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D E C I S I O N
of 19 February 2002

Case Number: T 0164/98 - 3.3.1

Application Number: 92204040.7

Publication Number: 0550107

IPC: C07C 45/89

Language of the proceedings: EN

Title of invention:
Long-chain ketene dimers

Patentee:
Akzo Nobel N.V.

Opponent:
Hercules Incorporated

Headword:
Ketene dimers/AKZO NOBEL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) - definition of the technical problem -
non-obvious solution"

Decisions cited:
T 0024/81, T 0219/83, T 0229/85, T 0422/93

Catchword:
-



Case Number: T 0164/98 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 19 February 2002

Appellant:
(Opponent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 18 December 1997
rejecting the opposition filed against European
patent No. 0 550 107 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: R. Freimuth
Members: J. M. Jonk
J. P. B. Seitz

Summary of Facts and Submissions

- I. The Appellant (Opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against the European patent No. 0 550 107 (European patent application No. 92 204 040.7), which was granted on the basis of eleven claims, the independent Claim 1 reading as follows:

"A process for the preparation of long-chain ketene dimers which comprises reacting carboxylic acid chlorides of the formula RCH_2COCl , wherein R is a saturated or unsaturated hydrocarbon group having 6-30 carbon atoms, with triethyl amine to obtain an amine hydrochloride-containing reaction mixture containing ketene dimer, and treating said mixture with dilute aqueous hydrochloric acid or an aqueous solution of triethyl amine hydrochloride and hydrochloride acid to separate out the ketene dimer product, wherein the process is characterized in that said acid chloride is fed, in the absence of an organic solvent into said triethyl amine under intensive mixing at a rate of not more than 3 moles/hour per mole of triethyl amine, and 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 1/sec) and the molar ratio of the total amount of carboxylic acid chloride fed into the triethyl amine is 1:1,025 to 1:2."

- II. 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) DE-A-2 927 118, and

(2) US-A-2 369 919.

III. The Opposition Division held that the problem underlying the patent in suit was to provide a process for preparing long-chain ketene dimers, whereby in particular the problems related to the use of solvents were avoided and impurities in the end products and in the waste water were reduced. Furthermore it held that the solution of this problem by the claimed process, which was in particular characterised by the absence of a solvent and the mixing conditions as defined leading to the specified low viscosity during the conversion of the reaction components, was not obvious in the light of the cited documents.

IV. Oral proceedings before the Board were held on 19 February 2002.

V. The Appellant argued that in the light of the disclosure of document (1) representing the closest state of the art the technical problem underlying the patent in suit was the provision of a process for preparing ketene dimers in the presence of a lawful environmentally-friendly solvent. The claimed solution of this problem involving the addition of the carboxylic acid chloride into the amine and the performance of the reaction in the absence of an additional solvent was, however, obvious in the light of document (2), since this document disclosed that the sequence of the addition of the carboxylic acid chloride and the amine could be reverted and that an excess of the amine could be used as a solvent. Moreover, he argued that the claimed feature concerning the viscosity of the reaction mixture was of no value and a technical merit on its own, since the viscosity directly resulted from the exchange of a conventionally

used solvent for an excess of the triethyl amine, and the use of a normally applied temperature and mixing rate. He also contended that under the stirring conditions as applied according to document (1) essentially non-dendrite type crystals of triethyl amine hydrochloride would be formed, and that therefore the claimed process features leading to the specific crystal morphology disclosed in the patent in suit were of no relevance in assessing inventive step either.

VI. The Respondent argued that, compared to the process of document (1), the claimed process of the patent in suit could be carried out at a low viscosity without being burdened with the typical drawbacks connected with the use of solvents, and led to ketene dimer products being free from undesirable impurities. Concerning the cited prior art, he emphasised that according to document (1) the use of an organic solvent was necessary in order to keep the reaction mixture stirrable, and that document (2) only disclosed the optional use of an excess of tertiary amine in combination with an inert organic solvent. He concluded therefore that the claimed process involved an inventive step over document (1) and document (2), either alone or in combination.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed or that the patent be maintained on the basis of the Claims 1 to 11 of the auxiliary request filed on 18 January 2002.

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

Reasons for the Decision

1. The appeal is admissible.

Main request

2. The only issue to be dealt with is whether or not the subject-matter of the claims involves an inventive step.
 - 2.1 In deciding whether or not a claimed invention meets this criterion, the Boards of Appeal consistently apply the problem and solution approach, which essentially involves identifying the closest prior art, 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.
 - 2.2 The Board considers, in agreement with the parties, that the closest state of the art with respect to the claimed subject-matter of the patent in suit is the disclosure of document (1).

This document discloses a process for preparing long-chain ketene dimers avoiding a high viscosity of the reaction mixture disturbing the performance of the process, in which the ketene dimer products are obtained in a high purity (see page 1, line 11 to page 2, line 8, of the description). The process is carried out by reacting a carboxylic acid chloride having 12 to 22 carbon atoms with a mixture of tertiary amines containing 0.5 to 10 parts by weight of trimethyl amine per 100 parts by weight of another a tertiary amine in an inert organic solvent at a temperature of up to 90°C, washing the reaction mixture

with a dilute aqueous hydrochloride, separating the aqueous phase and isolating the ketene dimer by evaporating the organic solvent (see Claim 1, page 1, lines 3 to 9, page 2, lines 10 to 32, and page 4, lines 20 to 28, of the description).

It also discloses that the use of an inert organic solvent is necessary for achieving a stirrable reaction mixture (see page 3, lines 15 to 35), and that in performing the process the tertiary alkyl amine is added to the solution of the fatty acid chloride (see page 5, lines 1 to 7, and the examples).

2.2.1 The Appellant alleged that the feed rate of at most 3 moles/hour per mole of triethyl amine, the molar ratio of the acid chloride to the triethyl amine of 1:1.025 to 1:2, and the maintenance of the viscosity of the mixture at less than 250 mPa.s, measured at 60°C (rate of shear higher than 100 1/sec) as claimed were disclosed in Example 1 of document (1).

2.2.2 However, in the Board's judgment, these features cannot be derived from said example, since

- no feeding of the acid chloride to the amine component occurs at all,
- the ratio of acid chloride to amine of 1:1.025 as calculated by the Appellant on the basis of Example 1 of document (1), which would fall within the claimed range, is not based on the amount of triethyl amine, but also includes trimethyl amine, and
- the functional feature relating to the control of the viscosity, which is interlinked with the feed rate of the acid chloride to the triethyl amine

and the applied molar ratio of acid chloride to amine of 1:1.025 to 1:2, is not disclosed anywhere.

Moreover, the technical teaching of said Example 1 concerning feed rate, mixing and temperature control is closely associated with the application of an inert solvent and a reversed order of addition of the acid chloride and the amine component, and therefore cannot be generalised and applied to the process of Claim 1 of the patent in suit.

- 2.3 Regarding this closest state of the art, the Respondent submitted essentially that by applying the process as claimed the technical and environmental drawbacks connected with the use of organic solvents would be overcome, the viscosity of the reaction mixture would be maintained on a satisfying low level, and the presence of undesirable impurities, including solvent residues, in the ketene dimer products would be avoided.
- 2.4 The Appellant did not contest these submissions, but he emphasised that the essential drawback of the process of document (1) concerned the use of environmentally unfriendly solvents leading to diketene dimers contaminated with toxic solvent residues. Moreover, subsequent products, such as package paper, containing such contaminated ketene dimers might not comply with legal provisions.
- 2.4.1 Accordingly, in the Appellant's opinion, the technical problem underlying the patent in suit was therefore to find a lawful environmentally-friendly solvent.

2.4.2 However, this technical problem is not in conformity with the established case law of the Boards of Appeal concerning the determination of the technical problem, since a properly defined technical problem must be successfully solved by the invention as claimed (see, e.g., T 24/81, OJ EPO 1983, 133), and must not contain a pointer to its solution or partially anticipate it (see, e.g., T 229/85, OJ EPO 1987, 237; and T 422/93, OJ EPO 1997, 24).

In this context, the Board observes that, according to Claim 1, the process is carried out in the absence of an organic solvent. In the light of the description of the patent in suit, which comprises a discussion of the closest prior art document (1), in the Board's judgment, this feature can only mean that the process as claimed excludes the use of any organic solvent, which is inert with respect to the reactants and the reaction product (see page 2, line 57, and page 3, lines 34 and 35, in combination with the passage on page 2, lines 29 to 53). Thus, if the technical problem as defined by the Appellant were to concern the finding of a lawful environmentally-friendly inert solvent, it would not be solved by the process of Claim 1.

If, on the other hand, the Appellant's definition of the technical problem concerned the finding of a suitable non-inert solvent, it would contain a pointer to its solution or partially anticipate its solution. Such a definition of the technical problem would be the result of an unallowable ex post facto view being taken of the claimed invention, and therefore - as indicated above - would not be in conformity with the established case law of the Boards of Appeal on defining the objective technical problem underlying the claimed invention.

Furthermore, the Board observes that in the light of document (1) as the closest prior art the viscosity problem has been solved. Therefore, the low viscosity as achieved according to this document should be maintained.

2.5 Thus, in view of the Respondent's submissions, and having regard to these considerations, it is the Board's position, that in the light of document (1) the technical problem underlying the patent in suit can only be seen in the provision of a technically simplified process for preparing long-chain ketene dimers, maintaining a satisfying low viscosity and avoiding the presence of undesirable impurities in the end-products (see also the patent in suit, page 2, lines 56 to 59, in combination with the evaluation of the prior art, including document (1), on page 2, lines 29 to 53, and the statement on page 3, lines 40 to 44).

2.6 According to present Claim 1 this technical problem is solved by providing a process in which the reaction is essentially characterised in that:

- (a) the reaction is carried out in the absence of an organic solvent,
- (b) the 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 1/sec).
- 2.7 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.
- 2.7.1 In this context, the Appellant disputed the relevance of the claimed features (c) to (e) indicated under point 2.6 above for the solution of the technical problem underlying the patent in suit as defined above, whereas according to the patent in suit these features would lead to the achievement of a particular crystal morphology rendering it possible to work at satisfying low viscosities without the use of an inert organic solvent (see page 2, lines 29 to 32, page 3, lines 34 to 37, and page 4, line 55 to page 5, line 2).
- 2.7.2 However, he did not provide any support for his contentions in this respect. Moreover, he did not dispute that the claimed process can be successfully performed at a satisfying low viscosity and in an environmentally friendly and technically simplified manner, and that the end products of the claimed process did not contain detrimental impurities.
- 2.7.3 Furthermore, the Board notes that according to the patent in suit a satisfying low viscosity can be achieved by applying an excess of 0.025 to 1 mole of triethyl amine per mole of the acid chloride (see said feature (d)), and according to the Examples 1 to 3 already by using a small excess of about 0.1 mole of the amine, whereas according to document (1) a solvent had to be applied in high amounts of at least an equal amount by weight on the basis of the carboxylic acid

chloride (see document (1), lines 26 to 35, and the examples). Such an equal amount by weight of solvent would according to Example 1 of the patent in suit correspond to an excess of triethyl amine of at least 614.3 g or about 6 moles. Therefore, the Board concludes that the triethyl amine used in a small excess as indicated in Claim 1 of the patent in suit functioning as a solvent is essential for the solution of the above defined technical problem not on its own but in combination with said features (c) to (e).

2.7.4 Regardless of that, however, it is not sufficient in opposition proceedings for the Opponent to impugn a granted patent with an assertion which cannot be substantiated. It is true that under Article 114(1) EPC the European Patent Office, in proceedings before it, examines the facts of its own motion and is not restricted in this examination to the facts, evidence and arguments provided by the parties and the relief sought. But if the European Patent Office is unable to establish the facts of its own motion, it is the party whose argument rests on these alleged facts who loses thereby (see e.g. T 219/83, OJ EPO 1986, 211, point 12 of the Reasons).

2.7.5 Accordingly, the Appellant's assertion can only be treated as an unproven allegation which cannot counter the finding that said features (c) to (e) of Claim 1 of the patent in suit in combination are essential to the claimed invention.

2.8 In assessing inventive step the question now is whether a skilled person starting from document (1), and having knowledge of document (2), would arrive at the solution of the above defined technical problem as claimed.

2.8.1 Document (2) 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 it is essential that the reaction and the isolation of the products take place under anhydrous conditions (see page 1, left column, lines 23 to 33; page 3, right column, lines 40 to 44; page 3, left column, lines 43 and 44; and page 3, right column, line 20; and the examples).

Moreover, it discloses that 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).

Further to this teaching, it also contains the following statement (see page 3, left column, lines 14 to 18):

"It is also feasible to use an excess of the tertiary aliphatic amine as solvent in cases where the substituted ethenone can be readily separated from the amine and its hydrochloride."

2.8.2 The Appellant argued that the claimed process was obvious in the light of this document, since it indicated the possibility of adding the carboxylic acid chloride into said tertiary amine, and because it

followed from the cited statement that the disclosed reaction could be performed in the presence of an excess of the tertiary amine as the sole solvent.

2.8.3 The Board concurs with the Appellant's point of view that the skilled person would indeed derive from the cited statement that the disclosed reaction could be carried out by adding the acid chloride to an excess of the tertiary amine without any additional inert solvent. In this context, the Board observes that said statement does not contain any pointer that the excess amine should be used in addition to another solvent.

2.8.4 However, in the Board's judgment, a skilled person would derive from document (2) as a whole, and particularly from the examples, that the disclosed embodiment using an inert solvent represents the preferred embodiment of that process, and that the alternative embodiment using an excess of the amine component as a solvent would suffer from purification problems (see column 2, lines 11 to 14 and 16 to 18, and column 3, lines 35 to 39). Consequently, a skilled person faced with the above defined technical problem underlying the patent in suit of avoiding the presence of undesirable impurities in the long-chain ketene dimers, and having regard to the teaching of document (1) emphasising the need of an inert solvent, would rather consider the preferred embodiment for its solution, i.e. the embodiment leading away from the solution as claimed.

2.8.5 Furthermore, even assuming that the excess of the tertiary amine would have about the same effect as an inert solvent, and disregarding the drawbacks of the use of this excess, a skilled person would derive from the teaching of document (2) that the solvent had to be applied in a large amount (see point 2.8.1 above, second paragraph), and that consequently the tertiary

amine acting as solvent had to be applied in a large excess of about 100 to 200 parts per tenth mole of each reactant (corresponding to about 10 to 20 moles of triethyl amine).

2.8.6 Therefore, document (2) does not give any pointer to the claimed solution of the above defined technical problem with respect to the use of only a small excess of 0.025 to 1 mole of the tertiary amine per mole of the acid chloride (said feature (d) of Claim 1), let alone concerning the functional feature (e) (indicated under point 2.6 above), which is credibly essential for maintaining a satisfying low viscosity of the reaction mixture (see also points 2.7.1 to 2.7.5 above).

2.9 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.

Auxiliary request

3. 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 the auxiliary request.

Order

For these reasons it is decided that:

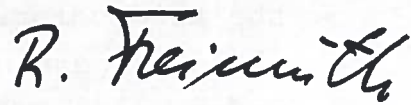
The appeal is dismissed.

The Registrar:



N. Maslin

The Chairman:



R. Freimuth