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Datasheet for the decision of 12 January 2010

Case Number: T 1489/07 - 3.2.03

Application Number: 96100665.7

Publication Number: 0736737

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Language of the proceedings: EN

Title of invention:
Expansion valve and refrigerating system

Patentee:
Fujikoki Corporation

Opponent:
Danfoss A/S

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
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Case Number: T 1489/07 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 12 January 2010

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 5 July 2007 concerning maintenance of European patent No. 0736737 in amended form.**

Composition of the Board:

Chairman: U. Krause
Members: C. Donnelly
U. Tronser

Summary of Facts and Submissions

I. The appeal lies from the interlocutory decision of the opposition division, posted on 05 July 2007, maintaining European patent no. EP-B-736737 in amended form.

II. The opponent (hereinafter the "appellant") filed a notice of appeal against this decision on 6 September 2007 and paid the fee the same day. The grounds of appeal were filed on 9 November 2007.

III. In support of its case that the subject-matter of claim 1 as maintained lacks an inventive step, the appellant referred to the following documents in the grounds of appeal:

D1: US-A-1578179
D3: US-A-5301520
D5: US-A-2471448
D14: US-A-5068003
D15: US-A-5601411
D16: ISA Handbook of Control valves, 2nd edition, fifth printing 1990, Instrument Society of America, pages 1, 2, 46, 56-65, 68-70,162,216,217
D17: Datasheet STELLITE 6B
D18: Datasheet STELLITE 6K.

The patentee (hereinafter the "respondent") replied to the appeal by letter of 28 March 2008 and inter alia submitted that documents D14 to D18 not be admitted into the procedure since they had been filed late and were not relevant.

IV. Both parties made auxiliary requests for oral proceedings to be held.

V. In a communication dated 12 May 2009, pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings, the Board informed the parties of its provisional opinion. In particular, the Board indicated that it saw no reason not to admit D16 into the proceedings since it served to substantiate the skilled person's general knowledge at the time of the priority date. The Board also made clear its preliminary conclusion that the subject-matter of claim 1 as maintained did not appear to involve an inventive step in view of D5 and the skilled person's general knowledge as evidenced by D16 for example.

VI. By letter of 22 September 2009, the appellant filed a further document "Lueger, Lexikon der Technik", Vol. 3, page 293, Deutsche Verlaganstalt Suttgart, 1961, (D19), as evidence of the skilled person's general knowledge.

VII. Oral proceedings before the Board took place on 12 January 2009.

The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed or that the patent be maintained in amended form on the basis of the claims according to one of the auxiliary requests 1 to 3 submitted with letter of 11 December 2009.

VIII. Claim 1 as maintained by the opposition division (main request) reads:

"An expansion valve including a valve portion (A) comprising a valve body (10) having an inlet path (11) for introducing a refrigerant of a high pressure, an outlet path (12) for letting out the refrigerant of a low pressure, and a valve opening (30) communicating the inlet path (11) with the outlet path (12); a valve member (9) for opening and closing the valve opening; and a driving portion (B) having a diaphragm (4) for driving the valve member via an actuating rod (17); characterised by
said valve opening (30) being formed in an orifice metallic member (100,110,120,260,360,460,500) having a hardness higher than that of said valve body (10), the orifice metallic member being fixed to a valve seat portion in said valve opening (30) for contact with said valve member (9), and wherein said metallic member is made of a metallic material having a Vickers hardness ranging from 150 to 500."

Claim 1 according to the first auxiliary request comprises the additional feature:
"which is chosen from a group consisting of stainless steel, aluminium bronze, nickel bronze, and high-strength brass alloys.".

Claim 1 according to the second auxiliary request comprises the further feature:
"said refrigerant being non-chlorinated halogenated hydrocarbon".

Claim 1 of the third auxiliary request reads:

"A refrigerating system including a compressor (51), a condenser (52) for condensing a refrigerant compressed to a high temperature and a high pressure by said compressor, a liquid tank (53) for separating the condensed refrigerant into vapor and liquid and for removing moisture and dust from the refrigerant, an expansion valve (54) for expanding the refrigerant sent from the liquid tank, and an evaporator (55) for heat exchange between air and the refrigerant from the expansion valve, which are connected by a pipe network, said refrigerant being non-chlorinated halogenated hydrocarbon; and said expansion valve being an expansion valve including a valve portion (A) comprising a valve body (10) having an inlet path (11) for introducing a refrigerant of a high pressure, an outlet path (12) for letting out the refrigerant of a low pressure, and a valve opening (30) communicating the inlet path (11) with the outlet path (12); a valve member (9) for opening and closing the valve opening; and a driving portion (B) having a diaphragm (4) for driving the valve member via an actuating rod (17); said valve opening (30) being formed in an orifice metallic member (100,110,120,260,360,460,500) having a hardness higher than that of said valve body (10), the orifice metallic member being fixed to a valve seat portion in said valve opening (30) for contact with said valve member (9), and wherein said metallic member is made of a metallic material having a Vickers hardness ranging from 150 to 500 which is chosen from a group consisting of stainless steel, aluminium bronze, nickel bronze, and high-strength brass alloys.".

IX. The arguments of the parties relevant to the decision can be summarised as follows:

(a) Admittance of late filed documents D14 to D19

The respondent argued that these documents should not be admitted since they had not been presented in response to any new circumstances or facts introduced late into the proceedings by the respondent-patentee. The auxiliary requests filed during the opposition proceedings were all based on dependent claims present in the patent as granted. Further, D15, D17 and D18 were all published after the priority date of the contested patent. D19 was filed even later with letter of 22 September 2009 and should also not be admitted into the proceedings.

The appellant was of the view that the documents D14 to D19 should be admitted since they provided evidence of the skilled person's general knowledge before the priority date of the patent. D15, D17 and D18 may be late published, but they make reference to the properties of Stellite before the priority date. D16 is pre-published and is highly relevant to the subject-matter under discussion since it provides a summary of the skilled person's general knowledge and explicit examples of material selection for valve parts under various operating conditions.

(b) Inventive step - main request

Appellant

The subject-matter of claim 1 does not involve an inventive step in view of D5 in combination with the skilled man's general knowledge as evidenced for example D16.

D5 describes all the features of claim 1 with the exception that:

(a) - there is no explicit disclosure that the orifice metallic member has a Vickers hardness ranging from 150 to 500.
(b) - a diaphragm instead of a bellows arrangement is used for the valve actuation.

There is no technical synergy between these two features, hence, they can be handled separately when assessing inventive step.

As regards feature (a) the problem facing the skilled person is simply one of selecting a suitable type of steel for the annular plug 39. Faced with this task the skilled person would consult D16 which recommends the use of a type 410 stainless steel for tough service conditions requiring resistance to erosion. The hardness range for this steel is given as 37 to 42 Rockwell C which falls in the range 150 to 500 Vickers. It is implicit that the annular plug must be harder than the valve body made which is stated as being made of brass since otherwise it would make no sense to employ a separate component for valve aperture. D5

repeatedly makes reference to the fact that the valve body comprises threaded bores, thus, the brass material employed must be easily machinable.

Concerning feature (b), it is debatable whether there is any difference between a "diaphragm" and a "bellows". Nevertheless, even if a difference is recognised then the skilled person knows that these are equivalent devices, the relative merits and disadvantages of which are generally known, such that the application of one or the other type would merely depend on circumstances and not require an inventive step.

The respondent's assertion that the contested patent relates to a problem-invention since for the first time it recognises and provides a solution to the increased erosion of valve parts caused by using refrigerants of the non-chlorinated halogenated hydrocarbon family, is not convincing. Firstly, in order to be aware of this problem the apparatus under consideration must be susceptible to it; this would not be the case in D5. Secondly, the solution of providing a hardened component for the orifice is banal.

Respondent

D5 also does not show the features of:

(c) an outlet path for letting out the refrigerant of a low pressure; and
(d) that the orifice metallic member has a higher hardness than that of the valve body.

Features (a) and (d) can be taken together. There is no reference in D5 to the fact that the metallic orifice member is made of a harder material than the valve body, such a conclusion can only be based on conjecture. Further, if the annular plug 39 in D5 is supposed to be made of very hard steel, then this could mean steel which has a hardness value within the range 550 to 650 Vickers. Although the skilled person might consult D16, there is no particular reason why the table on page 162 would be deemed relevant since it does not refer specifically to refrigeration applications. Further, the skilled person would not use type 410 stainless steel since it would be attacked by water at the low service temperatures produced in the device of D5 by virtue of it being especially adapted by the incorporation of an additional heat exchanger chamber in the valve to improve refrigeration performance.

The addition of the extra heat-exchanger in the valve of D5 also means that the skilled person would never swap out the bellows for a diaphragm since the bellows are an essential part of the heat-exchange device in that they form one of the walls in the chamber 5 (see D5, column 3, line 14).

Finally D5 does not even mention the problem of valve erosion with which the contested patent is concerned. Since the inventor of the contested patent was the first to recognise the particular problem of erosion associated with using non-chlorinated halogenated hydrocarbon refrigerants, the patent identifies a problem which is not known in the prior art and is

therefore a problem invention as outlined in decision T 225/84 and T 02/83.

(c) Inventive step - Auxiliary requests

Appellant

The first auxiliary request specifies the different groups of alloys from which the orifice member can be made. D16 gives an example of stainless steel, thus, this feature does not contribute anything to inventive activity.

The second auxiliary request comprises an additional featuring relating to the type of refrigerant used and not to any structural feature of the valve. Thus, the claim does not meet the requirements of Article 84 EPC since it is not clear. Further, even if the claim is considered clear the same objections apply as for the first auxiliary request.

The third auxiliary request is essentially directed at a conventional refrigeration system comprising an expansion valve according to the second auxiliary request. In this case the type of refrigerant becomes a clear feature. However, the use of non-chlorinated halogenated hydrocarbon refrigerants was imposed by legislation aimed at eliminating ozone depleting substances. Thus, the decision to use such refrigerants cannot involve an inventive step. Further, the fact that such refrigerants have inferior lubricating qualities compared to the earlier refrigerants would have been discovered by routine testing. The solution for dealing with erosion by particles borne in the

refrigerant is given in standard texts such as D16 as already outlined above.

Respondent

As regards the first auxiliary request, the reasons why martensitic stainless steels such as type 410 would not be used in D5 have already been given.

The definition of the refrigerant in the second auxiliary request implies clear structural limitations since the valve must be suitable for handling this type of fluid which contains a large amount of abrasive particles. The inclusion of this feature further emphasises the problem-invention nature of the contested patent by explicitly mentioning the type of refrigerant which led to the new problem.

The third auxiliary request removes all doubt that the invention concerns the solution of the problem only arising when non-chlorinated halogenated hydrocarbon refrigerants are used. The refrigerant is a clear apparatus feature of the system claimed. None of the prior art documents mentions or even hints at the problem of erosion by particles in expansion valves of refrigeration systems using such refrigerants which have inferior lubricant qualities.

Reasons for the decision

1. The appeal is admissible.

2. Admission of late filed documents

2.1 Documents D14 to D18 were first filed with the grounds of appeal and D19 with letter of 22 September 2009. Thus, all these documents have been filed after the expiry of the opposition period and are late filed such that their admission into the proceedings is at the Board's discretion.

2.2 D14 relates to a wear-resistant titanium alloy for use in automobile valve parts and the like. There are some background references to the properties of Stellite (see column 1, lines 30 to 42), however, these do not go beyond the common general knowledge of the person skilled in the art. Thus, this document is not immediately pertinent to the subject-matter of the patent in suit and the Board sees no reason to admit it into the proceedings.

2.3 Document D15 is dated Feb 11 1997, both D17 and D18 bear a copyright date of "2005". Thus, these documents were published after the priority date of the contested patent and do not form part of the prior art. For this reason the Board cannot admit them into the proceedings since to do so would blur the distinction between what was known before and after the priority date.

2.4 D16 is a design handbook which "is intended to acquaint engineers with the factors of control valve design and application and to assist instrument engineers in the

selection of the best valve body, actuator, and accessories for his applications" (see D16, page 2, final paragraph) as such there is no doubt that it constitutes standard design knowledge of the person skilled in the art before the priority date of the patent. D16 was also cited with the grounds of appeal in response to the impugned decision in order to show what would have been the skilled person's general knowledge concerning control valve design at the priority date. Further, it is immediately apparent that the content of D16 is directly relevant to the subject-matter under discussion since it discusses the properties of different materials used for control valve components under different operating conditions. In these circumstances, the Board admits D16 into the proceedings.

2.5 D19 is also a standard technical handbook, however, it is less relevant to the present case than D16.

3. Inventive Step - Main request

3.1 D5 is considered to be the most relevant prior art since it relates to an expansion valve where expansion takes place in the device.

This document (see figures 1 and 2) describes:

an expansion valve including a valve portion comprising a valve body (30) having an inlet path (37) for introducing a refrigerant of a high pressure, an outlet path (6) for letting out the refrigerant of a low pressure (see column 4, line 70), and a valve opening (12) communicating the inlet path (37) with the outlet

path (6); a valve member (13) for opening and closing the valve opening (12); and a driving portion having a bellows (16,20) for driving the valve member via an actuating rod (15,19);

wherein

said valve opening (12) is formed in an orifice metallic member (39) having a hardness higher than that of said valve body (30), the orifice metallic member (39) is fixed to a valve seat portion in said valve opening for contact with said valve member (13).

3.2 The subject-matter of claim 1 differs therefrom in that:

(a) - there is no explicit disclosure that the orifice metallic member has a Vickers hardness ranging from 150 to 500.

(b) - in the device according to D5 a diaphragm instead of a bellows arrangement is used for the valve actuation.

3.3 The respondent has stated (see letter of 28 March 2008, page 5, third to last line) that D5 does not show the feature of an outlet path for letting out the refrigerant of a low pressure. However, the Board cannot accept this point of view since it is expressly stated at column 4, line 70 that "the fluid expands through port 12" and must therefore exit at a lower pressure.

3.4 The respondent has also argued that D5 does not disclose the feature of the orifice metallic member having a hardness value higher than that of said valve body. However, the Board is of the opinion that this feature is directly and unambiguously derivable from D5

since it explicitly states that the valve casing 30 is of "some suitable material, such as brass" (see column 4, lines 24 to 25) and that "the aperture 12 is formed in an annular plug made of a hard metal that is not readily attacked by the refrigerating fluids employed" and that it "may be made of a very hard steel" (see column 4, lines 57 to 60). This is an unambiguous indication to the skilled reader that the annular plug is made of harder material than the valve casing, not only because the steel has specifically been designated as being "very hard" whilst brass has enjoyed no particular qualification in this respect and in order to be "suitable" must be readily machinable, but also because manufacturing an extra component to form the aperture 12 would only make sense if this had superior properties as regards resistance to the refrigerating fluid than the casing itself.

3.5 There is no technical synergy between the two features (a) and (b) cited above, feature (a) relates to the valve portion proper and feature (b) to the driving portion of the valve. Thus, separate and distinct problems can be used when assessing inventive step with the problem-solution approach.

3.6 As regards feature (a), it is correct that D5 gives no specific hardness values for the material of the annular plug.

3.7 The skilled person faced with the problem selecting a steel which meets the subjective requirement mentioned in D5 of being "a hard metal that is not readily attacked by the refrigerating fluids employed" (see column 4, line 58 to 59) would consult a standard

design handbook such as D16. This document provides at page 162 a table of materials suitable for different types of application. For tough service requiring erosive resistance, a trim material of type 17-4 PH or type 410 stainless steel having hardness values of 40 to 45 and 37 to 42 Rockwell C respectively (approximately 392 to 446 and 363 to 412 Vickers Hardness) is recommended.

3.8 Thus, the skilled person is given a direct instruction by D16 to select a material for the orifice member which is made of a metallic material having Vickers hardness values within the range of 150 to 500.

3.9 The respondent has argued that the skilled person would not choose type 17-4 PH or type 410 stainless steel as a material for the annular plug of D5 since this apparatus is intended to work at very low temperatures for which these stainless steels are unsuitable since they are martensitic. The Board is not convinced by this reasoning since the type 410 stainless steel material cited in D16 is stated as having a service temperature range down to minus 150°F (minus 100°C). This temperature is below that of the minimum design temperature of around minus 92°F (see D16, page 70 "Refrigeration service - typical operating temp.") expected in high performance refrigeration systems based on a classic refrigeration cycle using condensation, compression and evaporation of a freon gas or similar such as D5 (see D5, column 1, lines 5 to 8)

3.10 The Board shares to some extent the appellant's view that the term "diaphragm" is used in some texts as the

generic term to cover all types of pressure responsive membrane type structures including "bellows". However, the example depicted in the contested patent is of a plate type diaphragm which is the generally accepted meaning. Thus, in the present case this does represent a distinguishing feature albeit very subtle.

3.11 The technical effect of feature (b) is to reduce the space requirements of the driving portion and, hence, of the overall valve envelope. The objective technical problem can therefore be seen as one of reducing the space requirements of the valve whilst maintaining its functionality.

3.12 The embodiment shown in figure 3 of D5 already provides the skilled person facing this problem with a part solution consisting of eliminating the thermostatic control entirely (see column 6, lines 70 to 74). However, the skilled person would be reluctant to abandon this attribute, further, it is well known in the art that diaphragm devices of various types are used to provide thermostatic control of valves in the same way as the bellows 20 of the embodiment according to figure 3 of D5 (see for example D3, column 5, lines 57 to 60 and figures 1 to 5).

3.13 Thus, the skilled person wishing to solve the above problem and preserve the thermostatic control would realise that this can be done by using a diaphragm device to replace the upper bellows 20 of the embodiment according to figure 2 of D5 to work in conjunction with the elements 21 and 22.

3.14 Thus, the subject-matter of claim 1 according to the main request does not involve an inventive step.

4. Auxiliary requests

4.1 The first auxiliary request comprises an additional feature listing the families of alloys which can be used to form the orifice member and includes stainless steel which, as detailed above, is described in D16.

4.2 The second auxiliary request further specifies that the refrigerant is a non-chlorinated halogenated hydrocarbon. However, the refrigerant is not a part of the claimed valve nor does it imply any clear structural features of the valve.

4.3 The valve of D5 is anyway suitable for use with such a refrigerant since it comprises a very hard annular plug which it would be obvious to make of stainless steel as reasoned above.

4.4 As indicated by the appellant, the third auxiliary request is essentially directed at a conventional refrigeration system comprising an expansion valve according to the second auxiliary request. The respondent has not argued otherwise nor made any particular reference to any specific features of the refrigerating system apart from the nature of the refrigerant employed. It is accepted that in this case the type of refrigerant becomes a clear feature of the apparatus. However, the use of non-chlorinated halogenated hydrocarbon class refrigerants such as R-134a was not a choice made by the respondent, but one forced by the legislator (see contest patent, column 1,

lines 39 to 51 and "Montreal protocol on substances that deplete the ozone layer") as part of the drive to eliminate ozone depleting substances, such as CFC refrigerants. It would have been part of normal design procedure to subject the new refrigerants to routine testing which would have inevitably high-lighted any deficiencies such as poor lubricating qualities and the associated wear problems of susceptible components caused by the circulation of more abrasive particles in the system. The solution for dealing with erosion by particles borne in fluids passing through susceptible components is obvious for the reasons given above

4.5 The respondent's assertion that an inventive step should be acknowledged for being the first to recognise an old problem (abrasive wear of valve components by fluid borne particles) with a known solution (using hard materials to form susceptible components) just because the old problem is caused by the introduction of new operational parameter (the refrigerant) in response to legislation is not convincing. Lubricant qualities of refrigerants are known to vary and the skilled person would anticipate that this property would require investigation.

4.6 The decisions cited by the respondent do not contradict this point of view. T225/84 states that "the perception of the problem has to be considered as being the main contribution to inventive merits of the solution claimed". The problem in the present case is readily anticipated and would have been perceived through routine testing to determine the lubricant qualities. In T 0002/83 the subject-matter relates to a particular pharmaceutical problem of undesirable migration between

the components of a tablet used for treating stomach complaints. Given the myriad of compositions available in pharmaceutics it may have been that the two components in question had not previously found themselves in juxtaposition and that the problem was not to be readily anticipated. For these reasons the findings of this decision are not directly applicable to the present case.

4.7 In conclusion, the subject-matter of claim 1 according to the first, second auxiliary and third auxiliary requests also does not meet the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

Registrar: Chairman:

V. Commare U. Krause