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**Datasheet for the decision  
of 25 January 2007**

**Case Number:** T 0267/04 - 3.2.01

**Application Number:** 96903123.6

**Publication Number:** 0809737

**IPC:** E02F 9/20

**Language of the proceedings:** EN

**Title of invention:**

Electrohydraulic proportional control valve assemblies

**Patentee:**

Ultronics Limited

**Opponents:**

Danfoss A/S

Bosch Rexroth AG

**Headword:**

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**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0267/04 - 3.2.01

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.01  
of 25 January 2007

**Appellant I:**  
(Patent Proprietor)

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**Appellant II:**  
(Opponent II)

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**Representative:**

-

**Party as of right:**  
(Opponent I)

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**Decision under appeal:**

Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
14 January 2004 concerning maintenance of  
European patent No. 0809737 in amended form.

**Composition of the Board:**

**Chairman:** S. Crane  
**Members:** C. Narcisi  
G. Weiss

## Summary of Facts and Submissions

- I. The European patent No. 809 737 was revoked by the decision of the opposition division posted on 14 January 2004. An appeal was filed against the decision by the patentee (appellant I) and by opponent II (appellant II) on 5 March 2004 and on 21 February 2004 respectively and the appeal fees were paid at the same time of filing the respective notices of appeal. The statement of grounds was filed by the appellant I and by the appellant II on 14 May 2004 and on 11 May 2004 respectively.
- II. Oral proceedings took place on 25 January 2007. The appellant I requested that the patent be maintained in amended form according to its main request presented at the oral proceedings.

The appellant II and the party as of right (opponent I) requested the revocation of the patent.

Claim 1 according to the main request reads as follows:

"An electrohydraulic proportional control valve assembly (1) for controlling a bidirectional fluid actuated device (7) having first and second ports and a movable part (6) disposed between the first and second ports to be acted on on opposite sides by fluid supplied to the first port and by fluid supplied to the second port, the valve assembly having a first actuating port (4) for bidirectional fluid flow between the valve assembly and the first port of the fluid actuated device (7), a second actuating port (5) for bidirectional fluid flow between the valve assembly and

the second port of the fluid actuated device (7), a pump port (15,16) for input fluid flow to the valve assembly from a hydraulic pump (17), and a tank port (18,19) for output fluid flow from the valve assembly to a hydraulic tank (20), the valve assembly comprising first valve means (2) connected to the first actuating port (4), the pump port (15) and the tank port (18) for controlling the direction and rate of fluid flow between the first actuating port (4) and the pump port (15) and between the first actuating port (4) and the tank port (18), and second valve means (3) connected to the second actuating port (5), the pump port (16) and the tank port (19) for controlling the direction and rate of fluid flow between the second actuating port (5) and the pump (16) and between the second actuating port (5) and the tank port (19), the first valve means (2) having at least one first valve member (12) which is movable to vary the throughflow cross-section for fluid flow between the first actuating port (4) and the pump or tank port (15 or 18), and the second valve means (3) having at least one second valve member (13) which is movable, independently of movement of the first valve member(s) (12), to vary the throughflow cross-section for fluid flow between the second actuating port (5) and the pump or tank port (16 or 19), position sensing means (23,24) for supplying electrical position signals indicative of the actual positions of the first and second valve members (12 and 13), pressure sensing means (26, 27 and 28) for supplying electrical pressure signals indicative of the fluid pressures in the first and second actuating ports (4 and 5) and the pump port (15,16), and servo control means for controlling the positions of the first and second valve members (12 and 13) in dependence on the electrical position and

pressure signals and in response to an electrical demand signal provided in response to operator actuation, in order to set the throughflow cross-sections for fluid flow through the first and second valve means (2 and 3) between the first actuating port (4) and the pump or tank port (15 or 18) and between the second actuating port (5) and the pump or tank port (16 or 19) to effect the required control of the movable part (6) of the fluid actuated device (7), wherein a select signal supplied by a control computer in dependence on said electrical demand signal causes a selection to be made as to whether pressure control or flow control is to be effected; and wherein, where the flow control mode is selected, control is effected by determining whether the flow of fluid is to the first actuating port or the second actuating port and by setting the fluid flow cross-section through the relevant valve means; alternatively, where pressure control is selected, the pressures applied at both actuating ports are controlled."

III. The arguments presented by the appellant I may be summarized as follows:

The parties agree on the fact that the subject-matter of claim 1 according to the main request is new with regard to the cited prior art. In particular it distinguishes over closest prior art D1 (US-A-5 138 838) in two respects. Firstly, (i) "servo control means for controlling the positions of the first and second valve members in dependence on the electrical position and pressure signals and in response to an electrical demand signal provided in response to operator actuation" are provided according to claim 1, whereas

in D1 the control means operate only in dependence on the electrical pressure signals and in response to an electrical demand signal produced by the operator. Secondly, in the claimed valve assembly (ii) " a select signal supplied by a control computer in dependence on said electrical demand signal causes a selection to be made as to whether pressure control or flow control is to be effected; and wherein, where the flow control mode is selected, control is effected by determining whether the flow of fluid is to the first actuating port or the second actuating port and by setting the fluid flow cross-section through the relevant valve means; alternatively, where pressure control is selected, the pressures applied at both actuating ports are controlled". Admittedly, it is known from D2 (DE-C-33 47 000) or from D9 (magazine "Ölhydraulik und Pneumatik", 34, (1990), No. 2, pages 106-114) to control the valve members in dependence on the their actual position and in dependence on the pressure in the actuating ports. However, the valve assembly of D2 cannot be used as a predictive system, since it does not disclose a pressure sensor at the pump port, so that the pressure drop across the valve is unknown, and since it merely measures the flow by monitoring the position of the ram of the actuated device. D9 for its part employs a 4-landed spool to control a bidirectional actuated device and does not make any provision for measuring absolute pressure at each port, thus making it impossible to control pressure at each port. Thus, neither D2 nor D9 point clearly to said feature (i). As to above feature (ii) it is noted that it is not disclosed or suggested in any of the cited documents. In particular, D1 provides only a flow control, whereas neither D2 nor

D12 (DE-A-37 34 955) suggest providing a valve assembly capable of selecting between a flow operating and a pressure operating mode. Thus, as a result of above features (i) and (ii) claim 1 provides a valve assembly which is more versatile, more efficient and more precise than those known from the prior art.

IV. The arguments presented by the appellant II may be summarized as follows:

The subject-matter of claim 1 does not involve an inventive step in view of closest prior art D1 and having regard to further documents D2, D9 and D12. From D1 it is already known to control the valve members in dependence on an electrical signal indicative of the fluid pressures in the first and second actuating ports and in the pump port. Thus, in order to further improve the operating accuracy and precision of the valve assembly and in order to eliminate the disturbing influence of forces arising from fluid flow and friction, it would be obvious for the skilled person to use also position sensors for the valve members, as stated for instance in D9 (page 108, left column), so as to control more accurately their position in dependence on both their actual position and measured pressures at the ports. This would immediately lead the skilled person to mentioned feature (i). The further feature (ii) cannot contribute to inventive step either. In fact, both D2 (column 4, lines 29-36; lines 59-63) and D12 (column 2, lines 25-34; column 3, lines 29-43) give the skilled person a clear indication that the valve assembly disclosed therein is capable of performing both a pressure control or a flow control at the actuator inlet and outlet ports. Hence, in an

attempt to provide the valve assembly with additional control functions to improve its versatility the skilled person would clearly resort to documents D2 or D12 and thus arrive in an obvious manner essentially to said feature (ii). The only remaining difference to the prior art implied by feature (ii), i.e. that in the pressure control mode the pressures applied at both actuating ports are controlled, cannot justify an inventive step, given that, whatever the reason for this technical measure may be, this measure could anyway be achieved with the technical means provided by the disclosure of D2 and D12. Consequently, as said features (i) and (ii) additionally do not constitute a true combination but a mere juxtaposition of features, no inventive step is involved in the subject-matter of independent claim 1.

- V. The arguments presented by the party as of right may be summarized as follows:

The subject-matter of independent claim 1 does not involve an inventive step in view of closest prior art D1 and having further regard to documents D2 and D12. Concerning firstly the above mentioned feature (i) it is noted that from D2 it is known, in a valve assembly essentially similar to that of D1, to provide a position feedback control for a valve member (16 or 17) by detecting the actual position of the valve member. The use of a position feedback control in the valve assembly of D1 would be obvious for the skilled person in order to obtain a position control which is free of the influence of possibly disturbing physical effects, such as flow forces or friction forces. This is likewise explicitly suggested in D2 (column 1,



lines 28-33) and it is also well known to any person of ordinary skill in the art that a position feedback control is in principle more precise and reliable than an open loop position control. Consequently feature (i) cannot involve an inventive step. As to feature (ii) it is remarked that D1 (column 5, lines 16-29) already discloses a pressure control, albeit merely as a secondary control in order to obtain the desired flow rate as demanded by the main control. In addition, valve assemblies D2 and D12 indeed disclose the possibility of operating the valve assembly in a pressure control mode in response to a primary pressure demand. In particular it results from D2 (column 1, line 58-column 2, line 5) that the valve assembly therein disclosed is sufficiently versatile to be operated in both a flow and a pressure control mode. The remaining feature which is part of feature (ii), relating to the fact that the pressure is controlled at both actuator ports, can be likewise achieved by the technical means disclosed in D2 and D12 if necessary and lies within the skilled person's capabilities. This confirms that the subject-matter of claim 1 lacks an inventive step with respect to the above mentioned prior art.

### **Reasons for the Decision**

1. The appeals are admissible since they meet the requirements of Articles 106 to 108 EPC in conjunction with Rule 1(1) and 64 EPC.
2. The amendments introduced into granted claim 1 have been disclosed in the application as originally filed.

Specifically, feature (ii) is supported by page 12 (line 4-line 7), page 14 (lines 3-5) and figure 4 of the published patent application. These amendments therefore do not contravene Article 123(2) EPC. This was not contested either by appellant II or by the party as of right.

3. The novelty of the subject-matter of claim 1 is undisputed and this subject-matter differs from closest prior art D1 by the above mentioned features (i) and (ii). In fact, D1 merely teaches control of the first and second valve members 27,36 in dependence on electrical pressure signals received from pressure sensors 56,58,61 and in response to an electrical demand signal 54. No feedback control including measurement of the actual position of first and second valve members 27,36 is disclosed in D1. Further, as to feature (ii), only a primary flow control operating mode is disclosed in D1, see in general terms column 3, lines 60-64 and more specifically column 5, lines 16-29, where a desired flow rate, set by a primary flow control, is obtained, once the valve member 27 is at an operating position, by varying the displacement of the pump at a constant pressure drop, set by a secondary pressure control, across the valve member 27.
  
4. In view of said features (i) and (ii) which determine the difference to prior art D1 the objective problem to be solved can be stated as consisting in providing (a) a versatile and efficient valve assembly and (b) one capable of improving the control of the fluid actuated device connected to the valve assembly. In this respect it is noted that whilst the object (a) is largely achieved by means of feature (ii), object (b) is

certainly the result of the combination of both features (i) and (ii), in that apparently an increased accuracy in the control of the first and second valve members in conjunction with pressure control at both actuating ports leads to an improved control of the force exerted on the actuated device, which is determined by the difference between said pressures at the actuating ports across the movable piston of the actuated device. Insofar, the provision of said features (i) and (ii) in claim 1 cannot be seen as a mere juxtaposition of features without any functional or physical relation to each other or without any interaction.

5. With the above premises in mind it has to be appreciated whether the subject-matter of claim 1 involves an inventive step in view of closest prior art D1 and of further prior art D2, D9 and D12. Considering first D2 and D9 it is certainly correct that the cited passages in these documents give a clear indication to the skilled person that the use of position sensors for the first and second valve members in D1 would be advantageous for ameliorating the position control of the valve by minimizing the influence of disturbing physical effects, such as flow forces or friction forces. The same holds for D12, where the valve member position is measured by position sensor 28 (figure). Thus, the provision of feature (i) cannot by itself justify the presence of an inventive step.
  
6. As to feature (ii) both the appellant II and the party as of right alleged that this feature is already at least implicitly disclosed or clearly suggested to the skilled person in D2 or D12. The board does not share

this view for the following reasons. The disclosure of D2, for instance in column 1, line 58-column 2, line 19, emphasizes that the valve assembly is extremely versatile and that it may be operated in multiple different ways according to specific needs. Thus, according to the cited passage in D2 (see points IV and V above), "a proportional control of volume-flows and pressures is rendered possible with a minimum amount of efforts" and "additional specific requirements can be met by corresponding programming of the electric control equipment". As far as this quotation is concerned, it is evidently of a very general nature and implies that a multitude of different controls can be performed by the valve assembly without however giving any specific hint or any specific indication pointing to the solution of said mentioned technical problems (a) and (b) as given by said feature (ii). Looking further at column 4, lines 29-36 in D2, it is recited here that "each motor port of the hydraulic cylinder can be separately and specifically controlled by the three-way valves" and that "the electronic control operates according to a chosen control program and according to the measured volume-flows and pressures to perform the control algorithm adapted to the specific drive requirements". However, this does not give any suggestion to choose a control program or method operating according to feature (ii) either, following which first a selection between two alternatives is performed, i.e. whether the system is to be operated in a primary flow control or in a primary pressure control mode, and if the pressure control mode is selected, then the pressure at both actuating ports is controlled.

Moreover, controlling the pressure at both ports cannot be regarded as a common feature in the art, since as shown for example in D1 (see column 4, lines 59-62) and as mentioned by appellant II during the oral proceedings, the valve member which acts to allow a throughflow from one side of the actuator to the tank is usually moved to a position providing substantially unrestricted fluid flow to the tank.

Having further regard to column 4, lines 59-63 in D2, it does not even result from this passage that the valve assembly and the control system of D2 is at all apt or conceived to operate in a primary pressure control mode, i.e. according to a set external primary pressure demand signal, since there it is stated that "the pressure is measured by the pressure sensors 66,67 on both sides of the hydraulic cylinder 11 and the corresponding electric signals are processed by the electric control 33 in secondary control loops".

In conclusion it can be stated that there is no clear evidence that the valve assembly and control system in D2 is in principle operable according to feature (ii) of claim 1 and even if this were considered to be the case, nevertheless there is neither an explicit nor an implicit disclosure of feature (ii) in D2, let alone a hint or a suggestion for the skilled person.

7. In respect of D12 and the relevant passages cited therein (see point IV above) essentially the same arguments apply as above, in that first no definite statement is made as to the aptitude of the system to operate according to feature (ii) and secondly even relying on this assumption there is no indication or

suggestion in D12 for the provision of a specific operating program or method based on the selection of two distinct alternative operating modes depending on an external demand signal, i.e. a primary flow control or primary pressure control mode, and such that if the pressure control mode is selected, then pressure is controlled at both actuating ports. All that is stated in D12 is that the control valve may be operated in a flow control mode, in a pressure control mode and/or in an acceleration control mode (claim 14 in D2). Again, this passage does not give an indication that, for example, a primary pressure control mode in response to an external pressure demand signal can be provided in alternative to a primary flow control mode and that this pressure control mode operates such as to control pressure at both actuating ports.

In view of the above facts and reasons the board concludes that the subject-matter of claim 1 fulfils the requirements of Article 56 EPC.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
  
2. The case is remitted to the first instance with the order to maintain a patent on the basis of the following documents:
  - claims 1 to 14 presented at the oral proceedings;
  - description and drawings as granted.

The Registrar:

The Chairman:

A. Vottner

S. Crane