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Bezeichnung der Erfindung: Preparation of acetic anhydride
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : C07C 51/56

ENTSCHEIDUNG / DECISION
vom / of / du 26 October 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent / Titulaire du brevet : Eastman Kodak Company

Einsprechender / Opponent / Opposant : Hoechst Aktiengesellschaft, Frankfurt

Stichwort / Headword / Référence : Acetic anhydride/Kodak

EPÜ / EPC / CBE Article 56

Schlagwort / Keyword / Mot clé : Inventive step (affirmed)

Leitsatz / Headnote / Sommaire

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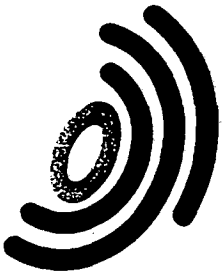

Case Number : T 236/88 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 26 October 1989

Appellant : (Opponent)
HOECHST AKTIENGESELLSCHAFT, Frankfurt
- Werk Knapsack -
Postfach 29 02
D-5030 Hürth-Knapsack

Representative :

Respondent : (Proprietor of the patent)
Eastman Kodak Company
343, State Street
Rochester, New York 14650
US

Representative :
Baron, Paul Alexander Clifford
Kodak Limited
Patent Department
Headstone Drive
Harrow
Middlesex HA1 4TY
GB

Decision under appeal : **Decision of the Opposition Division of the European Patent Office dated 11 May 1988 rejecting the opposition filed against European patent No. 0 064 986 pursuant to Article 102(2) EPC.**

Composition of the Board :

Chairman : F. Antony
Members : R. Spangenberg
G. Paterson

Summary of Facts and Submissions

I. The mention of grant of European patent No. 64 986 was announced on 14 August 1985 (Bulletin 85/33). The patent was granted in respect of European patent application No. 81 902 715.2 filed on 24 September 1981 as International application No. PCT/US 81/01289 claiming priority of 21 November 1980 from an earlier application in the United States of America. The patent contained four claims, the only independent one, Claim 1, reading as follows:

"A liquid-phase process for the preparation of acetic anhydride by the carbonylation of methyl acetate in the presence of rhodium, lithium, and an iodine compound, characterized in that hydrogen gas is also fed to the reaction zone in an amount of 2 to 7 volume percent, based on carbon monoxide and hydrogen gases."

II. A notice of opposition was filed on 7 December 1985. It was requested that the patent be revoked in its entirety since its subject-matter did not involve an inventive step. The opposition was supported by, inter alia, the following documents:

(1) DE-A-2 441 502
(2) DE-A-2 450 965
(3) DE-A-2 836 084

III. By a decision dated 11 May 1988 the Opposition Division rejected the opposition. Document (1), corresponding to BE-A-819 455 already mentioned in the patent in suit, was considered to be the closest prior art. The technical problem underlying the patent in suit was seen in improving

the space-time yield of the known process and at the same time reducing the tar formation. It was regarded as being plausibly solved by feeding hydrogen gas to the reaction zone in the amount specified in the characterising part of Claim 1. While it was already known from (1) that inert diluents such as carbon dioxide, nitrogen, or methane may be present in the carbon monoxide feed and do not influence the carbonylation reaction, hydrogen was not inert in this reaction. In (2) it was disclosed that, in the carbonylation of methyl acetate with carbon monoxide in the presence of a rhodium catalyst without a lithium promoter, the presence of hydrogen would reduce tar formation but would also significantly impair the space-time yield and the selectivity of the reaction. Document (3) taught likewise that the presence of hydrogen resulted in a lower space-time yield, since according to Example 7 the space-time yield is lower than that according to Example 5, which is carried out under comparable conditions but without hydrogen. Therefore, an inventive step was acknowledged.

IV. On 7 June 1988 an appeal was lodged against that decision and the prescribed fee was paid. In the Statement of Grounds of Appeal filed 30 August 1988 three further documents were cited.

V. Oral proceedings were held on 26 October 1989.

VI. In his written submissions and at the oral proceedings the Appellant contested the Opposition Division's analysis of (3) and stated that the yield in Example 7 thereof was lower owing to the amounts of catalyst, promoter and acetic acid used being smaller than in Example 5. Taking this into account, a person skilled in the art would easily recognise that the expected decrease in yield was almost balanced by the beneficial effect of hydrogen. The presence of hydrogen can be recognised as a preferred embodiment of (3) because

it is specifically claimed (see Claim 5) in this patent document. Since in this example substantially no ethylidenediacetate (EDA) is formed, the selectivity was said to be close to 100%. The Appellant further calculated the yields obtained according to the patent in suit in relation to the amount of rhodium catalyst used and compared them with those obtained according to (3). In his opinion, this showed that the process of (3) gave better yields. Therefore, the problem of improving the space-time yields of (1) had already been solved by (3) and the patent in suit did not provide any further improvement. Thus, in the Appellant's opinion it was at least obvious to try the catalyst system of (1) in the presence of hydrogen, the amount of which was the result of routine experimentation. With reference to the Decision T 21/81 (OJ EPO 1984, 15) the Appellant argued that it was known from (2), e.g. the paragraph bridging pages 2 and 3 (typed numbers) that the presence of hydrogen would result in lower tar formation and an increased amount of acetic acid at higher reaction temperatures, that the same result was obtained by the patent in suit (see Table II on page 7) and that under these circumstances, the increase in space-time yield was only an "additional effect" which did not make the incorporation of hydrogen into the reactor feed composition unobvious.

VII. The Respondent contended that none of the prior art documents provided a hint how to solve the problem of improving the space-time yield and at the same time to reduce the tar formation, since none of these documents showed a significant increase in yield upon introduction of hydrogen. Especially Examples 5 and 7 of (3) did not provide sufficient basis for the allegation that the presence of hydrogen would increase the space-time yield. The reasons given by the Appellant for the lower yield in Example 7 were speculative and not supported by

experimental evidence. Thus, this document could at most show that hydrogen had no significant influence on the reaction concerned. It was not the closest prior art since the catalyst system was quite different from that used in the patent in suit: instead of a lithium promoter, a much greater amount of a heterocyclic compound is used together with a large quantity of acetic acid. The smaller amounts of promoter required by the patent in suit were a further advantage. Since acetic anhydride was an important technical product even small improvements in space-time yield were very important. The situation in the present case, therefore, was in no way comparable with that underlying the decision T 21/81.

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

The Respondent requested that the appeal be dismissed.

At the end of the oral proceedings the decision was announced that the appeal was dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. The documents introduced with the statement of grounds of appeal were not filed in due time (Article 114(2) EPC). The Board has briefly considered them and has not found anything therein which could change the Board's decision.

Consequently, these documents are disregarded hereinafter.

3. The subject-matter of the patent in suit is novel with respect to the cited prior art since none of the citations describes a process for the preparation of acetic anhydride having all the features of Claim 1. Novelty has not been disputed by the Appellant, hence no more detailed explanation is necessary.

4. It remains to be examined whether the subject-matter of the patent in suit involves an inventive step.

4.1 In the Board's judgement, document (1) represents the closest prior art since it describes a liquid-phase process for obtaining acetic anhydride by the carbonylation of methyl acetate in the presence of rhodium, lithium and an iodine compound (see Claims 42, 44, 47 and 52). However, in this known process no hydrogen gas is present in the reactor feed.

It is true that also the process of (3) substantially differs from the process of the patent in suit only by one feature, i.e. the type of promoter. While in (3), a heterocyclic nitrogen compound is used, the promoter according to the patent in suit is a lithium salt. The difference in the amount of hydrogen gas, up to 10%, especially 8% according to (3) (see Claim 5 and Example 7) and 2 to 7% according to the patent in suit is, in the Board's view, not significant. However, the change of the type of promoter in fact means that in (3) a different catalyst system is used. This difference is more important than the different feed gas composition distinguishing the process of the patent in suit from that of (1).

4.2 Starting from (1) as closest prior art, the technical problem to be solved may be seen in further improving this known process with respect to space-time yield and reduction of tar formation.

The Board cannot share the Appellant's opinion that the improvement of the space-time yield was just a "bonus effect" and the only really important problem to be considered was the reduction of tar formation. The product obtained according to the patent in suit is acetic anhydride, a compound which is of great technical importance. The improvement of the yield of processes for obtaining such compounds is a continuous urgent need and, consequently, a process in which the tar formation is reduced at the expense of the space-time yield would not be desirable. Therefore, the above-defined double problem must be regarded as a whole, and part of it must not be regarded as a mere "additional" or "bonus" effect to be disregarded when assessing the inventive step in accordance with the decision T 21/81 (OJ EPO 1983, 15), see also this Board's recent decision T 155/88 of 14 July 1989, especially item 4.6.

4.3 In order to solve the existing double problem mentioned above, it is proposed by the patent in suit to add 2 to 7 volume % of hydrogen gas to the reactor feed. As shown by the test results contained in Tables I and IV, this will plausibly solve the above-referred problem.

4.4 There being clearly no suggestion in (1) to modify the process thereof in accordance with the claimed solution, it remains to be investigated whether the disclosure of (2) or (3) provides any incentive to so modify the process of (1) in order to solve the existing problem.

The reaction concerned is a catalytic one involving a complex heterogeneous catalyst system consisting of a noble metal salt (e.g. rhodium chloride), a lithium salt as a promoter, and an iodine compound. In (2) and (3), catalyst

systems with other, predominantly organic, promoters are described.

There is no evidence before the Board that the type of promoter used in catalyst systems comprising rhodium and an iodine compound has no influence on the effect of added hydrogen. On the contrary, it can be seen from (2), paragraph bridging pages 2 and 3, that in the catalyst systems described therein the presence of hydrogen increases the amount of EDA (or acetic acid). The same is apparently true for the catalyst system according to the patent in suit (see Table II on page 7). On the other hand, according to (3), Example 7, only traces of EDA are formed in the presence of hydrogen when the catalyst system of that document is used. Therefore, at least with respect to selectivity no general rule allowing a prediction of the effect of hydrogen does exist. The Board, therefore, finds it difficult to assume, on the basis of only a few documents selected with the benefit of hindsight, that a person skilled in the art looking for an improvement of a process involving a lithium promoter can, from documents relating to different catalyst systems, obtain a hint to solve the existing problem by addition of hydrogen to the reactor feed.

4.5 However, even if it was conceded that a person skilled in the art would indeed expect similar effects in processes using different catalyst systems, the information available from (2) and (3) would not point towards the addition of hydrogen to the reaction feed of the process of (1) with the aim to improve the space-time yield, since none of these documents suggests such an effect of hydrogen. Thus, (2) only states that hydrogen reduces the formation of tar but impairs selectivity; therefore, a skilled person looking for better yields of the process described in (1) would derive no incentive from this document to add

hydrogen to the reaction feed. Also (3), while indicating on page 5, lines 19 to 35 (as implicitly confirmed by Claim 5) that the addition of up to 10% hydrogen may be preferred, is completely silent about the reasons therefor.

In the Board's opinion, a comparison of Examples 5 and 7 of (3) does not permit the conclusion that addition of hydrogen would improve the space-time yield. Apart from the presence of hydrogen in Example 7, there are differences in the amounts of rhodium chloride, heterocyclic nitrogen compound and acetic acid employed, and there is no experimental evidence which precise effects on the yields of acetic anhydride are caused by each one of these differences. Therefore, this example is not suitable to prove the Appellant's assertion. Furthermore, in the Board's judgement, a person skilled in the art looking for an improvement of the yield would rather analyse those Examples of (3) with the best yields than consider just Example 7. Only after knowing that the addition of hydrogen might be a possible solution to the problem, he would have a reason to concentrate on Example 7, whereupon he might find out by detailed analysis that hydrogen does indeed improve the space-time yield. Such considerations are therefore based on hindsight and must be disregarded when assessing inventive step.

4.6 The Board cannot share the Appellant's opinion that the above-referred problem no longer existed since it had already been solved by (3). It may well be that the process of (3) provided a different solution to the stated problem. If so, this would not mean that there was no room for further inventive solutions of the same problem. In this connection, it would not, in the Board's judgement, be relevant if indeed the space-time yields and the selectivity of the process according to the patent in suit

should be less good that those obtained according to (3), since technical progress is not a requirement for patentability under the EPC. Therefore, the process according to the patent in suit would also not be obvious if (3) was chosen as the document representing the closest prior art. The problem might then be seen in providing an alternative process requiring smaller amounts of promoter, without any substantial loss of space-time yield and selectivity. The solution of this problem according to the patent in suit, i.e. to use the catalyst system known from (1) and to incorporate from 2 to 7 volume % hydrogen into the reactor feed, would involve an inventive step for substantially the same reasons as already explained in paragraphs 4.4 and 4.5.

4.7 Also the Appellant's submission that, since the addition of hydrogen had been previously suggested when using the catalyst systems of (2) and (3), both documents being published later than (1), it was at least obvious to try the addition of hydrogen also in the process of (1) in order to find out what effect might be obtained, does not render the process of the patent in suit obvious. This argument only means that a person skilled in the art could have performed this process but not, as would be required to demonstrate obviousness, that he would have done so in the reasonable expectation to obtain the desired result.

4.8 It follows from all this that the process of Claim 1 does involve an inventive step.

5. The dependent Claims 2 to 4 derive their patentability from Claim 1. The stated ground for opposition, therefore, does not prejudice the maintenance of the patent as granted.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Fabiani F. Antony