BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

A		B		C	X

File Number: T 346/90 - 3.2.3

Application No.: 85 111 242.5

Publication No.: 0 174 027

Title of invention: Heat pump apparatus

Classification: F25B 13/00, F25B 9/00, C09K 5/04

D E C I S I O N
of 28 July 1992

Applicant: Matsushita Electric Industrial Co., Ltd.

Headword: Heat pump/MATSUSHITA

EPC Article 56

Keyword: "Inventive step (confirmed after amendment)"

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 346/90 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 28 July 1992

Appellant : Matsushita Electric Industrial Co., Ltd.
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Decision under appeal : Decision of Examining Division of the European Patent Office dated 30 November 1989 refusing European patent application No. 85 111 242.5 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : C.T. Wilson
Members : H. Andrä
M.K.S. Aúz Castro

Summary of Facts and Submissions

I. European patent application No. 85 111 242.5, filed on 5 September 1985 and published on 12 March 1986 under No. 0 174 027, was refused by a decision of the Examining Division dated 30 November 1989.

II. The decision was based on Claim 1 submitted with letter of 28 July 1989 and Claims 2 to 6 submitted with letter of 27 February 1989.

The reason given for the refusal was that the subject-matter of independent Claims 1, 2, 4 and 6 did not involve an inventive step in the light of the disclosures of GB-A-2 059 646 and GB-A-2 068 996.

III. The Appellant (Applicant) lodged an appeal against this decision on 25 January 1990 paying the appeal fee on the same day. The statement of grounds of appeal was submitted on 28 March 1990.

IV. In a communication pursuant to Article 11(2) RPBA dated 2 April 1992 the Board of Appeal set out their preliminary opinion that independent Claims 1 to 3 of the category "method" as well as the remaining independent Claims 4, 6 and 8 of the category "apparatus" did not appear to be acceptable since the person skilled in the art would seem to be led to use the refrigerant mixtures as disclosed in GB-A-2 068 996 in order to improve the coefficient of performance of the method and apparatus known from GB-A-2 059 646, and arrive thus at solutions falling within the scope of the independent claims.

V. In the oral proceedings held on 28 July 1992, a new single claim was submitted together with a revised version of the description on the basis of which grant of a patent was requested.

VI. The text of the single claim is as follows:

"Use of a multiple-constituent refrigerant selected from the group consisting of:

(i) above 50 percent by weight of R22 and at least one minor constituent refrigerant having a lower critical pressure than R22 and being selected from the group consisting of R23, R13, R116, SF6, R13B1, R125, R12, R152a, R124, R142b, RC318, R12B1, R114, R133a, and R11; or

(ii) above 50 percent by weight of R12, and at least one minor constituent refrigerant having a lower critical pressure than R12 and being selected from the group consisting of R13, R116, SF6, R13B1, R125, R115, R218, R124, R142b, RC318, R114 and R133a,

as the working fluid in a heat pump refrigeration circuit comprising and operatively connecting:

(a) a variable-r.p.m. compressor driven by an electric motor connected to a frequency inverter;
(b) a primary heat exchanger for a heat sink;
(c) a capillary tube or expansion valve; and
(d) a secondary heat exchanger for a heat source,

to lower the discharge temperature of the compressor at times when the compressor is being operated at an increased speed in response to the required refrigeration capacity at which said compressor would be operated."

Reasons for the Decision

1. The appeal is admissible.

2. In substance, the claim is based essentially on the original Claims 1, 4, 6 and 7, the features concerning the provision of an electric motor and a frequency inverter for driving the compressor of the heat pump being disclosed in page 1, section 2 and on page 8, paragraph 2 of the original description. The functional feature to lower the discharge temperature of the compressor at times when the compressor is being operated at an increased speed in response to the required refrigeration capacity at which said compressor would be operated, can be derived from page 3, last paragraph to page 4, line 10 of the original description.

The claim, therefore, meets the requirement of Article 123(2) EPC.

3. Novelty

3.1 There is agreement between the Appellant and the Board that GB-A-2 059 646 (D1) reflects the most relevant available prior art. This citation discloses a heat pump including a refrigerating circuit comprising and operatively connecting a variable r.p.m. compressor (14) driven by an electric motor (28) connected to a frequency inverter (30), a primary heat exchanger (16) for a heat sink, an expansion device (18) and a secondary heat exchanger (20) for a heat source. As the compressor can be operated at an increased speed in response to required refrigeration capacity, the citation also discloses a method of operating a heat pump at an increased compressor speed in response to required refrigeration capacity.

3.2 The claim differs from the disclosure of D1 by the use of a multiple-constituent refrigerant selected from either of the groups (i) and (ii) as the working fluid in a heat pump refrigeration circuit as known from the citation to lower the discharge temperature of the compressor at times when the compressor is being operated at an increased speed in response to the required refrigeration capacity at which said compressor would be operated. Hence the claim contains novel subject-matter with regard to D1.

3.3 The other documents cited in the search report are further away from the subject-matter of the claim.

3.4 The subject-matter of the claim is therefore novel.

4. Inventiveness

4.1 As put forward by the Appellant and outlined in the original description of the application in suit, increasing the refrigeration capacity of a heat pump system such as known from D1 by increasing the compressor speed leads to an increase of the outlet port temperature of the compressor.

The increased compressor outlet temperature may induce decomposition and deterioration of the refrigerant and both the frequency inverter and the compressor may be negatively affected by the raised temperature.

4.2 The underlying problem may therefore be seen in providing a better mode of operation of a heat pump provided with a compressor lowering its discharge temperature when it is operated at an increased speed and having an extended variable range of refrigerating capacity.

The means provided for the solution to this problem, i.e. the use of a multiple-constituent refrigerant selected from the group (i) or (ii) as the working fluid in a heat pump refrigeration circuit such as known from D1 have been demonstrated in the originally filed application documents to be effective in lowering the compressor discharge temperature. In particular in Example 1 and 2 of the description it has been shown that the use of a refrigerant mixture composed of a major constituent refrigerant and of a minor constituent refrigerant, the latter having a lower critical pressure than the former, in a heat pump having a variable speed compressor leads to a decrease of the compressor discharge temperature as compared to a respective use of a refrigerant consisting of the major constituent refrigerant alone. No reason can be recognised as to why the results of the Examples illustrated should be doubted. The Board is therefore satisfied that the above-cited problem is solved by the claim.

4.3 In the heat pump system known from D1 varying the speed of the compressor is provided in response to load variations in the heating mode. It is proposed to design the compressor to operate at speeds in excess of the rated speed such as a 50% increase over rated speed and, should this still be insufficient, the turning on of supplemental heaters is recommended. The citation is concerned with the object of providing an improved heat pump system which minimises energy consumption and provides supplemental heating. No hint to the issue of lowering the temperature at the compressor outlet is provided nor is there proposed the use of a multiple-constituent refrigerant as indicated in the claim. The disclosure of D1 cannot therefore lead to the subject-matter of the claim.

4.4 GB-A-2 068 996 (D2) relied upon primarily by the Examining Division in its decision describes a process for heating a building by means of a heat pump in which the heat pump operates with a mixture of fluids that comprise a basic constituent and at least one second constituent, the difference between the critical temperature of the basic constituent and the critical temperature of the second constituent being at least 20°C and the molar concentration of the second constituent being in the range of 0.5 to 20% according to the general teaching of D2. A number of examples of refrigerant mixtures are given and investigated in respect of the performance rate of the heat pump to be obtained, some of these refrigerant mixtures such as R22-R11, R22-R13, R22-R114 and R22-RC318, R12-R114 and R12-RC318 corresponding with members of the group (i) and (ii) according to the claim. The heat pumps - which include the compressor - operated with the refrigerant mixtures may be of any type according to the teaching of D2 (cf. page 4, lines 11 to 14), which means that the compressors may be for example of the constant speed or the variable speed type.

There is no doubt that an improvement of the performance rate of the heat pump may be obtained with any type of heat pump and compressor when operated with the refrigerant mixtures disclosed in D2 such that the skilled person would seem to be led to operate also a heat pump having a compressor of the variable speed type with the known refrigerant mixtures when envisaging an improvement of the performance rate. It seems that in such a case, the effect of lowering the compressor discharge temperature would inherently take place under increased compressor speed conditions.

However, in the Board's opinion, it must not be disregarded that D2 is concerned with heat pumps having

any type of compressor whatever, that the claim of the application on the other hand has been restricted to the use of the known refrigerant mixtures in a heat pump having a variable speed compressor driven by an electric motor connected to a frequency inverter and that the problem objectively solved, namely, lowering of the compressor discharge temperature, arises only when operating a compressor under overrated speed conditions.

In his search for solutions to the above-cited problem, the skilled person, as outlined above, would not find in D2 any suggestions in respect of particular issues arising in heat pumps with variable speed compressors since for solving the problem underlying the known heat pump, any type of compressor would be appropriate.

4.5 When assessing inventive step the question to be answered is not whether certain technical effects claimed may have inherently occurred in a construction or a method forming part of the prior art but whether the teaching of the claim is obvious to a person skilled in the art having regard to what has been made available to the public (Articles 54(1) and (2) and 56 EPC).

In the present case, the Board considers that the prior art cited in the search report does not suggest the teaching of making use of the refrigerant mixtures indicated in the claim as the working fluid in a heat pump refrigeration circuit comprising a variable speed compressor to lower the discharge temperature of the compressor at times when the compressor is being operated at an increased speed in response to the required refrigeration capacity at which the compressor would be operated.

4.6 For these reasons, the Board has come to the conclusion that the subject-matter of the claim involves an inventive step.

5. The description and the drawings are in agreement with the actual wording and scope of the claim. The description also complies with Rule 27(1)(c) and (d) EPC. These documents appear to be suitable for the grant of a patent.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant the patent on the basis of the single claim and the description, both filed during oral proceedings of 28 July 1992 and two sheets of drawings filed on 19 May 1988.

The Registrar: The Chairman:

N. Maslin C.T. Wilson