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Datasheet for the decision of 15 March 2017

Case Number: T 1903/14 - 3.3.05

Application Number: 07733228.6

Publication Number: 2035117

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Language of the proceedings: EN

Title of invention:
Process for drying a gas stream comprising a fluoropropene

Patent Proprietor:
Mexichem Amanco Holding S.A. de C.V.

Opponents:
Arkema France
UOP LLC
CECA S.A.
E.I. DUPONT DE NEMOURS AND COMPANY

Headword:
Drying of R-1234yf/MEXICHEM

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step (no) - all requests - reasonable expectation of success

Decisions cited:

Catchword:

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Case Number: T 1903/14 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 15 March 2017

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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted on 18 July 2014 revoking European patent No. 2035117 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman E. Bendl
Members: J.-M. Schwaller
P. Guntz

Summary of Facts and Submissions

I. The present appeal lies from the decision of the opposition division to revoke European patent No. 2 035 117 on the grounds that the claims of the four requests then on file lacked either novelty or inventive step.

II. With its grounds of appeal, the appellant (proprietor) filed the three auxiliary requests underlying the decision and made them its main request and first and second auxiliary requests.

Claim 1 of the main and first auxiliary requests reads as follows:

"*1. A method of drying a fluid comprising R-1234yf, which method comprises the step of contacting the fluid with a desiccant comprising a molecular sieve having openings which have a size across their largest dimension of from 4 Å to about 3 Å.*"

Claim 1 of the second auxiliary request reads as follows (amendments to claim 1 above shown in **bold**):

"*1. A method of* ***manufacturing*** *a fluid comprising R-1234yf, which method comprises* ***drying the fluid comprising the R-1234yf, which drying comprises*** *the step of contacting the fluid with a desiccant comprising a molecular sieve having openings which have a size across their largest dimension of from 4 Å to about 3 Å.*"

III. Responses to the grounds of appeal were received from respondents II and IV (opponents 2 and 4).

IV. In a communication, the board informed *inter alia* the parties that

D13: 2002 ASHRAE® HANDBOOK REFRIGERATION, chapter 6: "*Control of Moisture and other Contaminants in Refrigerating Systems*", pages 6.1 to 6.15 (2002)

might serve as a suitable starting point for the problem-solution approach, which was to be discussed at the oral proceedings.

V. In response to the board's communication, the appellant, respondent I (opponent 1) and respondent II filed further observations. The appellant argued in particular that the closest prior art was represented by document

D9: JP 9 241189 A (D9a being its English translation).

VI. At the oral proceedings, the discussion focused on inventive step, inter alia in view of documents D13, D7 (WO 01/83411 A1) and D4 (A.P. COHEN, "*Compatibility and performance of molecular sieve desiccants with alternative refrigerants*", in "CFCs, The Day After", Padua 21-23 Sept. 1994).

VII. At the end of the oral proceedings, the parties' requests were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the claims of the main request or, alternatively, of one of auxiliary requests 1 or 2, all requests as submitted with the grounds of appeal dated 27 November 2014.

The respondents requested that the appeal be dismissed.

VIII. The arguments of the parties, insofar as they are relevant to the present decision, can be summarised as follows:

According to the respondents, the closest prior art was D13. For the appellant, D9 was closer to the invention.

The respondents argued that the claimed invention was obvious from D13 in combination with D7, which showed that R-1234yf was not trapped by 3A or 4A zeolites.

The appellant argued that the skilled person would not necessarily have considered molecular sieves for drying R-1234yf, but rather would have taken into account all known methods for drying a fluid, in particular distillation. Furthermore, he would have investigated all kinds of adsorbents, in particular alumina or silica gel. As shown by D4, the interaction of molecular sieves with a specific halocarbon was unpredictable.

Reasons for the Decision

1. Main request - inventive step

Applying the problem-solution approach, the board came to the conclusion that the subject-matter of claim 1 of this request does not involve an inventive step for the following reasons:

1.1 As regards the closest prior art, it is standard practice that this should normally be a document disclosing subject-matter conceived for the same purpose or aiming at the same objective as the claimed

invention and, in addition, having the most relevant technical features in common, i.e. requiring the minimum of structural modifications to arrive at the invention.

1.1.1 D13 is a handbook about refrigeration and its chapter 6 deals with the control of moisture in refrigerating systems and drying methods in this technical field. Its pages 6.3 to 6.5 disclose the desiccants used, and figures 1 to 6 graphically show the moisture equilibrium of various desiccants. In this respect, the molecular sieve is taught to have the greatest water capacity in comparison to alumina and silica (D13, page 6.5, left column, second full paragraph). Figures 5 and 6 moreover show the moisture equilibrium curves at 75°F and 125°F of three specific adsorbents (3A molecular sieve, activated alumina, bonded alumina core) in a system comprising refrigerant R-134a and 2% POE lubricant, and according to these figures the 3A molecular sieve has the highest water capacity.

1.1.2 Document D9 (paragraphs [0001] to [0007]), held by the appellant to represent the closest prior art, discloses the dehydration of 1,1,1,3,3-pentafluoropropane with a zeolite, in particular zeolites 3A or 4A.

1.1.3 For the board, although both documents:

i) have the same objective as the claimed invention, namely the drying of a fluid comprising a halocarbon suitable as refrigerant, and

ii) are distinguished from the claimed subject-matter by the type of refrigerant to be dried, which is R-1234yf in claim 1 at issue,

document D13 is the best starting point to assess the inventiveness of the claimed subject-matter because, in contrast to the 1,1,1,3,3-pentafluoropropane disclosed in D9, the refrigerating fluid illustrated in D13 (figures 5 and 6) is the refrigerating fluid R-134a which - as is commonly known and has additionally been explained in the contested patent (paragraphs [0009] and [0010]) - is supposed to be replaced (because of its high global warming potential) by the compound R1234yf defined in claim 1 at issue. It follows that D13 is the most promising springboard to the invention.

1.2 The problem underlying the invention is described in paragraph [0011] of the patent as consisting in the provision of a method for drying refrigerant R1234yf with a compatible desiccant.

1.3 According to the contested patent, this problem is solved by the process defined in claim 1 at issue, which is in particular characterised in that the desiccant "*comprises a molecular sieve having openings which have a size across their largest dimension of from 4 Å to about 3 Å.*"

1.4 For the board, the problem identified in point 1.2 above has been effectively solved. This was not disputed by the parties.

1.5 As to the question whether the proposed solution was obvious in the light of the state of the art, for the reasons set out below, the board takes the view that the skilled person faced with the problem of drying a fluid comprising the refrigerant R-1234yf would arrive at the claimed invention, when starting from the teaching of document D13, without having to exercise any inventive skill.

D13 is an acknowledged reference handbook in this technical field and relates to drying refrigerants. Figures 5 and 6 show that the 3A molecular sieve has a higher water capacity than alumina-based adsorbents in the presence of a fluid based on the refrigerant R-134a. The skilled person would therefore necessarily try the 3A molecular sieve with a reasonable expectation of success, since this sieve is described as the most efficient for drying the refrigerant that R-1234yf is supposed to replace.

Furthermore, as explained in point 1.5.4 below, it is known from table 1 of D7 at least that R-1234yf is not adsorbed by molecular sieves having a pore size falling within the terms of claim 1 at issue.

Bearing the above in mind, the skilled person will directly arrive at the subject-matter of claim 1 at issue without inventive skill.

1.5.1 The respondent argued that such a conclusion was based on hindsight, because the skilled person attempting to dry a fluid comprising R-1234yf would first consider all (other) known methods for drying a fluid, in particular distillation. Furthermore, he would have investigated all kinds of adsorbents, including e.g alumina or silica gel, which - as shown by figure 1 of D13 - have higher water capacity than molecular sieves. Even if he had chosen a molecular sieve, he would not have been prompted to use a 3A or 4A sieve, because the interaction of a halocarbon compound with molecular sieves was unpredictable, as evidenced by D4, which states that a "*screening test is used to compare the reactivity of various desiccant candidates with alternative refrigerants and lubricants*".

1.5.2 The board does not accept these arguments for the following reasons.

The skilled person would rather be dissuaded from using distillation for drying the halogenated fluid of claim 1 at issue, because this technique is known to be quite elaborate when used in domestic and automotive air-conditioning systems, which are the most common utilisations of such halogenated fluids. Furthermore, as disclosed in D13, page 6.3, right-hand column, desiccants such as alumina, silica or molecular sieves are widely used as dehydrating agents in refrigerating systems and so the skilled person would indeed try this technique. In particular, since the combination of the predecessor of R-1234yf, i.e. R-134A, is described in D13 as working successfully with 3A molecular sieves (page 6.5, left-hand column, first full paragraph) the skilled person would be tempted to test this also with its successor R-1234yf (see the reasoning above).

1.5.3 D13 does indeed disclose the use of activated alumina and silica for drying a halogenated fluid. However when selectivity and optimisation of volumes are sought, D13 (page 6.3, penultimate paragraph) teaches that 3A or 4A molecular sieves have uniform pores and are selective to water (since they exclude lubricant and certain refrigerant molecules) while alumina and silica absorb refrigerant, lubricant and water molecules owing to their broad range of pore sizes. D13 (page 6.5, left-hand column) furthermore describes that lower quantities of absorbents can be used because of the greater water capacity of 3A or 4A molecular sieves compared to alumina and silica.

1.5.4 In connection with the argument that interaction of a halocarbon compound with molecular sieves is

unpredictable, D4 in particular was referred to. However, the passage beginning on page 22 of D4, third full paragraph from the bottom, clearly indicates that molecular size and the type of desiccant are interrelated. Table 1 shows that compatibility problems only occur once the size of the refrigerant molecule falls **below** certain limits, which depend on the type of molecular sieve. However, since D13 concludes that R134a (1,1,1,2-tetrafluoro**ethane**) works well with type 3A molecular sieves, the skilled person will not have any doubt that the replacement for R134a, i.e. R-1234yf (2,3,3,3-tetrafluoro**propene**), a molecule with an apparently larger molecule size, will not be adsorbed by the desiccant. Thus, the skilled person would at least have a strong motivation to carry out tests using the compounds mentioned.

On page 23, penultimate paragraph of D4 it is furthermore pointed out that "*... maximum water capacity is achieved when the refrigerant is excluded from the molecular micropores. Where the refrigerant is adsorbed on the molecular sieve, water capacity is reduced*". Thus, it can be derived from this and the preceding passages that pores large enough to adsorb refrigerant cause a reduction of water capacity. In view of this teaching, the alleged effect achieved by the patent in suit (increased performance of 3-4 Å sieve sizes as compared to larger openings, see paragraph [0053]) is also rendered obvious.

In addition, D7 (Table 1) shows that R-1234yf is not adsorbed by the zeolites AW500 and MS-5A, which have a pore size between 3.7 and 4.2 Å. Since zeolites with this pore size are furthermore known to have greater water capacity than alumina and silica, the skilled person could thus easily predict that these zeolites

would be serious candidates for selectively drying R-1234yf.

1.6 It follows from the above considerations that, having regard to the state of the art, the subject-matter of claim 1 at issue is obvious to a person skilled in the art, and this claim cannot be regarded as involving an inventive step in the sense of Article 56 EPC.

2. First auxiliary request - inventive step

The subject-matter of claim 1 of this request is identical to that of claim 1 of the previous request, and therefore, for the same reasons as those given in points 1.1 to 1.5.4 above, does not meet the requirements of Article 56 EPC.

3. Second auxiliary request - inventive step

Claim 1 of this request relates to a method for manufacturing a fluid comprising R-1234yf, which method comprises the steps defined in claim 1 of the main request.

3.1 For the board, although claim 1 of this request relates to a manufacturing method, it does not comprise any further specific process feature in comparison to claim 1 of the previous requests, with the consequence that current claim 1 is nothing other than a method for manufacturing a dried fluid comprising R-1234yf with the same steps as the process according to claim 1 of the preceding requests, so that the conclusions arrived at for these claims apply *mutatis mutandis.*

The subject-matter of claim 1 of this request is therefore obvious from the state of the art, and

consequently does not involve an inventive step within the meaning of Article 56 EPC.

3.2 Even if, in favour of the appellant, the manufacturing process claimed were to be understood as implicitly encompassing further processing steps, and it were to be assumed that the skilled person would use distillation as a drying process for manufacturing said fluid, the board is of the opinion that these further implicit steps would not alter the conclusion that the claimed subject-matter is obvious vis-à-vis the state of the art.

The manufacturing process of halogenated desiccants may comprise two drying steps. D9 - which discloses a manufacturing process of a 1,1,1,3,3-pentafluoropropane comprising a drying operation - suggests that the drying be done in two steps (paragraph [0033]), first by distillation and then by dehydration on a molecular sieve (e.g. 3A or 4A molecular sieve). So, in any case the currently claimed subject-matter would be obvious from the combined teachings of D13 and D9.

4. As none of the sets of claims underlying the proposed requests meets the requirements of the EPC, the appeal cannot succeed and the opposition division's decision to revoke the patent is confirmed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Vodz E. Bendl

Decision electronically authenticated