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Description

[0001] The present invention refers to a dynamic fluid device.
[0002] Use of hydraulic pumps with a fixed flow rate to feed user means of the same machine is well known and, in order for each one of them to work, they require a predefined flow of pressurised fluid which is oil in this specific case.
[0003] Hydraulic pumps with a fixed flow rate have the advantage of being considerably more economical than those with a variable flow rate which are also known and widely used.
[0004] One example of where these pumps are installed is on agricultural machines: they have hydraulic systems that feed the main and secondary functions.
[0005] By the term main functions we mean those functions the machine needs to move safely, for example, hydraulic powered steannular, while by the term secondary functions we mean those operating functions machines can be equipped with for working, for example, a hydraulic lifting equipment, a bucket and the like.
[0006] To feed all the user means, the pumps with a fixed flow rate must be sized to guarantee a sufficient flow of pressurised oil under the heaviest conditions, i.e. when a great number of the primary and secondary equipments are being used simultaneously.
[0007] When this does not occur, i.e. when only one user apparatus is used, the pump, sized to supply a flow to meet the heaviest conditions, continues to supply the same flow of pressurised oil which becomes noticeably much more than what is really needed to operate a single user apparatus; consequently, a large part of the pressurised oil flow supplied by the pump is superfluous and, for this reason, sent to a discharge point of the hydraulic system provided for.
[0008] This situation leads to a useless consumption of energy to be supplied to the pump for it to work and an anomalous heating of the pressurised oil, due to the fact it is not all used.
[0009] To solve these drawbacks hydraulic circuits are used equipped with two pumps with a predefined fixed flow rate and installed in parallel with each other; each pump is connected by a pipe to a single first user means and a single second user means.
[0010] An extension of the feed pipes is provided for at the output of both the first and second user means that join together to flow into one single additional pipe which, in turn, is connected to a third user means; the sum of the flows of the single pumps when they are both working comes together in this one single additional pipe.
[0011] Nevertheless, a solenoid valve is mounted on one of the feed pipe extensions, before they join together, which opens or closes the extension it is mounted on, alternatively letting the flow of oil go through this extension to the third user means together with the flow of oil that goes through the parallel pipe of the other user means, or deviating the flow of the pipe extension on which it is mounted to a discharge contemplated for this purpose in the hydraulic circuit.
[0012] In this way three user means can be supplied with three different flows and the total value of the flow rates can be regulated with greater precision in line with the requirements of the user means being used, turning the pumps on or off as needed.
[0013] With this adjustment it is allowed to reduce the flow of pressurised oil to be discharged if all or part of it is not being used by one or more user means.
[0014] A second known hydraulic system to supply user means uses just one pump, normally a gear pump which, by means of a pipe, is connected to a distributor unit intended to distribute pressurised oil on demand to a multitude of user means.
[0015] The oil is distributed when requested in order to work one or more user means and the request for oil is activated either by a manual operation of a users means’ driving unit mounted on a machine by an operator or by an automatic device designed for this purpose on the distributor.
[0016] A valve is installed between the gear pump and distributor that connects the oil feeding pipe, adjusting the passage hole through which the oil flows to a discharge.
[0017] The valve is controlled by pressure signals that reach it by way of a pressure detecting pipe which in technical jargon is called a "load-sensing line"; pressure is detected inside the distributor and transmitted to the valve which, according to the specific requirements of pressurised oil modifies the passage hole to the distributor and, hence, the available flow of pressurised oil to the user means; when no signal is sent by the load-sensing line, the valve normally keeps the feed pipe connected to the discharge and all the pump flow goes into it.
[0018] An additional requirement of agricultural machines and work vehicles in general that are fitted with a multitude of hydraulically controlled user means, is that the feeding must be provided by the pumps according to an established priority, where the user means that control the machines main functions are supplied first followed by the user means that control the secondary functions.
[0019] The state of the technique described previously has a few drawbacks.
[0020] A first drawback is that the hydraulic circuits that have pumps with a fixed flow rate feeding single user means do not allow for priority in feeding such units.
[0021] A second drawback is that if, in a hydraulic circuit which has two pumps in parallel with each other, one of the pumps is damaged, the user means being supplied by this damaged pump cannot work .
[0022] A third drawback is that if a third user means requires a reduced flow of pressurised oil to work compared to the flow rate just one of the pumps installed in parallel on the hydraulic circuit can supply, a significant quantity of pressurised oil has to be discharged and the energy spent to operate the pump, or both pumps, is lost.
[0023] From document US 6,205,780 B1 a drive sys-
tem is known, comprising a plurality of hydraulic actuators which are driven by the hydraulic fluid supplied by two pumps, and a valve arrangement which is arranged between the pumps and the actuators for selectively connecting them, by controlling the flow of the hydraulic fluid from the pumps to the hydraulic actuators. However the disclosure of this document does not enter into the specific constructive details and structure of the valve arrangement provided for controlling the hydraulic fluid flow in order to selectively connect the pumps to the actuators.

[0024] The technical aim of the invention is to improve the state of the technique.

[0025] One object of the invention is to make a dynamic fluid device allowing to limit the losses of energy spent to feed pressurised oil to the work vehicle user means that require low oil rates of flow.

[0026] Another object of the invention is to make a dynamic fluid device allowing to feed work vehicle user means according to a predetermined priority.

[0027] Yet another object of the invention is to make a dynamic fluid device that can be installed on already existing hydraulic circuits and used on work vehicles.

[0028] The above objects are achieved by the dynamic fluid device comprising all the features recited by independent claim 1. The dynamic fluid device does, therefore, allow to send predefined rates of flow of pressurised oil to machine user devices according to pre-established requests and also according to pre-established priorities, thus noticeably reducing the amount of energy lost to operate the sources that supply machine user means with pressurised oil. Further characteristics and advantages of the present invention will appear even more evident from the description of a form of embodiment of a dynamic fluid device illustrated by way of non limiting example in the accompanying drawings, wherein:

Figure 1 is a longitudinal section view of a first version of a dynamic fluid device in a configuration where only one of three user means is fed with pressurised oil supplied at full rate by a first and a second pump installed in parallel with each other;

Figure 2 is the longitudinal section view of Figure 1 where one user means is fed with pressurised oil supplied at full rate by the first and second pump and a second user means is fed with a partial rate;

Figure 3 is the longitudinal section view of Figure 2 where two of the three user means are fed with pressurised oil supplied at full rate by the first and second pump;

Figure 4 is the longitudinal section view of Figure 3 where two of the three user means are fed with pressurised oil supplied at full rate by the first and second pump and a third user means starts receiving a small flow of pressurised oil;

Figure 5 is the longitudinal section view of Figure 4 where three user means are fed with pressurised oil supplied at full rate by both the first and second pump;

Figure 6 is the longitudinal section view of Figure 5 where the three user means are fed with pressurised oil supplied at full rate by the first pump and at partial rate by the second pump;

Figure 7 is the longitudinal section view of Figure 6 where the three user means are fed with pressurised oil supplied at full rate by just the first pump;

Figure 8 is the longitudinal section view of Figure 7 in a configuration where the three user means are fed with pressurised oil supplied at partial rate by just the first pump.

Figure 9 is a diagram of the dynamic fluid device in the configuration of Figure 1;

Figure 10 shows a longitudinal section view, on an enlarged scale, of the dynamic fluid device of Figure 8;

Figure 11 is a hydraulic diagram of the dynamic fluid device in the Figure 1 configuration where an over-pressure safety relief valve has been added connected to distributor means;

Figure 12 a longitudinal section view of a second version of the dynamic fluid device of Figure 7 to which third valve means have been added;

Figure 13 is a hydraulic diagram of the second version of the dynamic fluid device of Figure 12.

[0030] With reference to the Figures, 1 indicates a dynamic fluid device as a whole which comprises first pumping means 2 and second pumping means 3 arranged in parallel with each other to pump a pressurised fluid - which is oil in this specific case - to three user points or user means that are operable with pressurised oil and which are schematically indicated in the figures with PR1, PR2 and EF respectively, and more specifically, with PR1 the first user means, with PR2 the second user means and with EF the third user means.

[0031] The dynamic fluid device 1 also comprises distributor means 4 that are interposed amongst said first pumping means 2, second pumping means 3 and user means PR1, PR2 and EF and connected to them with connection means, for example, annular-shaped connection holes, a first hole 5, fifth hole 6, a sixth hole 7 and a connection hole 11, controlled by respective one-way valves 12 and 13, and send pressurised oil to the distributor means 4.

[0032] The first pumping means 2 and the second pumping means 3 each comprise their own first pump 8 and second pump 9, both with a fixed flow rate that, through the respective first connection hole 5 and second connection hole 11, controlled by respective one-way valves 12 and 13, send pressurised oil to the distributor means 4.

[0033] The latter comprise a body 14 in which at least one sliding chamber 15 is made and into which the connection holes 5, 6, 7 and 11 flow; besides these, a third connection hole 16 and a fourth connection hole 17 are

3
contemplated that connect the sliding chamber 15 with, respectively, two discharge means indicated in the drawings by arrows "S1" and "S2".

[0034] The sliding chamber 15 is cylindrical in shape and features a first end 115 closed with a plug 18 and an opposing second end 215 closed with contrast means 19 described more in detail further on.

[0035] The distributor means 4 also comprises a distributor element 20 sliding in the sliding chamber 15 and which is intended, slidingly accommodated inside it, to open and shut all the connection holes 5, 6, 7, 11, 16, 17 according to a predetermined sequence; slides of the distributor element 20 occurs by overcoming the action of the contrast means 19.

[0036] The distributor element 20 comprises a cylindrical body 21 axially crossed by a through conduit 22; this has a third open end 122 that faces the plug 18 and an opposing fourth end 222 that features first crosswise openings 23 flowing into the sliding chamber 15 and which are obtained in the cylindrical body 21; the through conduit 22 also has second crosswise openings 24 flowing into the sliding chamber 15 which are obtained in the cylindrical body 21 in a position between the first crosswise openings 23 and the third end 122, substantially by the first hole 5.

[0037] The first user means PR1 are connected to the first pump 8 and also to the second pump 9 by means of an intermediate conduit 111 obtained inside the body 14 which connects the second pump 9 to the first pump 8.

[0038] Peripherally, the cylindrical body 21 features at least three perimeter grooves created in succession: a first groove 25 is arranged to connect, by means of the sliding of the cylindrical body 21, the second connection hole 11 and the fourth connection hole 17 together, a second groove 26 is arranged to connect, between the first connection hole 5 and the third connection hole 16, a third groove 27 is provided to connect the first hole 5 and the sixth hole 7 together.

[0039] The second crosswise holes 24 open into the third groove 27 while the first crosswise holes 23 are provided to connect, according the slidings of the cylindrical body 21, the through conduit 22 with the fifth annular-shaped hole 6.

[0040] The contrast means 19 comprises a plug element 28 that can be screwed into the second end 215 of the sliding chamber 15.

[0041] A first housing 29 is defined inside the plug element 28, created axially and inside which a return spring 30 is housed, contained between the bottom 129 of the first housing 29 and the opposing second concave housing 31 obtained in the fourth end 222.

[0042] A detecting line between the sliding chamber 15 and the user means PR1, PR2 and EF detects the pressure inside the latter, known by the term "load-sensing line", by means of which a signal indicated with "LS" flows into the sliding chamber 15 through a connecting conduit 33 created in the body 14.

[0043] With reference to Figures 9 and 12, it can be seen that the load-sensing signal "LS" corresponds to the strongest of the "LS1", "LS2", and "LS3" signals because all the load-sensing signals "LS1", "LS2", "LS3" go towards the first valve means 35 and second valve means 36: more precisely, the load-sensing signals "LS2" and "LS3" reach the second valve means 36 coming from the second user means PR2 and third user means EF, the strongest of which goes through the second valve means 36, closing passage to the other signals and, through a line 10, flows to the first valve means 35 where the load-sensing signal "LS1" also flows, coming from the first user means PR1.

[0044] Also in this case, the strongest signal goes through the first valve means 35 which consequently close passage to the other signal.

[0045] The resulting "LS" signal reaches the first housing 29 through the connecting conduit 33 and acts jointly with the spring 30 on the surface of the second concave housing 31.

[0046] According to a second version of the dynamic fluid device 1 illustrated in Figures 12 and 13, a radial opening 37 is made in the second concave housing 31 which, when the cylindrical body 21 slides along, opens or closes, aligning itself with a seventh annular-shaped hole 38 which, in this second version, is created in the body 14, between the connecting conduit 33 and the fifth hole 6.

[0047] The seventh annular-shaped hole 38 is connected to a storage or drainage tank 39 with the interpolation of third valve means 40 that are normally closed, and opened when the pressure inside the annular-shaped hole 38 reaches an established limit value: more specifically, the third valve means 40 acts as a so-called "over-pressure safety relief valve".

[0048] Additional fourth valve means 41 comprising another "over-pressure safety relief valve", completely identical to the previous one, is interpolated between the tank 39 and the first hole 5 and also these fourth valve means 41 are normally closed and opened when the pressure inside the first hole 5 reaches a predetermined limit value.

[0049] Fifth valve means 42 are also contemplated between the first hole 5 and the first user means PR1, and are normally open, as can be seen in Figures 19 and 12; these fifth valve means 42 is provided to protect the first user means PR1 against excessive pressure values, closing the passage of oil towards it.

[0050] The operation of the dynamic fluid device is explained below with reference to the various positions of the cylindrical body 21 illustrated in Figures 8 to 1.

[0051] Figure 8 illustrates the configuration that occurs when a motor is turned on that operates the first pump 8 and the second pump 9 and when none of the user means PR1, that could coincide for example with the driving devices of a vehicle, PR2, that could correspond to the braking system of a vehicle, and EF, that could correspond to a working tool of a vehicle, require a flow of oil.
Consequently, the cylindrical body 21 remains balanced inside the sliding chamber 15 between the force exerted by the contrast means 19 and the pressure of the oil that is taking up the space 34 and which is pushing against the third end 122 of the body 21; with the body 21 in this position the second pump 9 is connected to the discharge means S2 through the first groove 25, and it’s just the first pump 8 that sends oil to the user means PR1, PR2 and EF.

EF through the second crosswise openings 24, the through conduit 22, the first crosswise holes 23, with a partial flow rate, because it is also connected partially to the discharge means S1 through the second groove 26 which, in this configuration, is located across the first hole 5 and the third hole 16.

When an user means requires a bigger flow of oil, that is, when a person operates one or more of the user means PR1, PR2 and EF, a "load-sensing" signal "LS" is generated which, through the connecting conduit 33, reaches the first housing 29 and acts pressing on the second concave housing 31, summing its own force with that of the spring 30.

In the eventuality more than one user means is activated simultaneously, the "LS" signal that acts on the second concave housing 31 coincides with the strongest of the "LS1", "LS2" and "LS3" signals that pass through the second valve means 36 and the first valve means 35.

This pressure makes the cylindrical body 21 move towards the plug 18, gradually reaching the configuration illustrated in Figure 7.

In this configuration, the whole flow rate of the first pump 8 is sent to the user means PR1, PR2 and EF because the passage between the second groove 26 and the third hole 16, which is in connection with the discharge means S1, has closed.

If the flow rate of oil is not sufficient to feed the user means PR1, PR2 and EF, the "load-sensing" signal continues to act on the concave housing 31, still moving the cylindrical body 21 in the direction of the plug 18 and gradually reaching the configuration illustrated in Figure 6.

In this configuration, the connection between the first groove 25 and the fourth hole 17 is reduced, the pump 9 builds up pressure, the one-way valve 13 starts to open and the second pump 9 also starts sending a flow of oil, even though it is partial, to the user means PR1, PR2 and EF in parallel with the first pump 8 through the intermediate conduit 111, while another part of the oil flow is still sent to the discharge means S2.

If the flow rate of oil is still not enough to meet the requirements of the user means PR1, PR2 and EF, the "load-sensing" signal continues acting on the second concave housing 31 making the cylindrical body 21 move again in the direction of the plug 18 and reaching the configuration illustrated in Figure 5.

In this configuration both the first pump 8 and the second pump 9 send their flows of oil to the user means PR1, PR2 and EF because as the cylindrical body 21 moves, the fourth hole 17 closes and the connection between the first groove 25 and the latter, and therefore to the discharge means S2, is interrupted.

From this configuration on, the cylindrical body 21, moving, starts feeding the first user means PR1, the second user means PR2 and the third user means EF according to a predetermined priority.

In fact, if the flow of both the first pump 8 and the second pump 9 is still not enough to feed all the user means PR1, PR2 and EF, the action of the "load-sensing" signal continues on the second concave housing 31 and the cylindrical body 21 further moves once more in the direction of the plug 18, as illustrated in Figure 4; the third groove 27 starts closing the sixth hole 7 by way of which the pressurised oil reaches the third user means EF.

If this is still not enough, the cylindrical body 21 continues moving in the direction of the plug 18, reaching the configuration illustrated in Figure 3.

In this configuration, the sixth hole 7 is completely closed and the third user means is no longer fed; therefore, the whole flow of the first pump 8 and of the second pump 9 is sent only to the second user means PR2 and the first user means PR1, having priority over the third user means EF.

If the flow continues to be insufficient to feed both the first user means PR1 and the second user means PR2 and the latter require an additional flow of pressurised oil, the cylindrical body 21, still due to the combined action of the spring 30 and the "load-sensing" signal that acts on the second concave housing 31, continues moving towards the plug 18, gradually reaching the configuration illustrated in Figure 2.

In this configuration, the first crosswise openings 23 of the cylindrical body 21 start becoming misaligned with respect to the fifth hole 6 which they close gradually.

Consequently, the flows of the first pump 8 and of the second pump 9 mainly reach the first user means PR1, giving it priority in the supply of oil, while a limited flow reaches the second user means PR2.

With the request for oil continuing by the first user means PR1 which, consequently, has priority over the second user means PR2, the cylindrical body 21 continues moving towards the plug 18, reaching the configuration illustrated in Figure 1 where the connection between the first crosswise openings 23 and the fifth hole 6 is completely closed and the flows of pressurised oil supplied both by the first pump 8 and the second pump 9 are sent to the user means PR1 only. The fourth valve means 41 are calibrated so as to connect the first hole 5 and the tank 39 together when the pressure inside the first hole 5 reaches values that are too high, for example, caused by an anomalous interruption in sliding of the cylindrical body 21, to avoid damaging the first pump 8 or the second pump 9.

In the second version of the dynamic fluid device 1, the movements of the cylindrical body 21 in the direction of the plug 18 place the radial opening 37 and
the seventh hole 38 in progressive mutual connection so the third valve means 40 reach the pressure value.

[0071] When this pressure value reaches and exceeds a predetermined opening limit value of the third valve means 40, it opens and places the storage tank 39 in connection with the first housing 29, discharging the pressure in it and causing the cylindrical body 21 to move in the direction of the contrast means 19 to such an extent that the connection opens between the second pump 9 and the discharge means S2, through the first groove 25 which is across the second hole 11 and the fourth hole 17.

[0072] As happens for the first hole 38, if the pressure inside the first hole 5 reaches a predefined limit value coinciding with the opening value of the third valve means 41, it will open and place the first hole 5 in connection with the storage tank 39, discharging the pressure into it until the closing value is reached for the third valve means 41.

[0073] At one end the fifth valve means 42 receive the thrust produced by an elastic element 45 that has a preselected load, and by the same LS1 pressure signal which is detected inside the first user means PR1, through a corresponding derived line 43.

[0074] Likewise, the fifth valve means 42, at the opposite end, receive the same thrust produced by the pressure of the oil that flows towards the first user means PR1, through a second derived line 44.

[0075] When the pressure of the oil flowing towards the first user means PR1 reaches an excessively high value, such to exceed the thrust produced jointly by the elastic element 45 and the load-sensing signal LS1, the fifth valve means 42 positions itself in the oil passage closed configuration, thus protecting the first user means PR1 from possible damage caused by an excessively high pressure value.

Claims

1. Dynamic fluid device (1) comprising:

   - first pumping means (2) and second pumping means (3) arranged in parallel with each other to pump a pressurised fluid to user means (PR1, PR2, EF); and
   - distributor means (4) interposed between said first pumping means (2), second pumping means (3) and said user means (PR1, PR2, EF) and connected to them with connection means, wherein said distributor means (4) are arranged to connect singly and/or jointly and/or according to predetermined sequences, said first pumping means (2) and/or said second pumping means (3) to said user means (PR1, PR2, EF), and comprise:
     - body means (14) in which at least one sliding chamber (15) is provided, fitted with connection holes (5, 6, 7, 11, 16, 17) respectively with said user means (PR1, PR2, EF), with said first pumping means (2) and said second pumping means (3), and with discharge means (S1, S2);
     - a distributor element (20) slidingly accommodated in said sliding chamber (15) and suitable, by sliding, to open and shut said connection holes (5, 6, 7, 11, 16, 17); and
     - contrast means (19) of the sliding of said distributor element (20) in said sliding chamber (15), wherein said sliding chamber (15) is cylindrically shaped and features a first end (115), closed by plug means (18), and an opposite second end (215), closed by said contrast means (19), and wherein said distributor element (20) comprises a cylindrical body (21) axially crossed by a through conduit (22) which has a third open end (122) that faces said plug means (18) and an opposite fourth end (222), said dynamic fluid device (1) being characterised in that said contrast means (19) comprise:
       - a plug element (28) that can be screwed into said second end (215) of said sliding chamber (15);
       - a first housing (29) created axially inside said plug element (28);
       - elastic contrast means (30) housed in said first housing (29) and contained between a bottom (129) of the same and a second concave housing (31), opposite to said first housing (29) and provided in said fourth end (222) of said through conduit (22).

2. Dynamic fluid device (1) according to claim 1, wherein said user means (PR1, PR2, EF) have respective feeding priorities, characterised in that said distributor means (4) are designed to connect according to said predetermined sequences, said first pumping means (2) and said second pumping means (3) to said user means (PR1, PR2, EF), while complying with the respective feeding priorities.

3. Dynamic fluid device (1) according to claim 1 or 2 wherein said first pumping means (2) and said second pumping means (3) comprise a first pump (8) and a second pump (9) respectively, both with fixed flow rate.

4. Dynamic fluid device (1) according to any of the claims from 1 to 3, wherein connections conduits are provided in said body means (14), between said user means (PR1, PR2, EF) and said sliding chamber
5. Dynamic fluid device (1) according to any of the claims from 1 to 4, wherein said opposite fourth end (222) of said through conduit (22) features first crosswise openings (23) which open into said sliding chamber (15), and wherein second crosswise openings (24) which open into said sliding chamber (15) are provided between said first crosswise openings (23) and said third open end (122) of said through conduit (22).

6. Dynamic fluid device (1) according to any of the claims from 1 to 5, wherein said connection holes (5, 6, 7, 11, 16, 17) comprise:

- a first annular-shaped connection hole (5) between said sliding chamber (15) and said first pump (8),
- a second annular-shaped connection hole (11) between said sliding chamber (15) and said second pump (9),
- a third annular-shaped connection hole (16) between said sliding chamber (15) and said discharge means (S1, S2),
- a fourth annular-shaped connection hole (17) between said sliding chamber (15) and said discharge means (S1, S2),
- a fifth annular-shaped connection hole (6) between said sliding chamber (15) and second user means (PR2) of said user means (PR1, PR2, EF),
- a sixth annular-shaped connection hole (7) between said sliding chamber (15) and third user means (EF) of said user means (PR1, PR2, EF).

7. Dynamic fluid device (1) according to any of the claims from 1 to 6 wherein first user means (PR1) of said user means (PR1, PR2, EF) are connected to said first pump (8) and second pump (9).

8. Dynamic fluid device (1) according to any of the claims from 1 to 7, wherein said cylindrical body (21) comprises at least three perimeter grooves (25, 26, 27) formed in succession on the outer surface of said cylindrical body (21), a first groove (25) of them being provided to connect, by means of the sliding of said cylindrical body (21) in said sliding chamber (15), said second connection hole (11) and said fourth connection hole (17) together, a second groove (26) being provided to connect, by means of said sliding, said first connection hole (5) and said third connection hole (16) together, and a third groove (27) being provided to connect, by means of said sliding, said first hole (5) and said sixth hole (7) together.

9. Dynamic fluid device (1) according to claim 5, wherein said second crosswise holes (24) open into said third groove (27).

10. Dynamic fluid device (1) according to claim 5, wherein said first crosswise holes (23) of said through conduit (22) are provided to connect, by means of the sliding of said cylindrical body (21) of the distributor element (20), said through conduit (22) with said sixth hole (7).

11. Dynamic fluid device (1) according to claim 1, wherein said plug element (28) can be screwed into said second end (215) of the sliding chamber (15).

12. Dynamic fluid device (1) according to claim 1, wherein said second concave housing (31) is provided with connecting radial openings (37) for the connection with a corresponding seventh hole (38) made in said body means (14), said seventh hole (38) being connected to a storage tank (39).

13. Dynamic fluid device (1) according to any of the claims from 1 to 12 wherein between said sliding chamber (15) and said user means (PR1, PR2, EF) there is provided a pipe (LS; LS1; LS2; LS3) detecting pressure in said user means (PR1, PR2, EF), known by the term "load-sensing lines, said pipe opening into near to said second end (215) of said sliding chamber (15) with a connecting conduit (33).

14. Dynamic fluid device (1) according to claim 1 or 2 wherein said first pumping means (2) and said second pumping means (3) comprise a first pump (8) and a second pump (9) respectively, at least one of which is of the fixed flow rate type and the other of the variable flow rate type.

**Patentansprüche**

1. Dynamische Fluidvorrichtung (1), die aufweist:

   - eine erste Pumpeneinrichtung (2) und eine zweite Pumpeneinrichtung (3), die parallel zueinander angeordnet sind, um ein unter Druck stehendes Fluid zu Verbrauchereinrichtungen (PR1, PR2, EF) zu pumpen; und
   - eine Verteilereinrichtung (4), die zwischen die erste Pumpeneinrichtung (2), die dritte Pumpeneinrichtung (3) und die Verbrauchereinrichtungen (PR1, PR2, EF) geschaltet ist und mit ihnen über Verbindungseinrichtungen verbunden ist, bei der die Verteilereinrichtung (4) so angeordnet ist, dass sie einzeln und/oder gemeinsam und/oder gemäß zuvor bestimmten Reihenfolgen die erste Pumpeneinrichtung (2) und/oder die zweite Pumpeneinrichtung (3) mit den Verbrauchereinrichtungen (PR1, PR2, EF) verbindet.
Die dynamische Fluidvorrichtung (1), in der mindestens eine Gleitkammer (15) bereitgestellt wird, versehen mit Verbindungsstöcken (5, 6, 7, 11, 16, 17) bzw. mit den Verbrauchereinrichtungen (PR1, PR2, EF), mit der ersten Pumpeinrichtung (2) und der zweiten Pumpeinrichtung (3) und mit den Austrittseinrichtungen (S1, S2); ein Verteilerelement (20), das gleitend von der Gleitkammer (15) aufgenommen wird und geeignet ist, durch Gleiten die Verbindungsstöcke (5, 6, 7, 11, 16, 17) zu öffnen und zu schließen; und

eine Abhebeeinrichtung (19) für das Gleiten des Verteilerelementes (20) in der Gleitkammer (15), bei der die Gleitkammer (15) zylindrisch geformt ist und ein erstes Ende (115), das durch eine Stopfeneinrichtung (18) verschlossen wird, und ein gegenüberliegendes zweites Ende (215), das durch die Abhebeeinrichtung (19) verschlossen wird, besitzt und bei der das Verteilerelement (20) einen zylindrischen Körper (21) aufweist, der axial von einem durchgehenden Kanal (22) gekreuzt wird, der ein der Stopfeneinrichtung (18) zugewandtes, drittes offenes Ende (122) und ein gegenüberliegendes viertes Ende (222) hat, wobei die dynamische Fluidvorrichtung (1) dadurch gekennzeichnet ist, dass die Abhebeeinrichtung (19) aufweist:

ein Stopfenelement (28), das in das zweite Ende (215) der Gleitkammer (15) geschraubt werden kann;
ein erstes Gehäuse (29), das axial im Stopfenelement (28) gebildet wird;
eine elastische Abhebeeinrichtung (30), die in das erste Gehäuse (29) eingesetzt ist und zwischen einer Unterseite (129) desselben und einem zweiten konkaven Gehäuse (31), gegenüber dem ersten Gehäuse (29) und im vierten Ende (222) des durchgehenden Kanals (22) bereitgestellt, enthalten ist.

2. Dynamische Fluidvorrichtung (1) gemäß Anspruch 1, bei der die Verbrauchereinrichtungen (PR1, PR2, EF) entsprechende Einspeiseprioritäten haben, dadurch gekennzeichnet, dass die Verteilereinrichtung (4) so gestaltet ist, dass sie je nach den vorher bestimmten Reihenfolgen die erste Pumpeinrichtung (2) und die zweite Pumpeinrichtung (3) mit den Verbrauchereinrichtungen (PR1, PR2, EF) verbindet, während sie die entsprechenden Einspeiseprioritäten einhält.

3. Dynamische Fluidvorrichtung (1) gemäß Anspruch 1 oder 2, bei der die erste Pumpeinrichtung (2) und die zweite Pumpeinrichtung (3) eine erste Pumpe (8) bzw. eine zweite Pumpe (9), beide mit nicht veränderbarer Fördermenge, aufweisen.

4. Dynamische Fluidvorrichtung (1) gemäß einem der Ansprüche 1 bis 3, bei der die Verbindungskanäle in den Körpereinrichtungen (14), zwischen den Verbrauchereinrichtungen (PR1, PR2, EF) und der Gleitkammer (15) und zwischen der ersten Pumpe (8) und der zweiten Pumpe (9) und der Gleitkammer (15) bereitgestellt werden.

5. Dynamische Fluidvorrichtung (1) gemäß einem der Ansprüche 1 bis 4, bei der das gegenüberliegende vierte Ende (222) des durchgehenden Kanals (22) erste über Kreuz angeordnete Öffnungen (23) besitzt, die sich in die Gleitkammer (15) hinein öffnen, und bei der zweite über Kreuz angeordnete Öffnungen (24), die sich in die Gleitkammer (15) hinein öffnen, zwischen den ersten über Kreuz angeordneten Öffnungen (23) und dem dritten offenen Ende (122) des durchgehenden Kanals (22) bereitgestellt werden.

6. Dynamische Fluidvorrichtung (1) gemäß einem der Ansprüche 1 bis 5, bei der die Verbindungslöcher (5, 6, 7, 11, 16, 17) aufweisen:
ein erstes ringförmiges Verbindungslöch (5) zwischen der Gleitkammer (15) und der ersten Pumpe (8),
ein zweites ringförmiges Verbindungslöch (11) zwischen der Gleitkammer (15) und der zweiten Pumpe (9),
ein drittes ringförmiges Verbindungslöch (16) zwischen der Gleitkammer (15) und den Austrittseinrichtungen (S1, S2),
ein viertes ringförmiges Verbindungslöch (17) zwischen der Gleitkammer (15) und den Austrittseinrichtungen (S1, S2),
ein fünftes ringförmiges Verbindungslöch (6) zwischen der Gleitkammer (15) und den Verbrauchereinrichtungen (PR2) der Verbrauchereinrichtungen (PR1, PR2, EF),
ein sechstes ringförmiges Verbindungslöch (7) zwischen der Gleitkammer (15) und der dritten Verbrauchereinrichtung (EF) der Verbrauchereinrichtungen (PR1, PR2, EF),
ein siebentes ringförmiges Verbindungslöch (8) zwischen der Gleitkammer (15) und der ersten Pumpe (8),
ein achtes ringförmiges Verbindungslöch (9) zwischen der Gleitkammer (15) und der zweiten Pumpe (9).

7. Dynamische Fluidvorrichtung (1) gemäß einem der Ansprüche 1 bis 6, bei der die erste Verbraucherein-
richtung (PR1) der Verbrauchereinrichtungen (PR1, PR2, EF) mit der ersten Pumpe (8) und der zweiten Pumpe (9) verbunden ist.


9. Dynamische Fluidvorrichtung (1) gemäß Anspruch 5, bei der die zweiten über Kreuz angeordneten Löcher (24) sich in die dritte Nut (27) hinein öffnen.

10. Dynamische Fluidvorrichtung (1) gemäß Anspruch 5, bei der die ersten über Kreuz angeordneten Löcher (23) des durchgehenden Kanals (22) bereitgestellt werden, um durch das Gleiten des zylindrischen Körpers (21) des Verteilerelements (20) den durchgehenden Kanal (22) mit dem sechsten Loch (7) zu verbinden.

11. Dynamische Fluidvorrichtung (1) gemäß Anspruch 1, bei der das Stopfenelement (28) in das zweite Ende (215) der Gießkammer (15) geschraubt werden kann.

12. Dynamische Fluidvorrichtung (1) gemäß Anspruch 1, bei der das zweite konkave Gehäuse (31) mit verbindenden radialen Öffnungen (37) zum Verbinden mit einem entsprechenden siebenten Loch (38), das in der Körpereinrichtung (14) hergestellt wurde, versehen ist, wobei das siebente Loch (38) mit einem Speicherbehälter (39) verbunden ist.

13. Dynamische Fluidvorrichtung (1) gemäß einem der Ansprüche 1 bis 12, bei der zwischen der Gießkammer (15) und den Verbrauchereinrichtungen (PR1, PR2, EF) ein Rohr (LS; LS1; LS2; LS3) zum Detektieren des Drucks in den Verbrauchereinrichtungen (PR1, PR2, EF), das unter der Bezeichnung "Load-Sensing-Leitung" bekannt ist, bereitgestellt wird, wobei das Rohr sich in die Nähe des zweiten Endes (215) der Gießkammer (15) mit einem Verbindungskanal (33) öffnet.

14. Dynamische Fluidvorrichtung (1) gemäß Anspruch 1 oder 2, bei der die erste Pumpeinrichtung (2) und die zweite Pumpeinrichtung (3) eine erste Pumpe (8) bzw. eine zweite Pumpe (9), mindestens eine von ihnen mit nicht veränderbarer Fördermenge und die andere mit veränderbarer Fördermenge, aufweisen.

Revendications

1. Dispositif fluidodynamique (1) comprenant:

- des premiers moyens de pompage (2) et des deuxième moyens de pompage (3) disposés en parallèle entre eux pour pomper un fluide sous pression vers des moyens utilisateur (PR1, PR2, EF); et
- des moyens de distribution (4) interposés entre lesdits premiers moyens de pompage (2), lesdits deuxième moyens de pompage (3) et lesdits moyens utilisateur (PR1, PR2, EF) et reliés à eux avec des moyens de connexion, où lesdits moyens de distribution (4) sont dispo-sés pour connecter individuellement et/ou conjointement et/ou selon des séquences prédéterminées, lesdits premiers moyens de pompage (2) et/ou lesdits deuxième moyens de pompage (3) desdits moyens utilisateur (PR1, PR2, EF), et comprenant :

- des moyens à corps (14) dans lesquels au moins une chambre de coulissement (15) est prévue, munie de trous de connexion (5, 6, 7, 11, 16, 17) respectivement avec lesdits moyens utilisateur (PR1, PR2, EF), avec lesdits premiers moyens de pompage (2) et lesdits deuxième moyens de pompage (3) et avec des moyens de décharge (S1, S2), - un élément distributeur (20) logé de ma-nière coulissante dans ladite chambre de coulissement (15) et apte, grâce à son coulis-sissement, à ouvrir et fermer lesdits trous de connexion (5, 6, 7, 11, 16, 17) ; et
- des moyens de contraste (19) du coulis-sement dudit élément distributeur (20) dans ladite chambre de coulissement (15), où ladite chambre de coulissement (15) est de forme cylindrique et dispose d’une pre-mière extrémité (115), fermée avec des moyens à bouchon (18), et une deuxième extrémité (215) opposée, fermée par lesdits moyens de contraste (19), et où ledit élément de distribution (20) com-prend un corps cylindrique (21) traversé axialement par un conduit traversant (22)
qui a une troisième extrémité ouverte (122) qui fait face auxdits moyens à bouchon (18) et une quatrième extrémité (222) opposée, ledit dispositif fluidodynamique (1) caractérisé en ce que lesdits moyens de contraste (19) comprennent :

- un élément à bouchon (28) qui peut être vissé dans ladite deuxième extrémité (115) de ladite chambre de coulissement (15) ;
- un premier logement (29) créé axialement à l'intérieur dudit élément à bouchon (28) ;
- des moyens de contraste élastique (30) logés dans ledit premier logement (29) et compris entre un fond (129) de lui-même et un deuxième logement (31) concave, opposé par rapport audit premier logement (29) et obtenu dans ladite quatrième extrémité (222) dudit conduit traversant (22).

6. Dispositif fluidodynamique (1) selon l'une quelconque des revendications de la 1 à 5, dans lequel lesdits trous de connexion (5, 6, 7, 11, 16, 17) comprennent :

- un premier trou de connexion (5) de forme annulaire entre ladite chambre de coulissement (15) et ladite première pompe (8) ;
- un deuxième trou de connexion (11) de forme annulaire entre ladite chambre de coulissement (15) et ladite deuxième pompe (9) ;
- un troisième trou de connexion (16) de forme annulaire entre ladite chambre de coulissement (15) et lesdits moyens de décharge (S1, S2) ;
- un quatrième trou de connexion (17) de forme annulaire entre ladite chambre de coulissement (15) et lesdits moyens de sortie (S1, S2) ;
- un cinquième trou de connexion (6) de forme annulaire entre ladite chambre de coulissement (15) et les deuxièmes moyens utilisateur (PR2) desdits moyens utilisateur (PR1, PR2, EF) ;
- un sixième trou de connexion (7) de forme annulaire entre ladite chambre de coulissement (15) et les troisièmes moyens utilisateur (EF) desdits moyens utilisateur (PR1, PR2, EF).

7. Dispositif fluidodynamique (1) selon l'une quelconque des revendications de la 1 à 6 dans lequel les premiers moyens utilisateur (PR1) desdits moyens utilisateur (PR1, PR2, EF) sont connectés à ladite première pompe (8) et deuxième pompe (9).

8. Dispositif fluidodynamique (1) selon l'une quelconque des revendications de la 1 à 7 dans lequel ledit corps cylindrique (21) comprend au moins trois rainures de périmètre (25, 26, 27) obtenues successivement sur la surface extérieure dudit corps cylindrique (21), une première rainure (25) étant prévue pour connecter ensemble, au moyen du coulissement dudit corps cylindrique (21) dans ladite chambre de coulissement (15), ledit deuxième trou de connexion (11) et ledit quatrième trou de connexion (17), une deuxième rainure (26) étant prévue pour connecter ensemble, au moyen dudit coulissement, ledit premier trou de connexion (5) est ledit troisième trou de connexion (16), une troisième rainure (27) étant prévue pour connecter, au moyen dudit coulissement, ledit premier trou (5) et ledit sixième trou (7) ensemble.

9. Dispositif fluidodynamique (1) selon la revendication 5, dans lequel lesdites deuxièmes ouvertures transversales (23) s'ouvrent dans ladite troisième extrémité ouverte (122) dudit conduit traversant (22).
10. Dispositif fluidodynamique (1) selon la revendication 5 dans lequel lesdites premières ouvertures transversales (23) dudit conduit traversant (22) sont prévues pour connecter, au moyen du coulissement dudit corps cylindrique (21) dudit élément de distribution (20), ledit conduit traversant (22) avec ledit sixième trou (7).

11. Dispositif fluidodynamique (1) selon la revendication 1, dans lequel ledit élément à bouchon (28) peut être vissé dans ladite deuxième extrémité (215) de ladite chambre de coulissement (15).

12. Dispositif fluidodynamique (1) selon la revendication 1, dans lequel ledit deuxième logement concave (31) est fourni avec des ouvertures radiales de connexion (37) pour la connexion avec un septième trou (38) correspondant réalisé dans lesdits moyens à corps (14), ledit septième trou (38) étant connecté à un réservoir de stockage (39).

13. Dispositif fluidodynamique (1) selon l’une quelconque des revendications de la 1 à la 12 dans lequel, entre ladite chambre de coulissement (15) et lesdits moyens utilisateur (PR1, PR2, EF), un tuyau (LS; LS1, LS2, LS3) est prévu pour la détection de la pression dans lesdits moyens utilisateur (PR1, PR2, EF), connu comme «ligne de load-sensing», ledit tuyau s’ouvre à proximité de ladite deuxième extrémité (215) de ladite chambre de coulissement (15) avec un conduit de connexion (33).

14. Dispositif fluidodynamique (1) selon la revendication 1 ou 2 dans lequel lesdits premiers moyens de pompage (2) et lesdites deuxièmes moyens de pompage (3) comprennent respectivement une première pompe (8) et une deuxième pompe (9), dont au moins une des deux est du type à débit fixe et l’autre du type à débit variable.
REFERENCES CITED IN THE DESCRIPTION

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