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D E C I S I O N
of 7 September 1994

Case Number: T 0971/92 - 3.3.1

Application Number: 86304619.9

Publication Number: 0206715

IPC: C07C 63/26

Language of the proceedings: EN

Title of invention:
Purification of terephthalic acid

Applicant:
AMOCO CORPORATION

Opponent:
-

Headword:
Terephthalic acid/AMOCO

Relevant legal norms:
EPC Article 56

Keyword:
"Inventive step (no)"
"Problem invention (no)"

Decisions cited:
-

Catchword:
-



Case Number: T 0971/92 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 7 September 1994

Appellant: AMOCO CORPORATION
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Chicago
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Representative: Ritter, Stephen David
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Decision under appeal: Decision of the Examining Division of the European Patent Office dated 17 June 1992 refusing European patent application No. 86 304 619.9 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. Jahn
Members: R. K. Spangenberg
S. G. Perryman

Summary of Facts and Submissions

I. European patent application No. 86 304 619.9 was filed on 16 June 1986 and was published under No. 0 206 715. On 17 June 1992 the Examining Division refused the application. On 8 August 1992 an appeal was filed against this decision and the appropriate fee was paid at the same date.

II. The decision under appeal was based on two sets of claims, the first one comprising 14 claims filed on 11 December 1990 (main request) and the second one (auxiliary request) comprising 12 claims filed on 14 January 1992. Claim 1 of the main request read as follows:

"A method for producing purified terephthalic acid by catalytic hydrogenation of a relatively impure terephthalic acid solution in a polar solvent, characterised by the step of modulating solution hydrogen concentration during said hydrogenation so as to maintain a predetermined Hunter Color Scale b*-value in the purified terephthalic acid."

The ground of refusal was that the application according to both requests did not meet the requirement of Article 56 EPC, since the subject-matter of the above claims was obvious in the light mainly of

(1) US-A-3 584 039,

taking into account the common general knowledge in the field of synthetic organic chemistry.

The Examining Division considered that document (1) described the purification of terephthalic acid by catalytic hydrogenation without giving details as to how this process was controlled. The technical problem was

therefore seen in providing a method for controlling this process. This problem was considered to have been solved by modulating the solution hydrogen concentration in the way indicated in Claim 1 of both requests. However this solution of the above technical problem was held obvious in view of the common general knowledge, according to which the velocity of a reaction is determined by the concentration of the reactants. If therefore a given solution hydrogen concentration was not sufficient to hydrogenate all impurities within a desired reaction time (space velocity), then it was obvious that the hydrogen concentration had to be increased. The use of the Hunter b^* -value for determining the concentration of the impurities to be hydrogenated was held to be a common alternative to the colour scale used according to document (1).

III. A Statement of Grounds of Appeal was received on 16 October 1992. The Appellant submitted that the present invention related to an improved process for providing polymer grade terephthalic acid involving subjecting the impure product to hydrogenation in the liquid phase. He stated that no effective procedure had been available hitherto for ensuring efficient utilisation of the necessary hydrogen and in practice hydrogen was used excessively and was wasted. Therefore, so he argued, the technical problem with which the present application was concerned was to avoid this wasting of hydrogen, a problem not addressed in document (1). Thus, in his submission, no hint towards a solution of this problem could be derived from this document, since the data contained in it disclosed no discernible correlation between hydrogen partial pressure and optical density which would give the skilled addressee any notion that measuring the latter might usefully be used to modulate the former.

On 30 August 1994 the Appellant submitted a further set of 6 claims named Second Auxiliary Claim Set, Claim 1 of which read as follows:

"A method for producing purified terephthalic acid having a predetermined Hunter Color Scale b*-value, by catalytic hydrogenation of a relatively impure terephthalic acid solution in a polar solvent, characterised by modulating solution hydrogen concentration in direct relation to the optical density of the impure terephthalic acid."

Oral proceedings took place on 7 September 1994. During these proceedings the Appellant showed a diagram demonstrating the interrelation of the Hunter b*-value of the purified terephthalic acid and the hydrogen concentration. He abandoned the line of argument developed in the Statement of Grounds of Appeal and submitted instead that at high hydrogen concentrations, such as those used in the examples of document (1), the colour of the hydrogenated product was independent of the hydrogen concentration, since there was always sufficient hydrogen present to ensure complete reduction of all reducible impurities. By contrast, so he now argued, the process according to the present claims did not aim at a complete reduction of all reducible impurities being present in the impure terephthalic acid, but at terminating the reduction process at a predetermined level different from the level of complete reduction. Thus the technical problem vis-à-vis document (1) was to obtain a less purified terephthalic acid still containing a predetermined amount of reducible yellow-coloured impurities. He admitted that document (1) contained sufficient information enabling the skilled person to solve the above technical problem, once it had been appreciated that such a problem existed. However, in his submission in the present case the inventive step was to be seen in the appreciation of the technical problem.

- IV. The Appellant requests that the decision under appeal be set aside and, as main request, that a patent be granted on the basis of the claims as filed with the letter dated 4 December 1990 (i.e. those according to the main request underlying the decision under appeal), and as auxiliary request to grant a patent with the set of claims filed by telefax on 30 August 1994, and in each case a description to be adapted if and as necessary.

At the end of the oral proceedings the decision to dismiss the appeal was pronounced.

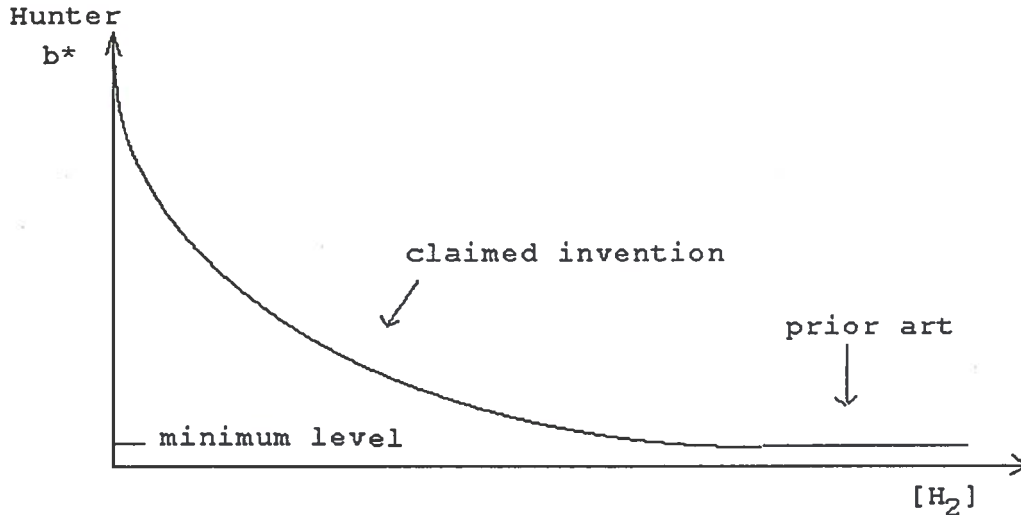
Reasons for the Decision

1. The appeal is admissible.
2. The Board is satisfied that no objection under Article 123(2) arises against the subject-matter of the present claims and that their subject-matter is novel with respect to the cited state of the art.
3. The only relevant question that remains to be answered in the present appeal is therefore that of inventive step.
 - 3.1. Document (1), which is mentioned in the present patent application, describes the conventional process for obtaining so-called "polymer grade" terephthalic acid by hydrogenation of an impure (technical grade) terephthalic acid feedstock. In this process the technical grade terephthalic acid containing about 2 to 3 weight percent of 4-carboxybenzaldehyde and further coloured contaminants of the benzil, fluorenone or anthraquinone structure (see column 1, lines 62 to 67 and col 2, lines 58 to 63) is dissolved in water under pressure, preferably at a temperature of about 240 to 275°C (column 2, line 64 to

column 3, line 37) and this solution is treated either batchwise or continuously with hydrogen at a partial pressure of about 70 to 1000 kPa (10 to 150 p.s.i.a., column 4, lines 16 to 18) in the presence of palladium on charcoal (column 5, lines 19 to 24). The resulting solution is separated from the catalyst, if necessary, and the purified terephthalic acid recovered by crystallisation (column 5, lines 32 to 35). According to column 4, lines 24 to 32 the main impurity to be reduced is 4-carboxybenzaldehyde, but nevertheless the measurement of the optical density, e.g. at 340 or 380 nm (see column 8, lines 39 to 72) of the recovered terephthalic acid may serve as a useful yardstick to measure the reduction or conversion of characteristically yellow-coloured impurities. Although the reduction requires very little hydrogen, it is preferred to use hydrogen in the range of 1 to 5 moles excess over the stoichiometric amount. The process may be performed in the absence of a separate gas phase of hydrogen, i.e. all the hydrogen required for reducing the impurities can be in solution (column 6, lines 19 to 24). According to column 4, lines 10 to 14 even very small amounts of hydrogen, corresponding to a partial pressure as low as 1 to 3 p.s.i.a. are in principle sufficient for the reduction reaction but would not be commercially attractive because the reaction would be too slow or incomplete.

3.2. The technical problem set out in the description of the present patent application is to "optimise control" of the reduction of coloured compounds (see page 2, lines 7 to 15) in the above process of producing "polymer grade" terephthalic acid.

During the oral proceedings the Appellant submitted, with reference to a diagram similar to that reproduced below



that the expression "control" implies that the process is performed under conditions where the product quality in fact depends on the process parameters, in particular on the hydrogen concentration, i.e. conditions outside the area of the horizontal part of the curve in the above diagram. Thus he submitted that the real problem was to control the process in a manner that a "predetermined level" of the Hunter b^* -value (well known for measuring the yellow appearance of a product, see description, page 7, line 29 to page 9, line 9) of the purified product could be maintained. The expression "predetermined level" should in his submission be construed to mean a level different from the minimum level indicated in the above diagram, because the latter is the inevitable level caused by non-reducible impurities and cannot be influenced by modulating the process parameters.

- 3.3. In other words, the Appellant wishes to have the present independent claims of both sets under consideration construed to be limited to the production of a purified terephthalic acid still containing some reducible yellow-coloured impurities. The Board is not satisfied that such a narrow construction of the expression "predetermined", which **excludes** the minimum level of the Hunter b^* -value

corresponding to complete reduction of all reducible impurities, is in accordance with the content of the application documents as filed, since the excess of hydrogen over the stoichiometric amount recommended in the present application (see page 6, lines 16 to 22) is exactly the same as that indicated as the preferred range in document (1), column 4, lines 19 to 24, and the hydrogen partial pressures and reaction temperatures used in the examples of the present application are all within the preferred range recommended in document (1), so that no indication can be found in the application documents as filed that the desired product of the claimed process should be different from "polymer grade" terephthalic acid, i.e. terephthalic acid of the quality described in document (1) (see column 8, line 39 to column 9, line 7). Moreover, the Appellant himself relied on this narrow construction of the scope of the present claims for the first time during the oral proceedings, whereas his earlier submissions were clearly based on the broader construction of the above expression which **includes** the said minimum level. In any case, however, the question of inventive step could not have been decided in the Appellant's favour even on the basis of the Appellant's narrow construction of the scope of the present application.

- 3.4. On that basis, the technical problem to be solved by the present patent application would be to provide a process for obtaining a terephthalic acid containing a predetermined amount of reducible yellow-coloured impurities, defined by its Hunter b*-value. Since the main and the auxiliary request have to be considered in relation to the same technical problem, and the Appellant acknowledged that nothing turned on the differences between the technical features recited in the respective main claims of the two requests, there is no need to deal with these requests separately.

- 3.5. The application proposes to solve this problem essentially by modulating the amount of hydrogen so as to obtain the desired "predetermined" Hunter b*-value (main request) or, more precisely, by calculating the necessary amount of hydrogen from the degree of purity of the crude terephthalic acid, indicated by the optical density at 340 nm (auxiliary request).
- 3.6. Although document (1) does not directly address the problem of obtaining such a product, it contains some basic information about the required amount of hydrogen and about the possibilities of checking the completeness of the reduction (see e.g. column 4, lines 24 to 32 and lines 10 to 14, referred to in item 3.1. above). From this disclosure the skilled person would infer that the completeness of the reduction reaction would depend on the hydrogen partial pressure in the manner reflected in the above diagram, i. e. in the manner the skilled person would expect on the basis of his common general knowledge, and could be monitored by measuring the optical density of the product. Moreover, document (1) describes the additional determination of the yellow colour of the purified product by dissolving it in DMF and determining the colour of the solution by comparison with APHA colour standards (column 8, lines 7 to 11). In the Board's judgment, nothing inventive can be seen in replacing this measurement of the yellow colour by the measurement of the Hunter b*-value, which is another well-established method for measuring the same property (see the present application, page 9, lines 5 to 9). In addition, as has already been mentioned in item 3.3 above, the excess of hydrogen over the stoichiometric amount recommended in the present application is exactly the same as that indicated as the preferred range in document (1), and the hydrogen partial pressures and

reaction temperatures used in the examples of the present application are all within the preferred range recommended in document (1).

Thus the Board holds that the solutions of the above technical problem provided by the main and the auxiliary request did not require inventive skill. This was no longer disputed by the Appellant during the oral proceedings.

- 3.7. The Board is also not satisfied that an inventive step can be seen in the mere appreciation of the above technical problem, as submitted by the Appellant.
- 3.7.1. It is the Board's position that the appreciation of conventional technical problems which form the basis of the normal activities of the notional "person skilled in the art", such as the removal of shortcomings, the optimisation of parameters, the saving of energy or time cannot involve an inventive step. The appreciation of a technical problem may thus only contribute to the inventive step in very exceptional circumstances. However, if an applicant nevertheless wishes to rely on an allegation that the inventive activity resides in the recognition of a technical problem to which the solution is admittedly obvious, as in the present case, then the minimum requirement that must be fulfilled is that this technical problem is clearly and unambiguously disclosed in the application as filed. For the reasons set out in item 3.3 above, the Board holds that this requirement is not met in the present case. Thus the Appellant's submission fails already for this reason.
- 3.7.2. Moreover, it appears from document (1) that the degree of purity of "polymer grade" terephthalic acid was solely determined by commercial demands of the fiber industry, which did not accept a poorer quality. Thus the only reason

why the skilled person did not seriously contemplate choosing reaction conditions leading to incomplete purification was a commercial one (see document (1), column 4, lines 10 to 16). The Appellant has asserted during the oral proceedings that in the meantime manufacturers of polyester fibers were prepared to accept a poorer quality of terephthalic acid. However, in the Board's judgment, the observation of the market in order to be able to respond to any of its demands belongs to the normal activities of the notional "person skilled in the art". Therefore the mere recognition that there was now a market for terephthalic acid made to less stringent purity requirements does not mean that any inventive step is involved in adapting a known process so as to make a less pure terephthalic acid.

- 3.7.3. During the oral proceedings the Appellant has additionally asserted that it has been found that terephthalic acid having a "predetermined" Hunter b*-value has technical advantages over the purer product described in document (1), without, however, providing evidence to this effect. He admitted that the application as filed did not disclose any particular Hunter b*-value or range of such values which could be correlated to such a technical effect. Therefore the Board holds that this submission cannot be taken into account in the assessment of the inventive step of the process of the present application, as this advantage, if it exists, relates only to something which has neither been described nor claimed in the present application, as any invention would here relate to the use of the impure product and not to the process of manufacturing it.

Order

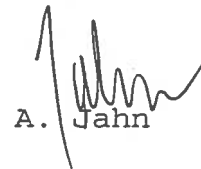
For these reasons it is decided that:

The appeal is dismissed.

The Registrar:


E. Görgmaier

The Chairman:


A. Jahn

