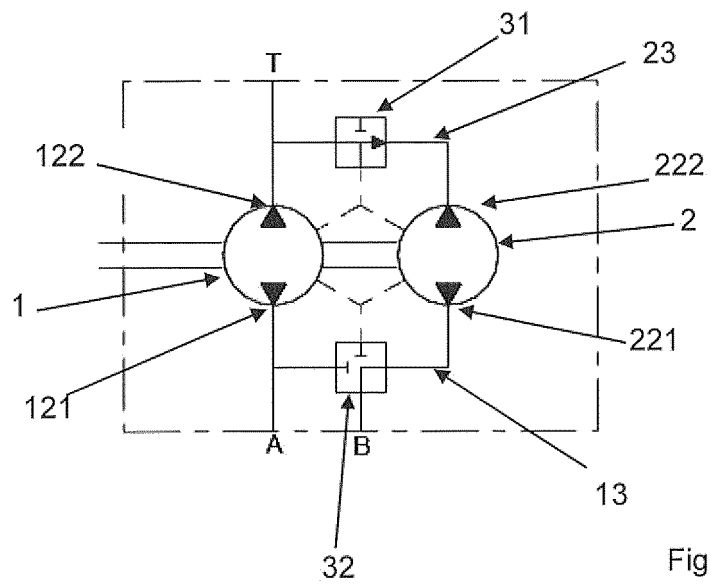
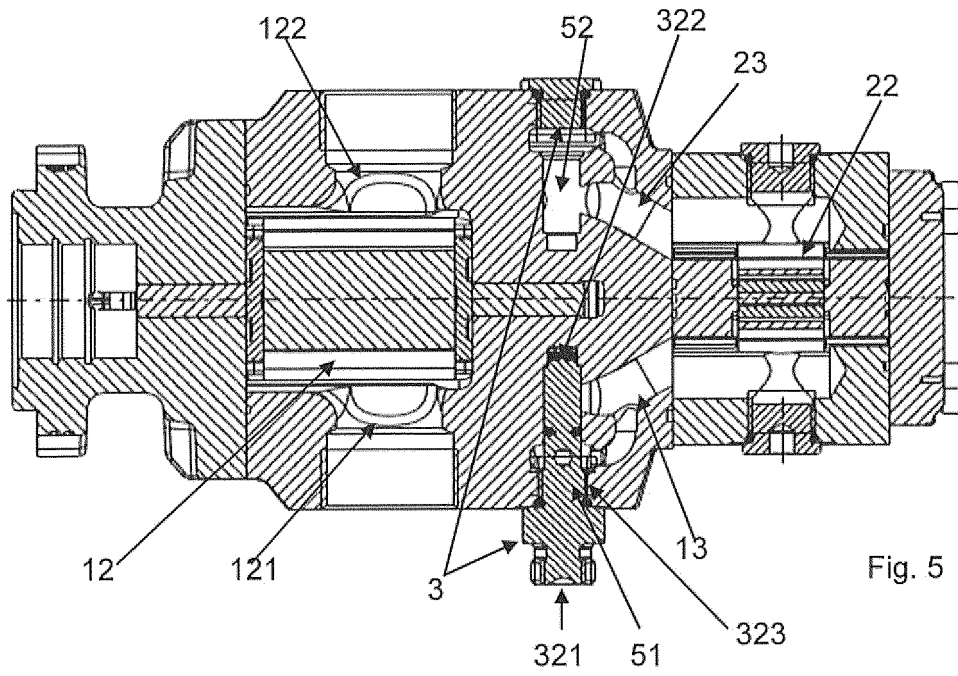
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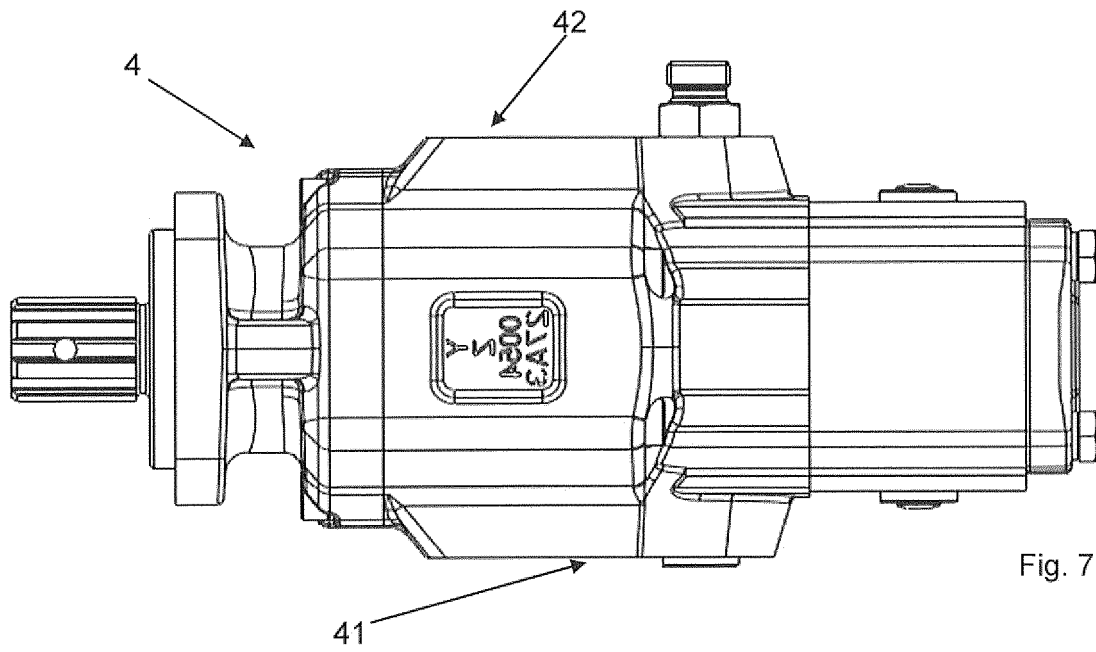


Fig. 7

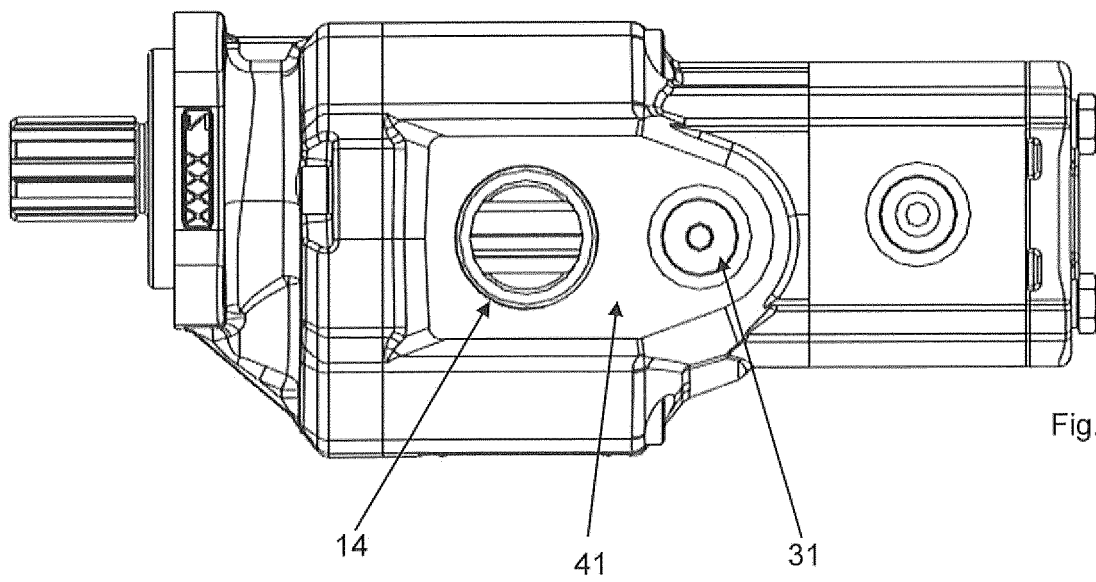


Fig. 8

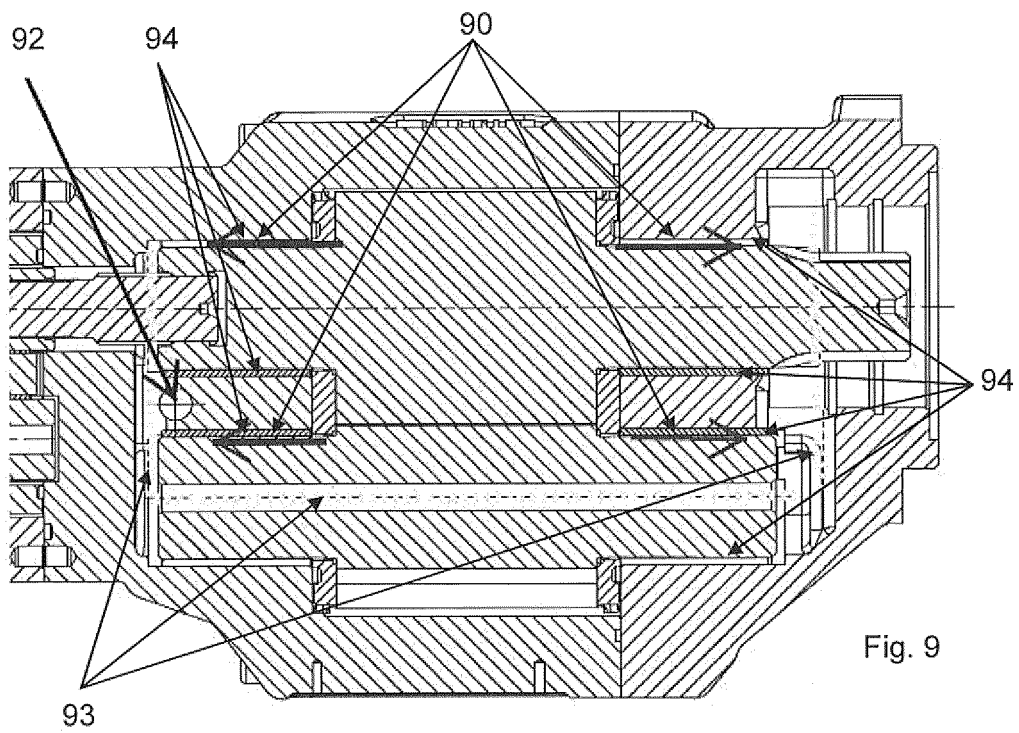


Fig. 9

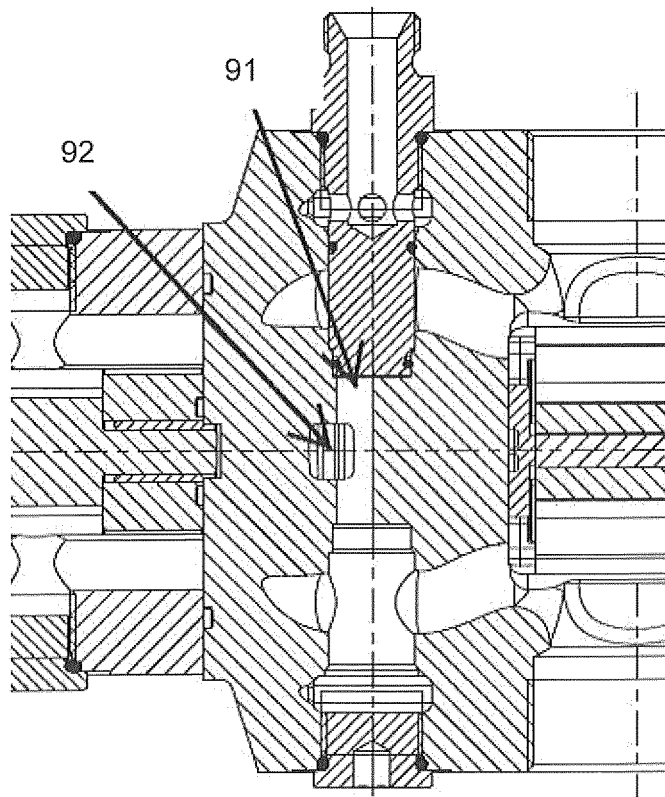
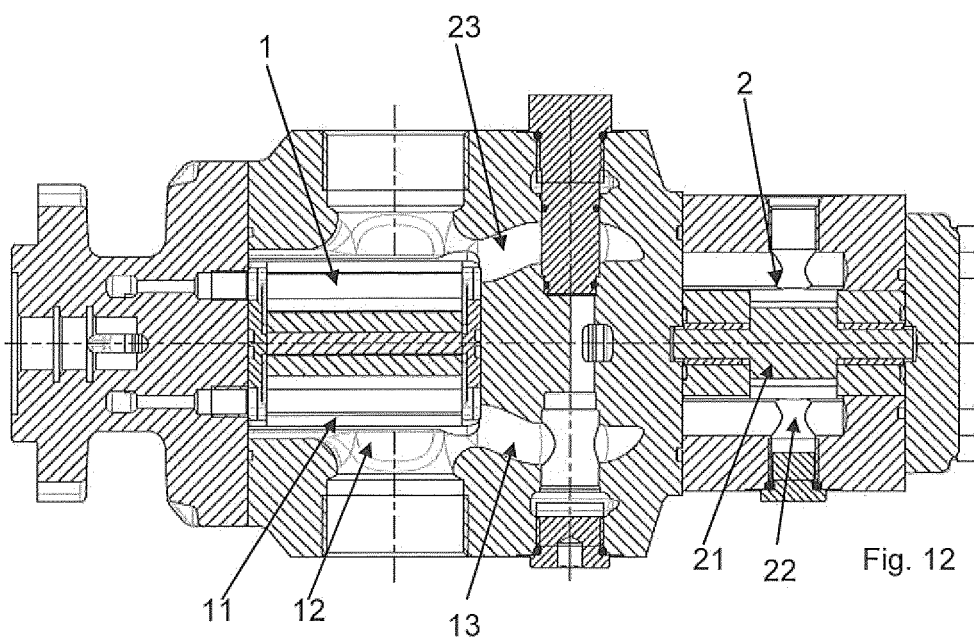
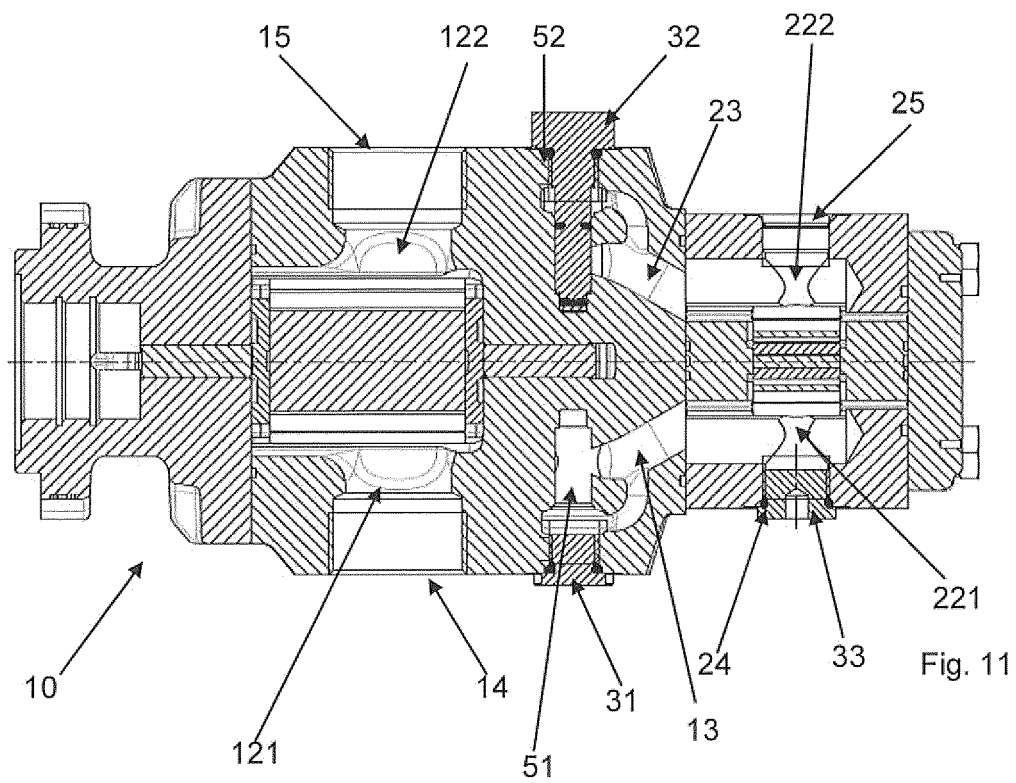


Fig. 10



REFERENCES CITED IN THE DESCRIPTION

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