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D E C I S I O N
of 18 November 2002

Case Number: T 0717/00 - 3.3.1

Application Number: 94909203.5

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IPC: C07C 17/20

Language of the proceedings: EN

Title of invention:
Production of difluoromethane

Patentee:
Ineos Fluor Holdings Limited

Opponent:
AlliedSignal Inc.

Headword:
Difluoromethane/INEOS FLUOR

Relevant legal provisions:
EPC Art. 56, 114(2)

Keyword:
"Late filed evidence (not admitted) - lack of relevance"
"Inventive step (yes) - (re)formulation of problem on the
basis of technical results achieved vis-à-vis closest prior
art - burden of proof - non-obvious solution"

Decisions cited:
T 0001/80, T 0020/81, T 0024/81, T 0184/83, T 0248/85,
T 0270/90, T 0039/93

Catchword:
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Case Number: T 0717/00 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 18 November 2002

Respondent: AlliedSignal Inc.
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Appellant: Ineos Fluor Holdings Limited
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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 26 May 2000
concerning maintenance of European patent
No. 0 690 832 in amended form.

Composition of the Board:

Chairman: A. J. Nuss
Members: R. Freimuth
J. P. B. Seitz

Summary of Facts and Submissions

I. The Appellant (Proprietor of the patent) lodged an appeal against the interlocutory decision of the Opposition Division posted on 26 May 2000 which found that European patent No. 690 832 in the form as granted did not satisfy the requirements of the EPC, but that it could be maintained in the form as amended during opposition proceedings according to the then pending auxiliary request.

II. Notice of Opposition had been filed by the Respondent (Opponent) requesting revocation of the patent in suit in its entirety for lack of inventive step based on the documents

(1) Chemistry, Bruce. H. Mahan, Addison-Wesley Publishing Co., 1966, pages 164 and 166, and

(2) US-A-2 745 886.

III. The Opposition Division decided that the patent as granted did not involve an inventive step. The patent was granted on the basis of ten claims, claim 1 reading as follows:

"1. A process for the production of difluoromethane comprising (a) contacting dichloromethane with hydrogen fluoride in the presence of a fluorination catalyst to produce a product stream comprising difluoromethane, monochloromonofluoromethane and unreacted starting materials and (b) separating difluoromethane from the product stream from step (a), wherein sufficient hydrogen fluoride is employed in the process such that during step (b) the molar ratio of hydrogen fluoride to

monochloromonofluoromethane is at least 100:1."

The Opposition Division held that the objective technical problem underlying the patent in suit was that defined in the patent specification, namely to suppress or overcome the toxicity problems associated with monochloromonofluoromethane HCFC 31 in a process for producing difluoromethane HCFC 32. To "suppress" that toxicity problem in terms of the patent in suit meant that reaction conditions were provided such that the high toxicity of HCFC 31 did no longer exceed the toxicity of hydrogen fluoride. Based on the Occupational Exposure Limit OEL the toxicity of HCFC 31 was 300 times that of hydrogen fluoride. However, claim 1 as granted required merely a molar ratio of hydrogen fluoride to HCFC 31 of at least 100:1 thereby including ratios of lower than 300:1 where the toxicity problem associated with HCFC 31 basically remained. Since not all the claimed embodiments solved the problem underlying the patent in suit claim 1 as granted lacked inventive step.

On the other hand, the Opposition Division decided that the Appellant's auxiliary request, in which the molar ratio of hydrogen fluoride to HCFC 31 was at least 300:1, involved an inventive step.

- IV. The Appellant argued during appeal proceedings that the claimed subject-matter was inventive. The closest prior art document (2) described a process for producing difluoromethane without addressing any safety problem. The drawback of the conventional process was the production of the highly toxic by-product monochloromonofluoromethane HCFC 31. The present invention aimed at "suppressing" the toxicity problem

associated with HCFC 31. The term "suppressing" meant to reduce the toxicity problem rather than to eliminate it completely. To solve that problem the claimed invention proposed to use a large molar excess of hydrogen fluoride, namely 100:1, in step (b) of the claimed process thereby diluting the HCFC 31 and modifying the toxicity profile. Regardless of any considerations of the precise meaning of the term "suppress" the claimed invention allowed the toxicity problem associated with HCFC 31 to be reduced, thus successfully solving the problem underlying the patent in suit. There was no doubt that this particular problem of reducing the toxicity was solved throughout the scope of the claims. Document (1) which dealt with a general thermodynamic principle did not render the claimed invention obvious since the Respondent's comments based thereon were mere academic and the present reaction was not in a thermodynamic equilibrium but rather kinetically controlled. The Respondent's objection completely missed the point that the invention solved a toxicity problem not addressed in document (1).

To back up his view, the Appellant additionally cited the following documents in appeal proceedings:

- (3) Press Release E047:00 - 23 March 2000, HSE updates list of occupational exposure limits,
- (9) Chamber's Maxi Paperback Dictionary, 1992, page 1096 and
- (10) The Shorter Oxford English Dictionary, 1991, pages 2166 and 2198.

V. The Respondent submitted that the subject-matter claimed was not inventive. The problem addressed by the claimed invention was that of "suppressing" toxicity problems associated with the production of HCFC 31 which was a highly toxic by-product in the preparation process of difluoromethane. What was meant by "suppressing" the toxicity problem was critical to the determination of whether or not the problem addressed by the claimed invention has been solved. That expression meant in the context of the patent in suit that the amount of HCFC 31 did not exceed its Occupational Exposure Limit OEL, otherwise the toxicity problem remained. The OEL of 10 ppb for HCFC 31 was 300 times that of hydrogen fluoride having an OEL of 3 ppm. Therefore, the excess of hydrogen fluoride indicated in the claimed process of at least 100:1 was not sufficient to ensure the suppression of the toxicity associated with HCFC 31, i.e. did not solve the problem underlying the patent in suit. The claimed process embraced embodiments in which the amount of hydrogen fluoride and/or HCFC 31 was well above their OEL values. A re-formulation of the problem was not justified on the basis that a less rigorous solution to the problem set out in the patent specification might be deemed acceptable. Thus, the claimed process lacked inventive step.

Moreover the claimed invention was obvious in the light of document (2) and common general knowledge represented by document (1). Document (2) described a process for preparing difluoromethane wherein a molar ratio of hydrogen fluoride to dichloromethane of 2,8:1 was used, while the process of the patent in suit according to page 3, line 20 of the specification differed therefrom only in using a ratio of 5:1.

However, to play with ratios was always obvious in view of the LeChatelier's principle. That principle and the Gibbs free energy values gave the skilled person guidance how to change the different parameters in the process affecting the amount of HCFC 31 in the system. Knowing that there were a limited number of options open to him that would achieve the desired reduction in HCFC 31, the skilled person would have expected an increase in the amount of hydrogen fluoride to result in an increase in the conversion of HCFC 31 to difluoromethane. This course of action was obvious to try with a reasonable expectation of success based upon thermodynamic principles. The Respondent doubted that the increase in the ratio of hydrogen fluoride in the claimed process reduced in fact the toxicity problems as it did nothing to the toxicity of HCFC 31. Adding more of the toxin hydrogen fluoride made things worse.

The Respondent referred to the following fresh documents in the appeal proceedings:

- (4) Collins English Dictionary, 1995, page 1550,
- (5) Thermodynamic tables - Non-Hydrocarbons, Gibbs energy values, undated,
- (6) Table of the equilibrium constants of the conversion of dichloromethane into HCFC 31 and of HCFC 31 into HCFC 32,
- (7) Graph of the conversion rate of dichloromethane into HCFC 31 as a function of the reaction temperature and
- (8) Graph of the conversion rate of HCFC 31 into

HCFC 32 as a function of the reaction temperature.

VI. The Appellant requested that the patent be maintained as granted (main request) or subsidiarily that the patent be maintained on the basis of one of the three auxiliary requests filed on 26 September 2000.

The Respondent requested that the appeal be dismissed.

VII. At the end of the oral proceedings held on 18 November 2002 the decision of the Board was announced.

Reasons for the Decision

1. The appeal is admissible.

2. *Late filed evidence (Article 114 EPC)*

2.1 Documents (3) and (4) are new evidence submitted for the first time with the Appellant's letter dated 26 September 2000 and with the Respondent's letter dated 5 June 2000, respectively. Document (3) was published in 2000 and document (4) in 1995. The priority date of the patent in suit being 24 March 1993, both documents are postpublished and, thus, of no relevance in the assessment of patentability. Thus, these late filed documents are not admitted into the proceedings (Article 114(2) EPC).

2.2 Documents (5) to (10) are new evidence submitted for the first time in appeal proceedings with the Appellant's letter dated 18 October 2002 and with the Respondent's letter dated 5 June 2000, respectively. They address either the meaning of the verb "to

suppress" or individualised thermodynamic data. These matters, however, are not relevant to the assessment of inventive step (cf. point 3 below). Therefore those documents lack relevance for the decision to be taken, and are not admitted into the proceedings as well (Article 114(2) EPC).

Main request

3. *Inventive step*

The sole issue arising from this appeal consists in deciding whether or not the subject-matter of the claims of the patent in suit as granted according to the main request or of the claims as amended according to the auxiliary requests involves an inventive step.

3.1 According to the established jurisprudence of the Boards of Appeal it is necessary, in order to assess inventive step, to establish the closest state of the art, to determine the technical results or effects successfully achieved by the claimed invention vis-à-vis the closest state of the art, to define the technical problem to be solved as the object of the invention to achieve these results or effects, and to examine the obviousness of the claimed solution to this problem in view of the state of the art (see decisions T 1/80, OJ EPO 1981, 206, points 3, 6, 8, 11 of the reasons; T 20/81, OJ EPO 1982, page 217, point 3 of the reasons; T 24/81, OJ EPO 1983, 133, point 4 of the reasons; T 248/85, OJ EPO 1986, 262, point 9.1 of the reasons). This "problem-solution approach" ensures assessing inventive step on an objective basis.

3.2 The patent in suit is directed to a process for

preparing difluoromethane by contacting dichloromethane with hydrogen fluoride and separating difluoromethane from the resulting product stream.

A similar process already belongs to the state of the art in that document (2) discloses in claims 8 and 12 a process for preparing difluoromethane by contacting dichloromethane with hydrogen fluoride. That process is exemplified in example 9 wherein the molar ratio between both reactants is 1:2,8. and wherein the reaction product is subsequently separated by fractional distillation.

For these reasons, the Board considers, in agreement with the Appellant, the Respondent and the Opposition Division, that the disclosure of document (2) specified above represents the closest state of the art, and, hence, the starting point in the assessment of inventive step.

- 3.3 In view of this state of the art the problem underlying the patent in suit as submitted by the Appellant is to achieve a reduction in toxicity problems associated with HCFC 31 formed as a by-product in the production of difluoromethane.

This formulation of the technical problem to be solved is supported by the fact that document (2) is not concerned with process-related toxicity aspects. Nevertheless, the Respondent argued that the problem to be solved by the claimed invention was that of "suppressing" toxicity problems associated with the production of HCFC 31 as defined in the patent specification on page 2, lines 27 and 28. This expression of "suppressing" toxicity problems meant in

the context of the patent in suit that the amount of HCFC 31 did not exceed its OEL and, thus, was more ambitious than merely reducing them.

However, it is established jurisprudence of the Boards of Appeal that the objective problem underlying the claimed invention is to be solely determined on the basis of the technical results or effects successfully achieved vis-à-vis the closest state of the art (cf. point 3.1 *supra*). When doing so it is permissible to (re)formulate the arising technical problem in particular in less ambitious terms (see decisions T 184/82, OJ EPO 1984, page 261, point 5 of the reasons; T 39/93, OJ EPO, page 134, point 5.3.2 of the reasons). In the present case, hence, the objective problem underlying the patent in suit may be (re)formulated in other and even less ambitious terms than in the patent specification, as the Appellant-Patentee did when using a different term, namely the expression of "reducing" toxicity problems associated with HCFC 31. As the Appellant is not irreversibly bound by the literal formulation of the problem in the specification of the patent in suit which uses indeed the term "suppressing" the exact meaning of that term is irrelevant for the matter to be decided.

- 3.4 As the solution to the above stated problem the patent in suit proposes a process for the production of difluoromethane which is characterised in that during the separation step (b) the molar ratio of hydrogen fluoride to HCFC 31 is at least 100:1.

The Respondent alleged at the oral proceedings before the Board that the essential feature of the invention vis-à-vis document (2) was the use of a molar ratio of

hydrogen fluoride to dichloromethane of 5:1 in the preparation step (a) indicated on page 3, line 20 of the specification of the patent in suit. However, the Respondent's argument is beside the point as the solution proposed in claim 1 is silent about that feature but rather requires a molar ratio of at least 100:1 in the separation step (b).

3.5 The Appellant and the Respondent were divided on the matter whether the proposed solution successfully solves the problem underlying the patent in suit.

3.5.1 However, the large excess of hydrogen fluoride provided for in claim 1 during step (b) makes plain that the HCFC 31 present is diluted thereby (see also patent specification, page 2, line 48). Since hydrogen fluoride having an OEL of 3 ppm is 300 times less toxic than HCFC 31 having an OEL of 10 ppb, the level of toxicity is reduced due to the dilution with hydrogen fluoride. Thus, the objective of the patent in suit of reducing the toxicity problems associated with HCFC 31 is successfully achieved, contrary to the Respondent's allegation that increasing the ratio of hydrogen fluoride did nothing to the toxicity problem.

3.5.2 Moreover, the Appellant submitted at the oral proceedings before the Board, which remained undisputed by the Respondent, that both hydrogen fluoride and HCFC 31 have different toxicity profiles. While HCFC 31 shows long term toxicity, hydrogen fluoride as an acid has rather an instant toxic effect. Therefore the presence of a large excess of hydrogen fluoride during step (b) as defined in claim 1 modifies the toxicity profile in lessening the long term impact of HCFC 31 and, thus, reducing the toxicity problems associated

with HCFC 31 which is the sole problem underlying the patent in suit.

- 3.5.3 The Respondent expressed doubts as to that the claimed invention achieves the technical effect of reducing the toxicity problems associated with HCFC 31, i.e. that it successfully solved the problem underlying the patent in suit.

However, according to the jurisprudence of the Boards of Appeal, each of the parties to the proceedings carries the burden of proof for the facts it alleges (see e.g. decision T 270/90, OJ EPO 1993, 725, point 2.1). If a party, whose arguments rest on these alleged facts, is unable to discharge its onus of proof, it loses thereby. In the present case, the Respondent merely expressed doubts that the claimed invention does not achieve at least in part a reduction of toxicity problems associated with HCFC 31 formed as a by-product in the production of difluoromethane. Therefore, the burden of proof for that allegation rests upon him. In the absence of any supporting piece of evidence, however, the Respondent has not discharged this burden of proof, with the consequence that his unsubstantiated allegation is not to be taken into account by the Board.

- 3.5.4 For these reasons, the Board is satisfied that the solution proposed by the patent in suit successfully solves the problem underlying the invention as defined in point 3.3 *supra*.

- 3.6 Finally, it remains to be decided whether or not the proposed solution to the problem underlying the patent in suit is obvious in view of the cited state of the

art.

- 3.6.1 The closest prior art document (2) to start from teaches a process for preparing difluoromethane by contacting dichloromethane with hydrogen fluoride. It does not address the problem underlying the patent in suit of reducing the toxicity problems associated with HCFC 31 formed as a by-product in that preparation process. Consequently document (2) cannot give a hint on how to solve that problem.

Furthermore, document (2) neither discloses the feature of the claimed process to use a molar ratio of hydrogen fluoride of at least 100:1 in step (b), nor suggests a large molar excess of hydrogen fluoride to be critical.

Thus, document (2), on its own, does not render obvious the solution proposed by the claimed invention.

- 3.6.2 Document (1) deals with the LeChatelier's principle which is a thermodynamic rule applying to chemical equilibria in general. The Appellant and the Respondent had divergent views as to whether or not the claimed process is in a thermodynamic equilibrium and, thus, subject to that principle.

However, regardless of those divergent views, neither Party disputes the fact that document (1) does not address the problem underlying the patent in suit, i.e. of reducing the toxicity problems associated with HCFC 31 formed as a by-product in the preparation of difluoromethane (cf. point 3.3 *supra*). For this simple reason that document cannot give any hint on how to solve that technical problem.

Moreover, document (1) neither addresses a preparation process of difluoromethane as such nor the use of a large excess of hydrogen fluoride in the separation step (b) of that process. Hence that document does not comprise any pointer to the claimed solution, which is characterised by using a molar ratio of hydrogen fluoride of at least 100:1 in the separation step.

Consequently, document (1) does not render obvious the proposed solution to the technical problem underlying the patent in suit.

- 3.7 For these reasons the Board concludes that the subject-matter of claim 1, and by the same token, that of independent claim 4 directed to a particular embodiment of the process as defined in claim 1 and that of dependent claims 2, 3 and 5 to 10 involves an inventive step within the meaning of Articles 52(1) and 56 EPC.

Auxiliary requests

4. Since the preceding main request is allowable for the reasons set out above, there is no need for the Board to decide on the lower ranking first, second and third auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

The Registrar:

The Chairman:

N. Maslin

A. Nuss