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

(11) EP 2 372 167 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.10.2011 Bulletin 2011/40

(51) Int Cl.:
F15B 11/00 *(2006.01)* ***F15B 13/02*** *(2006.01)*

(21) Application number: **10425101.2**

(22) Date of filing: **30.03.2010**

(84) Designated Contracting States:
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
Designated Extension States:
AL BA ME RS

(71) Applicant: **Bosch Rexroth Oil Control S.p.A.**
20149 Milano (IT)

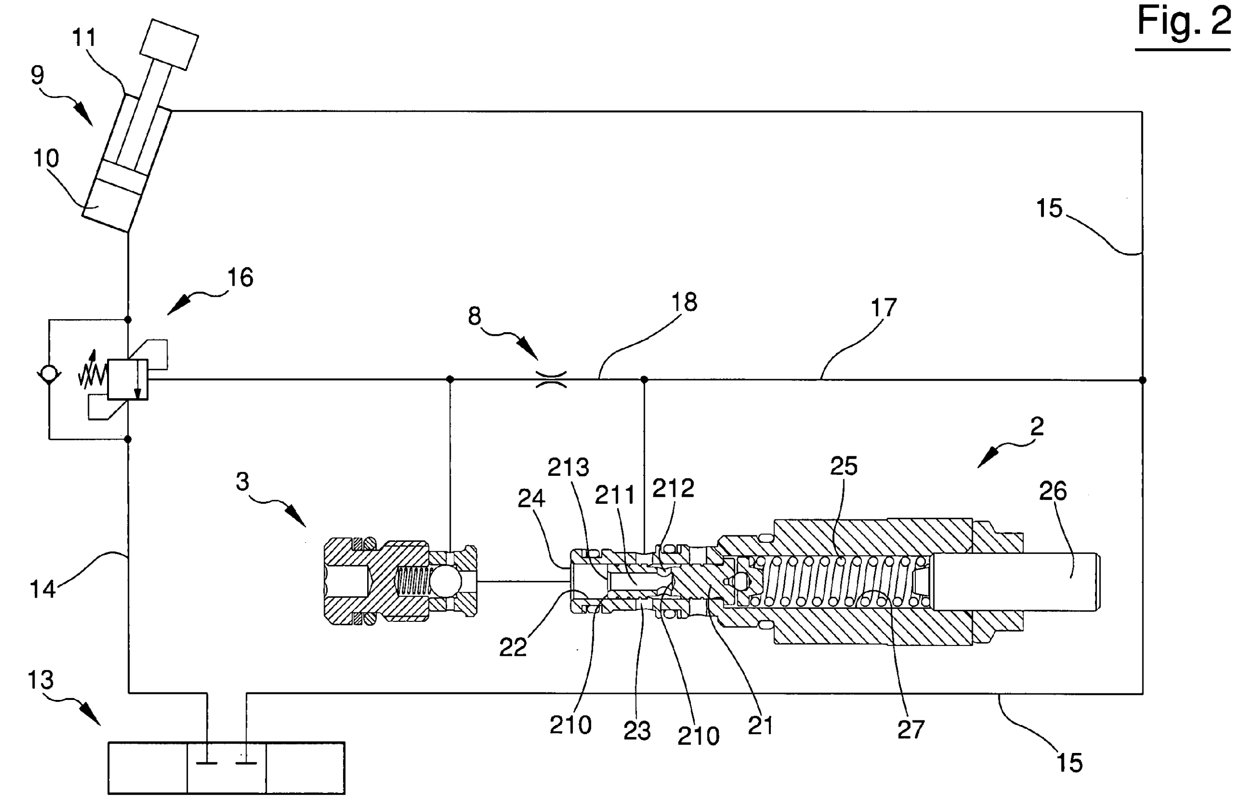
(72) Inventor: **Storci, Andrea**
41015 Nonantola (Modena) (IT)

(74) Representative: **Colò, Chiara**
Bugnion S.p.A.
Via Vellani Marchi, 20
41124 Modena (IT)

(54) **A device for controlling a piloting pressure, in particular of a balance valve.**

(57) The device for controlling a piloting pressure comprises: a choke (8), predisposed to be interposed between a piloting fluid source and an organ (16) activatable by the piloting fluid; a valve (2), arranged in parallel to the choke (8), which valve (2) is normally open and is predisposed to close when the piloting fluid pressure reaches a determined value; the valve (2) being a pressure reducer valve provided with an obturator (21).

Fig. 2



EP 2 372 167 A1

Description

[0001] The invention relates to a device for controlling a piloting pressure, in particular the piloting pressure of a balance valve.

[0002] The prior art contains hydraulic activating circuits for hydraulic actuators, for example for a cylinder of an arm of a lifting apparatus, in which a first circuit branch connects a hydraulic distributor, in turn associated to a pump, with the chamber of the actuator being associated to the lifting of the load and a second branch connects the distributor with the chamber associated to the descent of the load. The circuit is provided with a balance valve predisposed for controlling the fluid flow along the first branch during the descent stage of the load. A piloting conduit removes a piloting pressure from the second branch which piloting pressure acts by opening the balance valve during the descent stage of the load.

[0003] In a circuit of this type instability and oscilation phenomena occur in the balance valve on activation of the cylinder for the descent of the load or the inversion of motion thereof. In particular, on lowering the load there can be a frequent succession of blocks and free-ups of the actuator before stabilisation occurs, which causes dangerous oscillation of the load.

[0004] To resolve the problem chokes have been placed on the piloting conduit. These chokes determine a localised load loss by effect of which the increase in the piloting pressure P_{PIL} commanding the opening of the balance valve is gradual and controlled with respect to the increase in pressure P_B in the second branch (i.e. the branch which during the lowering stage of the load is the delivery branch). In the diagram of figure 1 the curve S approximately represents the progress of the piloting pressure P_{PIL} as a function of the pressure P_B in the second branch using a choke.

[0005] A drawback of the above-cited known solution is the delay in the activation of the cylinder with respect to the operator's command, especially evident when the operating liquid in the hydraulic circuit is very viscous (for example when cold). This delay is due to the presence of the choke and can be schematised in figure 1 by observing that the piloting pressure P_{PIL} reaches value P_V of opening of the balance valve (a value predetermined by the calibration of the valve spring) when the delivery pressure P_B to the cylinder has already reached a relatively high level P_S. This means that the activation of the cylinder during the lowering stage starts from the moment in which the pressure P_B reaches the value P_S. The time required for the pressure P_B to reached value P_S (to which value P_V of the piloting pressure P_{PIL} corresponds) can be relatively high, which determines the mentioned delay.

[0006] In patent EP 1178219 the present Applicant provided a satisfactory solution to the technical problem described above. In that solution, a check valve is located along the piloting conduit, in parallel with the choke. The valve, normally open, enables passage of the piloting fluid up to reaching a determined pressure downstream of the valve. On reaching the determined pressure, the valve closes and the piloting fluid flow continues via the choke. The presence of the check valve, located in parallel with the choke, enables a rapid increase of the piloting pressure in the first stages of sending the piloting signal to the balance valve. In this way, the lowering of the load begins promptly in response to the lowering command.

[0007] The above-described solution exhibits however a not entirely satisfactory aspect. The check valve exhibits a certain tendency to closure following pressure peaks or flow peaks along the piloting conduit. As these pressure or flow peaks are rather frequent, so are the closures of the check valve, which undesirably slow down the opening of the balance valve.

[0008] The aim of the present invention is to realise a device for control of a piloting pressure of a balance valve which enables reduction of the delay in response of the balance valve or, more in general, of a hydraulically-piloted organ.

[0009] An advantage of the invention is that is provides a device which enables prompt and progressive activation of the piloted organ.

[0010] A further advantage of the invention is to considerably reduce the delay in opening of the balance valve in an activating circuit for a hydraulic actuator and to prevent onset of instability and oscillation phenomena of the valve. Further characteristics and advantages of the present invention will more fully emerge from the detailed description that follows of some preferred though not exclusive embodiments, which are illustrated purely by way of example in the accompanying figures of the drawings, in which:

- figure 1 is a diagram indicating the piloting pressure P_{PIL} according to the pressure P_B in the delivery conduit during the lowering stage of the load, respectively for a known valve (curve S) and for a valve made according to the invention (curve T);
- figure 2 is a schematic illustration of an embodiment of the invention, combined to an activating circuit for a hydraulic actuator, wherein a pressure reducer valve is in an open configuration;
- figure 3 shows the device of figure 2 in which the pressure reducer valve is in a closed configuration;
- figures 4 and 5 show a variant of the device illustrated in figures 2 and 3, wherein the pressure reduction valve is respectively in an open and closed configuration.

Figure 2 illustrates an activating circuit for a hydraulic actuator 9 which, merely by way of example, is constituted by a cylinder.

[0011] The hydraulic actuator 9 has a first chamber 10 and a second chamber 11 respectively associated to the raising and lowering of a load 12.

[0012] The activating circuit comprises a hydraulic distributor 13 in turn connected to a source of operating fluid under pressure, typically a pump. A first branch 14 connects the distributor 13 with the first chamber 10, while a second branch 15 connects the distributor 13 with the second chamber 11. A balance valve 16 is arranged along the first branch 14 to regulate the flow rate of operating fluid which unloads from the first chamber 10 during the descent stage of the load 12. A piloting conduit 17 takes from the second branch 15 a piloting pressure which acts to open the flow rate control valve 16.

[0013] The balance valve 16, of known type, exhibits a first connection which is connected to the first chamber 10 and a second connection connected to the distributor 13. The balance valve has a obturator which is mobile between the open position, in which the first connection is set in communication with the second connection, and a closed position, wherein the first and the second connections are not in communication with one another. The obturator of the balance valve 16 is pushed towards the closed position thereof by means of a spring, while it is pushed towards its open position by the force exerted thereon by the pressure exerted by the piloting fluid removed from the second branch 15. The balance valve comprises a single-acting valve connected in parallel to the obturator for enabling free flow of the piloting fluid from the second to the first connection.

[0014] The function of the balance valve 16 is to enable, during raising of the load, free flow of the operating liquid 13 to the first chamber 10 of the actuator 9. During the descent of the load, the balance valve 16 controls and limits the flow rate of the operating fluid which unloads from the first chamber 10 towards the distributor 13, such as to slow down the descent of the load. The device of the present invention, illustrated in figure 2, is predisposed to be positioned along the piloting conduit 17. It comprises a choke 8, predisposed to be interposed between a piloting fluid source and an organ 16, in particular the balance valve 16, which is activatable by the piloting fluid. The device further comprises a pressure reducer valve 2, arranged in parallel with the choke 8, which is normally open and is predisposed to close when the piloting fluid pressure reaches a determined level.

[0015] The reducer valve 2 is provided with an obturator 21 which is mobile between an open position, in which the piloting fluid flow is enabled through the reducer valve 2, and a closed position, in which the piloting fluid flow is not enabled through the reducer valve 2. The obturator 21 is pushed towards the open position thereof by effect of the thrust exerted by an elastic element 25, while it is pushed towards the closed position thereof by effect of the thrust exerted by the piloting fluid pressure on a thrust surface 210 of the obturator 21. The thrust surface 210 is defined by the front section of the obturator 21, i.e. by the area of the circle delimited by the external edge of the obturator 21.

[0016] The obturator 21 is advantageously conformed and arranged such that the thrust surface 210 is not exposed to the direct flow of the piloting liquid in inlet to the reducer valve 2. The thrust surface 210 is exposed directly only to the piloting fluid pressure downstream of the reducer valve 2.

[0017] The conformation of the obturator 21 and the arrangement of the thrust surface 210 are such that any peaks of flow rate and/or pressure of the piloting fluid in inlet to the reducer valve 2 do not have the effect of nudging the obturator 21 towards the closed position. The obturator 21 is only subject to the effect of the pressure present downstream of the reducer valve 2, which pressure also acts on the balance valve 16. In this way any peaks of flow rate and/or pressure of the piloting fluid in inlet to the reducer valve 2, as they do not nudge the obturator 21 to closure, do not slow down the flow of the piloting fluid towards the balance valve 16.

[0018] The obturator 21 is sealedly slidable along a longitudinal axis x internally of a seating 22. The seating 22 exhibits at least an inlet opening 23, predisposed to be connected to the piloting conduit 17, and at least an outlet opening 24 predisposed to be connected to the balance valve 16. The obturator 21 is mobile between at least an open position (figure 2), in which the inlet opening 23 and the outlet opening 24 are in communication and the piloting fluid can flow from the inlet opening to the outlet opening, and at least a closed position (figure 3), in which communication between the inlet opening and the outlet opening is prevented. An elastic element 25, preferably a helical spring possible provided with a calibrating organ 26 is predisposed to push the obturator 21 towards the open position. Differently, the pressure downstream of the outlet opening 24, which unloads on the thrust surface 210, pushes the obturator 21 towards the closed position.

[0019] The obturator 21 exhibits a communicating conduit 211 arranged longitudinally and parallel to the sliding direction of the obturator 21. The communicating conduit 211 is provided with a first opening 212 and a second opening 213.

[0020] The second opening 213 is set in communication with the outlet opening 24 of the reducer valve 2. The first opening 212, in the open position of the obturator 21, is in communication with the inlet opening 23 of the reducer valve 2, such that the inlet opening 23 is in communication with the outlet opening 24 via the first opening 212, the communicating conduit 211 and the second opening 213. In the closed position of the obturator 21, the first opening 212 is not in communication with the inlet opening 23 of the reducer valve 2. To this end, the first opening 212 is arranged at an annular groove 214 located on the lateral surface of the obturator 21. The annular groove 214 delimits, in cooperation with the internal wall of the seating 22, an annular chamber into which the first opening 212 opens.

[0021] In the open position of the obturator 21, the annular chamber at least partly faces the inlet opening 23 of the reducer valve 2, while in the closed position of the obturator 21 the annular chamber is not in communication with the inlet opening 23. The first opening 212 develops perpendicular to the communicating conduit 211, such that the piloting fluid coming from the inlet opening 23 of the reducer valve 2 flows internally of the communicating conduit 211 from a transversal direction with respect to the longitudinal development of the communicating conduit 211. In this way, the dynamic effect due to the flow of the piloting fluid in inlet to the communicating conduit 211 is directed perpendicular to the sliding direction of the obturator 21, and the obturator 21 is therefore not pushed to slide.

[0022] The inlet opening 23 and the first opening 212 are substantially facing in the same direction. The outlet opening 24 and the second opening 213 are reciprocally aligned. The directions of orientation of the inlet opening and the first opening are in turn perpendicular to the orientation direction of the outlet opening and the second opening.

[0023] As already mentioned herein above, the special conformation of the obturator 21 is such that the obturator 21 does not suffer from any pressure or flow rate peaks on opening the inlet 23 of the reducer valve 2. The displacement of the obturator 21 towards the closed position is determined only by the pressure present at the outlet opening 24 of the reducer valve 2. In this way, the reducer valve 2 does not perform undesired and unexpected closures, but closes only when the pressure present at the outlet opening 24 reaches a determined value, in particular a value determined by the force exerted by the elastic element 25.

[0024] The elastic element 25 or spring is housed in a low-pressure chamber 27. In particular the chamber 27 of the spring 25 is set in communication with the first branch 14 of the circuit connecting the distributor 13 with the first chamber 10 of the actuator 9, which chamber 10 is associated to the raising of the load. During the stages of supporting and lowering the load, this branch is normally at low pressure, and the spring chamber of the reducer valve is also at low pressure. The eventual presence of pressure in the chamber 27 would raise the calibration value of the reducer valve 2, i.e. the pressure required for determining the displacement of the obturator 21 towards the closed position. This might effectively occur by effect of a pressurised oil flow present in the first branch 14 of the circuit during the descent. In this condition the calibration of the reducer valve 2, i.e. the pressure required for displacing the obturator 21 towards the closed position, would increase slightly and, consequently, the pressure transmitted to the piloting of the balance valve would also increase, in this way facilitating the opening of the valve. Alternatively to the connection with the first branch 14, the chamber 27 containing the spring 25 might also be ventilated by air.

[0025] A single-acting valve 3 can be interposed between the reducer valve 2 and the balance valve 16, which single-acting valve 3 has a function of enabling flow of the fluid only from the reducer valve 2 towards the piloting of the balance valve 16, while reverse flow is prevented. In this way all unexpected back-flow of the piloting fluid in outlet from the piloting of the balance valve 16 is prevented. This unexpected flow might obtain in a case of a pressure drop in the second branch 15 of the circuit, and might lead to an undesired closing of the balance valve 16.

[0026] The functioning of the reducer valve 2 and the activating circuit of the hydraulic actuator 9 are as follows.

[0027] On starting the load lowering stage, i.e. when the distributor 13 is brought into a configuration in which the operating fluid is sent to the second chamber 11 of the actuator 9 through the second branch 15, the pressure P_B is in the second branch 15 is raised, and therefore also in the piloting conduit 17. The piloting pressure P_{PIL} on connection of piloting of the balance valve 16 reaches the predetermined value for the opening of the valve in a relatively brief time. This pressure increases rapidly up to the predetermined calibrated pressure of the reducer valve 2, which is normally open. On reaching the predetermined calibrated pressure P_X of the reducer valve 2, the obturator 21 displaces into the closed position and the piloting fluid flow proceeds through the choke 8, such that the piloting pressure P_{PIL} further increases through the choke up to reaching the value P_V at which the balance valve 16 opens. Thereafter, on closure of the reducer valve 2, the piloting pressure P_{PIL} increases from value P_X to value P_V at a smaller inclination with respect to a situation in which the reducer valve 2 is open, as shown by the curve T of figure 1. This smaller inclination depends on the pressure drop caused by the choke 8.

[0028] The curve S of figure 1 denotes the progress of the piloting pressure P_{PIL} for a control device comprising only the choke 8 but not the reducer valve 2. The curve S clearly shows how the piloting pressure P_{PIL} reaches the start value P_V of the opening of the balance valve 16 when the pressure P_B in the second branch 15 is at a decidedly greater value than the curve T. This means that, thanks to the device of the invention, the balance valve 16 opens decidedly before, such that the lowering of the load follows very rapidly on from the operator's descent command.

[0029] It has further been observed that the choke 8, which has the task of stabilising the functioning of the actuator 9 during the descent stage of the load, effectively performs this task even where the passage section is relatively large. In particular, the choke 8 of the device of the invention can be decidedly more open with respect to a stabilising choke in a device lacking the reducer valve 2. Consequently it can be seen from figure 1 that the inclination of the curve S, relative to a more accentuated choke, is less than the inclination of the second tract of the curve T, which relates to the choke used in the present device, in which P_{PIL} is greater than P_X. This enables the operator to have an even more direct and immediate control of the actuator 9, as the response of the actuator 9 is even more prompt for each positional variation of the distributor 13.

[0030] During the descent manoeuvre it can happen that the load has to be sharply halted, either by a command of the operator or following an eventual fault or breakage of a tube. In order to enable rapid halting, the balance valve 16, the obturator of which has been piloted, i.e. pushed, into the open position by the piloting fluid, has to return to the closed position, sending at least a part of the piloting fluid in discharge.

[0031] For closure of the balance valve 16, the piloting fluid can be discharged only passing through the choke 8, due to the presence of the single-acting valve 3. This might cause an undesired delay in the closure of the obturator of the balance valve 16, and therefore an excessive delay in the halting of the load.

[0032] To obviate this delay, the device of the present invention, as illustrated in figures 4 and 5, can advantageously be provided with a pressure limiter valve 4 arranged in parallel with the choke 8 and the reducer valve 2. The limiter valve is provided with an obturator which is mobile between an open position, in which the operating fluid flow through the valve is enabled, and a closed position, in which the flow is not enabled. The obturator is pushed towards the closed position by effect of the thrust exerted by an elastic means, while it is pushed towards the open position by the piloting fluid pressure. The limiter valve 4 enables the piloting fluid flow only from the balance valve 16 to the second branch 15, while it prevents the reverse flow, and enables flow only if the piloting fluid pressure rises above a determined value corresponding to the thrust exerted by the elastic means. At least a part of the piloting fluid can be rapidly discharge through the limiter valve 4, such as to enable the obturator of the balance valve 16 to displace rapidly towards the closed position thereof, at least for a considerable part of the run towards the closed position. Although the above description relates to the use of the device in combination with a balance valve, the device of the invention can be used for controlling the piloting pressure towards any hydraulically-piloted organ, with the aim of having a very rapid start-up of the piloted organ in response to an external command supplied via the piloting pressure supply. The device obviates delays in start-up of the hydraulically-piloted organ while at the same time preventing instability phenomena in the functioning of the piloted organ after start-up.

Claims

1. A device for controlling a piloting pressure, comprising: a choke (8), predisposed to be interposed between a piloting fluid source and an organ (16) activatable by the piloting fluid; a valve (2), arranged in parallel to the choke (8), which valve (2) is normally open and is predisposed to close when the piloting fluid pressure reaches a determined value; **characterised in that** the valve (2) is a pressure reducer valve provided with an obturator (21).

2. The device of claim 1, wherein the obturator (21) is mobile between an open position, in which a piloting fluid flow is enabled through the reducer valve (2), and a closed position, in which the piloting fluid flow is not enabled through the reducer valve (2), the obturator being pushed towards the open position thereof by effect of a thrust exerted by an elastic element (25), the obturator being pushed towards the closed position thereof by effect of the thrust exerted by the piloting fluid pressure on a thrust surface (210) of the obturator (21).

3. The device of claim 2, wherein the obturator (21) is conformed and arranged such that the thrust surface (210) is not exposed to a direct flow of the piloting fluid in inlet to the reducer valve (2).

4. The device of claims 2 or 3, wherein the thrust surface (210) is directly exposed to the direct flow of the piloting fluid in inlet to the reducer valve (2).

5. The device of one of the preceding claims, wherein the obturator (21) is sealedly slidable along a seating (22) which exhibits at least an inlet opening (23) predisposed to receive the piloting fluid, and at least an outlet opening (24), through which the piloting fluid can be sent to the organ (16).

6. The device of claim 5, wherein the obturator (21) is mobile between at least an open position, in which the inlet opening (23) and the outlet opening (24) are in mutual communication and the piloting fluid can flow from the inlet opening to the outlet opening, and at least a closed position, in which the communication between the inlet opening and the outlet opening is prevented.

7. The device of claim 6, wherein: the obturator (21) exhibits a communicating conduit (211) provided with a first opening (212) and a second opening (213); the second opening (213) is set in communication with the outlet opening (24) of the reducer valve (2); the first opening (212), in the open position of the obturator (21), is in communication with the inlet opening (23), such that the inlet opening (23) is in communication with the outlet opening (24) via the first opening (212), the communicating conduit (211) and the second opening (213); in the closed position of the obturator (21), the first opening (212) is not in communication with the inlet opening (23).

8. The device of claim 7, wherein: the inlet opening (23) and the first opening (212) substantially face in a same direction; the outlet opening (24) and the second opening (213) are aligned to one another; the orientation direction of the inlet opening (23) and the first opening (212) are perpendicular to the alignment direction of the outlet opening (24) and the second

opening (213).

9. The device of claim 8, wherein: the first opening (212) is arranged at an annular channel (214), afforded on the lateral surface of the obturator (21), which delimits, in cooperation with the internal wall of the seating (22), an annular chamber in which the first opening (212) opens; in the open position of the obturator (21), the annular chamber at least partly faces the inlet opening (23); in the closure position of the obturator (21) the annular chamber is not in communication with the inlet opening (23).

10. The device of one of claims from 2 to 9, wherein the elastic element or spring (25) is housed in a low-pressure chamber (27).

11. The device of claim 10, wherein the chamber (27) of the elastic element (25) is open to air.

12. The device of one of the preceding claims, comprising a single-acting valve (3) arranged downstream of the reducer valve (2), which is predisposed to enable flow of the piloting fluid from the reducer valve (2) towards the organ to be piloted (16) and to prevent a reverse flow.

13. The device of one of the preceding claims, comprising a pressure limiter valve (4), arranged in parallel to the choke (8) and to the reducer valve (2), which is predisposed to enable the piloting fluid flow in discharge from the organ (16) and to prevent a reverse flow.

14. An activating circuit for a hydraulic actuator (9), comprising: a hydraulic cylinder (13); a first branch (14) predisposed to connect the distributor (13) with a first chamber (10) of the hydraulic actuator (9); a second branch (15) predisposed to connect the distributor (13) with a second chamber (11) of the hydraulic actuator (9); a balance valve (16), arranged along the first branch (14) in order to regulate the operating fluid flow in outlet from the first chamber (10) during a lowering stage of the load (12); a choke (8) interposed between the second branch (15) and the balance valve (16); **characterised in that** it comprises a device for controlling the piloting pressure as in one of the preceding claims, arranged in parallel to the choke (8) between the second branch (15) and the balance valve (16).

Fig. 1

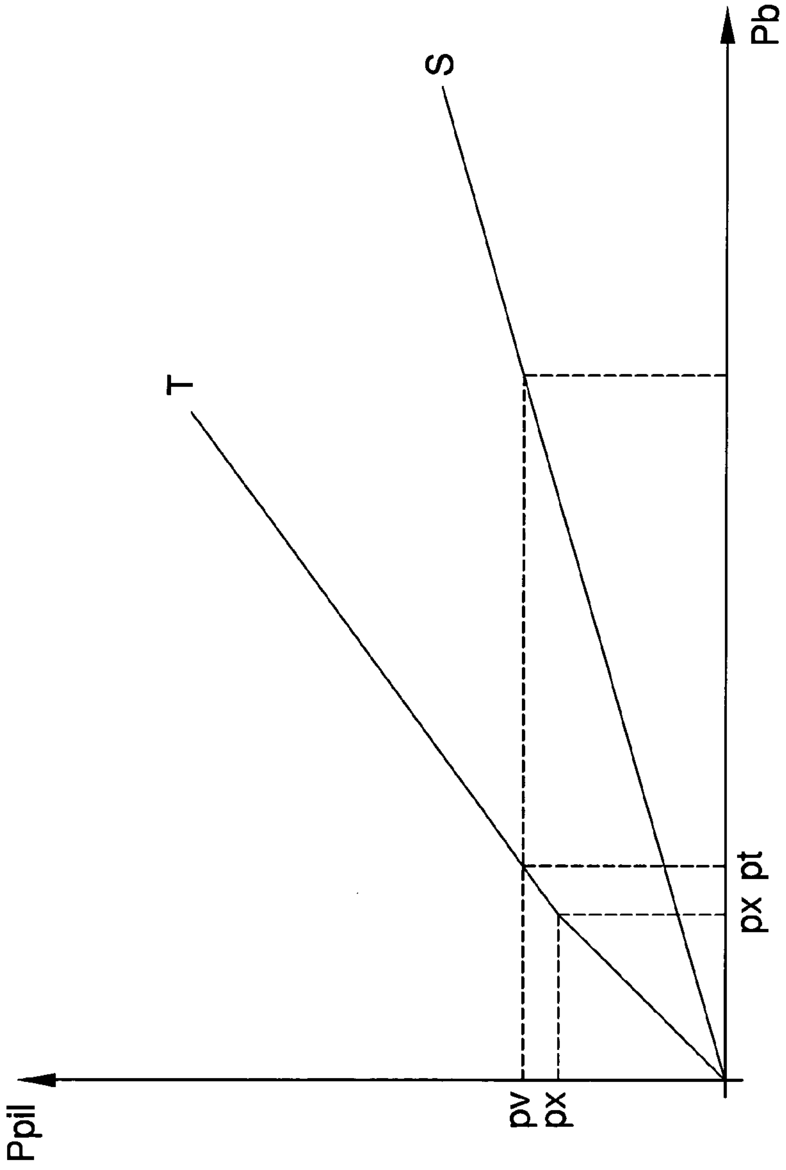


Fig. 2

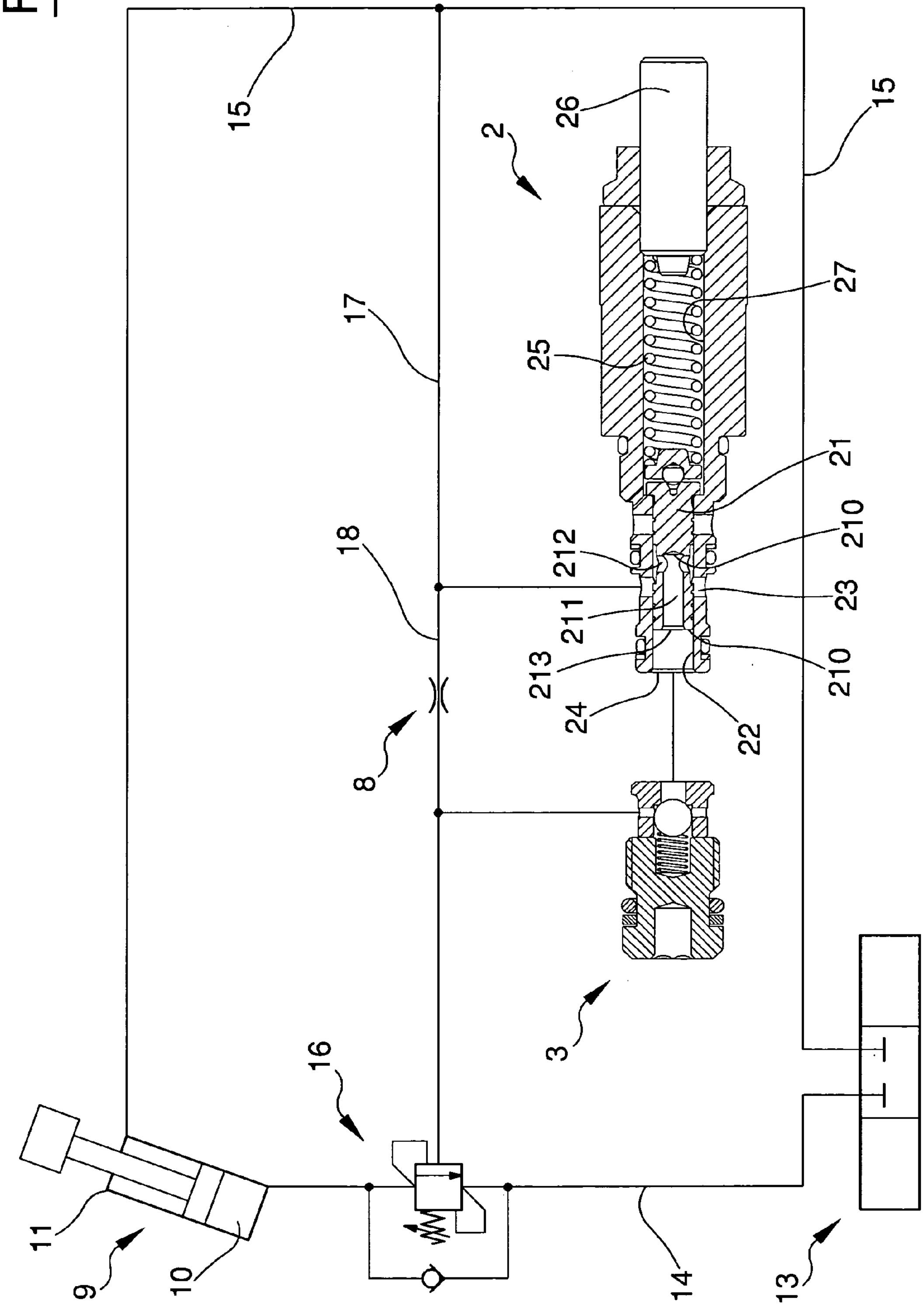

15
2
26
15
27
17
25
21
210
18
212
23
211
213
210
24
22
8
3
16
11
9
10
14
13

Fig. 3

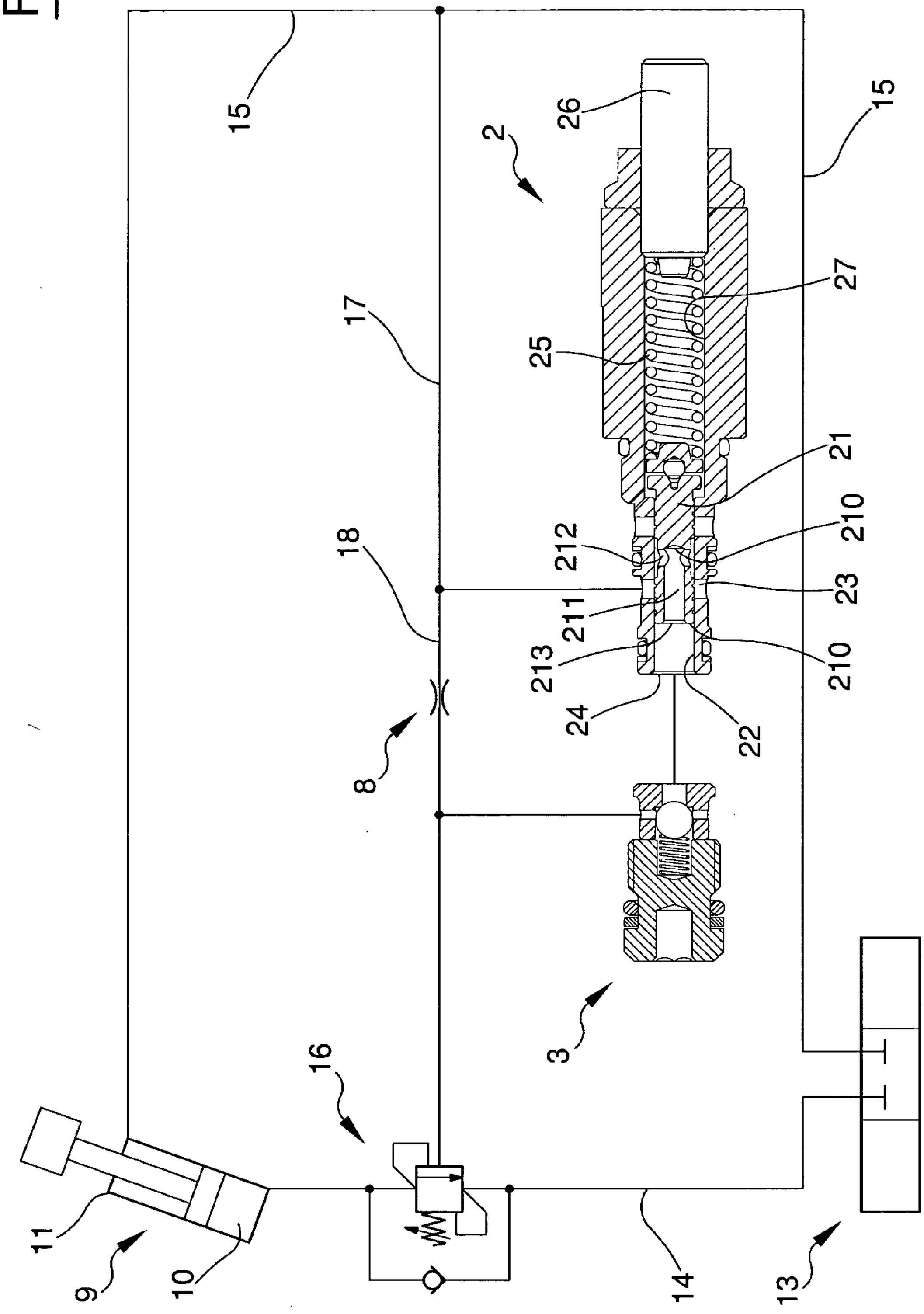

15
15
2
26
27
17
25
21
210
212
18
23
211
213
210
24
22
8
3
16
11
9
10
14
13

Fig.4

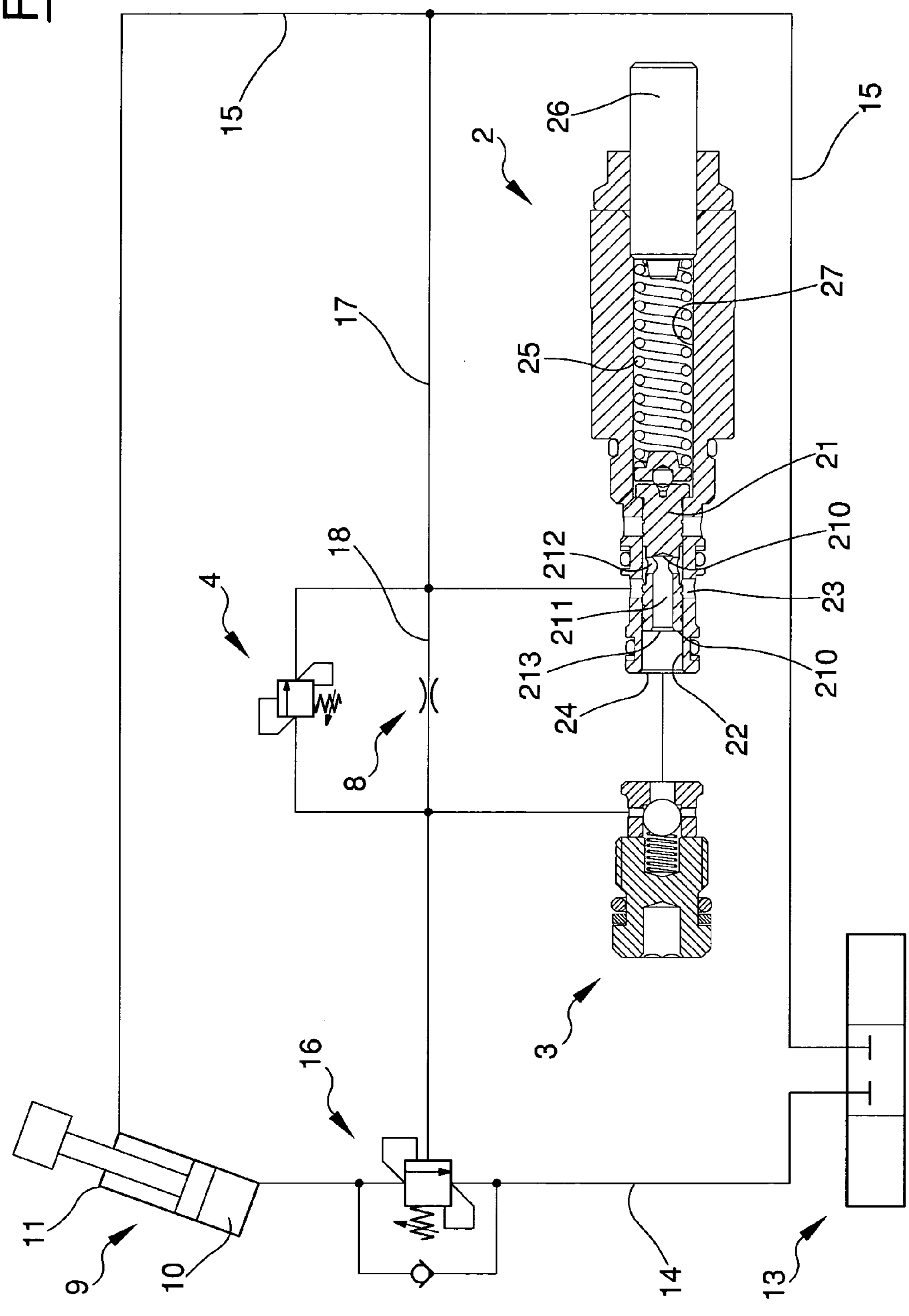
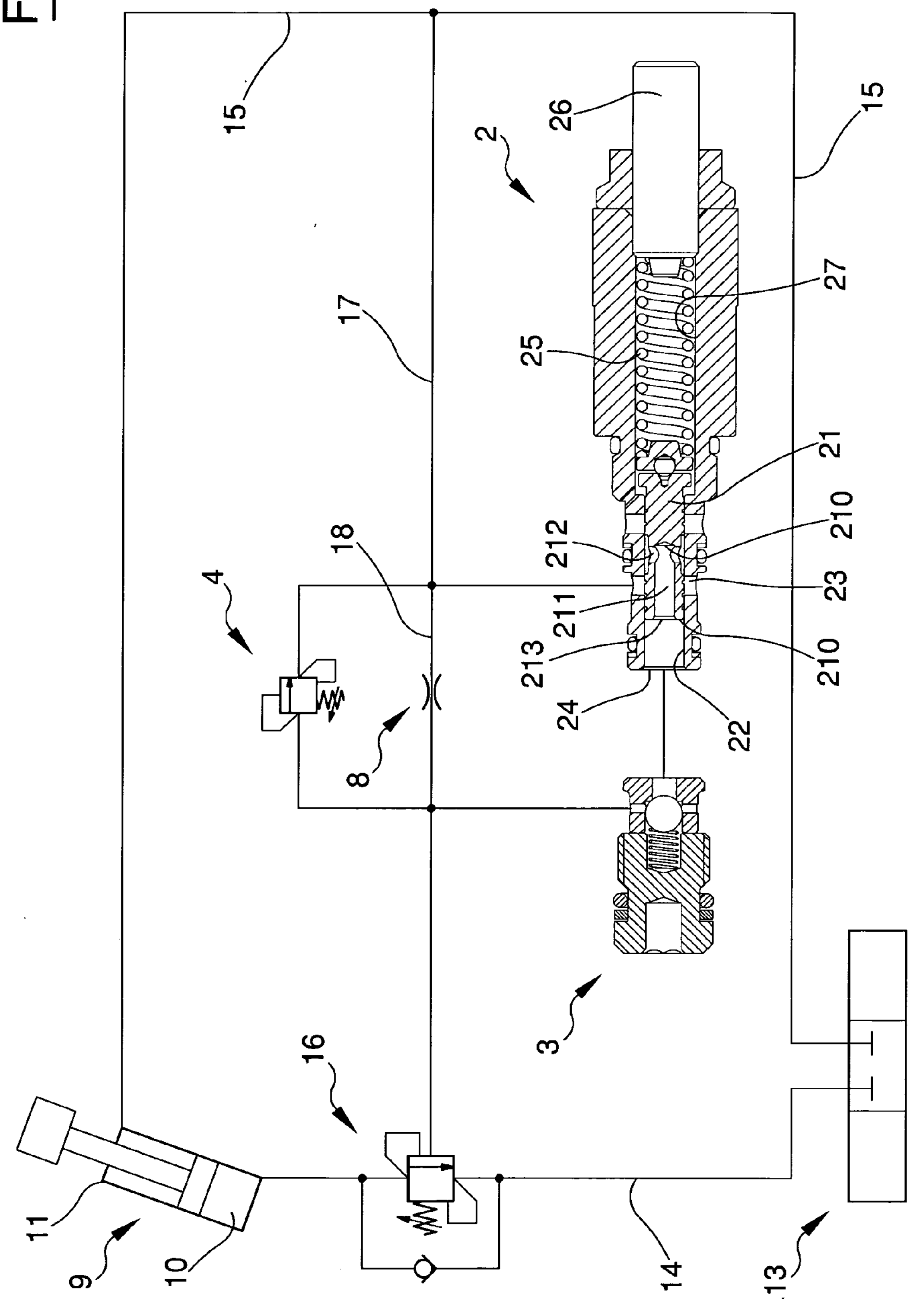

15
15
2
26
27
25
17
21
210
212
18
4
23
211
213
210
24
22
8
3
16
11
9
10
14
13

Fig. 5


15
15
2
26
27
25
17
21
210
212
23
211
18
4
213
210
24
22
8
3
16
11
9
10
14
13

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 42 5101

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	JP 59 016022 A (UCHIDA YUATSU KIKI KOGYO KK) 27 January 1984 (1984-01-27) * abstract; figure 3 *	1,12 2-11,13, 14	INV. F15B11/00 F15B13/02
X	US 4 523 430 A (MASUDA KENJI [JP]) 18 June 1985 (1985-06-18) * column 1, line 1 - column 2, line 35; figures 4,8 *	1	
Y A	US 2008/302428 A1 (NOMICHI KAORU [JP] ET AL) 11 December 2008 (2008-12-11) * paragraphs [0007] - [0008], [0 23] - [0024]; figure 1 *	2-11 1	
Y A	EP 1 178 219 B1 (OIL CONTROL SPA [IT]) 27 April 2005 (2005-04-27) * claim 1; figure 5 *	14 1	
Y	DE 94 12 530 U1 (HEILMEIER & WEINLEIN [DE]) 10 November 1994 (1994-11-10) * figure 6 *	13	TECHNICAL FIELDS SEARCHED (IPC)
A	DE 94 12 531 U1 (HEILMEIER & WEINLEIN [DE]) 29 September 1994 (1994-09-29) * pages 9-10; figure 1 *	1	F15B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	20 September 2010	Regaud, Christian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 42 5101

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-09-2010

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
JP 59016022	A	27-01-1984	NONE			
US 4523430	A	18-06-1985	DE	3209811	A1	21-10-1982
			DE	3249820	C2	21-01-1988
US 2008302428	A1	11-12-2008	NONE			
EP 1178219	B1	27-04-2005	AT	294332	T	15-05-2005
			DE	60019743	D1	02-06-2005
			DE	60019743	T2	02-03-2006
			EP	1178219	A1	06-02-2002
DE 9412530	U1	10-11-1994	AT	181404	T	15-07-1999
			DK	695877	T3	22-11-1999
			EP	0695877	A1	07-02-1996
DE 9412531	U1	29-09-1994	AT	187228	T	15-12-1999
			EP	0695878	A1	07-02-1996

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- EP 1178219 A **[0006]**