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

Case Number: T 0319/98 - 3.3.1

Application Number: 92301825.3

Publication Number: 0506240

IPC: C07C 51/44

Language of the proceedings: EN

Title of invention:
Process for the recovery of acetic acid from compositions comprising acetic acid and water

Patentee:
BP Chemicals Limited

Opponent:
HNA Holdings, Inc.

Headword:
Acetic acid/BP CHEMICALS

Relevant legal provisions:
EPC Art. 54(1)(2), 56

Keyword:
"Novelty (yes) - new use according to G 0002/88 and G 0006/88"
"Inventive step (yes) - non obvious alternative"

Decisions cited:
G 0002/88, G 0006/88, T 0958/90, T 0254/93, T 0279/93, T 0892/94

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0319/98 - 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 February 1998 rejecting the opposition filed against European patent No. 0 506 240 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: P. P. Bracke
Members: P. F. Ranguis
S. C. Perryman

Summary of Facts and Submissions

I. This appeal lies from the Opposition Division's decision to reject pursuant to Article 102(2) EPC the opposition filed against the European patent No. 0 506 240 (European application No. 92 301 825.3).

II. The patent was granted with sixteen claims, the only independent Claims 1 and 10 reading as follows:

"1. The use of one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen for suppressing the volatility of water relative to acetic acid in a process for the recovery of acetic acid from a composition comprising acetic acid and water, which process comprises partitioning the composition into a vapour phase comprising at least a portion of the acetic acid in the composition and a liquid phase comprising the remaining portion of the acetic acid in the composition and separating the phases."

"10. The use of one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen for suppressing the volatility of water relative to acetic acid in a process for the production of acetic acid which process comprises:

a) reacting methanol, methyl iodide, methyl acetate and/or dimethyl ether with carbon monoxide in the liquid phase in a reaction zone in the presence of a carbonylation catalyst and at least a finite amount of water at a temperature of 50 to 400°C and a carbon monoxyde pressure of 7.10^3 to 1.10^8 Pag (1 to 15000 psig) to produce acetic acid,

b) withdrawing liquid reaction composition from the reaction zone,
c) introducing the liquid reaction composition into a flash zone at a pressure below that of the reaction zone with or without additional heating to produce a vapour phase comprising a portion of the acetic acid carbonylation product and water and a liquid phase,
d) introducing to the flash zone together with or separately from the liquid reaction composition, the one or more iodides of the elements of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen, and
e) separately removing from the flash zone the vapour phase and the liquid phase."

III. By its opposition the Appellant (Opponent) sought revocation of the patent in suit under Article 100(a) EPC on the ground that its subject-matter lacked novelty in view of documents:

(1) EP-A-55 618

(2) US-A-3 845 121

(3) EP-A- 161 874

and did not involve an inventive step in view of documents (1), (2), (3) and

(4) Schönfeld et al, Monatshefte für Chemie, 99(3), 913-917 (1968) and translation into English and

(5) Translation into English of Feng et al., Taiwan Science, 23(3-4), 29-31 (1969).

IV. The Opposition Division held that neither document (1)(with reference to document (2)), nor document (3) disclosed the effect of the iodides on the relative volatility of water and acetic acid in a mixture containing both these mentioned compounds. Claims 1 and 10 relating to a "second non-medical indication" were, therefore, novel in accordance with the provisions stated in decision G 6/88 (OJ EPO 1990, 114).

Although it was generally admitted that the dissolution of a salt in water would lower the volatility of a solution, in view of documents (4) and (5), it would not have been obvious to select iodides to lower the volatility of water with respect to that of acetic acid, given that those documents taught that the effect of a salt on the relative volatility of the components of a mixture water/acetic acid could not be predicted.

V. Oral proceedings before the Board took place on 19 February 2002.

VI. The Appellant's submissions in the written proceedings and at the oral proceedings can be summarized as follows:

The subject matter of Claim 10 fell completely within the scope of Claim 1 and, consequently, if Claim 10 was invalid, Claim 1 was also invalid.

Document (1) (with reference to document (2) whose disclosure is explicitly incorporated in that of document (1)) and document (3) disclosed all the features a) to e) of Claim 10.

Furthermore, it was known or obvious that the iodides

of Group IA or of hydrogen had the effect of depressing the volatility of water relative to that of acetic acid in processes disclosed in documents (1) and (3). It was indeed a standard principle that the addition of a solute to a liquid lowered the chemical potential of the liquid and thus lowered the vapour pressure. When it was desirable to separate a mixture of water and acetic acid, the person skilled in the art would not have considered adding an extraneous material until he had decided whether any of the materials already present would be likely to produce the desired result. In the liquid reaction composition obtained in the processes disclosed in documents (1) or (3), the Group IA or IIA metal iodides were present as catalyst stabilizer and it was evident that those metal iodides would give the desired distillation effect for the following reasons:

- It was known that iodide salts were ionic solids that formed ionic solution in polar solvent such as water/acetic acid and that such salts were more soluble in pure water than they were in pure acetic acid. That indicated that the free energy of dissolution of such salts was greater in water than in acetic acid. The skilled man would have deduced that the microscopic interactions between the dissolved salt and the water molecules were stronger than the microscopic interactions between the dissolved salt and acetic acid molecules, and accordingly would have expected depression of the volatility of water relative to that of acetic acid in a mixed solution containing the salt.

- This was consistent with the disclosure of documents (4) and (5). Document (4) taught the

suitability of an addition of calcium chloride to improve the separation of an acetic/water mixture by distillation. Document (5) reported experiments with an acetic/water two-component system, with the addition of various salts (calcium chloride, potassium chloride, sodium chloride, potassium sulphate, sodium acetate) and among them calcium chloride gave a marked fractionation effect.

- Furthermore, in terms of infringement, it was not possible to differentiate between the acetic acid obtained according to Claim 10 and the acetic acid produced in a manner usual well before the filing date of the patent in suit. Since Claim 10 in accordance with the provisions of Article 64(2) EPC conferred protection on the said acetic acid, it caused an insoluble infringement problem and was, therefore, inadmissible.

Regarding inventive step, the technical problem to be solved could be seen in the depression of the volatility of water relative to that of acetic acid in a process for the production of acetic acid that comprises steps a) to e) as defined in Claim 10 of the patent in suit. On the basis of the art discussed above, it would have been obvious for the person skilled in the art to investigate alkali metal or alkaline earth metal halides. Since the optional introduction of alkali metal iodides as stabilizers into the system was already taught by document (1) there would have been a good motivation to investigate the action of alkali metal iodides for solving the above defined technical problem. Even though the effect of such salts could not be predicted *a priori* it would have emerged directly from routine experimentation.

There could be no invention in obtaining the results of routine trials that it would have been obvious to carry out.

VII. The Respondent's (Proprietor of the patent) submissions in the written proceedings and at the Oral Proceedings can be summarized as follows:

It was not contested that the process defined in features a) to e) of Claim 10 was known from document (1) or (3). However, none of documents (1) and (3) disclosed the use of one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen for depressing the volatility of water relative to that of acetic acid. This use feature conferred novelty to Claim 10 in accordance with decision G 6/88.

Addition of a solute to a solvent could lower the vapour pressure of the solution and if the solvent was a mixture of acetic acid and water, it was indeed desired to separate the mixture into constituent parts by a technique involving vapour pressure, e.g. flashing and/or distillation, and to introduce to this end an additive which would have proportionally more effect on the water than on the acetic acid.

However, a desirable additive might include but would not be restricted to material already present in the reaction system. Furthermore, there would not have been any reasons to select, in the mixture, iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen among all the compounds present in the carbonylation process. In that respect, neither document (4) nor document (5) was concerned with the

addition of iodides of the elements of Groups IA or Group IIA of the Periodic Table or of hydrogen.

VIII. 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.

IX. 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. *Article 54(1)(2) EPC*

2.1 Document (3) discloses the production of acetic acid by reaction of methanol with carbon monoxide in the presence of a rhodium carbonylation catalyst and water (cf. page 6, lines 28 to 33; page 7, lines 28 to 31; page 8, lines 31 to 39). The catalyst stability is increased by maintaining in the reaction medium an appropriate amount of methylacetate and methyl iodide and a specified concentration of iodide ions (cf. page 7, lines 22 to 35). The iodide ion, which is over and above the iodide which is present as methyl iodide or other organic iodide is present as a simple salt, lithium iodide being preferred (cf. page 7, line 34 to page 8, line 2). The liquid reaction composition is introduced into a "flash" zone where the catalyst solution is withdrawn as a base stream (predominantly acetic acid containing the rhodium and the iodide salt along with lesser quantities of methyl acetate, methyl iodide and water), while the overhead of the flasher

comprises largely the product acetic acid along with methyl iodide, methyl acetate, and water (cf. page 10, lines 6 to 17). Such a reaction is disclosed in detail in Example 1 wherein, in particular 19 to 19.5% of lithium iodide and 4 to 5% of water are present in the reaction medium (cf. page 22, line 19). The liquid reaction product is continuously fed to a single-tray flasher. Of the liquid fed into the flasher, approximately 35% was distilled overhead for further redistillation in the methyl iodide-acetic acid splitter, while the remainder (catalyst) was drawn from the base of the column and returned to the carbonylation reactor (cf. page 23, lines 16 to 25).

2.2 It was not contested that the step of distilling the liquid reaction product into a "flash zone" anticipates the process feature defined in the claimed invention, namely "partitioning the composition into a vapour phase comprising at least a portion of the acetic acid in the composition and a liquid phase comprising the remaining portion of the acetic acid in the composition and separating the phases." (cf. Claim 1, point II above). The same applies to Claim 10 (cf. point II above) which falls within the scope of Claim 1.

2.3 Document (1) also relates to a process of carbonylation of an alcohol, in particular methanol, involving a rhodium catalyst stabilized by a iodine compound. The teaching of this document is not more relevant than the teaching of document (3) and it is not necessary, in the context of the present decision, to give detailed reasons for this finding.

2.4 From the above, it follows that the wording of Claim 1 differs from the disclosure of document (3) due to the

functional feature "use of one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen for suppressing the volatility of water relative to acetic acid in a process for the recovery of acetic acid from a composition comprising acetic acid and water". In accordance with the principle laid down in point 9 of the decision G 2/88 of the Enlarged Board of Appeal (cf. OJ EPO 1990, 93), the Board holds that such functional feature is a technical feature which qualifies the invention.

2.5 The sole question to be decided here is whether this functional (technical) feature (cf. point 2.4 above) can confer novelty on Claim 1 (and on Claim 10).

2.6 According to the orders of decisions G 2/88 and 6/88 of the Enlarged Board of Appeal, "a claim to the use of a known compound for a particular purpose, which is based on a technical effect which is described in the patent, should be interpreted as including that technical effect as a functional technical feature, and is accordingly not open to objection under Article 54(1) EPC provided that such technical feature has not previously been made available to the public".

2.7 The first point to be examined is, therefore, whether this "technical feature" had been made available to the public and, in that context, whether or not the skilled reader having the general knowledge in mind would have derived unambiguously from document (3) that, in addition to their stabilizing effect on the catalyst system, the iodide salts (in particular lithium iodide) would have suppressed the volatility of water relative to acetic acid.

First, the Appellant submitted no argument or evidence showing that given the amount of water involved in the process disclosed in document (3), in particular example 1, it would have been apparent for the skilled reader that volatility of water relative to that of acetic acid was depressed in the partitioning step (flash zone). Although the Board recognizes, and it was not contested by the Respondent, that the addition of solute to a liquid lowers the chemical potential of the liquid and thus lowers the vapour pressure, this general principle gives no information regarding a mixture of water and acetic acid. Furthermore, the allegation of the Appellant that free energy of dissolution of iodide salts was greater in water than in acetic acid and that the skilled man would have deduced therefrom that the microscopic interactions between the dissolved salt and the water molecules were stronger than the microscopic interactions between the dissolved salt and acetic acid molecules, and accordingly would have expected depression of the volatility of water relative to that of acetic acid in mixed solution containing the salt, was supported by no evidence. Finally, the reference to documents (4) and (5) in addition is not acceptable since those documents are not part of the common technical knowledge, nor do those documents mention iodide salts.

2.8 Thus a comparison of the claimed subject-matter of Claim 1 with the disclosure of the state of the art makes it clear that what was in the present case indeed not made available to the public in document (3) was the technical feature that iodides of the elements of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen had the capability of depressing the volatility of water relative to that of

acetic acid in a process for the recovery of acetic acid from a composition comprising acetic acid and water.

2.9 However, in order that such a claim be considered as novel, it is necessary that its wording **clearly** defines a new use of a known compound (G 2/88, loc.cit., point 9). This requirement was confirmed by the decision T 892/94 (OJ EPO 2000, 1) which held that the newly discovered effect must end in a new technical application or use which is not necessarily correlated with the known application or use and can be clearly distinguished therefrom (cf. point 3.5).

2.10 In the Board's judgment, depressing the volatility of water relative to acetic acid is a technical feature which clearly distinguishes from the known one namely, stabilizing the catalyst. As evidence, the Board observes that **independently** of any process involving a catalyst for preparing acetic acid according to document (3), this technical feature does bring about the technical effect, namely the depression of the volatility of water relative to acetic acid (cf. patent in suit, examples Nos. 1 to 7). In conclusion, this technical feature is not correlated to the known use and amounts to a new use of a known compound for a new purpose

2.11 This finding does not deviate from the line adopted by the Enlarged Board of Appeal in the decisions G 2/88 and G 6/88 (loc.cit). It is true, as submitted by the Appellant, that the Enlarged Board of Appeal considered as fundamental the distinction between "a new use of an old thing for a new purpose" and "an old use of an old thing for a new purpose". However, in the present case,

the use of the iodide salts is novel as explained above.

2.12 In the decision T 254/93 (OJ EPO 1994, 285) also cited by the Appellant, the competent Board considered that the mere explanation of an effect obtained when using a compound in a known composition cannot confer novelty on a known process if the skilled person was already aware of the occurrence of the desired effect when applying the known process (cf. point 4.8). However, in contrast with the situation which prevailed in that case, the person skilled in the art was not aware, in the present case, of the occurrence of the depression of the volatility of water relative to that of acetic acid in applying the process of document (3) (cf. point 2.7 above).

In decision T 958/90, also cited by the Appellant, the technical feature was not considered as novel given that the sequestering activity of a known mixture was already known and that a known effect could not become novel for the sole reason that it was present to a hitherto unknown greater extent (cf. point 6.3). However, in the present case, the depression of the volatility of water relative to that of acetic acid was not known even at a lesser extent from document (3) (cf. point 2.7 above).

In decision T 279/93, also cited by the Appellant, no new technical effect could be found in the use of an alkanolamine in a process for preparing hydroxy-functional melamine in order to reduce the formation of isomelamine impurities since it was a mere discovery which did not give rise to a new use exploiting this discovery (cf. point 5.4 of the reasons). This case is

again different from the present one where the finding that one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen depressed the volatility of water relative to that of acetic acid gives rise to a new use not correlated to the known use and independent thereof (cf. point 2.10 above).

2.13 Furthermore, although the European Patent Convention confers no powers on a Board of Appeal to consider infringement issues, the assessment of novelty and infringement involves closely related questions of claim construction. Thus, something falling within the scope of a claim will be a potential infringement, but at the same time destructive of novelty if available to the public by use or description before the priority date of the claim.

Article 64(2) EPC concerns the protection of a product directly obtained by a claimed process. However, there is no provision in the EPC stating that a use claim amounts to a process claim (Rule 29(2) EPC mentions *inter alia* process or use claims). It thus still appears an open question, for resolution by infringement courts, whether a product, such as here acetic acid, would fall under the provisions of Article 64(2) EPC merely because it is made by a process involving a particular claimed use. Further the Board is not persuaded by the argument of the Appellant that for assessing infringement it would not be possible to distinguish the use of iodides as catalyst stabilizer from the use of iodides as water volatility suppressor. The use involving a new technical effect which confers novelty on Claim 1 would in the infringement proceedings be an intent which the

proprietor would have to prove. The issue might not be easy to resolve, but the Board has no information that such infringement courts would face insuperable difficulties when considering such use claims. The Board thus sees no reason of its own motion for referring any questions to the Enlarged Board of Appeal concerning what can be recognized as a new technical feature.

2.15 For the above reasons, the Board comes to the conclusion that Claim 1 clearly defines a new use of a known compound and therefore, meets the requirements of Article 54(1)(2) in accordance with the decisions G 2/88 and G 6/88 (loc.cit). This finding also applies to Claim 10 which falls within the scope of Claim 1.

3. *Article 56 EPC*

3.1 In accordance with the "problem-solution approach" consistently applied by the Boards of Appeal to assess inventive step on an objective basis, it is necessary to establish the closest state of the art being the starting point, to determine in the light thereof the technical problem which the invention addresses and solves, and to examine the obviousness of the claimed solution to this problem in view of the state of the art. In this context, the Boards of Appeal have developed certain criteria that should be adhered to in order to identify the closest state of the art being the starting point. One such criterion is that the "closest prior 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.

3.2 The objective to be achieved by the patent in suit is to recover acetic acid from a composition comprising acetic acid and water. None of the documents (1), (2) or (3) address that objective (cf. points 2.1, 2.3 and 2.7 above). Thus, in sharp contrast with the Appellant's view, those documents cannot qualify as the closest prior art since they do not meet the prerequisite condition of aiming at the same objective as the patent in suit.

Document (4) studies the composition of vapour during the distillation of acetic acid-water-calcium chloride mixtures, in particular the occurrence of HCl due to the protonation of chloride ions ($CaCl_2$) by acetic acid (cf. page 914, bottom). Document (5) studies the effects on acetic acid fractional distillation from an aqueous solution of acetic acid in presence of various salts, i.e. sodium acetate, K_2SO_4, Na_2SO_4, KCl, NaCl and $CaCl_2$ (cf. page 3, paragraph III to page 4 of the English translation), $CaCl_2$ being preferred. Both document (4) and (5) aim at the same objective as the patent in suit. However, in the Board's judgment, document (5) is the most relevant prior art since it is a quite exhaustive study of different salts in an acetic acid fractional distillation process.

3.3 In view of the closest state of the art, i.e. document (5), the technical problem underlying the patent in suit can be seen in the provision of an alternative means to recover acetic acid from a composition comprising acetic acid and water. Indeed, the Respondent did not submit that the patent in suit provided any advantage compared with the preferred embodiment disclosed in document (5), namely with $CaCl_2$. The solution to this provision of alternative means is,

according to the claimed invention, to use one or more iodides of Group IA or Group IIA of the Periodic Table of the Elements or of hydrogen.

3.4 In view of the examples 1 to 7 of the patent in suit, the Board is satisfied that the technical problem is solved within the entire scope of the claims.

3.5 It remains to be decided whether or not the claimed invention is obvious in view of the prior art, namely whether it would have been obvious for the person skilled in the art to use the iodides as defined in Claim 1 to recover acetic acid from a composition comprising acetic acid and water.

3.6 Document (5) teaches that the presence of $CaCl_2$ has a marked effect on the acetic acid fractional distillation, while sodium acetate has a harmful effect, K_2SO_4 and Na_2SO_4 no effect, KCl and NaCl a slight effect. The Board shares the opinion of the Respondent that from those results, it appears that the effect of the salts is quite unpredictable. This lack of guidance is not made up by document (4) which deals only with the effect of $CaCl_2$. Furthermore, looking for solving the above defined technical problem (cf. point 3.3 above), the person skilled in the art would not have found any relevant information in any of documents (1), (2) or (3) since they do not mention the problem of recovering acetic acid from a composition comprising acetic acid and water. Consequently, there was nothing in the state of the art to encourage the person skilled in the art to choose the iodides as defined in Claim 1 for solving the above defined technical problem.

3.7 It follows from the above considerations that the subject-matter of Claim 1 is not rendered obvious over the cited prior art within the meaning of Article 56 EPC. The same applies to dependent Claims 2 to 9 relating to specific embodiments of Claim 1. The subject-matter of Claim 10 falls within the scope of Claim 1 and is, therefore, not rendered obvious over the cited prior art for the same reasons as set out for Claim 1. The same applies to dependent Claims 11 to 16 relating to specific embodiments of Claim 10.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

N. Maslin P. P. Bracke