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D E C I S I O N
of 5 July 2000

Case Number: T 0355/97 - 3.3.1

Application Number: 88303825.9

Publication Number: 0289297

IPC: C07C 213/08

Language of the proceedings: EN

Title of invention:

Improved hydrogenation process for preparing 4-aminophenol

Patentee:

NORAMCO, INC.

Opponent:

Mallinckrodt Speciality Chemicals Company

Headword:

Hydrogenation/NORAMCO

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no) - alleged improvement of technical effect - burden of proof on proprietor - not discharged by unverifiable statement in description - reformulation of problem - obvious solution"

Decisions cited:

T 0020/81, T 0270/90

Catchword:

Each of the parties to the opposition-appeal proceedings carries the burden of proof for the facts it alleges (following T 270/90, OJ EPO 1993, 725). If the Proprietor of the patent alleges the fact that the claimed invention improves a technical effect, then the burden of proof for that fact rests upon him. The unverifiable statement in the specification of the patent in suit that the technical effect is improved which

is devoid of any corroborating evidence, does not discharge the Proprietor from his burden of proof with the consequence that the unsubstantiated allegation is not to be taken into account (point 2.5.1 of the reasons).



Case Number: T 0355/97 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 5 July 2000

Appellant:
(Opponent)

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Representative:

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 19 February 1997
rejecting the opposition filed against European
patent No. 0 289 297 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: R. Freimuth
S. C. Perryman

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal on 27 March 1997 against the decision of the Opposition Division posted on 19 February 1997 rejecting the opposition against European patent No. 289 297 which was granted on the basis of nine claims, the independent claim 1 reading as follows:

"1. A process for the synthesis of 4-aminophenol by the reduction of nitrobenzene with hydrogen and a hydrogenation catalyst in a sulfuric acid solvent, which comprises pretreating the sulfuric acid with hydrogen peroxide."

II. Notice of Opposition had been filed by the Appellant requesting revocation of the patent as granted in its entirety for the sole ground of lack of inventive step. The following documents were submitted *inter alia* in opposition proceedings:

- (1) US-A-2 765 342,
- (2) US-A-3 383 416,
- (5) IT-A-612 445, considered in the form of its english translation,
- (9) US-A-4 176 138.

III. The Opposition Division held that the subject-matter claimed involved an inventive step in the light of the documents cited. The document (2) was considered as closest prior art disclosing a hydrogenation process of nitrobenzene to 4-aminophenol in the presence of aqueous sulfuric acid and a metal catalyst. The problem underlying the patent in suit consisted in improving the performance index, i.e. increasing the rate of reaction, without losing selectivity. In view of the statements in the specification of the patent in suit

and of the experimental data provided by the Opponent-Appellant that problem was considered to have been successfully solved by the claimed process, in particular by pretreating the sulfuric acid with hydrogen peroxide. The Opposition Division concluded that none of the documents addressed in opposition proceedings gave an incentive to effect that pretreatment of the sulfuric acid in order to solve the problem underlying the patent in suit of improving the performance index without loss of selectivity. Therefore the documents cited did not render obvious the subject-matter of the claimed invention.

- IV. The Appellant consented at the oral proceedings before the Board to start from document (9) as closest prior art when assessing inventive step after having taken documents (1) and (2) into consideration in the Statement of Grounds of Appeal filed on 1 July 1997. Document (9) disclosed a process for preparing 4-aminophenol by hydrogenating nitrobenzene in the presence of aqueous sulfuric acid and a metal catalyst. According to the examples thereof the sulfuric acid was of reagent grade, which had a purity superior to that of technical grade. The alleged effect of improving the rate of reaction, i.e. the performance index, while maintaining the selectivity of the preparation process due to pretreating the sulfuric acid with hydrogen peroxide according to the claimed invention, lacked any supporting evidence. The specification of the patent in suit was silent about any experimental result comparing the achievement of the claimed process with that of the closest prior art. However, in the absence of corroborating evidence, that alleged effect was not to be taken into account when formulating the problem underlying the patent in suit; thus, that problem was the mere provision of a further process for preparing 4-aminophenol. However, document (5) taught a method for treating sulfuric acid of technical grade with

hydrogen peroxide thereby decolorizing that sulfuric acid and reducing the sulfur dioxide content thereof, thus guiding the person skilled in the art to the claimed process without involving any inventive ingenuity.

- V. The Respondent (Proprietor of the patent) submitted that document (9) was the closest state of the art. That document came closer to the claimed invention than documents (1) or (2) since the former document represented an improvement of the teaching of the latter and was chronologically nearer to the patent in suit. Starting from document (9) in the assessment of inventive step, the problem underlying the patent in suit consisted in improving the performance index of the preparation process without loss of selectivity. The specification of the patent in suit stated that this effect was achieved by the claimed process. That statement was sufficient to demonstrate the successful solution of the problem underlying the invention. It was up to the Appellant-Opponent to provide experimental evidence to the contrary. Nevertheless, the comparison of examples 2 and 3 of the Appellant's experimental report filed on 16 February 1995 in opposition proceedings showed the achievement of an improved performance index by the claimed invention. Furthermore, example 1 of the specification of the patent in suit indicated the reaction time of the claimed process to be shorter than in document (9) which evidenced an improved performance index too. The improvement achieved by the process of the patent in suit was due to the destruction of catalyst poisoning agents in the sulfuric acid used therein by the pretreatment thereof with hydrogen peroxide. The prior art neither comprised any teaching that the sulfuric acid component used in the preparation process should be free of catalyst poisons nor that the absence of catalyst poisons in the sulfuric acid component was

essential for achieving the improved performance index, i.e. for solving the problem underlying the patent in suit. Document (2) referred exclusively to the nitrobenzene component without addressing the sulfuric acid component. Document (1) dealing in particular with the characteristics of the catalyst itself, was silent about any catalyst poison. Document (9) linked the yield of the preparation process to a list of several factors without referring therein to a catalyst poison. Document (5) teaching the treatment of sulfuric acid with hydrogen peroxide, nonetheless, was unrelated to the claimed preparation process.

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

The Respondent requested that the appeal be dismissed.

- VII. Oral proceedings were held on 5 July 2000. At the end of the oral proceedings the decision of the Board was given orally.

Reasons for the Decision

1. The appeal is admissible.
2. *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 involves an inventive step.

- 2.1 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 in the light thereof the technical problem which the invention addresses and successfully solves, and to examine the obviousness of the claimed solution to this problem in view of the state of the art. This "problem-solution approach" ensures assessing inventive step on an objective basis and avoids assessing it by using an *ex post facto* analysis the Respondent objected to.

2.2 The patent in suit relates to a process for preparing 4-aminophenol from nitrobenzene by catalytic hydrogenation of nitrobenzene to phenylhydroxylamine followed by rearrangement to p-aminophenol in aqueous sulfuric acid without isolation of the intermediate product.

A similar process already belongs to the state of the art in that document (9) discloses in claim 1 a method for preparing 4-aminophenol by catalytic hydrogenation of nitrobenzene in an acidic medium. In this process phenylhydroxylamine is first formed which promptly rearranges in the acid reaction medium to form 4-aminophenol (column 1, lines 17 to 19). The preferred acid is sulfuric acid (claim 3) which is in particular of reagent grade (examples, column 3, lines 20 and 21). At the oral proceedings before the Board, the Appellant and the Respondent concurred on the matter that the feature "reagent grade" defining the sulfuric acid used in document (9) specifies a purity superior to that of technical/industrial grade.

Document (9) aims at improving the process of documents (1) and (2) which have been acknowledged therein at column 1, lines 32 to 47 and 52 to 68 as state of the art. Therefore, both documents initially addressed by the Appellant represent prior art which is less promising for the skilled man to start from than document (9).

- For these reasons, the Board considers, in agreement with both parties, that the disclosure of document (9) specified above represents the closest state of the art, and, hence, the starting point in the assessment of inventive step.
- 2.3 The technical problem as indicated in the patent in suit (page 2, lines 46 to 51) consists in **improving** the performance index of the preparation process, i.e. increasing the rate of reaction, without loss of selectivity. That is identical to the technical problem, which the Respondent identified in appeal proceedings in his letter dated 8 January 1998 on page 6, point 5.8 and at the oral proceedings before the Board vis-à-vis the closest prior art document (9) in view of the technical information provided.
- 2.4 As the solution to this problem, the patent in suit suggests a process for preparing 4-aminophenol by catalytic hydrogenation of nitrobenzene in a sulfuric acid solvent which is characterised by pretreating the sulfuric acid with hydrogen peroxide.
- 2.5 In the next step of the problem-solution approach it needs to be examined whether or not the proposed solution successfully solves the technical problem as defined in point 2.3 above, i.e. to improve the performance index of the preparation process without loss of selectivity. The Appellant and the Respondent were divided on the matter upon whom the burden of proof rests for demonstrating the success or the failure of solving the problem underlying the patent in suit by the claimed invention, i.e. for the presence or the absence of the alleged technical effect. Both parties expressed also divergent views as to whether or not the evidence provided demonstrates convincingly the successful solution of that technical problem.

2.5.1 The Respondent argued that he would not be the one carrying the onus of proof for the alleged fact that the claimed invention achieved the technical effect of improving the performance index without loss of selectivity, 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 alleges the fact that the claimed invention improves the performance index of the preparation process without loss of selectivity. Therefore, the burden of proof for that fact rests upon him. The unverifiable statement in the specification of the patent in suit on page 2, lines 45 to 51, that the performance index is improved without loss of selectivity referred to by the Respondent as proof for the alleged fact, is devoid of any corroborating evidence. In the absence of evidence, however, the Respondent has not discharged the burden of proof which is upon him, with the consequence that his unsubstantiated allegation is not to be taken into account by the Board.

2.5.2 To support his allegation that the purported improvement of the performance index without loss of selectivity is achieved by the claimed invention, the Respondent submitted that the hydrogenation step took 2 to 3 hours in the claimed process using a pretreated sulfuric acid compared to 5 to 7 hours in the process of the closest prior art document (9) using an untreated sulfuric acid (cf. specification of the patent in suit page 4, lines 41 and 42). He argued that

this comparison reflected the impact of the solution suggested by the patent in suit, i.e. of pretreating the sulfuric acid with hydrogen peroxide, on the results indicated.

The Board notes that the Respondent's submission deals exclusively with that part of the problem underlying the patent in suit of improving the performance index, i.e. the rate of reaction, without, however, addressing the other part of that problem of not losing selectivity. Thus, his submission cannot back up the alleged fact that no loss of selectivity is achieved by the claimed invention.

Furthermore, the Respondent's comparison is merely based on the reaction time given in example 1 of the patent in suit and on the reaction time indicated in the examples at column 3, line 42 of document (9). However, in addition to the pretreatment of the sulfuric acid with hydrogen peroxide, there are further discrepancies to be noticed between that example 1 of the invention, on the one hand, and those examples of the prior art, on the other, with regard to numerous reaction parameters, in particular the power input into the reaction liquid by means of the agitator and the position thereof in that liquid. The examples of document (9) are silent about both parameters whereas example 1 of the patent in suit uses a high power input by means of the agitator of 4,34 J/s·l and a particular position of thereof at 50% of the reaction liquid depth (specification of the patent in suit page 4, lines 24 and 26). The Respondent acknowledges in the specification of the patent in suit on page 2, lines 55 to 58 and page 4, lines 22, 25 and 27 that both reaction parameters have also a very strong impact on the rate of hydrogenation, which is the reaction time indicated. Therefore the mere comparison of the reaction time of example 1 of the patent in suit with

that of the examples in document (9) does not truly reflect the impact exclusively of the solution proposed by the patent in suit, namely to pretreat the sulfuric acid with hydrogen peroxide, but is biased and rendered unfair by the discrepancies in the other reaction parameters. The comparison made by the Respondent, hence, cannot support the alleged fact that an improved performance index is achieved by the claimed invention.

2.5.3 To further support his allegation that the purported improvement of the performance index without loss of selectivity is in fact achieved by the claimed invention, the Respondent referred additionally to the results of the test report submitted by the Appellant on 16 February 1995 in opposition proceedings. The Respondent relied on examples 2 and 3 of that test report, which were, apart from applying or not applying the pretreatment of the sulfuric acid with hydrogen peroxide, both carried out in the same way. Example 2 using a not pretreated sulfuric acid corresponded to the prior art and was comparative; it showed a performance index of 0.56 g/l/min. Example 3 using a pretreated sulfuric acid corresponded to the claimed invention; showing a performance index of 0.65 g/l/min, the result of that example was superior to that of comparative example 2 thereby demonstrating the improvement achieved by the claimed invention.

The Board notes like in point 2.5.2 above that the Respondent's submission deals exclusively with the improvement of the performance index without, however, addressing selectivity. Thus, this submission cannot back up the alleged fact that the claimed invention leads to no loss of selectivity.

Furthermore, the Respondent's submission is based on considering example 2 of that test report provided by the Appellant as comparative example reflecting the

closest prior art. That example uses "plant" sulfuric acid of electrolyte grade sampled directly from the railcar and having "lower purity" (Appellant's letter filed on 16 February 1995, page 2, last paragraph to page 3, first paragraph). Document (9) which is the closest piece of prior art in the present case (see point 2.2 above) teaches in its examples at column 3, lines 20 and 21, however, to use sulfuric acid of reagent grade. According to the concurring submissions of both the Appellant and the Respondent that sulfuric acid of reagent grade shows a purity superior to that of the "plant" sulfuric acid used in the above comparative example 2 (see also specification of the patent in suit, page 3, lines 12 to 14). The purity of the sulfuric acid used, in particular the absence of catalyst poisons, is essential for improving the performance index (specification of the patent in suit page 2, line 56). Hence, Appellant's comparative example 2 referred to by the Respondent in his favour, with respect to an essential feature, does not truly reflect the closest state of the art, i.e. document (9), already using a purer sulfuric acid. For that reason, the Respondent cannot successfully rely on the Appellant's test report as evidence for the alleged improvement of the claimed subject-matter over the closest state of the art.

2.5.4 To conclude, in the Board's judgement, the evidence on file neither demonstrate properly that the purported advantages of the claimed invention, i.e. the improvement of the performance index without loss of selectivity, have successfully been achieved nor that they are due to the pretreatment of the sulfuric acid with hydrogen peroxide, i.e. the solution proposed by the patent in suit.

2.6 According to the jurisprudence of the Boards of Appeal, alleged but unsupported advantages cannot be taken into

consideration in respect of the determination of the problem underlying the claimed invention (see e.g. decision T 20/81, OJ EPO 1982, 217, point 3, last paragraph of the reasons). Since in the present case the alleged advantages, i.e. improvement of the performance index without loss of selectivity, lack the required adequate support, the technical problem as defined in point 2.3 above needs reformulation. In view of the teaching of the closest prior art document (9), the objective problem underlying the patent in suit can only be seen in providing merely a **further** method for preparing 4-aminophenol.

2.7 Finally, it remains to decide whether or not the proposed solution to the objective problem underlying the patent in suit is obvious in view of the state of the art.

2.7.1 The closest prior art document (9) to start from teaches in claims 1 and 3 a preparation process which requires in general sulfuric acid as reaction medium without imposing any restriction on the sulfuric acid to be used while sulfuric acid of reagent grade having a purity superior to that of technical/industrial grade is used in the examples thereof. In view of that general description, it is within the ambit of the person skilled in the art seeking to solve the less ambitious objective problem underlying the patent in suit of providing merely a further preparation process, to consider routinely any conceivable modification of that known process including the use of a modified reaction medium which is sulfuric acid. Thus, he would not ignore document (5) referring to a modified sulfuric acid. That document teaches a process for decolorizing and reducing the free sulfur dioxide content of industrial sulfuric acid which is characterized by treating the sulfuric acid with

hydrogen peroxide. The person skilled in the art acting routinely, hence, is driven to use the pretreated sulfuric acid of document (5) as reaction medium in the preparation process known from document (9), which is the solution proposed by the patent in suit. The person skilled in the art is all the more likely to pursue this course since the sulfuric acid resulting from the process of document (5) is superior in purity to that of industrial grade, which is also the case for the sulfuric acid of reagent grade exemplified in document (9).

The Board concludes from the above that the state of the art gives the person skilled in the art a concrete hint on how to solve the objective problem underlying the patent in suit as defined in point 2.6 above, namely by using in the preparation process known from document (9) a sulfuric acid which was treated with hydrogen peroxide, thereby arriving at the claimed process. In the Board's judgement, to follow the avenue indicated in the state of the art is obvious without involving any inventive ingenuity.

- 2.7.2 In support of the non-obviousness of the solution suggested by the patent in suit, the Respondent argued that document (5) was unrelated to the claimed process and in particular that this document did not disclose the pretreatment of sulfuric acid with hydrogen peroxide in combination with a process for preparing 4-aminophenol by catalytic hydrogenation of nitrobenzene in the presence of aqueous sulfuric acid.

The Respondent's submission amounts to the allegation that the person skilled in the art would have been deterred from following the teaching of document (5) when aiming at the solution of the objective problem underlying the patent in suit. The Board concurs with the Respondent that document (5) does not address the

use of pretreated sulfuric acid in that preparation process; to derive from that silence that the person skilled in the art was deterred from contemplating using the pretreated sulfuric acid as taught in document (5) in the preparation process known from document (9), as the Respondent does, cannot convince the Board since the person skilled in the art knows from document (9) that sulfuric acid is a suitable reaction medium for preparing 4-aminophenol.

- 2.7.3 For these reasons, in the Board's judgement, the subject-matter of claim 1 represents an obvious solution to the problem underlying the patent in suit and does not involve an inventive step.

Since a decision can only be taken on a request as a whole, none of the further dependent claims need to be examined.

3. In these circumstances, the Respondent's request is not allowable as the subject-matter of claim 1 lacks inventive step pursuant to Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:


N. Maslin

The Chairman:


A. Nuss

