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

(11) EP 2 435 671 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.09.2018 Bulletin 2018/38

(21) Application number: **10728144.6**

(22) Date of filing: **27.05.2010**

(51) Int Cl.:
F01M 1/02 *(2006.01)* ***F16N 13/04*** *(2006.01)*

(86) International application number:
PCT/EP2010/057318

(87) International publication number:
WO 2010/136525 (02.12.2010 Gazette 2010/48)

(54) **A LUBRICATION OIL PUMP, A CYLINDER LUBRICATING SYSTEM, AND AN INTERNAL COMBUSTION ENGINE**

SCHMIERMITTELPUMPE, ZYLINDERSCHMIERVORRICHTUNG UND BRENNTKRAFTMASCHINE

POMPE DE LUBRIFICATION, CIRCUIT DE LUBRIFICATION DE CYLINDRE ET MOTEUR À COMBUSTION INTERNE

(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 MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **28.05.2009 EP 09161426**

(43) Date of publication of application:
04.04.2012 Bulletin 2012/14

(73) Proprietor: **Wärtsilä Schweiz AG**
8401 Winterthur (CH)

(72) Inventors:
- **FULLAGAR, Edwin**
  CH-8400 Winterthur (CH)
- **CASE, William**
  Ripon
  WI 54971 (US)

(74) Representative: **Intellectual Property Services GmbH**
Langfeldstrasse 88
8500 Frauenfeld (CH)

(56) References cited:
WO-A1-2006/089558
DE-A1- 4 230 106
DE-U1- 20 107 681
JP-A- 1 116 209
JP-A- 4 287 817
JP-A- 2003 003 966
JP-B- 49 040 724

EP 2 435 671 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The invention relates to a cylinder lubrication oil pump for dosing a cylinder lubrication oil to a lubricating quill-opening of a cylinder of an internal combustion engine, in particular a slow running two stroke large diesel engine, as well as to a cylinder lubricating arrangement comprising a lubrication oil pump, and to an internal combustion engine in accordance with the precharacterising part of the respective independent claims.

[0002] Large diesel engines are often used as power units for ships or also in stationary operation, for example for driving large generators for the production of electrical power. Here as a rule the engines are in constant operation over a considerable period of time which makes high demands on the operating reliability and availability. For this reason, for the operators, long intervals between services, low degrees of wear and an economical use of fuel and operating materials in particular are central criteria for the operation of the machines. Among other things the running behaviour of the pistons of such large bore slowly running diesel engines is a determining factor for the length of the intervals between servicing, the availability and, via the lubricant consumption, also directly for the operating costs and thus for the economic viability. Thus the complex problems associated with the lubrication of large diesel engines are of ever-increasing importance.

[0003] In large diesel engines, however not only in these, the piston lubrication is undertaken by lubrication devices in the reciprocating piston or in the cylinder wall by which the lubrication oil is applied to the running surface of the cylinder wall in order to minimize the friction between the piston and the running surface and thus the wear of the running surface and the piston rings. Thus in the case of modern engines, such as for example Wärtsilä's RTA engines, the wear of the running surface is less than 0.05 mm for an operating time of 1000 hours. The quantity of lubricant being transported is circa 1.3 g/kWh or less and should be reduced further, not least for reasons of cost, and the wear should be minimised at the same time.

[0004] Totally different solutions are known for lubrication systems for lubricating the running surfaces, not only with regard to the actual operation of the lubrication devices themselves but also with respect to the method of lubrication. Thus lubrication devices are known in which the lubrication oil is applied through a plurality of lubricant openings, which are accommodated in the cylinder wall in the circumferential direction, to the pistons running past at the lubricant openings, with the lubricant being distributed by the piston rings not only in the circumferential direction but also in the axial direction.

[0005] Apart from the manner in which the lubricant is applied to the running surface of the cylinder wall, the dosage of the lubricant is a central point. For this purpose, a large variety of different oil dosage pumps are known from the state of the art. In order to ensure an even oil distribution to the lubricating quills of the cylinder of the internal combustion engine, the known oil dosage pumps include an actuating piston driving a certain number of dosage plungers being attached or connected to the actuating piston. The dosage plungers are driveable arranged in a dosing space so as to reciprocate in a delivery and a return stroke over a working travel along the plunger axis. In the return stroke, a pre-settable amount of lubrication oil is filled into the dosing space on top of the plunger. On receiving an injection signal, the actuating piston starts to move and the lubrication oil is pressurized by the plungers driven by the actuating piston and the lubrication oil is supplied from each dosing space to the respective lubricating quill.

Such known cylinder oil dosage pumps as for example disclosed in CH 673 506, DE 197 43 955 B4, or EP 1 386 063 A1 which all are very complex in construction resulting in a comparably high price for the pumps. 2-stroke marine diesel engines require an accurately timed, metered and independently delivered pulsed lubrication oil flow to multiple points in the periphery of each engine cylinder. As each engine cylinder requires its own pump, such a pump must be produced at the lowest possible cost whilst being as simple and reliable as possible. In order to meet these demands, other pump proposals use only a single piston to deliver multiple flows, but in that case it is not possible to guarantee individual flows to each injection site on the engine cylinder. JP01116209, JP2003003966 and DE20107681 U1 relate to pumps that form part of the state of the art. The object of the invention is thus to suggest an improved cylinder oil dosage pump for dosing a cylinder lubrication oil which oil dosage pump is simple in construction, more reliable as the pumps known from the state of the art and, as a result, saving considerably costs. It is also an object of the invention to provide an improved cylinder lubricating arrangement comprising an improved cylinder oil dosage pump as well as an internal combustion engine having such a cylinder lubricating arrangement.

The subject-matter of the invention which satisfies these objects are characterised by the features of the respective independent claims.

The respective dependent claims relate to particularly advantageous embodiments of the invention.

The invention thus relates to a lubrication oil pump for dosing a pre-settable amount of a cylinder lubrication oil to a lubricating quill-opening of a cylinder of an internal combustion engine, in particular a two stroke large diesel engine. Said lubrication oil pump comprising a housing with a main hydraulic cylinder section having a first axial end surface and a second axial end surface, and further comprising a primary piston section within the main hydraulic cylinder section. According to the invention, the primary piston section includes an injection bore for receiving an injection piston in such a way, that the injection bore and the injection piston arranged therein form a lubricating volume for dosing the pre-settable amount of the cylinder lubrication oil und are relatively movable with

respect to each other along a cylinder axis. In addition, the invention relates to a cylinder lubricating arrangement and an internal combustion engine with a lubricating arrangement according to the invention.

[0006] According to the invention, the primary piston section includes two or more injection bores for receiving an injection piston each in such a way, that each injection bore and the injection piston arranged therein form a lubricating volume for dosing the pre-settable amount of the cylinder lubrication oil.

The main hydraulic cylinder section usually includes a main hydraulic cylinder bore which can be used for example for hydraulically driving a primary piston section or primary piston or a piston plate within the main hydraulic cylinder bore and/or for guiding a primary piston section or primary piston along a cylinder axis within the main hydraulic cylinder bore and/or for providing a sealing surface with respect to a primary piston section or a primary piston when the primary piston section or primary piston or piston plate is pressurized by a working hydraulic fluid and/or when lubrication oil is dosed. In an advantageous embodiment a primary piston is drivable or movable by a secondary piston in order to perform a compression stroke and/or a recharge stroke of the primary piston.

The invention will be described more closely with the help of the schematic drawings. There are shown:

Fig. 1 a special embodiment of a lubrication oil pump according to the invention, and

Figs. 2A, B a second special embodiment of a lubrication oil pump according to the invention during recharging of the pump and after a compression stroke.

[0007] A primary piston 7 traverses the length of a main hydraulic cylinder bore 4 with the stroke limited at both end surfaces 5, 6. On one end, the primary piston 7 has a plurality of closed injection (cylinders) bores 8 machined into it, into each of which an injection piston 9 is inserted. Each injection piston 9 is fixed to the hydraulic cylinder housing 3, such that during the compression and recharge strokes of the primary piston 7 a compression and vacuum are created inside each injection bore 8. Each injection bore 8 is connected via a small hole to its own axial groove V12 machined into the outer surface of the primary piston 7.

[0008] During each traversal of the primary piston 7, each axial groove V12 opens and closes against a filling groove machined into the main hydraulic cylinder bore 4, respectively allowing the injection bores 8 which established a lubricating volume V, to re-charge with lubrication oil 2 and preventing compressed oil 2 in each injection bore 8 from short-circuiting back to the inlet side of the lubrication oil 2 circuit.

[0009] During the compression stroke of the primary piston 7, the axial grooves V12 in the primary piston 7 are fed with compressed lubrication oil 2 from the injection bores 8, and these grooves transmit the compressed lubrication oil 2 to the outlet checkvalves, from which a plurality of independent, metered and pulsing flows of lubrication oil 2 come.

[0010] During the recharge stroke of the primary piston 7, a vacuum is formed in each injection cylinder, which is used to refill the injection bores 8 when the axial grooves open against the filling groove in the main hydraulic cylinder bore 4.

[0011] In an advantageous embodiment, the injection piston or injection pistons 9 are stationary with respect to a fixing surface 11 of the housing 3 and/or stationary fixed to a fixing surface 11 of the housing 3. In a further advantageous embodiment the primary piston section 7 is a primary piston 7 which is arranged to be movable to and fro along the cylinder axis 10 within a main hydraulic cylinder bore 4 of the main hydraulic cylinder section.

[0012] In another advantageous embodiment, the primary piston section 7 is stationary with respect to a fixing surface 11 of the housing 3 and/or stationary fixed to a fixing surface 11 of the housing 3. In a further advantageous embodiment the injection piston or injection pistons 9 are arranged to be movable to and fro along the cylinder axis 10 within a main hydraulic cylinder bore 4 of the main hydraulic cylinder section. The injection piston or injection pistons 9 can for example be mounted onto a piston plate when required, with the piston plate being movable to and fro along the cylinder axis 10 within the hydraulic cylinder bore 4.

[0013] Each lubricating volume V can be connected to a lubrication oil inlet V1 in order to feed the pre-settable amount of lubrication oil 2 into the lubricating volume V independent of the above described embodiments and embodiment variants. The lubricating volume V can further be connected to a lubrication oil outlet V2 each in order to feed the pre-settable amount of lubrication oil 2 to the lubricating quill-opening or -openings. A connecting line V12 is favorably provided extending between the lubrication oil inlet V1 and the lubrication oil outlet V2, so that the lubricating volume V can be connected to the lubrication oil inlet V1 or to the lubrication oil outlet V2 alternately.

[0014] The injection piston or injection pistons 9 are advantageously fixed to the fixing surface 11 in such a way that during a compression stroke of the primary piston 7 a compression of the cylinder lubrication oil 2 is created inside the injection bore or injection bores 8 and the pre-settable amount of the cylinder lubrication oil 2 is fed to the lubricating quill-opening or -openings of the cylinder of the internal combustion engine.

[0015] It can further be advantageous to fix the injection piston or injection pistons 9 to the fixing surface 11 in such a way that during a recharge stroke of the primary piston 7 a vacuum is created inside the injection bore or injection bores 8 and the pre-settable amount of the cylinder lubrication oil 2 is fed into the lubricating volume V inside the injection bore or injection bores 8.

[0016] In an advantageous embodiment variant, a first working surface 701 and/or a second working surface 702 of the primary piston 7 can be pressurized by a working hydraulic fluid 12 in order to perform the compression stroke of the primary piston 7. In a further advantageous embodiment variant, the first working surface 701 and/or the second working surface 702 of the primary piston 7 can be pressurized by the working hydraulic fluid 12 in order to perform the recharge stroke of the primary piston 7.

[0017] In another advantageous embodiment variant, the first working surface 701 and/or the second working surface 702 of the primary piston 7 can be pressurized by a spring in order to perform the compression stroke and/or the recharge stroke of the primary piston 7.

[0018] The injection piston or injection pistons 9 can for example be stationary fixed at the first axial end surface 5 or at the second axial end surface 6 of the main hydraulic cylinder bore 4 independent of the above described embodiments and embodiment variants. The injection piston or injection pistons 9 can furthermore be an integral part of the housing 3 or be removable fixed to the housing 3.

[0019] In a further advantageous embodiment, the primary piston 7 is a double-acting primary piston able to perform a compression stroke with respect to the first axial end surface 5 and, at the same time, to perform a recharge stroke with respect to the second axial end surface 6, or vice versa.

[0020] The lubricating volume V is advantageously adjustable independent of the above described embodiments and embodiment variants.

[0021] Figures 2A and 2B show a second special embodiment of a lubrication oil pump according to the invention, with Fig. 2A depicting the lubrication oil pump during the recharging of the pump and with Fig. 2B depicting the lubrication oil pump after a compression stroke. In the embodiment shown, the lubrication oil pump 1 for dosing a pre-settable amount of a cylinder lubrication oil to a lubricating quill-opening of a cylinder of an internal combustion engine, such as a two stroke large diesel engine, comprises a housing 3 with a main hydraulic cylinder section 4 having a first axial end surface 5 and a second axial end surface 6, and further comprises a primary piston section 7 within the main hydraulic cylinder section 4. According to the invention, the primary piston section 7 includes at least one injection bore 8 for receiving an injection piston 9 each in such a way, that each injection bore 8 and the injection piston 9 arranged therein form a lubricating volume V for dosing the pre-settable amount of the cylinder lubrication oil 2 und are relatively movable with respect to each other along a cylinder axis 10.

[0022] In an advantageous embodiment, a first working surface 701 and/or a second working surface 702 of the primary piston 7 can be pressurized by a spring in order to perform a compression stroke and/or a recharge stroke of the primary piston 7.

[0023] In a further advantageous embodiment the primary piston 7 is drivable or movable by a secondary piston 72 as shown in Figures 2A and 2B in order to perform the compression stroke and/or the recharge stroke of the primary piston 7. The secondary piston 72 can e.g. be arranged to be movable to and fro along the cylinder axis 10 within a secondary hydraulic cylinder bore 42, with the secondary hydraulic cylinder bore typically having a smaller diameter than the main hydraulic cylinder bore 4, and favorably being able to be pressurized by a working hydraulic fluid 12 in order to perform a drive movement along the cylinder axis 10.

[0024] The lubrication oil pump 1 can optionally include a sensor 2a for monitoring the pulsing flow of the lubrication oil 2 of the pump independent of the above described embodiments and embodiment variants.

[0025] Regarding additional design particulars and possible advantageous embodiments and embodiment variants, reference is made, where applicable, to the design particulars, embodiments and variants described above within the scope of the first embodiment.

[0026] The function of the lubrication oil pump 1 according to the second special embodiment will be described below in detail with the help of Figures 2A and 2B. In Figures 2A and 2B a primary piston 7 is in connection with a secondary piston 72, with the primary piston 7 being able to be moved to and fro along the cylinder axis 10 within the main hydraulic cylinder bore 4.

[0027] On one end, the primary piston 7 is provided with a plurality of closed injection (cylinders) bores 8 which for example can be machined into the primary piston and into each of which an injection piston 9 is inserted. Each injection piston 9 is fixed to the hydraulic cylinder housing 3, such that during a compression and a recharge stroke of the primary piston 7 a compression and vacuum are created respectively inside each injection bore 8. Each injection bore 8 is connected via a small hole to its own axial groove V12 machined into the outer surface of the primary piston 7.

[0028] In a recharge position of the primary piston 7, each axial groove V12 is open towards a filling groove machined into the main hydraulic cylinder bore 4 allowing the injection bores 8 which established a lubricating volume V to recharge with lubrication oil 2 as shown in Fig. 2A.

[0029] During a compression stroke of the primary piston 7, the secondary piston 72 is pressurized by a working hydraulic fluid 12 in order to perform a drive movement along the cylinder axis 10 and thus to drive the primary piston 7. When the primary piston is moving, the axial grooves V12 in the primary piston 7 are typically closed with respect to the filling groove, thus preventing compressed oil 2 in each injection bore 8 from short-circuiting back to the inlet side of the lubrication oil 2 circuit. At the same time, the axial grooves V12 in the primary piston 7 are fed with compressed lubrication oil 2 from the injection bores 8, and said grooves transmit the compressed lubrication oil 2 to outlet checkvalves, from which

an independent, metered and pulsing flow of lubrication oil 2 comes each.

[0030] The compression stroke of the primary piston 7 is limited by a second end surface 6 of the main hydraulic cylinder bore 4 and/or via the secondary piston 72 and/or by an adjustable stopping device which allows adjusting the lubricating volume V as shown in Fig. 2B. The stopping device can e.g. include a pin provided with a thread.

[0031] During a recharge stroke of the primary piston 7, the working hydraulic fluid 12 acting on the secondary piston 72 is allowed to discharge while a second working surface 702 of the primary piston 7 is pressurized by a spring in order to perform the recharge stroke of the primary piston 7. During moving of the primary piston a vacuum is formed in each injection cylinder 8, which is used to refill the injection bores 8 when the primary piston arrives in the recharge position and the axial grooves V12 are open against the filling groove in the main hydraulic cylinder bore 4.

[0032] The recharge stroke of the primary piston 7 is limited by a first end surface 5 of the main hydraulic cylinder bore 4 and/or via the secondary hydraulic piston 72 at an end surface of a secondary hydraulic cylinder bore 42 and/or by or at an adjustable stopping device which allows adjusting the lubricating volume V. The stopping device can e.g. include a pin provided with a thread.

[0033] The invention further includes a cylinder lubricating arrangement comprising a lubrication oil pump 1 in accordance with anyone of the embodiments and embodiment variants described above. In an advantageous embodiment of the cylinder lubricating arrangement, a pressurizeable oil supply is provided that is connected to a lubrication oil inlet V1 of the lubrication oil pump 1. The pressurizeable oil supply can for example be a common rail accumulator.

[0034] Furthermore, the invention includes an internal combustion engine, such as a two-stroke large diesel engine, comprising a lubricating oil pump 1 in accordance with anyone of the embodiments and embodiment variants described above or comprising a cylinder lubricating arrangement in accordance with the embodiments described above.

Claims

1. A lubrication oil pump for dosing a pre-settable amount of a cylinder lubrication oil (2) to a lubricating quill-opening of a cylinder of a two stroke large diesel engine, said lubrication oil pump comprising a housing (3) with a main hydraulic cylinder section (4) having a first axial end surface (5) and a second axial end surface (6), and further comprising a primary piston section (7) within the main hydraulic cylinder section (4) wherein the primary piston section (7) includes at least two injection bores (8) for receiving an injection piston (9) each in such a way, that each injection bore (8) and the injection piston (9) arranged therein form a lubricating volume (V) for dosing the pre-settable amount of the cylinder lubrication oil (2) und are relatively movable with respect to each other along a cylinder axis (10), **characterized in that** each injection bore (8) is connected via a small hole to its own axial groove (V12) machined into an outer surface of the primary piston section (7), and during each traversal of the primary piston section (7), each axial groove (V12) opens and closes against a filling groove machined into the main hydraulic cylinder bore (4), respectively

2. A lubrication oil pump in accordance with claim 1, wherein the injection piston (9) or the primary piston section (7) is stationary with respect to a fixing surface (11) of the housing (3) and / or stationary fixed to a fixing surface (11) of the housing (3).

3. A lubrication oil pump in accordance with any one of claims 1 or 2, wherein the primary piston section (7) is a primary piston (7) being arranged to be movable to and fro along the cylinder axis (10) within a main hydraulic cylinder bore (4) of the main hydraulic cylinder section.

4. A lubrication oil pump in accordance with any one of the preceding claims, wherein the injection piston (9) is arranged to be movable to and fro along the cylinder axis (10) within a main hydraulic cylinder bore (4) of the main hydraulic cylinder section, and wherein in particular the injection piston (9) or in particular a plurality of injection pistons (9) is or are mounted onto a piston plate being movable to and fro along the cylinder axis (10) within the main hydraulic cylinder bore (4).

5. A lubrication oil pump in accordance with any one of the preceding claims, wherein the lubricating volume (V) is connectable to a lubrication oil inlet (V1) in order to feed the pre-settable amount of lubrication oil (2) into the lubricating volume (V), and/or wherein the lubricating volume (V) is connectable to a lubrication oil outlet (V2) in order to feed the pre-settable amount of lubrication oil (2) to the lubricating quill-opening.

6. A lubrication oil pump in accordance with claim 5, wherein between the lubrication oil inlet (V1) and the lubrication oil outlet (V2) a connecting line (V12) is provided, so that the lubricating volume (V) can be connected to the lubrication oil inlet (V1) or to the lubrication oil outlet (V2) alternately.

7. A lubrication oil pump in accordance with any one of the preceding claims, wherein the injection piston (9) is fixed to the fixing surface (11) in such a way that during a compression stroke of the primary piston

(7) a compression of the cylinder lubrication oil (2) is created inside the injection bore (8) and the presettable amount of the cylinder lubrication oil (2) is fed to the lubricating quill-opening of the cylinder of the internal combustion engine.

8. A lubrication oil pump in accordance with any one of the preceding claims, wherein a first working surface (701) and / or a second working surface (702) of the primary piston (7) can be pressurized by a working hydraulic fluid (12) in order to perform the compression stroke of the primary piston (7), and/or wherein the first working surface (701) and / or the second working surface (702) of the primary piston (7) can be pressurized by the working hydraulic fluid (12) in order to perform the recharge stroke of the primary piston (7).

9. A lubrication oil pump in accordance with any one of the preceding claims, wherein the first working surface (701) and / or the second working surface (702) of the primary piston (7) can be pressurized by a spring in order to perform the compression stroke and / or the recharge stroke of the primary piston (7).

10. A lubrication oil pump in accordance with any one of the preceding claims, wherein the primary piston (7) is movable by a secondary piston (72) in order to perform the compression stroke and / or the recharge stroke of the primary piston (7).

11. A lubrication oil pump in accordance with claim 10, wherein the secondary piston (72) is arranged to be movable to and fro along the cylinder axis (10) within a secondary hydraulic cylinder bore (42), in particular in a secondary hydraulic cylinder bore having a smaller diameter than the main hydraulic cylinder bore (4), and can be pressurized by a working hydraulic fluid (12) in order to perform a drive movement along the cylinder axis (10).

12. A lubrication oil pump in accordance with any one of the preceding claims, wherein the injection piston (9) is stationary fixed at the second axial end surface (6) of the main hydraulic cylinder bore (4), or wherein the injection piston (9) is stationary fixed at the first axial end surface (5) of the main hydraulic cylinder bore (4).

13. A lubrication oil pump in accordance with any one of the preceding claims, wherein the primary piston (7) is a double-acting primary piston (7) able to perform a compression stroke with respect to the first axial end surface (5) and, at the same time, to perform a recharge stroke with respect to the second axial end surface (6), or vice versa.

14. A lubrication oil pump in accordance with anyone of the preceding claims, wherein the lubricating volume (V) is adjustable.

15. Cylinder lubricating arrangement comprising a lubrication oil pump (1) in accordance with anyone of the preceding claims.

16. Cylinder lubricating arrangement in accordance with claim 15, wherein a pressurizeable oil supply is provided which is connected to a lubrication oil inlet (V1) of the lubrication oil pump (1), and in particular wherein the pressurizeable oil supply is a common rail accumulator.

17. Internal combustion engine, in particular two-stroke large diesel engine comprising the lubricating oil pump (1) in accordance with anyone of claims 1 to 14 or comprising a cylinder lubricating arrangement in accordance with anyone of claims 15 or 16.

Patentansprüche

1. Schmierölpumpe zum Dosieren einer vorgebbaren Menge eines Zylinderschmieröls (2) an eine Öffnung eines Schmierstutzens eines Zylinders eines Zweitakt-Grossdieselmotors, wobei die Schmierölpumpe ein Gehäuse (3) mit einem Haupthydraulikzylinderabschnitt (4) umfasst, welcher eine erste axiale Endfläche (5) und eine zweite axiale Endfläche (6) aufweist, wobei die Schmierölpumpe des Weiteren einen Primärkolbenabschnitt (7) innerhalb des Haupthydraulikzylinderabschnitts (4) umfasst, wobei der Primärkolbenabschnitt (7) mindestens zwei Einspritzbohrungen (8) zur Aufnahme je eines Einspritzkolbens (9) umfasst, derart, dass jede Einspritzbohrung (8) und der darin angeordnete Einspritzkolben (9) ein Schmiervolumen (V) zur Dosierung der vorgebbaren Menge des Zylinderschmieröls (2) bilden und sie relativ zueinander entlang einer Zylinderachse (10) beweglich sind, **dadurch gekennzeichnet, dass** jede Einspritzbohrung (8) über eine kleines Loch mit ihrer eigenen Axialnut (V12) verbunden ist, die in eine Außenfläche des Primärkolbenabschnitts (7) eingearbeitet ist, und dass jede Axialnut (V12) bei jedem Durchgang des Primärkolbenabschnitts (7) sich gegen eine in den Haupthydraulikzylinderabschnitt (4) eingearbeitete Füllnut öffnet beziehungsweise schliesst.

2. Schmierölpumpe nach Anspruch 1, wobei der Einspritzkolben (9) oder der Primärkolbenabschnitt (7) gegenüber einer Befestigungsfläche (11) des Gehäuses (3) ortsfest ist und / oder ortsfest an einer Befestigungsfläche (11) des Gehäuses (3) befestigt ist.

3. Schmierölpumpe nach einem der Ansprüche 1 oder

2, wobei der Primärkolbenabschnitt (7) ein Primärkolben (7) ist, der innerhalb einer Haupthydraulikzylinderbohrung (4) des Haupthydraulikzylinderabschnitts entlang der Zylinderachse hin- und her bewegbar angeordnet ist.

4. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei der Einspritzkolben (9) innerhalb einer Haupthydraulikzylinderbohrung (4) des Haupthydraulikzylinderabschnitts entlang der Zylinderachse hin- und her bewegbar angeordnet ist, und wobei insbesondere der Einspritzkolben (9) oder insbesondere eine Mehrzahl von Einspritzkolben (9) auf einer Kolbenplatte montiert ist oder sind, die entlang der Zylinderachse (10) innerhalb der Haupthydraulikzylinderbohrung (4) hin- und her bewegbar ist.

5. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei das Schmiervolumen (V) an einen Schmieröleinlass (V1) anschliessbar ist, um die vorgebbare Schmierölmenge (2) dem Schmiervolumen (V) zuzuführen und / oder wobei das Schmiervolumen (V) an einen Schmierölauslass (V2) anschliessbar ist, um die vorgebbare Schmierölmenge (2) der Öffnung des Schmierstutzens zuzuführen.

6. Schmierölpumpe nach Anspruch 5, wobei zwischen dem Schmieröleinlass (V1) und dem Schmierölauslass (V2) eine Verbindungsleitung (V12) vorgesehen ist, so dass das Schmiervolumen (V) abwechselnd mit dem Schmieröleinlass (V1) oder dem Schmierölauslass (V2) verbunden werden kann.

7. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei der Einspritzkolben (9) an der Befestigungsfläche (11) so befestigt ist, dass bei einem Kompressionshub des Primärkolbens (7) eine Kompression des Zylinderschmieröls (2) innerhalb der Einspritzbohrung (8) erzeugt wird und die vorgebbare Menge des Zylinderschmieröls (2) der Öffnung des Schmierstutzens des Zylinders des Verbrennungsmotors zugeführt wird.

8. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei eine erste Arbeitsfläche (701) und / oder eine zweite Arbeitsfläche (702) des Primärkolbens (7) durch eine Arbeitshydraulikflüssigkeit (12) mit Druck beaufschlagt werden kann um den Kompressionshub des Primärkolbens (7) auszuführen, und / oder wobei die erste Arbeitsfläche (701) und / oder die zweite Arbeitsfläche (702) des Primärkolbens (7) durch die Arbeitshydraulikflüssigkeit (12) mit Druck beaufschlagt werden kann um den Nachladehub des Primärkolbens (7) auszuführen.

9. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei die erste Arbeitsfläche (701) und / oder die zweite Arbeitsfläche (702) des Primärkolbens (7) durch eine Feder mit Druck beaufschlagt werden kann um den Kompressionshub und / oder den Nachladehub des Primärkolbens (7) auszuführen.

10. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei der Primärkolben (7) durch einen Sekundärkolben (72) bewegt werden kann um den Kompressionshub und / oder den Nachladehub des Primärkolbens (7) auszuführen.

11. Schmierölpumpe nach Anspruch 10, wobei der Sekundärkolben (72) entlang der Zylinderachse (10) innerhalb einer sekundären Hydraulikzylinderbohrung (42) hin- und her bewegbar angeordnet ist, insbesondere in einer sekundären Hydraulikzylinderbohrung mit einem kleineren Durchmesser als die Haupthydraulikzylinderbohrung (4), und durch eine Arbeitshydraulikflüssigkeit (12) mit Druck beaufschlagt werden kann um eine Antriebsbewegung entlang der Zylinderachse (10) auszuführen.

12. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei der Einspritzkolben (9) an der zweiten axialen Endfläche (6) der Haupthydraulikzylinderbohrung (4) ortsfest befestigt ist, oder wobei der Einspritzkolben (9) an der ersten axialen Endfläche (6) der Haupthydraulikzylinderbohrung (4) ortsfest befestigt ist.

13. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei der Primärkolbens (7) ein doppeltwirkender Primärkolben (7) ist, der einen Kompressionshub bezüglich der ersten axialen Endfläche (5) ausführen kann, und zur gleichen Zeit einen Nachladehub bezüglich der zweiten axialen Endfläche (6) ausführen kann oder umgekehrt.

14. Schmierölpumpe nach einem der vorhergehenden Ansprüche, wobei das Schmiervolumen (V) einstellbar ist.

15. Zylinder-Schmieranordnung, die eine Schmierölpumpe (1) nach einem der vorhergehenden Ansprüche umfasst.

16. Zylinder-Schmieranordnung nach Anspruch 15, wobei eine druckbeaufschlagbare Ölversorgung vorgesehen ist, die mit einem Schmieröleinlass (V1) der Schmierölpumpe (1) verbunden ist und wobei insbesondere die druckbeaufschlagbare Ölversorgung ein Common-Rail-Akkumulator ist.

17. Verbrennungsmotor, insbesondere Zweitakt-Grossdieselmotor, der die Schmierölpumpe (1) nach einem der Ansprüche 1 bis 14 umfasst oder der eine Zylinder-Schmieranordnung nach Anspruch 15 oder

16 umfasst.

Revendications

1. Une pompe à huile de lubrification pour doser une quantité prédéfinissable d'une huile de lubrification de cylindre (2) à une ouverture d'un embout de lubrification d'un cylindre d'un gros moteur diesel à deux temps, ladite pompe à huile de lubrification comprenant un boîtier (3) avec une section de cylindre hydraulique principal (4), qui a une première face d'extrémité axiale (5) et une deuxième face d'extrémité axiale (6), ladite pompe à huile de lubrification comprenant en outre une section de piston primaire (7) à l'intérieur de la section de cylindre hydraulique principal (4), dans lequel la section de piston primaire (7) comprend au moins deux alésages d'injection (8) pour recevoir chacun un piston d'injection (9) de telle manière que chaque alésage d'injection (8) et le piston d'injection (9) qui y est disposé forment un volume de lubrification (V) pour doser la quantité prédéfinissable de l'huile de lubrification du cylindre (2), et qu'ils sont mobiles l'un par rapport à l'autre le long d'un axe de cylindre (10), **caractérisé en ce que** chaque alésage d'injection (8) est relié par un petit trou à sa propre rainure axiale (V12), qui est travaillée dans une surface extérieure de la section de piston primaire (7), et que chaque rainure axiale (V12) s'ouvre et se ferme contre une rainure de remplissage travaillée dans la section de cylindre hydraulique principal (4), à chaque passage de la section de piston primaire (7).

2. Une pompe à huile de lubrification selon la revendication 1, dans laquelle le piston d'injection (9) ou la section de piston primaire (7) est stationnaire par rapport à une surface de montage (11) du boîtier (3) et / ou est fixé de manière fixe à une surface de montage (11) du boîtier (3).

3. Une pompe à huile de lubrification selon la revendication 1 ou 2, dans laquelle la section de piston primaire (7) est un piston primaire (7), qui est disposé à l'intérieur d'un alésage de cylindre hydraulique principal (4) de la section de cylindre hydraulique principal pouvant être déplacé d'avant en arrière le long de l'axe du cylindre.

4. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le piston d'injection (9) est disposé à l'intérieur d'un alésage de cylindre hydraulique principal (4) de la section de cylindre hydraulique principal pouvant être déplacé d'avant en arrière le long de l'axe du cylindre, et dans laquelle en particulier le piston d'injection (9) ou en particulier une pluralité de pistons d'injection (9) est ou sont monté sur une plaque de piston, qui est déplacé d'avant en arrière le long de l'axe du cylindre (10) à l'intérieur de l'alésage de cylindre hydraulique principal (4).

5. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le volume de lubrification (V) peut être connecté à une entrée d'huile de lubrification (V1) pour fournir la quantité prédéfinissable d'huile de lubrification (2) au volume de lubrification (V) et / ou dans laquelle le volume de lubrification (V) peut être connecté à une sortie d'huile de lubrification (V2) pour fournir la quantité prédéfinissable d'huile de lubrification (2) à l'ouverture de l'embout de lubrification.

6. Une pompe à huile de lubrification selon la revendication 5, dans laquelle une ligne de raccordement (V12) est prévue entre l'entrée d'huile de lubrification (V1) et la sortie d'huile de lubrification (V2) de sorte que le volume de lubrification (V) peut être connecté alternativement à l'entrée d'huile de lubrification (V1) ou à la sortie d'huile de lubrification (V2).

7. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le piston d'injection (9) est fixé à la surface de montage (11) de telle sorte que pendant une course de compression du piston primaire (7), une compression de l'huile de lubrification du cylindre (2) à l'intérieur de l'alésage d'injection (8) est produite et la quantité prédéfinissable de l'huile de lubrification du cylindre (2) est fournie à l'ouverture de l'embout de lubrification du cylindre du moteur à combustion interne.

8. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle une première surface de travail (701) et / ou une deuxième surface de travail (702) du piston primaire (7) peut être pressurisée par un fluide hydraulique de travail (12) pour effectuer la course de compression du piston primaire (7), et / ou dans laquelle la première surface de travail (701) et / ou la deuxième surface de travail (702) du piston primaire (7) peut être pressurisée par le fluide hydraulique de travail (12) pour effectuer la course de recharge du piston primaire (7).

9. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle la première surface de travail (701) et / ou la deuxième surface de travail (702) du piston primaire (7) peut être pressurisée par un ressort pour effectuer la course de compression et / ou la course de recharge du piston primaire (7).

10. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le piston primaire (7) peut être déplacé par un piston secon-

daire (72) pour effectuer la course de compression et / ou la course de recharge du piston primaire (7).

11. Une pompe à huile de lubrification selon la revendication 10, dans laquelle le piston secondaire (72) est disposé à l'intérieur d'un alésage de cylindre hydraulique secondaire (42) pouvant être déplacé d'avant en arrière le long de l'axe du cylindre, en particulier dans un alésage de cylindre hydraulique secondaire avec un diamètre inférieur à l'alésage de cylindre hydraulique principal (4), et peut être pressurisé par un fluide hydraulique de travail (12) pour effectuer un mouvement d'entraînement le long de l'axe du cylindre (10).

12. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le piston d'injection (9) est fixé de manière fixe à la deuxième surface d'extrémité axiale (6) de l'alésage de cylindre hydraulique principal (4), ou dans laquelle le piston d'injection (9) est fixé de manière fixe à la première surface d'extrémité axiale (6) de l'alésage de cylindre hydraulique principal (4).

13. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le piston primaire (7) est un piston primaire à double effet (7), qui peut effectuer une course de compression par rapport à la première face d'extrémité axiale (5) et en même temps effectuer une course de recharge par rapport à la deuxième face d'extrémité axiale (6) ou vice versa.

14. Une pompe à huile de lubrification selon l'une des revendications précédentes, dans laquelle le volume de lubrification (V) est réglable.

15. Un dispositif de lubrification de cylindre, qui comprend une pompe à huile de lubrification (1) selon l'une des revendications précédentes.

16. Un dispositif de lubrification de cylindre selon la revendication 15, dans lequel une alimentation en huile pouvant être mise sous pression est prévue, qui est connecté à une entrée d'huile de lubrification (V1) de la pompe à huile de lubrification (1) et dans lequel, en particulier, l'alimentation en huile pouvant être mise sous pression est un accumulateur à rail commun.

17. Un moteur à combustion interne, en particulier un gros moteur diesel à deux temps, qui comprend la pompe à huile de lubrification (1) selon l'une des revendications 1 à 14 ou qui comprend un dispositif de lubrification de cylindre selon la revendication 15 ou 16.

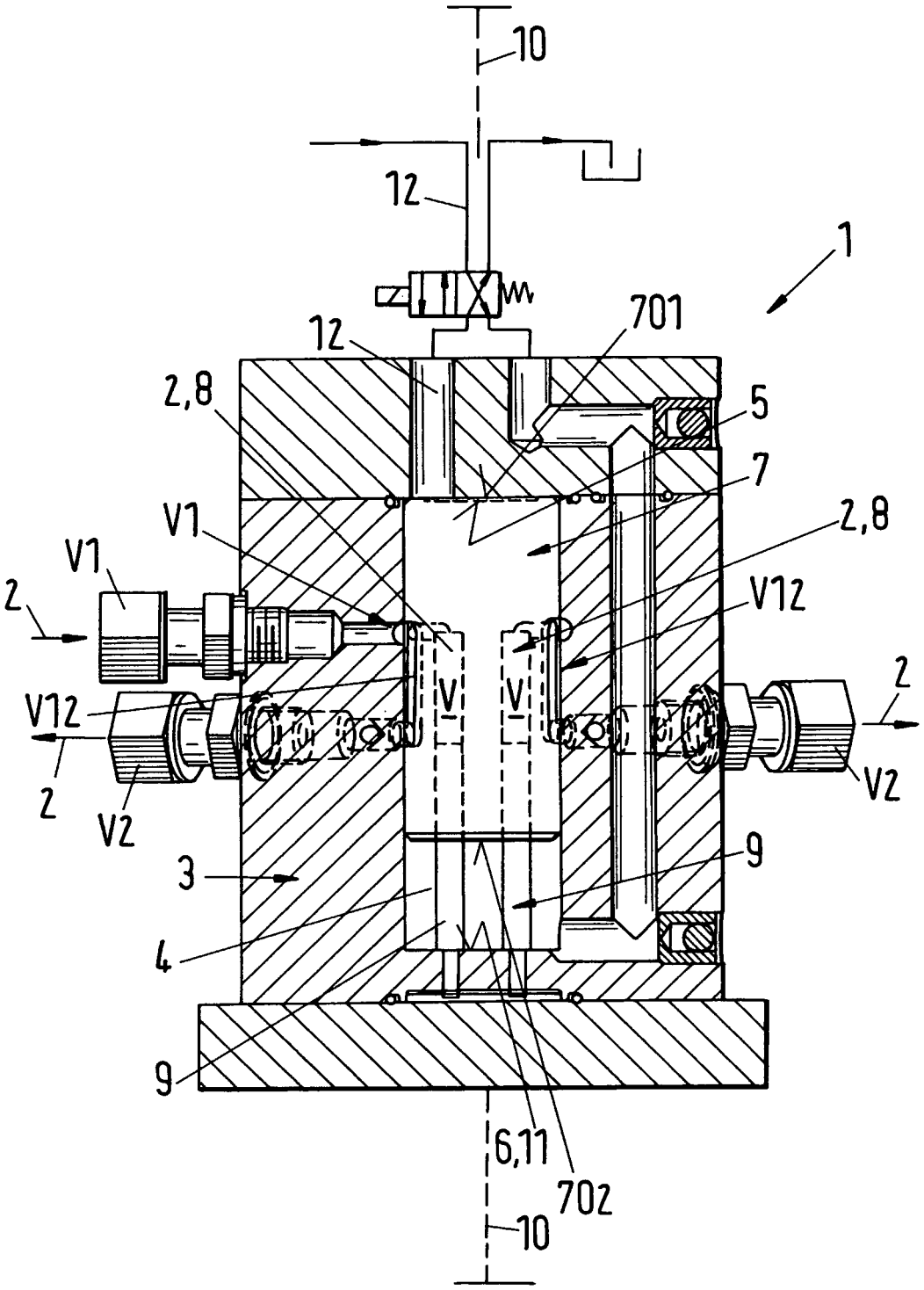

Fig.1

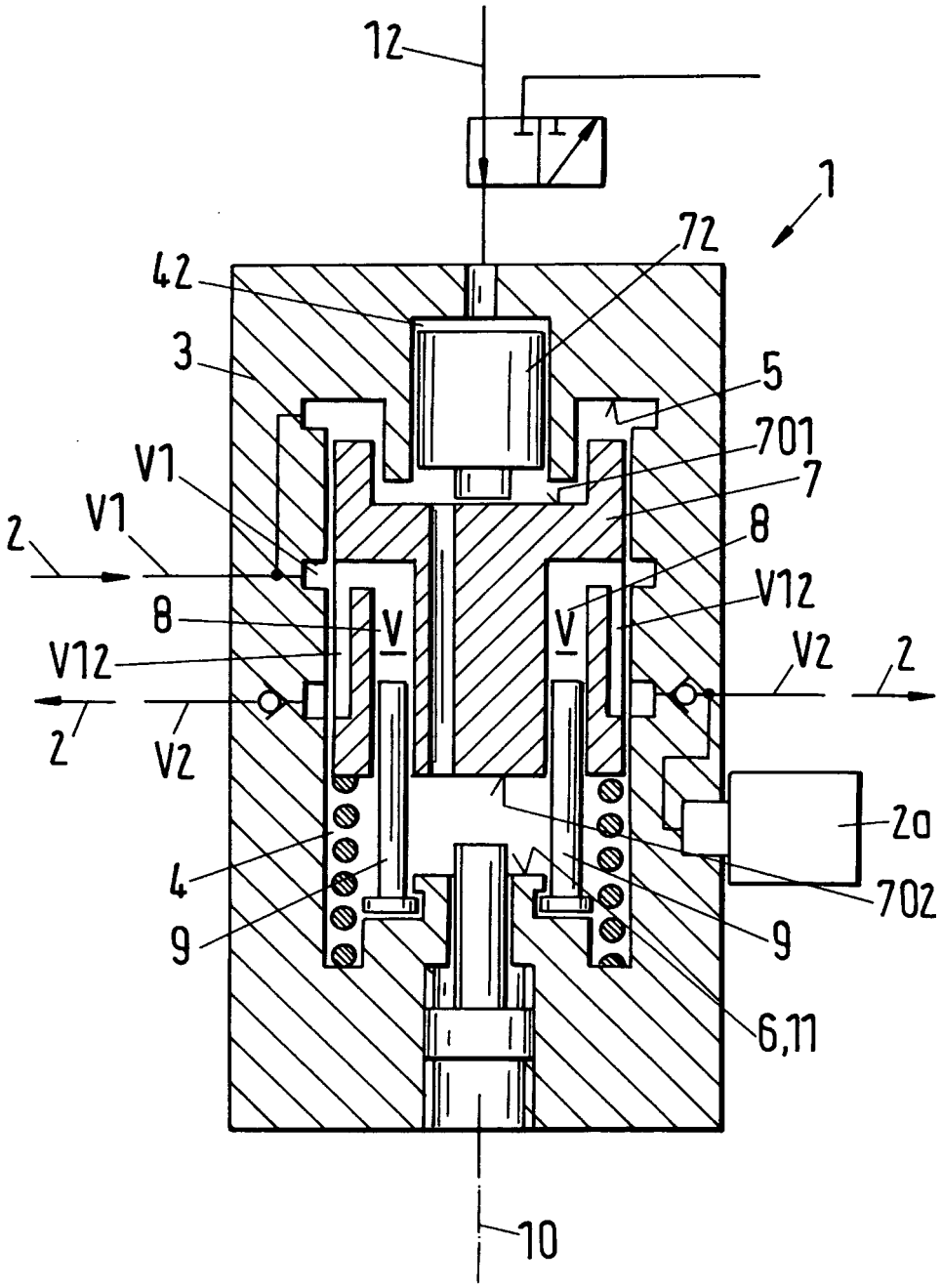

Fig. 2A

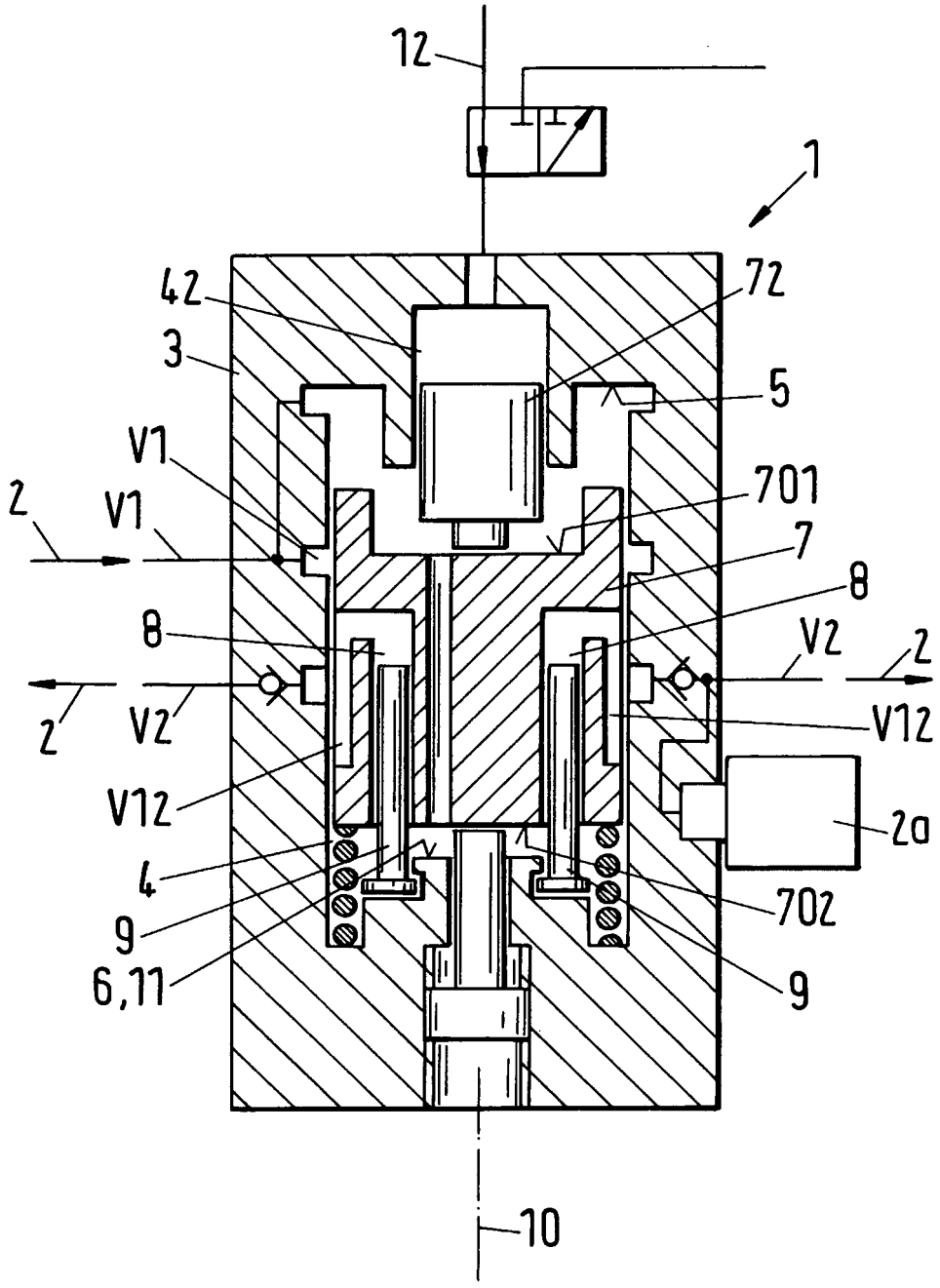

Fig.2B

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CH 673506 **[0005]**
- DE 19743955 B4 **[0005]**
- EP 1386063 A1 **[0005]**
- JP 01116209 A **[0005]**
- JP 2003003966 B **[0005]**
- DE 20107681 U1 **[0005]**