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D E C I S I O N
of 3 December 2003

Case Number: T 0538/99 - 3.3.1

Application Number: 93303977.8

Publication Number: 0573189

IPC: C07C 53/08

Language of the proceedings: EN

Title of invention:
Process for the production of acetic acid

Patentee:
BP Chemicals Limited

Opponent:
Hoechst Celanese Corporation

Headword:
Acetic acid production/BP CHEMICALS

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - obvious solution of the problem underlying the patent in suit"

Decisions cited:
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Catchword:
-

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Case Number: T 0538/99 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 3 December 2003

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 18 March 1999 revoking European patent No. 0573189 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: A. J. Nuss
Members: J. M. Jonk
R. T. Menapace

Summary of Facts and Submissions

I. The Appellant (Proprietor of the patent) lodged an appeal against the decision of the Opposition Division revoking the European patent No. 0 573 189 (European patent application No. 93 303 977.8).

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

(1) EP-A-0 161 874, and

(4) US-A-3 791 935.

III. The decision was based on the claims as granted, independent Claim 1 reading as follows:

"A process for the production of acetic acid which comprises:

(a) feeding methanol and carbon monoxide to a carbonylation zone in which there is maintained during the course of the process a liquid reaction composition comprising:

(i) a rhodium carbonylation catalyst;
(ii) methyl iodide;
(iii) a carbonylation catalyst stabiliser comprising an iodide salt which is soluble in the reaction composition;

(iv) a finite amount of water at a concentration up to 10% by weight;

(v) methyl acetate at a concentration of at least 2% by weight; and

(vi) acetic acid

(b) withdrawing liquid reaction composition from the reactor and introducing it, with or without the addition of heat, to a flash zone to form a vapour fraction comprising water up to 8% by weight, acetic acid product, propionic acid by-product and the majority of the methyl acetate and methyl iodide from the flash zone feed,

(c) recycling the liquid fraction from the flash zone to the reaction zone, and recovering acetic acid product from the flash zone vapour fraction by use of a single distillation zone by:

(d) introducing the vapour fraction from the flash zone into the distillation zone as a vapour and/or liquid,

(e) removing from the head of the distillation zone a light ends recycle stream comprising water, methyl acetate, methyl iodide and acetic acid, and

(f) removing from the distillation zone at a point below the introduction point of the flash zone vapour fraction, an acid product stream having a water concentration of less than 1500 ppm and a propionic acid concentration of less than 500 ppm."

IV. The Opposition Division held that the subject-matter of Claim 1 as granted was novel and also met the requirement of sufficiency within the meaning of Article 83 EPC. However, it concluded that the subject-matter of present Claim 1 did not involve an inventive step in the light of document (1) alone or, for example, in combination with document (4).

V. Oral proceedings before the Board were held on 3 December 2003.

VI. The Appellant essentially argued that the subject-matter of Claim 1 as granted was related to a commercially useful process for the production of acetic acid having acceptable low levels of water and propionic acid as indicated in Claim 1, and that neither document (1) nor document (4) or the combination of these two documents suggested the claimed maintenance of a water content in the vapour fraction of the flash zone of up to 8 wt% and the use of a single distillation column. Supported by calculations filed on 23 February 1999, he submitted that when working according to Example 1 of document (1) it was possible to obtain a flasher overhead containing more than 8 wt% of water. Moreover, he submitted that the skilled person would not combine the teaching of document (1) with that of document (4), since the feeds to be distilled were different, in particular with respect to the water and acetic acid contents. Even if document (4) were taken into consideration, the skilled person would rather prefer the use of the distillation system comprising two distillation columns as illustrated in Figure 2, which system was recommended

when the crude carboxylic acid stream contained some metallic halides from the reaction process.

VII. The Respondent essentially argued that document (1) representing the closest prior art disclosed a process for the production of acetic acid using a relative small amount of water in the reaction mixture (preferably 1 to 4 wt%). The skilled person faced with the technical problem underlying the patent in suit in the light of this closest prior art, namely the provision of a method for producing acetic acid comprising an improved recovery system leading to an acetic acid product stream having a low water concentration of less than 1500 ppm, would be able to solve it by using the process of document (1) without any need of any inventive step, since he would know how to set up a single distillation column in order to obtain the desired low water content. In this context, he disputed that the overhead of the flasher in the process of document (1) contained water in an amount of 8 wt% or more arguing that the calculations provided by the Appellant were based on the wrong assumption that all the water went into the flasher overhead, and that the presence of a high water content in said overhead was in contradiction with the teaching and experimental results indicated in the patent in suit. He also argued that the skilled person would consider the distillation unit corresponding to Figure 1 of document (4) as a suitable means for solving the technical problem underlying the patent in suit, since in view of the composition of the flasher overhead achieved according to document (1) he would not expect difficulties in obtaining the desired low water content of the acid product.

VIII. The Appellant requested that the decision be set aside and the patent be maintained on the basis of the claims as granted.

The Respondent requested 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. The sole issue to be dealt with in the present case is the assessment of inventive step in view of the cited documents.

3. 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.

4. The Board considers, in agreement with the parties to the proceedings, 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 is concerned with a process for the production of acetic acid, which substantially corresponds to the process of Claim 1 of the patent in suit. It teaches that by using relatively high amounts of methyl acetate and lithium iodide of preferably between 2-5 wt% and 10-20 wt%, respectively, the acetic acid production can be carried out at a low water content of preferably 1-4 wt%, while maintaining a stable catalyst system and a high productivity (see, in particular, page 6, lines 27 to 33; page 8, lines 14 to 21; and Table II on page 18).

The use of a low water content has the advantages that there is a great reduction in the rate of formation of by-product propionic acid (see Example 1, in particular, page 26, lines 17 to 22, and Table III on page 27 indicating a propionic acid content of 91 ppm), and that the expenditure in the recovery-purification system needed to obtain dry acetic acid can be reduced (see page 11, lines 28 to page 12, line 5).

The reaction system which can be employed comprises (a) a liquid-phase carbonylation reactor, (b) a so-called "flasher", and (c) a so-called "methyl iodide-acetic acid splitter column" (see page 9, lines 7 to 13). In this context, it is indicated in Example 1 that the liquid reaction product from the carbonylation reactor is fed to a single-tray flasher operated at a head pressure of about 2.4 atmosphere absolute and that about 35% is distilled overhead for further distillation in the methyl iodide-acetic acid splitter column (see page 23, last paragraph). The residue stream from this splitter column is then drawn off as crude acetic acid containing about 4-7 wt% of water and

can be purified further by conventional methods outside the scope of the described invention (see page 25, second paragraph, and lines 19 to 20).

4.1 The Appellant submitted that the process of Claim 1 of the patent in suit differed from that of document (1) by maintaining the water content of the flasher overhead up to 8 wt% and by using a single distillation zone in recovering the acetic acid product from the flash zone overhead. On the other hand, the Respondent submitted that the use of said single distillation zone would be the sole difference between the processes, since under the reaction conditions as indicated in Example 1 of document (1) involving the use of a low water content in the reaction composition of 4 to 5 wt%, the flasher overhead would have a water content of less than 8 wt%.

4.2 The Appellant referred in support of his submission that the water content of the flasher overhead was a distinguishing feature to calculations filed on 23 February 1999 showing that the water content of the flasher overhead obtained according to Example 1 of document (1) could be 11.4%, i.e. well above the upper limit as claimed in Claim 1 of the patent in suit.

4.3 However, having regard to the fact

(a) that said calculations have been made with the assumption that all the water in the feed to the flasher went overhead,

(b) that a complete transition of the water into the flasher overhead is unlikely in view of the distillation conditions (see point 5 above, last paragraph), and

(c) that said assumption is in contradiction with the patent in suit indicating that under comparable distillation conditions the liquid fraction from the flasher contains water (see page 7, lines 31 to 37), and that the water content of the flasher overhead (distillation column feed) is lower than the water content of the reaction composition (see all the examples, and in particular Example 1 indicating 3.8 wt.% water in the flasher overhead and 5.6 wt% water in the reaction mixture),

it is the Board's position that the Appellant's submissions in this respect cannot be accepted, and that there exists no doubt that the water content of the flasher overhead achieved according to the preferred embodiment of the process of document (1) applying a low water content in the reaction composition such as indicated in Example 1 falls within the range of up to 8 wt% as indicated in Claim 1 of the patent in suit.

4.4 Thus, in these circumstances, the Board concludes that - as submitted by the Respondent - the process of Claim 1 of the patent in suit only differs from that of the preferred embodiment of the process of document (1) applying a low water content in the reaction composition, such as the process of Example 1, by the use of a single distillation zone in recovering the dry acetic acid product from the flasher overhead.

5. Having regard to the closest prior art document (1), the Appellant considered that the process of Claim 1 of the patent in suit had the advantage that the recovery system for achieving the dry acetic acid was improved.

Thus, in the light of the closest state of the art, the technical problem underlying the patent in suit can be seen in the provision of a process for preparing acetic acid with an improved recovery system (see also page 2, lines 45 to 46, of the patent in suit).

According to Claim 1 of the patent in suit this technical problem is solved by recovering the acetic acid product from the flash zone vapour fraction by use of a single distillation zone.

Furthermore, in view of the examples of the patent in suit, the Board is satisfied that the technical problem as defined above has indeed been solved. This has not been disputed by the Respondent.

6. The question now is whether the solution of the technical problem underlying the patent in suit by the process of Claim 1 would have been obvious to the skilled person in view of common general knowledge and the cited prior art.

7. As indicated above (point 4), document (1) discloses that the liquid reaction product from the carbonylation reactor is fed to a single-tray flasher, that the flasher overhead is further distilled in the methyl iodide-acetic acid splitter column, and that subsequently the crude acetic acid can be purified

further by conventional methods outside the scope of the described invention.

Therefore, document (1) as such does not provide an incentive to the skilled person to replace the methyl iodide-acetic acid splitter column and the subsequent recovery method by a single distillation zone.

8. However, in the Board's judgment, the skilled person faced with the technical problem underlying the patent in suit and being informed by document (1) that the use of a low water content has the advantage that the expenditure in the recovery-purification system needed to obtain dry acetic acid can be reduced (see page 11, lines 28 to page 12, line 5) would find in document (4) a clear pointer to the solution of the technical problem as claimed.

Document (4) discloses namely a process for the purification of crude acetic acid, produced by the reaction of methanol with carbon monoxide in the presence of a catalyst system of a group VIII noble metal component and an iodide by using a flasher and subsequently a single distillation unit (see column 1, lines 11 to 31; Claim 6; and Example I). In particular, it discloses in said Example I that by flashing a stream of acetic acid, water, hydrogen iodide and methyl iodide, and distilling the overhead from the flasher in a single distillation unit as illustrated by Figure 1 a dry acetic acid product containing 83-132 ppm of water (see Table I) can be obtained.

9. In this context, the Appellant submitted that the skilled person would not combine the teaching of document (1) with that of document (4), since the flasher overhead compositions were quite different in view of the high water content of about 18 wt% in the composition of document (4) and the relatively high methyl acetate concentration in the composition of document (1). Moreover, he submitted that even if the skilled person had combined both documents, he would have found a clear incentive in document (4) to use the distillation system consisting of 2 distillation units as illustrated by Figure 2 in view of the presence of a iodide salt in the flasher overhead of document (1).

However, the Board does not accept these submissions for the following reasons:

Although it is true that the flasher overhead in the process of document (4) comprises more water than the flasher overhead in the process of document (1), the skilled person considering the suitability of the distillation unit as illustrated by Figure 1 of document (4) would rather conclude that said distillation unit would even be more appropriate for removing a lower amount of water. Moreover, like the Respondent, the Board does not see any reason why the single distillation unit as indicated in Figure 1 of document (4) would not be appropriate for purifying a crude acetic acid feed containing some methyl acetate. In fact, the Appellant could not provide any support for his contention in this respect.

Furthermore, the Board finds that the Appellant's submission that in view of the presence of lithium iodide in the flasher overhead in the process of document (1) the skilled person would rather select the distillation system of Figure 2 instead of the single distillation unit of Figure 1 (see document (4), column 4, lines 1 to 5) also fails, since lithium iodide is involatile, so that the skilled person would rather expect that the lithium iodide content in the flasher overhead being fed to the distillation unit would be negligible. This finding is also confirmed by the patent in suit indicating that the involatile lithium salt stabiliser forms part of the liquid fraction from the flasher (see page 7, lines 35 to 37).

10. 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 obvious to the skilled person, and consequently does not involve an inventive step within the meaning of Article 56 EPC.

Claims 2 to 14 fall with Claim 1, since the Board can only decide on the Appellant's request as a whole.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

N. Maslin A. Nuss