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D E C I S I O N
of 17 March 2005

Case Number: T 0977/01 - 3.3.1

Application Number: 96901757.3

Publication Number: 0804402

IPC: C07C 45/74

Language of the proceedings: EN

Title of invention:

Organic compounds and processes for their manufacture

Applicant:

ExxonMobil Chemical Patents Inc.

Opponent:

-

Headword:

Aldehydes/EXXONMOBIL

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - non-obvious solution"

Decisions cited:

-

Catchword:

-



Case Number: T 0977/01 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 17 March 2005

Appellant: ExxonMobil Chemical Patents Inc.
5200 Bayway Drive
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Representative: Bawden, Peter Charles
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 10 April 2001
refusing European application No. 96901757.3
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: P. P. Bracke
R. T. Menapace

Summary of Facts and Submissions

I. The appeal lies from the Examining Division's decision refusing European patent application No. 96 901 757.3 published as WO 96/22268, on the ground that a product by process claim in the set of claims underlying the decision was not novel over the disclosure of document

(1) US-A-2 852 563

and that the claimed process was obvious over the teachings of documents (1),

(3) US-A-4 270 006 and

(4) DE-A-2 727 330.

II. In particular, the Examining Division found that document (1) represented the closest state of the art, that the problem to be solved was to provide a further process for the manufacture of saturated C₉ aldehydes and that it was obvious to combine the starting aldehydes used in the examples of document (1) in order to solve that problem.

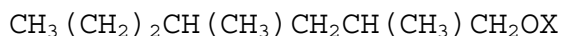
Moreover, the Examining Division was of the opinion that the condensation of propanal to the corresponding hexanals and nonanals was known from documents (3) and (4).

III. By telefax of 10 March 2005 the Appellant filed sets of claims according to a main request and three auxiliary requests.

The main request consisted of twenty-one claims, with the independent claims reading:

"1. A process for the manufacture of a saturated aliphatic aldehyde or alcohol containing a total of 9 carbon atoms which comprises dimerising propanal by an aldol condensation and subjecting the resulting product to an aldol condensation with propanal to form an unsaturated C₉ aldehyde and hydrogenating the unsaturated C₉ aldehyde to a saturated C₉ aldehyde or alcohol."

"17. An ester of the formula



wherein X represents the residue of an acid other than the ester 2,4-dimethylheptyl 4,6-dimethylheptyl 1,2-benzene dicarboxylate."

"20. A plasticiser composition comprising esters according to Claim 17 or Claim 19 which comprise esters of a polybasic acid and an alcohol mixture comprising a major proportion of 2,4-dimethylheptanol and a minor proportion (up to 50%) of another alcohol or alcohols having from 6 to 12 carbon atoms."

"21. A polymeric composition comprising a polymer and an ester as claimed in Claim 17 or Claim 19."

IV. The Appellant argued in particular that the claimed process enabled the preparation of single isomers of C₉ aldehydes or alcohols with high selectivity, namely those having the 2,4-dimethylheptyl structure, and that

this could not be derived from any of the cited prior art documents.

- V. The Appellant requested that a patent be granted on the basis of the claims set out in the main request filed with telefax of 10 March 2005.

Reasons for the Decision

1. The appeal is admissible.
2. Main request
- 2.1 Article 123(2) EPC

Claim 1 results from the combination of the process described in original Claim 1 with the further specifications that the starting C₆ aldehydes are prepared by dimerising propanal by an aldol condensation, as described on page 6, lines 20 to 22, of the application as filed and that the C₉ aldehyde may be hydrogenated to the corresponding C₉ alcohol, as stated on page 3, line 30, of the application as filed.

The hydrogenation step in Claim 2 is supported by the disclosure on page 16, lines 20 to 23, of the application as filed; the hydroformylation in Claim 3 is known, for example, from page 4, lines 30 to 33, of the application as filed; ethylene according to Claim 4 as C₂ unsaturated hydrocarbon is disclosed on page 8, line 35, of the application as filed; Claim 5 corresponds to original Claim 4; the alcohols cited in Claim 6 are disclosed on page 23, lines 4 to 10, of the

application as filed; Claim 7 is supported by the disclosure on page 3, lines 29 to 32, of the application as filed; Claims 8 to 13 are supported in the application as filed by the disclosures on page 19, lines 20 to 30, page 19, line 31 to page 20, line 7, page 20, lines 8 to 20, page 20, lines 21 to 30, page 21, lines 10 to 19, respectively page 21, line 28 to page 22, line 1; Claims 14 to 16 correspond to original Claims 24, 25 respectively 27; the esters of Claims 17 correspond to those described on page 24, line 33 to page 25, line 1 respectively page 25, lines 7 and 8 of the application as filed; Claims 19 and 21 correspond to original Claim 33 respectively 36; and the plasticizer composition of Claim 20 is disclosed on page 25, lines 27 to 32, of the application as filed.

2.2 Novelty

Since the product-by-process claim which the Examining Division considered to be known from document (1) no longer figures in the set of claims, the novelty objection made by the Examining Division is not to be considered.

The claimed process differs from the processes known from the prior art documents cited in the International Search Report at least by the dimerisation of propanal by an aldol condensation and subsequent aldol condensation with propanal.

Claims 1 to 21 are thus novel over the disclosure of the prior art documents cited in the International Search Report.

2.3 Inventive step

2.3.1 In accordance with the "problem-solution approach" applied by the Boards of Appeal to assess inventive step on an objective basis, it is in particular necessary to establish the closest state of the art forming the starting point, to determine in the light thereof the technical problem which the invention addresses and successfully solves, and to examine the obviousness of the claimed solution to this problem in view of the state of the art.

2.3.2 In selecting "the closest state of the art", the first criterion is that it is directed to **the same purpose** as the claimed invention.

Since the claimed process concerns a process for manufacturing saturated aliphatic aldehydes or alcohols containing a total of 9 carbon atoms and document (1) is the only cited prior art document disclosing such process, only document (1) can be considered as the closest state of the art and, thus, as a suitable starting point for assessing inventive step.

2.3.3 Document (1) is concerned with a process for preparing unsaturated aldehydes by condensing an aliphatic aldehyde containing only one available hydrogen atom on the α carbon with a lower aliphatic aldehyde containing two available hydrogen atoms on the α carbon under conditions whereby the addition takes place at the CH_2 group rather than the CH group (see column 1, lines 20 to 25, and column 2, lines 10 to 12). It also describes the hydrogenation of the unsaturated aldehydes thus

obtained to the saturated aldehydes or saturated alcohols and the reaction of such alcohols with dibasic acids (column 1, line 54 to column 2, line 3).

As far as the preparation of aldehydes containing a total of 9 carbon atoms is concerned, document (1) specifically describes in column 3, lines 17 to 28, and in examples 3 to 5 the preparation of

- (a) 2-propyl-4-methylpentenal from isobutyraldehyde with n-valeraldehyde;
- (b) 2-isopropyl-4-methylpentenal from isobutyraldehyde with 3-methylbutyraldehyde; and
- (c) 2-ethyl-4-methylhexenal from 2-methylbutyraldehyde with n-butyraldehyde.

Additionally, document (1) describes in column 6, lines 58 to 68, and column 8, lines 6 to 11, the hydrogenation to the corresponding saturated aldehydes and the subsequent hydrogenation to the saturated alcohols.

- 2.3.4 Contrary to the Examining Division's view, when starting from document (1), the problem to be solved consists not only of providing a further process for the manufacture of saturated aliphatic aldehydes or alcohols containing a total of 9 carbon atoms, but of one allowing the production of aldehydes and alcohols having the 2,4-dimethylheptyl structure in high selectivity.

2.3.5 The application in suit claims to solve that problem by the process defined in Claim 1.

Therefore, the question arises whether it has been plausibly shown that the problem defined in point 2.3.4 above has been effectively solved by the claimed process.

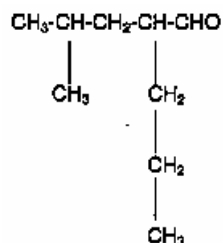
Examples 8, 9 and 10 describe the dimerisation of propanal by an aldol condensation to produce 2-methyl-2-pentenal and example 10 additionally describes its hydrogenation to 2-methylpentanal. Moreover, examples 11 and 12 describe the condensation of propanal with 2-methyl-2-pentenal and 2-methylpentanal respectively and both examples show a high selectivity for aldehydes having the 2,4-dimethylheptyl structure. Finally, example 19 describes the full hydrogenation of 2,4-dimethyl-2,4-heptadienal to 2,4-dimethylheptanol.

Therefore, it has been made plausible in the experimental part of the application that the claimed process has the ability to produce aldehydes and alcohols having the 2,4-dimethylheptyl structure with a high selectivity and, thus, that the problem defined in point 2.3.4 above has been effectively solved.

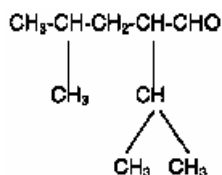
2.3.6 Therefore, it remains to be decided whether in the light of the teachings of the cited documents a skilled person seeking to solve the above-stated problem would have arrived at the claimed process in an obvious way.

2.3.7 The only saturated aldehydes and alcohols containing a total of 9 carbon atoms disclosed in document (1) are the

(a) 2-propyl-4-methylpentanal having the formula

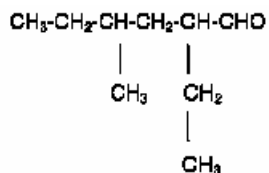


(b) 2-isopropyl-4-methylpentanal having the formula



and

(c) 2-ethyl-4-methylhexanal having the formula



2.3.8 Since document (1) thus does not disclose aldehydes or alcohols having a 2,4-dimethylheptyl structure, no suggestion can be found therein as to how such aldehydes or alcohols can be prepared, let alone with which reactions such aldehydes may be prepared in high selectivity. Therefore, the claimed process is not rendered obvious by the disclosure of document (1) taken alone. This applies all the more, since document (1) is completely silent about the possibility of preparing C₆ aldehydes by dimerising propanal, the dimerisation of propanal and subsequent condensation

with a second propanal molecule, as in the claimed process, is not suggested there.

2.3.9 The Examining Division nevertheless took the view that it was obvious for the skilled person to combine the starting aldehydes used in the examples of document (1) in order to solve the problem posed. In particular, the Examining Division found that there was no reasoned statement in document (1) indicating that 2-methylpentanal could only be reacted with n-hexaldehyde as described in example 9, nor that propionaldehyde, used in example 8 as a starting aldehyde, could only be reacted with 2-methyl butyraldehyde.

2.3.10 The Board does not deny that by condensing 2-methylpentanal used as reactant in example 9 with propanal used as reactant in example 8 of document (1) a skilled person could have come to the second step of the claimed reaction. However, in assessing inventive step, it is not relevant whether by combining different reactants known in a prior art document a skilled person could have come to the claimed process. Rather, the relevant question is whether the skilled person would actually find any suggestion in the cited prior art that the problem underlying the invention could be solved by a process such as now claimed. Since document (1) nowhere suggests the production of compounds having the 2,4-dimethylheptyl structure backbone, the claimed process cannot be rendered obvious by the teaching of the said document.

2.3.11 Furthermore, the statement in the decision under appeal that aldol condensations of propanal to the corresponding dimers or trimers and their hydrogenation

to the corresponding hexanals and n-nonanals are well established in the prior art, such as documents (3) and (4), cannot be followed.

It is true that documents (3) and (4) describe the dimerisation of propanal to 2-methylpent-2-enal or 2-methylpentanal. However, both documents concern specific reaction conditions of the aldol condensation and are completely silent about the use of the C₆ aldehydes in a further reaction. Whereas document (3) does not mention the purpose of the 2-methylpentanal, in document (4) it is stated on page 5, lines 11 to 13, that 2-methylpent-2-enal serves as intermediate in the preparation of pharmaceuticals, softeners, raw material for fibers and auxiliary agents. This general statement, however, does not give any indication in which reaction the C₆ aldehydes may be used, let alone, that they could be used in a further aldol condensation with propanal in order to prepare aldehydes having the 2,4-dimethylheptyl structure.

Consequently, the claimed process is neither made obvious by document (3) or (4) nor by the combined teaching of any of documents (3) and (4) with the teaching of document (1).

- 2.4 The Examining Division did not call into question the patentability of the esters of present Claim 17. Also the Board has no reason to deny the patentability of those esters and of the plasticizer and polymeric compositions containing such esters having regard to the available prior art documents.

3. Auxiliary requests

In the light of the above findings, there is no need to consider the auxiliary requests.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant the patent with the following documents
 - Claims 1 to 21 according to the main request filed with telefax of 10 March 2005.
 - A description to be adapted thereto.

The Registrar:

The Chairman:

N. Maslin

A. Nuss