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Datasheet for the decision of 26 September 2007

Case Number: T 1145/05 - 3.3.10

Application Number: 99305660.5

Publication Number: 0976711

IPC: C07C 51/12

Language of the proceedings: EN

Title of invention:
Process for the production of acetic acid

Patentee:
BP Chemicals Limited

Opponent:
Celanese Ltd.

Headword:
BP Chemicals/Celanese

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (no) - purposive choice - solution obvious"

Decisions cited:
T 0001/80, T 0020/81, T 0024/81, T 0248/85, T 0800/91, T 0068/95

Catchword:
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Case Number: T 1145/05 - 3.3.10

D E C I S I O N
of the Technical Board of Appeal 3.3.10
of 26 September 2007

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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 30 June 2005 rejecting the opposition filed against European patent No. 0976711 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: R. Freimuth
Members: C. Komenda
J.-P. Seitz

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal on 8 September 2005 against the decision of the Opposition Division dated 30 June 2005 rejecting the opposition against European patent No. 976 711 which was granted on the basis of nine claims, and on 17 October 2005 filed a written statement setting out the grounds of appeal. Claim 1 of the patent as granted read as follows:

"1. A continuous process for the production of acetic acid by the carbonylation of methanol and/or a reactive derivative thereof which process comprises the steps of:

(1) feeding methanol and/or a reactive derivative thereof to a carbonylation reactor in which the methanol and/or reactive derivative thereof is reacted with carbon monoxide in a liquid reaction composition, the liquid reaction composition comprising a Group VIII noble metal carbonylation catalyst, methyl iodide co-catalyst at a concentration of at least 2% w/w, optionally at least one promoter, at least a finite concentration of water, methyl acetate at a concentration of at least 8% w/w and acetic acid product;

(II) withdrawing liquid reaction composition from the carbonylation reactor and introducing the withdrawn liquid reaction composition into at least one flash separation zone, with or without the addition of heat, to produce a vapour fraction comprising water, acetic acid product, methyl acetate and methyl iodide, and a liquid fraction

comprising Group VIII noble metal carbonylation catalyst and optionally at least one promoter;

(III) recycling the liquid fraction from step (II) to the carbonylation reactor;

(IV) introducing the vapour fraction from step (II) into a light ends distillation column;

(V) removing a process stream comprising acetic acid product from the light ends distillation column;

(VI) removing from the head of the light ends distillation column a vapour fraction comprising methyl acetate, methyl iodide, water and acetic acid;

(VII) condensing the overhead vapour fraction from (VI);

(VIII) passing the condensed overhead vapour fraction from (VII) to a decanter wherein the fraction is separated into an upper (aqueous) layer and a lower (organic) layer;

(IX) recycling in whole or in part the upper (aqueous) layer separated in (VIII) as reflux to the light ends distillation column and the lower (organic) layer separated in (VIII) in whole or in part to the reactor characterised in that separability of an upper (aqueous) layer and a lower (organic) layer in the decanter in step (VIII) is achieved by maintaining the concentration of acetic acid in the condensed overhead vapour fraction passed to the decanter at or below 8 wt%."

II. Notice of Opposition had been filed by the Appellant requesting revocation of the patent as granted in its entirety on the grounds of lack of novelty and lack of inventive step (Article 100(a) EPC) and insufficiency of disclosure (Article 100(b) EPC). *Inter alia* the

following documents were submitted in opposition proceedings:

(1) EP-A-0 573 189,
(3) EP-A-0 768 295 and
(4) EP-A-0 752 406.

III. The Opposition Division held that the process according to the invention was novel and was sufficiently disclosed for a skilled person to be carried out. Further, it held that the subject-matter of the patent in suit involved an inventive step, since a skilled person starting from document (3) would not have had an incentive to limit the concentration of acetic acid in the condensed overhead vapour fraction to 8% w/w or less. The passage in document (1) indicating an acetic acid concentration of less than 5% w/w was only referring to a part of the recycle stream and was, therefore, not relating to the acetic acid concentration in the condensed overhead vapour fraction.

IV. The Appellant submitted that the claimed process was not novel in view of document (4), which disclosed all the technical features of the claimed process. The concentration of the acetic acid in the overhead vapour stream was not explicitly disclosed therein, but the use of a distillation column having 36 distillation stages, as used in Examples 17 to 19 of document (4) would inevitably lead to an acetic acid concentration of 8% w/w or less.

As regards inventive step the Appellant submitted that the process according to the patent in suit did not involve an inventive step. He argued that either

document (1) or document (4) may serve as closest state of the art.

Document (1) was directed to a process for the preparation of acetic acid describing all the technical features of the process of the patent in suit, although not in combination. The problem to be solved was to enable phase separation in the condensed overhead vapour fraction passed to the continuously operated decanter. Document (1) further indicated that phase separation often occurs, when the vapour stream passing overhead from the distillation zone was cooled (page 6, lines 35 to 36). The two phases of this condensed vapour overhead fraction were separated and recycled to the distillation zone and to the reactor (page 6, lines 36 to 38). In the same passage it was indicated that this light ends recycle stream may comprise less than 5% w/w of acetic acid. Thus, the claimed solution to the technical problem was already suggested by document (1). Therefore, he concluded that the subject-matter of the patent in suit was obvious in view of document (1). The same argumentation was brought forward when starting from document (4) as closest state of the art. In this document the use of a distillation column having 36 distillation stages would inevitably have reduced the concentration of acetic acid to 8% w/w or less and causing phase separation. Thus, the claimed solution to the technical problem was already suggested in document (4).

Further, he submitted that document (3) taught various solutions to the technical problem underlying the patent in suit of enabling phase separation, such as increasing the number of stages in the light ends

distillation column. This feature would inevitably have resulted in a reduction of the acetic acid concentration in the condensed overhead vapour fraction to 8% w/w or below. Therefore, the process according to the patent in suit was also obvious from a combination of documents (1) and (3).

At the oral proceedings the Appellant declared that his objection as to insufficiency of disclosure of the invention was no longer maintained.

V. The Respondent (Proprietor of the Patent) submitted that document (4) did not anticipate the subject-matter of the patent in suit as this document was silent on the reflux ratio of the distillation process. Without the indication of the reflux ratio it could not automatically be concluded that the acetic acid concentration of the resulting overhead vapour fraction was 8% w/w or below.

As regards inventive step he started from document (3) as closest prior art. Document (3) did, however, not teach that phase separation could be achieved by controlling the acetic acid concentration to a level of 8% w/w or less, when at the same time the concentration of methyl acetate was higher than 8% w/w and the concentration of methyl iodide at least 2% w/w in the reactor. A mere teaching in document (3) that increasing the number of distillation stages would provide phase separation did not correspond to the implicit teaching of reducing the concentration of acetic acid in the condensed overhead vapour fraction, since document (3) referred to this feature only in combination with either the addition of water to the

distillation column, the lowering of the cooling temperature of the overhead vapour fraction or the reduction of the methyl acetate content in the decanter. Thus the process of the patent in suit was inventive over document (3).

Concerning document (1) the Respondent submitted that this document was primarily concerned with the preparation of acetic acid having lower contents of by-products. Further, none of the examples of this document used a concentration of at least 8% w/w of methyl acetate in combination with at least 2% w/w of methyl iodide in the reactor. The passage on page 6 lines 35 to 39 indicating that the light ends recycle comprised less than 5% w/w of acetic acid related only to a part of the condensed overhead vapour fraction and, therefore, did not give any incentive for a skilled person to control the acetic acid concentration in the entire condensed overhead vapour fraction to 8% w/w or below in order to achieve phase separation.

Moreover, a skilled person would have known from document (3) that the phase separation, which was achieved in the examples of document (1), would not have been achieved successfully with higher concentrations of methyl acetate and methyl iodide. Therefore, a skilled person would not have increased the concentration of methyl acetate in the reactor in order to achieve phase separation in the decanter. Therefore, the process according to the patent in suit was not obvious from a combination of documents (3) and (1).

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 26 September 2007 at the end thereof the decision of the Board was announced.

Reasons for the Decision

1. The appeal is admissible.

2. *Novelty*

The Appellant objected to the novelty of the invention with regard to document (4). In view of the negative conclusions with respect to inventive step of the claimed process (see point 3 below), a decision of the Board on the issue of novelty is not necessary.

3. *Inventive step*

3.1 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 the technical results of or effects successfully achieved by the claimed invention vis-à-vis the closest state of the art, to define the technical problem to be solved as the object of the invention to achieve these results or effects, and to examine the obviousness of the claimed solution to this problem in view of the state of the art (see decisions T 1/80, OJ EPO 1981, 206, points 3, 5, 8, 11 of the

reasons; T 20/81, OJ EPO 1982, 217, point 3 of the reasons; T 24/81, OJ EPO 1983, 133, point 4 of the reasons; T 248/85, OJ EPO 1986, 262, point 9.1 of the reasons). This "problem-solution approach" ensures assessing inventive step on an objective basis.

3.2 The patent in suit is directed to a continuous process for the preparation of acetic acid, wherein phase separation in the decanter is enabled.

3.2.1 Such a process belongs to the state of the art in that document (1) describes a continuous process for the preparation of acetic acid by the carbonylation of methanol, which comprises feeding methanol and carbon monoxide to a carbonylation reactor in the presence of a liquid reaction composition comprising a rhodium carbonylation catalyst, methyl iodide , water, acetic acid and methyl acetate (claim 1 (a)). Methyl acetate is present in a concentration of up to 15% w/w (claim 5). A liquid reaction composition is withdrawn from the reactor and introduced into a flash zone to form a vapour fraction comprising water, acetic acid product, methyl acetate and methyl iodide and a liquid fraction comprising the carbonylation catalyst (claim 1 (b)),recycling the liquid fraction from the flash zone to the reaction zone (claim 1 (c)) introducing the vapour fraction from the flash zone into the distillation zone (claim 1 (d)) and withdrawing acetic acid product from the distillation zone at a point below the introduction point of the flash zone vapour fraction (claim 1 (f)). From the head of the distillation zone a vapour stream is removed, which according to claim 1, step (e) of document (1) is called the light ends recycle stream. Further

information concerning step (e) of claim 1 is contained in the description. Particularly, the passage on page 6, lines 35 to 39 indicates that the light ends recycle stream recovered in step (e) is composed of water, methyl acetate, methyl iodide and acetic acid. It is further described as often forming two phases when being cooled, with the light aqueous phase being recycled to the distillation zone, and the heavy, methyl iodide-rich phase being recycled to the reactor. The same passage indicates that the light ends recycle stream may comprise a concentration of acetic acid of less than 5% w/w, thus linking the occurrence of two phase condition in the light ends recycle stream with its content of acetic acid. Therefore, the general disclosure of document (1) taken as a whole embraces the subject-matter claimed in describing all the features of claims 1, but it does not specifically disclose all these features in combination.

Document (1) was cited and acknowledged in the specification of the patent in suit on page 2, paragraph [0008] as closest state of the art and starting point of the invention. Where the patent in suit indicates a particular piece of prior art as being closest to the claimed invention and the starting point for determining the problem underlying the patent in suit, then the Board should adopt this as the starting point for the purpose of a problem-solution analysis unless it turns out that there is a closer state of the art of greater technical relevance (see e.g. decisions T 800/91, point 6 of the reasons; T 68/95, point 5.1 of the reasons).

3.2.2 The parties also referred to documents (3) and (4) as possibly representing the closest state of the art.

Document (4), addressed by the Appellant relates to a process for the preparation of acetic acid as indicated in the precharacterising portion of claim 1. However, that document is silent about the concentration of acetic acid in the condensed overhead vapour fraction removed from the head of the light ends distillation column. The indication in document (4) of the number of distillation plates used in the first distillation column is not sufficient to determine the separation effect of that column and thus implicitly the concentration of acetic acid in the condensed overhead vapour fraction, since the composition of the condensed overhead vapour fraction is further affected by the reflux ratio and the number of thermodynamic distillation plates. In absence of sufficient information it cannot be concluded that the concentration of acetic acid in the condensed overhead vapour fraction is necessarily within the claimed range. Since document (4) does neither explicitly, nor implicitly describe the feature of the characterising part of claim 1 of the patent in suit, the Board considers this document to be further away from the claimed process than document (1).

The Respondent argued that rather document (3), which was also acknowledged in the specification of the patent in suit, was the closest state of the art, since document (1) was primarily concerned with a process for the preparation of acetic acid using a lower concentration of methyl acetate in the reaction liquid as shown in the examples of document (1), whereas

document (3) specifically addressed the problem of phase separation in the condensed overhead vapour fraction. However, document (3) does not describe an acetic acid concentration in the condensed overhead vapour fraction of less than 8% w/w, while document (1) does. The Board concludes, therefore, that document (3) represents prior art which is further away from the patent in suit than document (1).

3.2.3 Thus, the Board considers that in the present case the process described in document (1) represents the closest state of the art and, hence takes it as the starting point when assessing inventive step.

3.3 The drawback of this prior art process lies in that a phase separation becomes increasingly difficult at high methyl acetate concentrations (patent specification page 3, paragraph [0009]). Thus, the technical problem underlying the patent in suit, as submitted by the Appellant and as indicated in the specification of the patent in suit at page 3, paragraph [0010] consists in maintaining two liquid phases in a continuously operated decanter.

The Respondent supplemented the above problem underlying the patent in suit as maintaining phase separation in the decanter when the concentration of methyl acetate in the reactor is at least 8% w/w. However, as document (1) describes already a process having a concentration of up to 15% w/w of methyl acetate in the reactor, the concentration of at least 8% w/w cannot be part of the objective problem, since the technical problem has to be formulated starting from the teaching of the closest state of the art.

Thus, the Respondent's alleged supplement to the problem relating to the concentration of methyl acetate cannot be taken into account so that the objective problem underlying the patent remains the one formulated above, i.e. to maintain two liquid phases in a continuously operated decanter.

3.4 As the solution to this problem the patent in suit proposes the process according to claim 1, characterized in that the acetic acid concentration in the condensed overhead vapour fraction passed to the decanter is maintained at 8% w/w or below.

3.5 The example in the patent specification refers to a continuously operated process for the preparation of acetic acid. When the acetic acid concentration in the condensed overhead vapour fraction is 8% w/w or below, phase separation occurs. After having run the preparation process for 5218 hours a comparison test was run, wherein the acetic acid concentration in the condensed overhead vapour fraction was increased to above 8% w/w. As a consequence the operation mode in the decanter turns to single phase operation (see Fig. 1). Therefore, the Board is satisfied that the problem underlying the invention has been successfully solved.

The Respondent argued that maintaining the acetic acid concentration at 8% w/w or below has a further benefit of enabling a phase separation in the decanter when combined with concentrations of at least 8% w/w of methyl acetate in the reactor.

However, the Respondent who bears the onus of proof for its allegations, has neither provided substantiating facts nor corroborating evidence that the concentration of at least 8% w/w of methyl acetate in the reactor has any impact on the phase separation achieved in the decanter. The test report contained in the patent specification only shows effects which are due to the varying concentrations of acetic acid, since in the example the concentration of methyl acetate in the reactor was kept constant at a level of 15% w/w, which was known from document (1). Thus, the Respondent has merely speculated about any impact on the concentration of methyl acetate in the reactor on the phase separation in the decanter, what the Board cannot sanction.

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

3.6.1 As set out in paragraph 3.2.1, above, document (1) describes a continuous process for the preparation of acetic acid wherein a light ends recycle stream is removed from the head of the distillation zone (claim 1, step (e)). If starting from document (1) a skilled person aims at maintaining phase separation in the condensed light ends recycle stream he would turn his attention to passages relating to the light ends recycle streams and in particular to the passage on page 6, lines 35 to 39, which refers to the possibility of the light ends recycle stream separating in two phases. In that passage he finds the hint that the concentration of acetic acid may be less than 5% w/w,

which, thus, links the information of the light ends recycle stream separating in two phases to its content of acetic acid. Following this teaching a skilled person gets the incentive to use a concentration of acetic acid in the light ends recycle stream of less than 5% w/w, in order to solve the problem underlying the patent in suit, namely to maintain phase separation, thus arriving at the claimed subject-matter, i.e. a concentration within the range of 8% w/w or less without any inventive ingenuity.

3.6.2 The Respondent submitted that the passage on page 6 lines 35 to 39 of document (1) should be interpreted as relating only to a part of the condensed overhead vapour fraction. He referred to the passage on page 7, lines 23 to 40, which described that the condensed overhead vapour fraction was separated into three fractions, one methyl iodide-rich portion and two aqueous portions. Therefore, the Respondent concluded that the former passage on page 6, lines 35 to 39 referred only to one of both aqueous portions of the condensed overhead vapour fraction, therefore, not giving any information of how to achieve the phase separation between aqueous and non-aqueous phase, which was the problem underlying the patent in suit.

This line of reasoning relates to one particular embodiment within the ambit of document (1). However, the teaching of that document is not confined to this specific embodiment, but embraces all the information contained therein, in particular that information addressed in point 3.6.1, above, namely that a separation into two phases, an aqueous and a non-aqueous, can be achieved by maintaining the

concentration of acetic acid below 5% w/w. Therefore, the Respondent's arguments cannot succeed.

3.6.3 For these reasons the solution proposed in claim 1 to the problem underlying the patent in suit is obvious in the light of the prior art.

3.7 As a result the request of the Respondent is not allowable for lack of 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 The Chairman

P. Cremona R. Freimuth