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D E C I S I O N
of 30 July 2002

Case Number: T 0355/99 - 3.3.1

Application Number: 94908540.1

Publication Number: 0684940

IPC: C07C 45/89

Language of the proceedings: EN

Title of invention:

A process for the production of ketene dimers

Patentee:

Eka Chemicals AB

Opponent:

Hercules Incorporated

Headword:

Ketene dimers / EKA Chemicals

Relevant legal provisions:

EPC Art. 54(1)(2), 56, 88

Keyword:

"Right of priority (no) - no specific disclosure of the claimed process in the previous application as a whole"
"Novelty (yes) - process not directly and unambiguously derivable from the prior art"
"Inventive step (yes) - characterising features not suggested in the cited documents"

Decisions cited:

T 0026/85, T 0012/90, T 0133/92, T 0290/86

Headnote:

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Case Number: T 0355/99 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 30 July 2002

Appellant: Eka Chemicals AB
(Proprietor of the patent) S-44580 Bohus (SE)

Representative: Tauchner, Paul
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Respondent: Hercules Incorporated
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Representative: Hansen, Bernd, Dr. Dipl.-Chem.
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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 2 February
1999 concerning maintenance of European patent
No. 0 684 940 in amended form.

Composition of the Board:

Chairman: J. M. Jonk
Members: P. P. Bracke
M. B. Tardo-Dino

Summary of facts and submissions

I. The Appellant (Proprietor of the patent) lodged an appeal against the interlocutory decision of the Opposition Division maintaining the European patent No. 0 684 940 (European patent application 94 908 540.1, filed on 14 February 1994, published as WO 94/19306, and claiming priority from the previous Swedish application No. 9 300 584-1 filed on 22 February 1993) on the basis of the claims of the then pending fourth auxiliary request.

II. The patent was granted on the basis of 11 claims, the only independent claim 1 reading as follows:

"1. A process for the production of ketene dimers from fatty acid halides by reaction with tertiary amines, **characterised** in that the process is operated batchwise and that the reaction is started in the presence of an initial reaction mixture containing ketene dimer and pre-prepared crystals of tertiary amine hydrogen halide and is carried out in the presence of not more than 10% by weight, based on the amount of fatty acid halide, of additional solvents."

III. The opposition was filed against the patent as a whole, and based on the ground of lack of inventive step as indicated in Article 100(a) EPC. It was supported by several documents, including:

(1) US-A-2 369 919, and

(5) J. Am. Chem. Soc. 69, pages 2444 to 2448 (1947).

Furthermore, during the opposition proceedings, the Respondent (Opponent) also contested novelty and inventive step of the claimed process in view of the late filed document

(7) EP-A-0 550 107,

which was published after the priority date, but before the filing date of the patent in suit.

IV. The Opposition Division held that the subject-matter of the claims as granted, as well as those of the auxiliary requests 1 to 3 then on file, implicitly lacked novelty in view of document (7), since it had to be expected that in a batchwise large scale industrial process each time a rest of a previous batch would be present at the start of the preparation of the next batch.

However, concerning the fourth auxiliary request, it decided that, account being taken of the introduced feature in Claim 1 as granted indicating that the weight ratio of the initial reaction mixture to the fatty acid halide had to be within the range of from 1:1 to 1:15, the claimed subject-matter was found to meet the requirements of the EPC. In this context, the Opposition Division held that in view of said introduced feature the claimed priority could not be acknowledged anymore, and that therefore document (7) represented prior art within the meaning of Article 54(1) and (2) EPC.

V. Oral proceedings before the Board were held on 30 July 2002. The Respondent was not represented there, as announced in its letter of 13 June 2002.

VI. The Appellant defended the patent in suit on the basis of the claims as granted. Moreover, he filed several auxiliary requests.

He argued that the subject-matter of the claims as granted was novel, since document (7) did not directly and unambiguously disclose a batchwise process wherein the initial mixture contained ketene dimer and pre-prepared crystals of tertiary amine hydrogen halide. In this context, he submitted in particular that said document neither disclosed a large scale process, nor suggested a batchwise process involving more than once the use of the same batch reactor without intermediate cleaning.

The Appellant also submitted that the claimed process involved an inventive step in the light of the cited documents, since these documents did not provide any incentive to a skilled person to start a batchwise reaction in the presence of the initial mixture as defined in Claim 1 as granted.

VII. The Respondent argued with respect to the subject-matter of the claims as granted that the claimed priority was not valid, since the priority document only disclosed a process in which the reaction was started in the presence of pre-prepared ketene dimer or a reaction mixture product containing ketene dimer, which mixture product not only contained crystals of a tertiary amine hydrogen halide, but also unreacted starting compounds and by-products. Therefore, document (7) represented prior art within the meaning of both Article 54(1)(2) and 56 EPC.

Furthermore, he maintained his opinion that the claimed

process lacked novelty in view of document (7). In particular, he submitted

- (i) that this document not only disclosed a batchwise preparation method, but also the use of an initial reaction mixture containing ketene dimer and pre-prepared crystals of tertiary amine hydrogen halide as indicated in example 4, and
- (ii) that it had to be expected that in a batchwise large scale industrial process each time a rest of a previous batch would be present at the start of the preparation of the next batch.

Concerning inventive step, he submitted that the claimed process was obvious in view of document (7) alone or in combination with document (5), or in view of document (1) in combination with document (5), since said document (5) recommended the seeding of the reaction mixture with tertiary amine hydrogen halide crystals before carrying out the dehydrohalogenation.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained, on the basis of the patent as granted, or, alternatively, on the basis of any of its auxiliary requests.

The Respondent requested, in its written submissions, that the appeal be dismissed.

IX. At the conclusion of the oral proceedings the Board's decision was pronounced.

Reasons for the decision

1. The appeal is admissible.
2. *Main request*
 - 2.1 Right of priority
 - 2.1.1 In reply to the Respondent's objection with respect to the right of priority, the Appellant submitted that the priority could be acknowledged since the priority document disclosed the use of an initial mixture containing ketene dimer and pre-prepared crystals of tertiary amine hydrogen halide.
 - 2.1.2 However, in the Board's judgement, it can only directly and unambiguously be derived from the priority document that, at the start of the reaction, a pre-prepared ketene dimer or a reaction mixture product containing ketene dimer can be applied (see Claim 1, page 6, lines 18 to 21 and examples 3 and 4). Due to the reaction scheme for preparing ketene dimers by reacting a fatty acid halide with a tertiary amine, such a reaction mixture product not only contains unreacted starting compounds and by-products, but also tertiary amine hydrogen halide crystals in an amount which is at least equivalent to the amount of formed ketene dimer. On the other hand, according to Claim 1 of the patent in suit any initial reaction mixture comprising ketene dimer and crystals of a tertiary amine hydrogen halide can be applied, i.e. initial reaction mixtures comprising low amounts of crystals such as 1% by weight (see patent in suit, column 4, lines 30 to 35). Therefore, this broad feature of present Claim 1 cannot be derived from the priority document.

2.1.3 Thus, under the circumstances of the present case, the Board concludes that the claimed priority cannot be acknowledged, and that document (7) being published before the filing date of the patent in suit represents prior art within the meaning of both Article 54(1)(2) and 56 EPC.

2.2 Novelty

2.2.1 Regarding novelty the Respondent submitted, in particular, that the claimed process lacked novelty in view of document (7), since this document not only disclosed a batchwise preparation method, but also the use of an initial reaction mixture containing ketene dimer and crystals of tertiary amine hydrogen halide as indicated in example 4, and because it had to be expected that in a batchwise large scale industrial process each time a rest of a previous batch would be present at the start of the preparation of the next batch.

2.2.2 However, in the Board's judgment, document (7) does not disclose a large scale batchwise process, let alone such a process involving more than once the use of the same batch reactor without intermediate cleaning. Moreover, the Board observes that said Example 4 only concerns a continuous process, wherein the reaction was started in the presence of ketene dimer alone.

2.2.3 Thus, in accordance with the established case law of the Boards of Appeal that a document can only take away novelty of claimed subject-matter if it is directly and unambiguously derivable from that document, the Board concludes that the claimed process is novel over document (7).

2.2.4 Concerning the decisions of the Boards of Appeal, namely T 0026/85, T 0012/90, T 0133/92 and T 0290/86, cited by the Respondent in support of his submissions, the Board observes that they are considered as not relevant, since they relate to quite different cases. In this context, the Board emphasises that the question of novelty has to be decided in view of the facts of each particular case, and that the essential point in assessing novelty is that it is not sufficient for a finding of lack of novelty of claimed features that such features **could** have been derived from a prior document. In order to be novelty destroying, there must be a clear and unmistakable teaching of the claimed features in a prior art document.

2.3 Inventive step

2.3.1 In deciding whether or not a claimed invention meets this criterium on an objective basis, the Boards of Appeal consistently apply the "problem-solution approach", which essentially involves identifying the closest state of the art as the starting point, determining in the light thereof the technical problem which the claimed invention addresses and successfully solves, and examining whether or not the claimed solution to this problem is obvious for the skilled person in view of the state of the art.

2.3.2 The "closest state of the art" is normally a prior art document disclosing subject-matter aiming at the same objective as the claimed invention and having the most relevant technical features in common.

2.3.3 Thus, in view of the fact that document (7) is the only cited document concerned with the problem of carrying

out a process of preparing ketene dimers starting from acid halides and tertiary amines at sufficiently low viscosity in the substantial absence of additional solvents, the Board considers that this document represents the closest prior art.

2.3.4 Document (7) discloses a process for preparing ketene dimers in which carboxylic acid chlorides are reacted with a tertiary amine characterised in that

- (a) the reaction is carried out in the absence of a solvent,
- (b) the carboxylic acid chloride is fed to the triethyl amine,
- (c) this feeding is carried out at a rate of at most 3 moles/hour per mole of triethyl amine,
- (d) a molar ratio of the acid chloride to the triethyl amine of 1:1.025 to 1:2 is applied, and
- (e) the mixing, feed rate and heat exchange are controlled such that the viscosity of the mixture is maintained at less than 250 mPa.s, measured at 60°C (rate of shear higher than 100 l/sec).

2.3.5 Regarding this closest state of the art, the Appellant submitted essentially that the process according to the claimed invention is much more simple than the process of document (7), since the claimed process can be carried out at a sufficiently low viscosity without being necessarily bound to the combination of the feature (a) to (e) as indicated in point 2.3.4 above.

- 2.3.6 Thus, in view of the Appellant's submissions it is the Board's position that in the light of document (7) the technical problem underlying the patent in suit is the provision of a technically simplified process for preparing ketene dimers of a satisfying purity in the absence or substantial absence of an additional solvent, while maintaining a sufficiently low viscosity (see column 1, line 51 to column 2, line 16, and column 2, line 24 to column 3, line 17, of the patent in suit).
- 2.3.7 According to present Claim 1 this technical problem is solved by providing a process in which the reaction is essentially characterised in that the process is operated batchwise, and that the reaction is started in the presence of an initial reaction mixture containing ketene dimer and pre-prepared crystals of tertiary amine hydrogen halide and is carried out in the presence of not more than 10% by weight, based on the amount of fatty acid halide, of additional solvents.
- 2.3.8 Having regard to the technical information provided in the patent in suit, in particular in the examples, the Board considers it plausible that the technical problem as defined above has been solved. The results achieved according to the examples, all being performed in the absence of an additional solvent, were never contested by the Respondent.
- 2.3.9 The question now is whether a skilled person starting from document (7), and having knowledge of the other cited documents, would arrive at the solution of the above defined problem as claimed.
- 2.3.10 In this context, the Respondent argued that the claimed

process would be obvious to the skilled person in view of document (7), since this document teaches that the preparation of the ketene dimers can be carried out batchwise (see Claim 6), and because it follows from example 4 that the reaction components (carboxylic acid chloride and tertiary amine) can be added to a reaction medium containing ketene dimer and crystals of a tertiary amine hydrogen halide.

However, said example 4 concerns a continuous process, which is started in the presence of ketene dimer only. Furthermore, the batchwise embodiment as disclosed in document (7) (see page 3, lines 15 to 24, and Example 1), is always conducted by adding the carboxylic acid chloride to the tertiary amine as initial reaction medium.

Therefore, no incentive can be found in document (7) to the solution of the present problem as claimed, which involves the use of an initial reaction medium as defined in Claim 1 and a batchwise process as a mandatory feature.

2.3.11 The Respondent also submitted that the subject matter of Claim 1 was obvious in view of the combined teaching of documents (7) and (5), since document (5) recommended the seeding of the reaction mixture with tertiary amine crystals before carrying out the dehydrohalogenation.

It is true that document (5) describes a process of preparing ketene dimers by adding a tertiary amine to a solution of a carboxylic acid halide, which is seeded with crystals of the tertiary amine hydrogen halide (see page 2446, right column, under "Synthesis of

Ketene Dimers and Derivatives.").

However, the purpose of this seeding was to avoid the forming of a gelatinous mass and to achieve a good filtration (see the footnote 13 on said page 2446). Therefore, the teaching of document (5) in this respect does not concern the technical problem underlying the patent in suit as defined above, and consequently does not give a pointer to its solution.

Moreover, the Board observes, that the process as described in document (5) comprising a seeding of the reaction solutions with crystals of the tertiary amine hydrogen halide, which allows an advantageous crystal growth, involves the use of solutions comprising a large excess of solvent. However, such solutions totally differ from the reaction media as applied in accordance of Claim 1 of the patent in suit, which substantially comprise the starting mixture of the ketene dimer and the crystals of the tertiary amine, as well as at most a very small amount of solvent. Thus, in view of the different reaction media, the skilled person would not expect a similar effect on the crystal growth, and consequently would not have any reason to apply a seeding with crystals of a tertiary amine hydrogen halide under the conditions of the process of the patent in suit.

Furthermore, the technical teaching of document (5) - like document (7) - does not give any pointer to the skilled person to the use of an initial mixture comprising ketene dimer and crystals of the tertiary amine hydrogen halide.

Thus, having regard to the above considerations, the

Board concludes that also a combination of the teaching of document (7) with that of document (5) does not lead a skilled person to the claimed solution of the problem as defined above.

2.3.12 Finally, the Respondent submitted that the claimed subject-matter was obvious in view of the combined teaching of documents (1) and (5).

Document (1) discloses the preparation of ketene dimers by reacting an acid halide, preferably an acid chloride, with a tertiary amine, such as triethyl amine, in which the reaction is carried out in the presence of any organic solvent which is inert towards the reactants and the ketene dimers formed (see page 1, left column, lines 35 to 44; page 1, right column, lines 13 to 23; and page 2, right column, line 61 to page 3, left column, line 7). The amount of solvent should be sufficient to dissolve the ketene dimer, thus facilitating the separation of the insoluble tertiary amine hydrochloride by filtration, whereby the use of 100 to 200 parts solvent per tenth mole of each reactant was found satisfactory (see page 3, left column, lines 8 to 14, and the examples).

Furthermore, it also discloses that it is feasible to use an excess of the tertiary amine as solvent in cases where the ketene dimer can be readily separated from the amine and its hydrochloride (see left-hand column on page 3, lines 14 to 18). However, having regard to the teaching of this document as a whole, in the Board's judgment, this embodiment, which is apparently less preferred in view of purity problems with respect to the ketene dimer products, also involves the use of a large excess of solvent, i.e. a large amount of the

tertiary amine acting as a solvent (about 10 to 20 moles of triethyl amine, which would correspond to about 100 to 200 parts solvent per tenth mole of each reactant).

In any case, document (1) - like document (5) - does not give any incentive to the skilled person to start the reaction in the presence of the initial reaction mixture as defined in present Claim 1.

2.3.13 Thus in view of these considerations, the Board concludes that the solution of the above defined technical problem as claimed in Claim 1 of the patent in suit is not obvious to the skilled person in the light of the cited documents either taken alone or in combination, and consequently involves an inventive step within the meaning of Article 56 EPC.

Claims 2 to 11 relate to particular embodiments within the ambit of the subject-matter of Claim 1. They are therefore also allowable.

3. *Auxiliary requests*

3.1 Since the subject-matter of the claims of the main request is allowable for the reasons set out above, there is no need for the Board to decide on any of the auxiliary requests.

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

J. Jonk