BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

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BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 407/91 - 3.3.1

Application No.: 84 104 657.6

Publication No.: 0 124 078

Title of invention: Process for the production of dimethyl ether useful as a propellant

Classification: C07C 43/04

DECISION of 15 April 1993 ·

Applicant:

Opponent:

Mitsubishi Kasei Corporation

Hüls Aktiengesellschaft DEA Mineralöl Aktiengesellschaft

Headword: Dimethyl ether/Mitsubishi

EPC Article 56

Keyword: "Inventive step - no" - "Combination of known process features by merely applying common general knowledge is not inventive"

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Europäisches Patentamt European Patent Office Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number : T 407/91 - 3.3.1

D E C I S I O N of the Technical Board of Appeal 3.3.1 of 15 April 1993

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Respondent : (Proprietor of the patent) MITSUBISHI KASEI CORPORATION 5-2, Marunouchi 2-chome Chiyoda-ku Tokyo 100 Japon

(Representative):

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Other party: (Opponent 01) Hüls Aktiengesellschaft Postfach 1320 W - 4370 Marl 1 Allemagne

Decision under appeal :

Decision of the Opposition Division of the European Patent Office of 22.01.91, posted on 14.03.91, rejecting the oppositions filed against European patent N. 0 124 078 pursuant to Article 102(2) EPC.

Composition of the Board :

Chairman : A. Jahn Members : P. Krasa J.A. Stephens-Ofner

Summary of Facts and Submissions

I. The mention of the grant of patent No. 0 124 078 in respect of European patent application No. 84 104 657.6 filed on 25 April 1984, was published on 4 March 1987 (c.f. Bulletin 87/10) on the basis of eight claims. Independent Claim 1 reads:

> "A process for producing dimethyl ether, which is useful as a propellant by dehydrating methanol and recovering dimethyl ether from the dehydrated product by distillation, which comprises

- (a) dehydrating methanol in the vapour phase under a pressure of from 19.6133 to 490.3325 Pa.Nm⁻².G
 (2 to 50 kg/cm².G) over a solid catalyst,
- (b) cooling the obtained reaction mixture;
- (c) distilling said cooled reaction mixture in a first pressurized distillation column under a pressure of at least 49.03325 Pa.Nm⁻².G (5kg/cm².G), whereby substances having a boiling point less than dimethyl ether are removed from the top of said column, refined dimethyl ether is removed as a side stream from said column and the bottoms of said column are withdrawn;
- (d) introducing said bottoms into a second distillation column;
- (e) distilling said bottoms in the second distillation column under a pressure lower than the pressure in the first distillation column, whereby substances having a boiling point lower than that of methanol are removed from the top of said second distillation column, unreacted methanol is recovered as a side stream from said second distillation column and the bottoms of said second distillation column are withdrawn; and

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- (f) recycling said unreacted methanol to said dehydration reaction step."
- II. Two notices of opposition were duly filed within the prescribed period (Article 99 EPC).

The grounds of opposition were that the subject-matter of the disputed patent lacked inventive step and, furthermore, that the subject-matter of Claim 1 was not sufficiently disclosed which latter ground was, however, not maintained in the course of the opposition proceedings.

The oppositions were based, inter alia, on

- (1) US-A-2 014 408 (1935)
- (3) Billet, Industrielle Destillation, 46, Verlag Chemie
 (1973)
- (5) Manufacturing Chemist & Aerosol News, August 1978, 39-40
- (13) Winnacker-Küchler, Chemische Technologie, Bd. 3, 382, Carl Hanser Verlag (1971)

After expiry of the opposition period the Appellant (Opponent II) also relied on:

(13A) Winnacker-Kuchler, Chemische Technologie, Bd. 5, Carl Hanser Verlag (1981)

The Respondent (Patent Proprietor) introduced, <u>inter</u> <u>alia</u>, the following additional document:

(16) Drug and Cosmetic Industry, November 1979, 58-74.

Document (13A), which was designated in the decision under appeal as document (15), is a later edition of document (13).

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III. By a decision of 22 January 1991, posted on 14 March 1991, the Opposition Division rejected the oppositions.

> The Opposition Division held that document (1), which disclosed the features (a), (b), and (f) of Claim 1 of the patent in suit, represented the most relevant prior art, and differed from present Claim 1 in not disclosing the particular two-step distillation process where dimethyl ether (DME) is withdrawn as a side stream of the first distillation column, and unreacted methanol as a side stream of the second column. According to the Opposition Division, the technical problem to be solved in view of citation (1) could be defined as finding a process to manufacture DME which is "odourless" and, thus, useful as a propellant. The Opposition Division was of the opinion, that documents (13) and (13A) provided no guidance to solve this problem, as they related to the purification of crude methanol obtained from methanol synthesis and, thus, were dealing with impurities differing from the present ones both in nature and amount. While all the features of Claim 1 were known per se from separate citations, there - so it was said - was no hint to be found in the prior art to combine the DME preparation known from document (1) with the distillative purification of crude methanol disclosed in citations (13) and (13A).

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IV. An appeal was lodged against this decision on 21 May 1991 with payment of the prescribed fee. In his statement of Grounds of Appeal, filed on 24 July 1991, and during the oral proceedings held on 15 April 1993, the Appellant (Opponent II) argued that documents (13) and (13A) related to the purification of DME and not only of methanol and that these citations, in particular document (13A), clearly disclosed the features (c), (d), and (e) of the present Claim 1. As the selection of the suitable pressure differences between the two distillation columns used were to be considered only as an optimisation, the subject-matter of Claim 1 was, in the Appellant's

opinion, obvious from document (1) in combination with of document (13 A).

V. The Respondent submitted that it was not known, prior to the present invention, that DME of such improved purity, that it was virtually odourless and, was thus, suitable as a propellant, could be obtained by specifically combining the process features (a) to (f). He also emphasised that document (13A) related to the purification of crude methanol obtained from methanol synthesis and, thus, dealt with DME only as a by-product without disclosing anything about its purity. In his submission, the citations and in particular document (16) showed that commercially available DME, i.e. DME manufactured according to the process of document (1), had to be thoroughly purified, if it was to be used as a propellant.

> By contrast, so he argued, the process of the patent in suit yielded directly DME, which was odourless and did not give rise to a "wet" feeling. While the claimed process was a combination of features, each of them known per se, this combination would not have been obvious to the skilled person in view of the technical problem to be

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solved and, furthermore, the very simplicity of this solution could be indicative for its inventiveness, for such simple solutions are frequently, so he said, the most inventive ones.

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In the Respondent's submission, a skilled person, to whom several possibilities for the purification and deodourisation of DME were available, would not have considered that it was possible to dispense with the DME purification by simply modifying the distillation of the methanol in the recycle stream of the process of document (1) which had been in continuous use from about 1931 - a fact specifically denied by the Appellant.

VI. The Appellant requested that the impugned decision be set aside and the patent in suit be revoked; the Respondent requested that the appeal be dismissed. At the end of the oral proceedings, the Chairman announced the decision of the Board to allow the appeal.

Reasons for the Decision

1. The appeal is admissible.

2. <u>Novelty</u>

None of the citations discloses the subject matter of Claim 1 of the patent in suit which, thus, is novel. Since this is not in dispute, it is not necessary to give detailed reasons for this finding.

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3. <u>Inventive Step</u>

The patent in suit relates to a process for the manufacture of DME, whereby methanol from any source is dehydrated in the vapour phase under elevated pressure over a solid acidic catalyst, and the DME is recovered from the cooled reaction mixture by distillation in a pressurised column, from which it is taken off as a side stream, whilst the bottoms of the said column are rectified in a second column, operating at a lower pressure than the first one, from which purified methanol is then removed as a side stream, and recycled to the dehydration reaction. From the top of the first column, fractions are removed with boiling points lower than that of DME, while from the top of the second column fractions having boiling points lower than that of methanol are removed. The bottoms of the second distillation column are then withdrawn.

3.1 Such vapour phase dehydration reactions on a solid catalyst under pressurised conditions for the manufacture of DME are known, in particular from document (1) (see the disputed patent, column 1, lines 26 to 39), which the Board takes as the starting point for the evaluation of inventive step.

Document (1) discloses a process for the manufacture of DME comprising

(i) passing methanol in the vapour phase over a suitable dehydration catalyst at elevated pressure, preferably at about 15 atmospheres (page 1, left hand column, lines 21 to 25, in combination with page 1, right hand column, lines 4 to 7, and page 2, left hand column lines 38 to 41);

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(ii) passing the reaction mixture into a condenser where it may be partly or completely liquified (page 1, right hand column, lines 25 to 28);

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- (iii) introducing it into a first distillation column, from which the DME is removed at the top and condensed thereafter in a condenser (page 1, right hand column, lines 28 to 29 in combination with lines 14 to 19);
- (iv) introducing the bottoms of this first distillation column into a second distillation column from which the unreacted methanol is removed from the top (page 1, right hand column, lines 30 to 33 in combination with the figure); and
- (v) recycling the thus recovered methanol (page 1, right hand column, lines 34 to 35).

Hence, document (1) discloses the process features (a), (b), and (f) of Claim 1 of the patent in suit which are identical with the above features (i), (ii), and (v) respectively. This fact is not in dispute between the parties.

3.2 The DME resulting from the process of document (1) is, according to the patent in suit, not sufficiently pure to be used as a propellant as it retains an undesirable odour (see column 2, lines 17 to 22). Thus, the technical problem to be solved can be defined as finding a process which results in a DME with such improved purity as to qualify it for use as a propellant.

The additional feature of a "wet" feeling is so vague and ill defined that it cannot be considered as being part of the problem requiring solution.

3.3 The means proposed according to Claim 1 of the patent in suit as the solution of this problem consist in a process combining the above process features (i), (ii) and (v) with the distillation features (c), (d), and (e), which relate to the distillative purification of the reaction mixture obtained, and which were all known as such, as was indeed conceded by the Respondent.

According to the example of the disputed patent, the DME obtained by the claimed process has a purity of at least 99.9% (column 7, lines 10 to 14). As document (5) discloses that a DME, which is suitable as a propellant has a purity of 99.8% (min. 99.6%; page 39, left hand column, first line of the first table), it is entirely credible that the process of Claim 1 does solve the above mentioned technical problem.

3.4 It remains to be decided whether or not the subject matter of Claim 1 of the patent in suit results from an inventive step.

> As already indicated, all the process steps (a) through (f) were known as such. While conceding this, the Respondent submitted that the combination of features (a), (b), and (f), all being known from document (1), with the features (c), (d), and (e), was not obvious to a person skilled in the art. A process, so he argued, which was in continuous use from the early thirties of this century would have been deemed to be an optimised one, and not be open for improvement by measures which seem to be simple ones.

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The Board cannot accept the Respondents arguments. The process for the manufacture of DME as disclosed in document (1) requires, in any case, a distillative workup of the reaction mixture. In such a process, if the purity of a product is insufficient, it is the normal way for the skilled person to apply his common general knowledge in respect to distillation methods, when looking for improvements. As it was agreed to have been common general knowledge to remove pure components from multi-component systems by distillation, and via side streams (see e.g. document (3), page 46, lines 2 to 5 after the figure), it clearly belonged to the routine approach of a skilled person to try this possibility - i.e. feature (c) of the present Claim 1 - also in combination with the process features disclosed in document (1).

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This holds true all the more, because the removal of pure DME from a methanol comprising mixture in a side stream from a pressurised distillation column was already known from document (13A) (see page 515, lines 4 to 6 after the table). The fact that this latter document refers to the purification of methanol, and gives no data for the purity of the DME obtained is not decisive. Differences in product composition would perhaps require adaptation and optimisation of the column setup (e.g. column dimensions, number of plates, location of the side stream removal). This, however, can be done by an ordinary skilled person by simple experimentation or calculation, as was confirmed by the Respondent - at least in respect to the positioning of the DME withdrawal - in his submission of 26 September 1988 to the Opposition Division, countering an objection of lack of sufficient disclosure (page 9, last sentence).

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For the same reasons inventive merits cannot be seen either in features (d) and (e) or in their combination with the other features of Claim 1 of the disputed patent. To apply the principle of product removal as a side stream from a second column for the distillative purification of the methanol to be recycled is, again, a measure which lies within the common general knowledge of the notional skilled person.

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Furthermore, it would have been obvious to operate this second distillation column at a lower pressure than the first one, because economical reasons would have rendered it unreasonable to maintain there the high pressure of the first distillation column as this would mean an unnecessary increase in energy consumption.

It is true that, as the Respondent maintained, there were in theory other possibilities available to the skilled person to obtain a sufficiently purified DME, e.g. the use of adsorption columns and of active coal. However, a skilled person would, in the Board's judgement, have availed himself of such other possibilities only if he would have failed to solve the existing technical problem by adapting, using his common generals knowledge, mandatory measures (here: the distillative work up) according to his general common knowledge. This holds true particularly in the present situation, where he succeeded by applying the general principle as such (here: the withdrawal of products as side streams) without the necessity to specify technical details of such an application.

3.5 While DME for use as a propellant was already known (see documents (5) and (16)), commercially available DME, according to the Respondent, had to be purified and deodourised to that end in a two-step process. In

support, the Respondent referred to document (16), page 60, left hand column, the first sentence in the paragraph after the formula line. Sentences one and two of this paragraph read: "DME is separated from methanol by distillation and subjected to a purification and deodourisation process. By changing the conditions of the process, it was found possible to enhance DME recovery considerably." According to the Respondent, it became possible by the claimed process to dispense with the two steps of purification and de-odourisation of the DME.

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This argument cannot be accepted by the Board for the following reason: The first sentence of the quoted passage is ambiguous, to say the least, and does not clearly disclose two processes (or a two-step process). The same justification exists for concluding that the said first sentence refers to a process where DME is purified and deodourised at the same time. Such a conclusion is clearly supported by the second sentence of the quoted passage, which refers only to one process. Furthermore, and more importantly, the Respondent conceded that the odor of the DME, being linked to impurities, was a question of the product's purity which means, in the Board's judgement, that purification and de-odourisation went hand in hand and did not require separate process steps.

Nor can the Respondent's argument, which expressly did not rely on the argument of long-felt need, be accepted that all the technical measures now combined were old technologies which became available to the skilled person not only recently and that the simplicity of the claimed solution achieved by such combination should be taken as a sign for an inventive step. According to the established case law of the Boards, such a purely inferential approach to the evaluation of inventive step

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cannot replace a step-by-step and exhaustive investigation of this issue (see e.g. decision T 24/81, paragraph 15 of the reasons; OJ EPO 1983, 133, 141). Therefore, the mere simplicity of the technical solution of a problem can be relied upon merely as an auxiliary matter, and then only in cases where the question of inventive step remains in doubt, even after the application of the step-by-step and exhaustive problemsolution approach. This, however, is not the case here.

3.6 It follows that the subject matter of the present Claim 1, which is a combination of process features known from document (1) and of features belonging to the general common knowledge of the skilled person, was obvious as the means to solve the existing technical problem in view of said citation (1) and said common general knowledge. Hence, its subject matter does not meet the requirements of Article 56 EPC. Dependent Claims 2 to 8 fall together with Claim 1.

Order

For these reasons, it is decided that:

1. The appeal is allowed.

2. The patent is revoked.

The Registrar:

The Chairman: