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D E C I S I O N
of 25 July 2002

Case Number: T 0766/98 - 3.3.7

Application Number: 92203090.3

Publication Number: 0522669

IPC: B01J 23/80

Language of the proceedings: EN

Title of invention:
Process for preparing hydrogenation catalysts

Applicant:
ENGELHARD CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 76, 84, 123(2)
EPC R. 67

Keyword:
"Amendments - added subject-matter (no)-(revised fourth auxiliary request)"
"Novelty - (yes)-(revised fourth auxiliary request)"
"Inventive step - (yes) - closest prior art, problem and solution (revised fourth auxiliary request)"
"Reimbursement of appeal fee (no)"

Decisions cited:
T 0142/96, T 0357/96, T 0250/92

Catchword:
-

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Case Number: T 0766/98 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 25 July 2002

Appellant: ENGELHARD CORPORATION
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 17 February 1998 refusing European patent application No. 92 203 090.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: R. E. Teschemacher
Members: G. Santavicca
B. L. ter Laan

Summary of Facts and Submissions

I. European patent application 92 203 090.3 was filed on 8 October 1992 as a divisional application relating to earlier European patent application 90 311 264.7 (publication number 0 424 069), the parent application being filed on 15 October 1990 and claiming a priority in the USA of 17 October 1989 (US 422624). The divisional application was published on 13 January 1993 (publication number 0 522 669). The divisional application as originally filed comprised 14 claims, independent claim 1 reading as follows:

"1. A process for preparing a hydrogenation catalyst comprising the oxides of copper, zinc and aluminium which comprises the steps of

(a) preparing a first aqueous solution containing at least one water-soluble copper salt and at least one water-soluble zinc salt;

(b) preparing a second solution containing at least one water-soluble basic aluminium salt and at least one alkaline precipitating agent;

(c) mixing the first and second solutions whereby an insoluble solid is formed;

(d) recovering the insoluble solid; and

(e) calcining the recovered solid."

Dependent claims 2 to 14 concerned preferred embodiments of the process according to claim 1.

II. A first decision to refuse the application was posted on 17 June 1996. Following a notice of appeal lodged by the applicant on 16 August 1996, the Examining Division rectified that decision by a communication dated 5 November 1996. Thereafter, oral proceedings took place on 3 February 1998, which the applicant did not attend.

III. By a second decision of the Examining Division, posted on 17 February 1998, the application was again refused. That decision was based on four sets of claims as the main request and three auxiliary requests. Independent claims 1 and 20 of the main request read as follows:

Main request

"1. A process for preparing a hydrogenation catalyst comprising the oxides of copper, zinc and aluminium which comprises the steps of

(a) preparing a first aqueous solution containing at least one water-soluble copper salt and at least one water-soluble zinc salt;

(b) preparing a second solution containing at least one water-soluble basic aluminium salt and at least one alkaline precipitating agent;

(c) mixing the first and second solutions whereby an insoluble solid is formed;

(d) recovering the insoluble solid; and

(e) calcining the recovered solid,

characterised in that the atomic ratio of copper to zinc in the first aqueous solution is less than 1, and in that step (c) is carried out by simultaneously adding the first and second solutions to a vessel at a rate whereby the pH of the resulting mixture is in the range of from 7 to 9."

"20. A process for hydrogenating an aldehyde, ketone, carboxylic acid or carboxylic acid ester to an alcohol, comprising contacting the aldehyde, ketone, acid or ester with hydrogen and a catalyst under catalytic hydrogenation conditions, characterised by using a catalyst prepared by a process according to any of claims 1 to 19".

Auxiliary requests

All auxiliary requests comprised an independent claim 20 identical to that of the main request, but their independent claims 1 were distinguished from claim 1 of the main request by the definition of step (c) in their characterising portions, as follows (emphasis added):

First auxiliary request

"1. ... and in that step (c) is carried out by simultaneously adding the first and second solutions to a vessel at a rate whereby the pH of the resulting mixture is **maintained** in the range of from 7 to 9."

Second auxiliary request

"1. ... and in that step (c) is carried out by **the simultaneous addition of** the first and second solutions to a vessel at a rate whereby the pH of the resulting mixture is **maintained in** the range of from 7 to 9 **during said addition.**"

Third auxiliary request

"1. ... and in that step (c) is carried out by simultaneously adding the first and second solutions to a vessel at a rate whereby the **mixing of the said solutions is conducted at a** pH in the range of from 7 to 9."

IV. In its decision, having regard *inter alia* to documents:

D1: US-A-3 388 972

D2: US-A-4 588 848

D3: US-A-4 393 251

the Examining Division held that:

(a) Independent claim 1 according to the main request and independent claim 20 in all of the requests fulfilled the requirements of Article 123(2) EPC.

(b) The subject-matter of all claims 20, however, was known from D2, which disclosed neoalkanol synthesis by hydrogenation of a neoacid using a CuO/ZnO/alumina catalyst. In particular, the product-by-process definition of the catalyst in all claims 20 could not render the catalyst novel just because the preparation process had not been disclosed in D2.

The subject-matter of claim 1 according to the main request was novel over the disclosure of D1, since in D1 the solutions were not added simultaneously to a vessel.

(c) As regards inventive step, D1 taught several methods, involving co-precipitation, for combining the alumina with the two carbonate derived metal oxides, as in the application in suit, and thus represented the closest state of the art.

The process set forth in claim 1 of the application in suit represented a selection of the conditions illustrated in D1. However, no

improvement had been shown. The declaration of Mr Brian Roberts of 3 February 1992 before the USPTO, filed by letter of 29 August 1995, related to D3 and was not suitable for justifying an inventive selection from D1 of the claimed process. Also, there was no evidence that the catalysts illustrated in the examples of the application in suit had in fact been made by the process defined in claim 1.

Therefore, the subject-matter of claim 1 was obvious in the light of D1 and did not involve an inventive step.

(d) Concerning the auxiliary requests:

- Claim 1 according to the first auxiliary request contained added subject-matter, namely the feature "the pH of the mixture is maintained in the range of from 7 to 9";

- Claim 1 according to the second auxiliary request defined a "resulting mixture" that could not exist during the addition, so that it was unclear;

- Claim 1 according to the third auxiliary request also contained added subject-matter, ie the feature in step (c) that the mixing of the solutions was conducted at a pH in the range of 7 to 9.

(e) Therefore, the application had to be refused.

V. On 24 April 1998, the applicant lodged an appeal against that decision, the prescribed fee being paid on the same day. With the statement of the grounds of appeal, filed on 25 June 1998, the appellant enclosed

four further sets of claims identified as the fourth, fifth, sixth and seventh auxiliary requests, respectively.

The sets of claims according to these further auxiliary requests, contrary to those according to the main and first to third auxiliary requests which included claim 20, no longer included claims directed to a process for hydrogenating an aldehyde, ketone, carboxylic acid or carboxylic acid ester to an alcohol.

VI. By letter dated 28 January 2000, the appellant submitted a report of experiments comparing the properties of a catalyst obtained according to the process of preparation underlying the application in suit with those of a catalyst obtained according to Example 3 of D1, as supplementary evidence.

VII. In a communication in preparation for oral proceedings, the Board detailed the points to be dealt with, *inter alia* which of documents D1, D2 and D3 qualified as the closest prior art and whether the introduction of the limitation "simultaneously adding" in claim 1 required that the examples of the application in suit needed to be qualified as comparative.

VIII. In reply, the appellant submitted four further sets of claims identified as the eighth, ninth, tenth and eleventh auxiliary requests, respectively. The sets of claims according to these requests were based upon, respectively, those of the fourth to seventh auxiliary requests then on file, claims 2 and 9 to 19 having been omitted.

IX. Oral proceedings were held on 25 July 2002. The appellant submitted further auxiliary requests, namely revised fourth and eighth auxiliary requests.

Claim 1 of the revised fourth auxiliary request reads as follows:

"A process for preparing a hydrogenation catalyst comprising the oxides of copper, zinc and aluminium which comprises the steps of

(a) preparing a first aqueous solution containing at least one water-soluble copper salt and at least one water-soluble zinc salt;

(b) preparing a second solution containing at least one water-soluble basic aluminium salt and at least one alkaline precipitating agent;

(c) mixing the first and second solutions by simultaneously adding the two solutions to a vessel and by conducting the mixing of the solutions at a pH above 7, the pH of the resulting mixture being controlled by adjusting the relative rates of addition of the two solutions, whereby an insoluble solid is formed;

(d) recovering the insoluble solid; and

(e) calcining the recovered solid,

wherein the atomic ratio of copper to zinc in the first aqueous solution is less than 1, and wherein the catalyst recovered from the calcination of the removed solid in step (e) contains from 0.5 to 40% by weight of aluminium oxide."

Dependent claims 2 to 17 of the revised fourth auxiliary request concern preferred embodiments of the process of preparation according to claim 1.

The revised eighth auxiliary request corresponds to the fourth auxiliary request apart from the omission of dependent claims 2 and 8 to 17 and a concurring renumbering of the claims.

X. The arguments of the appellant can be summarised as follows:

(a) *Main and first to third auxiliary requests*

(a1) The amendments to the claims, in particular the incorporation of the pH range of 7 to 9 into claim 1 of these requests, had their basis in the original application.

(a2) The terms used in the amendments to claim 1 were either clear by themselves or could be easily understood in the light of the description. In particular:

- the term "rate" meant the addition of a given amount of matter per unit of time;

- usual means such as a glass electrode could be used to control the pH of the mixture resulting while addition was still in progress, during the actual mixing procedure;

Hence, claim 1 was clear.

(a3) The presence of claim 20 was necessary for a fair protection of the invention underlying the application in suit. Since the core of the invention was formed by the process of preparation of the catalysts, these were defined in claim 20 by reference to that process.

D2 did not disclose that the catalysts had to be prepared by a process as defined in claim 1 of the application in suit. Hence, the use of a catalyst prepared according to the process to which reference was made, as defined in claim 20, was novel.

(b) *Revised fourth auxiliary request*

(b1) The amendments to the claims had their basis in the original application.

(b2) The terms used in the amendments to claim 1 were clear.

(b3) The novelty of the process of preparation according to claim 1 had been acknowledged in the impugned decision and did not need to be discussed.

(b4) As regards inventive step, the closest prior art document was D1.

The technical problem underlying the application in suit was to provide a process for the production of improved catalysts over those of D1.

Since none of the methods disclosed in D1 suggested the simultaneous addition of the copper/zinc salt solution and of the solution of the basic aluminium salt and the alkaline precipitating agent to a vessel, the claimed process was not obvious, so that there was no need to prove any surprising advantage over D1.

Taking D3 as the starting point, the technical problem was to provide a process for the production of a catalyst with a high surface area and a narrow particle size distribution that was

suitable for slurry- or liquid-phase hydrogenation, in line with the original description.

Although the processes of the application in suit and that of D3 used the same starting materials, they used different precipitation procedures, which resulted in different products.

In particular, the products of D3 were obtainable by a homogenous solution of all of the components.

Since an improved product was sought, the skilled person needed a specific technical incentive, not just any random hint, to arrive at a workable catalyst with good activity and filterability in the slurry- or liquid-phase hydrogenation.

However, D3 gave no guidance to the skilled person to proceed otherwise and to use the process as now claimed.

Therefore, the subject-matter of claim 1 was inventive.

(c) The appellant also requested reimbursement of the appeal fee. By granting interlocutory revision after the first refusal of the application on the ground of lack of novelty over D1, the Examining Division had implied that the (first) appeal was well founded and that therefore the applicant had disposed of the objections to grant. Instead, the application had been refused a second time on the ground of lack of inventive step and the applicant had been obliged to pay a second appeal fee.

In this respect, decision T 142/96, dated 14 April 1999, not published in OJ EPO, was mentioned.

XI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of one of the following sets of claims, in the order given:

- Main request or auxiliary requests 1 to 3 as annexed to the contested decision,

- Auxiliary request 4 as submitted during the oral proceedings,

- Auxiliary requests 5 to 7 as filed with the statement of grounds of appeal dated 25 June 1998,

- Auxiliary request 8 as submitted during the oral proceedings,

- Auxiliary requests 9 to 11 as submitted by letter dated 11 July 2002.

Furthermore, the appellant requested that the case be remitted to the Examining Division for adaptation of the description and that the appeal fee be reimbursed.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Novelty*

2.1 The hydrogenation process defined in claim 20 is characterized by the use of a catalyst defined only in terms of the process by which it is obtained.

2.2 D2 discloses a process for the synthesis of 1,1,1-trialkylalkanols of the formula $R_1R_2R_3CCH_2OH$ by hydrogenation of a neoacid of the formula $R_1R_2R_3CCOOH$, wherein R_1, R_2 and R_3 each are alkyl of 1-10 carbon atoms, at 175°to 350°C and a pressure of 10 to 100 kg/cm over a copper oxide/zinc oxide catalyst (column 2, lines 36 to 43).

As regards catalysts suitable for the hydrogenation process, D2 refers to the documents mentioned in column 3, line 56 to column 4, line 25.

2.3 Although no specific catalyst preparation is disclosed in D2, it is not apparent that the specific process according to present claim 1 results in catalysts that differ from those used in the process of D2. In fact, it has never been argued in these proceedings that the process of claim 1 of the application in suit results exclusively in new catalysts over those mentioned in D2.

Instead, the appellant has taken the position that the mere fact that claim 20 defines a specific mode of preparing the catalyst that is not mentioned for the catalysts in D2, is sufficient to distinguish the subject-matter of claim 20 from the hydrogenation process described in D2.

2.4 Present claim 20 is a process claim and the catalyst defined in its characterizing portion is a specific substance to be used in that process, ie a physical entity. The structure and properties of this substance are not necessarily changed by the process of its preparation (T 357/96 of 9 December 1998, Point 2.3 of the Reasons, last sentence of the last paragraph; T 250/92 of 8 December 1994, Point 2.3 of the Reasons; both not published in OJ EPO).

Therefore, claim 20 cannot be read as a consecutive sequence of process steps in which the catalyst is prepared in a certain way and then used in a hydrogenation process as defined.

On the contrary, the present definition in claim 20 allows for the use of any catalyst having the same structure and properties as one prepared by the process of any of claims 1 to 19.

2.5 To establish novelty, evidence should be provided that the properties of catalysts obtainable by the method specified in any of claims 1 to 19 of the present application are different from those of the catalysts mentioned or referred to in D2.

The appellant has alleged that the subject-matter as claimed and that of the prior art are distinct catalysts. However, since the alleged distinction is not defined by structural features, the burden of proof for the existence of any distinction rests on the appellant.

2.6 Whereas the appellant has shown that different products over D1 and D3 are obtained (declaration of Mr Roberts of 3 February 1992; supplementary evidence submitted by letter of 28 January 2000), no such evidence is available in respect of D2. Moreover, any specific conditions for obtaining different catalysts are not contained in claim 20, nor in claim 1, to which claim 20 refers for the preparation method of the catalyst.

2.7 Since it has not been established that a catalyst broadly defined as being prepared by a process according to any of claims 1 to 19 differs from those used in D2, the novelty of the subject-matter of claim 20 cannot be acknowledged.

2.8 Consequently, the main request is not allowable.

2.9 Since, for the reasons given *supra*, the main request fails on the lack of novelty of the subject-matter of claim 20, there is no reason to discuss the further points addressed in the Board's communication, eg the allowability of the amendments.

First to third auxiliary requests

3. All of the first to third auxiliary requests contain an independent claim 20 that is identical to claim 20 of the main request.

Therefore, for the above reasons (points 2.1 to 2.9), these auxiliary requests are not allowable either.

(Revised) fourth auxiliary request

4. *Amendments*

4.1 The description of the original divisional application is identical to the description of the original earlier (parent) application. Claims 1 to 14 of the original divisional application correspond to claims 13, 14, 20, 21(c), 15, 16, 21, 19, 17, 10, 18, 24 and 30 of the original parent application, respectively.

Therefore, the subject-matter of the original divisional application does not extend beyond the content of the earlier (parent) European patent application as originally filed, and the requirements of Article 76(1) EPC are fulfilled.

4.2 Compared with the claims as originally filed, the claims of the present request include the following amendments that have their basis in the original divisional application:

In claim 1,

- the feature in step (c) "by simultaneously adding the two solutions to a vessel and by conducting the mixing of the two solutions at a pH above 7, the pH of the resulting mixture being controlled by adjusting the relative rates of addition of the two solutions,", is based on claims 2 to 4 as well as page 9, second full paragraph, and page 10, first full paragraph, of the original description of the divisional application.

- The feature "wherein the atomic ratio of copper to zinc in the first aqueous solution is less than 1" is based on claim 7 of the original divisional application.

- The feature "wherein the catalyst recovered from the calcination of the removed solid in step (e) contains from 0.5 to 40% by weight of aluminium oxide" is based on claim 10 of the original divisional application.

In claim 2, a range is defined of from at least 0.2 to less than 1 (see claim 1 which is referred to in claim 2, for the atomic ratio of copper to zinc). This is based on page 7, second full paragraph, of the original description of the divisional application.

Claims 3 to 7 are based on claims 8 to 9 and 11 to 13 of the original divisional application, respectively.

Claims 8 to 11 are based on the paragraph bridging pages 9 and 10 of the original description of the divisional application.

Claim 12 is based on claim 14 of the original divisional application.

Claim 13 is based on page 24, first paragraph, of the original description of the divisional application.

Claim 14 is based on page 10, first full paragraph, of the original description of the divisional application.

Claim 15 is based on pages 9 and 10 of the original description of the divisional application (see also page 9, lines 21 to 24).

Claims 16 and 17 are based on page 10, first full paragraph, of the original description of the divisional application.

4.3 Therefore, the requirements of Article 123(2) EPC are fulfilled.

5. Claim 1 *inter alia* requires that the process for preparing the hydrogenation catalyst should comprise simultaneous addition of the first and second solutions to a vessel, while conducting the mixing of these solutions at a pH above 7, the pH of the resulting mixture being controlled by adjusting the relative rates of addition of the two solutions, whereby an insoluble solid is formed.

The same terminology is used in D3 for a similar type of co-precipitation.

Therefore, the Board is satisfied that the requirements of Article 84 EPC are met.

6. *Novelty*

6.1 D2 refers to known catalysts but does not specifically describe any preparation method for the catalysts it concerns (see point 2.3 *supra*). Consequently, it cannot be prejudicial to the novelty of the process now being claimed.

6.2 D1 discloses a process for the preparation of a copper oxide-zinc oxide shift catalyst resistant to loss of activity at temperatures in the approximate range of 550°F to 700°F and which gives high conversions in a shift reaction at temperatures of 350°F to 700°F, containing as its active ingredients after reduction zinc oxide and copper in a weight ratio based on metal of 0.5 to 3 zinc to 1 copper, which comprises forming an aqueous slurry of a mixture of precipitates of copper and zinc as their carbonates with alumina, washing the mixture to remove sodium salts therefrom, and calcining the alumina-copper and zinc carbonate precipitate to form the oxides, said aqueous slurry containing about 5 to about 50 percent alumina based on total oxides of zinc and copper (claim 9).

Preferably, the zinc oxide-copper oxide-alumina is formed from an aqueous suspension of copper and zinc carbonates by mixing these carbonates with alumina (claim 10).

The slurry of zinc oxide, copper oxide and alumina can result from the addition of alumina to aqueous solutions of soluble copper and zinc salts followed by the addition thereto of sodium carbonate (claim 11), from the addition of sodium aluminate to sodium carbonate used to precipitate an aqueous solution of

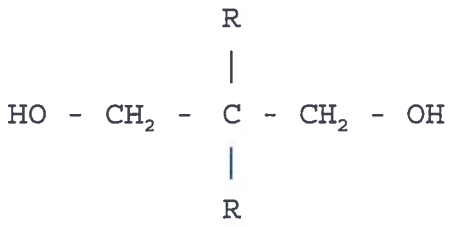
soluble copper and zinc salts (claim 12), or from the addition of alumina to sodium carbonate used to precipitate an aqueous solution of soluble copper and zinc salts (claim 13).

Thus, several methods for mixing the various ingredients for preparing the catalyst are mentioned, according to which, in particular, the desirability of co-precipitating the Cu and Zn is emphasized.

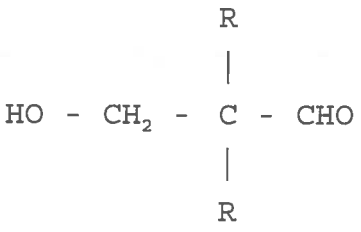
The description and examples, for instance Example 3, contain further details, none of which comprises the simultaneous addition of a Cu/Zn containing solution and an alumina containing precipitant solution to a vessel while controlling the pH at a specified value as required by present claim 1.

Consequently, the claimed subject-matter is novel over D1.

6.3 D3 discloses a process for the preparation of a propanediol of the formula



where the R's may be identical or different and each is an aliphatic, araliphatic or aromatic radical, or the two R's together with the adjacent carbon atom are members of an alicyclic ring, by hydrogenating a hydroxypropionaldehyde of the formula



where R has the above meanings, in the presence of a copper-containing hydrogenation catalyst, whereby the hydrogenation is carried out in the liquid phase with a hydrogenation catalyst which has been obtained by precipitating copper and zinc in a ratio of from 0.6 to 3 atoms of copper per atom of zinc from a solution of their compounds in the presence of a carbonate at a pH of from 6.9 to 8, and decomposing the resulting mixed crystals of the formula

$$Cu_{1.5-3}Zn_{1-2.5}(CO_3)_{1-2}(OH)_{4-6}(H_2O)_{0-1}$$

at from 200° to 500°C., introducing into said catalyst during its preparation at least one metal additive selected from the group consisting of chromium, calcium, magnesium and aluminum in an amount of up to 10 percent by weight, based on the total catalyst (claim 1).

The mixed crystals are preferably prepared from two aqueous solutions, one of which contains the nitrates of copper, zinc and eg aluminum in the specified atomic ratio, whilst the other solution is an aqueous sodium carbonate solution (column 4, lines 62 to 68).

Both solutions are preferably heated to the precipitation temperature and then simultaneously fed into a stirred kettle. In this parallel precipitation

method, the pH is advantageously maintained at a value of from 7 to 8 from the start and throughout the precipitation period by regulating the feed rates (claim 4; column 5, lines 2 to 14).

This method is illustrated in Example 1, wherein the two solutions are added in parallel into the reaction kettle and a pH of 7 is monitored with a glass electrode and maintained at the specified value during the entire precipitation period by accurately regulating the feed speeds.

Although D3 discloses a process for the preparation of hydrogenation catalysts wherein the first and second solutions are simultaneously added to a vessel while maintaining the pH at a specified value, the first solution contains all of the metal salts of Cu, Zn and Al, while the second solution only contains the alkaline precipitating compound.

Therefore, D3 does not disclose the preparation of a second solution containing at least one water-soluble basic aluminum salt together with the alkaline precipitating agent as required by present claim 1.

6.4 Since none of the cited documents discloses the present combination of features defined in claim 1, the claimed-subject-matter is novel (Article 54 EPC).

7. *Inventive step*

7.1 The present application relates to a process for preparing hydrogenation catalysts.

More particularly, the application relates to a process for the preparation of catalysts that are suitable for the hydrogenation of aldehydes, ketones, carboxylic acids and carboxylic esters (page 1, lines 1 to 7).

7.2 Such a process is known from D3 as well as D1.

7.2.1 The object of D1 is the production of a long life, low temperature copper-zinc catalyst for the shift reaction of carbon monoxide and water to carbon dioxide and hydrogen, the catalyst having a good activity and good physical properties (column 2, line 55, to column 3, line 5).

To achieve that object, D1 proposes to combine Cu and Zn oxides, derived from carbonates, with a selected quantity of alumina as a modifier (column 3, lines 6 to 12).

7.2.2 The object of D3 is the preparation of propanediols, especially neopentyl glycol, in a simple and economical way, in good yield and high purity, without significant formation of by-products and decomposition products (column 3, lines 9 to 14).

To achieve this object, D3 proposes to prepare the catalyst used for that process from mixed crystals having a specific structure (column 3, lines 34 to 50).

The high hydrogenation activity of these catalysts makes it possible to carry out the hydrogenation of the untreated starting substances at low temperature and pressure, in the liquid phase, with a high space-time yield, with a low degree of ester formation (column 3, lines 16 to 33).

7.3 Although D1 describes a hydrogenation catalyst that has been prepared by a co-precipitation method, as illustrated in Example 3, that document does not disclose the same purpose and effect as the application in suit, nor does it relate to the same or a similar technical problem.

In fact, D1 does not mention the use of the catalysts for the hydrogenation of aldehydes, ketones, carboxylic acids and carboxylic esters. The properties associated with the hydrogenation of the above substrates, such as activity and selectivity, use in powdery form and filterability, are not addressed in D1. Pore volume and particle dispersion are not specified either in D1.

D3 not only relates to the technical field of hydrogenation catalysts and their use for the hydrogenation of aldehydes to obtain alcohols, but also discloses a solution to the technical problem of manufacturing hydrogenation catalysts that are highly active and selective in the liquid phase hydrogenation.

Furthermore, D3 discloses a process of manufacture that comprises parallel precipitation by the simultaneous addition of the metals and precipitant solutions to a vessel where the co-precipitation is carried out.

Therefore, D3 rather than D1 qualifies as the closest prior art document.

7.4 Although the catalysts described in D3 have adequate hydrogenation properties such as good activity and selectivity in the liquid phase hydrogenation of aldehydes to alcohols, they are shaped, ie molded into pills or extrudates, prior to introduction in the hydrogenation reactor, such as a fixed bed reactor, in which the liquid phase hydrogenation takes place.

Since it is also desirable that catalysts can be used in powder form, eg in fluidized bed reactors or in slurry-phase hydrogenation, the preparation of catalysts disclosed in D3 still leaves room for improvement.

7.5 Thus, the technical problem underlying the application in suit can be seen in the preparation of catalysts useful in hydrogenation reactions which can be carried out not only in a fixed bed but also in a fluidized bed reactor or in a slurry-phase hydrogenation process, in line with the original application (page 5, second full paragraph, and page 24, second full paragraph).

7.6 According to the application in suit, the above defined technical problem is solved by a process for preparing a hydrogenation catalyst as defined in claim 1.

The catalyst powder particles prepared in Examples 1 to 8 can be slurried with an aldehyde, ketone, carboxylic acid or carboxylic ester in order to achieve intimate contact between the catalyst and the liquid, and used in a batch or continuous ebullated bed reactor. Thereby, high yields of alcohols are obtained in short times, and the slurry, upon completion of the hydrogenation reaction, is easily filtered (page 25, third full paragraph, of the original application).

From the additional experiments in the Declaration by Mr Roberts, it is apparent, in particular from the data in Table I that relate to Examples 1, 2, 4 and from the relevant pictures, that the preparation procedure with the simultaneous addition of the two solutions as defined in present claim 1 (see points (5) and (6) in that declaration) effectively results in catalysts having desirable properties, such as surface area over 100 m^2/g, a good pore volume distribution and discrete particles with a narrower particle size distribution than the catalysts of D3.

In view of the above, the Board comes to the conclusion that the process for the preparation of the hydrogenation catalysts according to the application in suit results in catalysts with adequate catalytic

properties and filterability that can be used either in shaped form or as powder particles in slurry phase hydrogenation, so that the above-defined technical problem has been effectively solved.

7.7 It remains to be decided whether the claimed subject-matter is obvious having regard to the documents on file.

7.7.1 The catalysts of D3 should possess a particular crystal structure that is obtainable from a homogenous acidic solution containing all the copper, zinc and aluminum salts and are shaped and used in fixed bed reactors.

D3 is silent about any usefulness of the catalyst in powdered form and does not hint at the simultaneous addition to the reaction vessel of one solution containing Cu and Zn salts and a second solution containing a basic aluminium salt and a precipitating agent in order to obtain such a catalyst, or any effect thereof.

Consequently, D3 by itself cannot render the claimed subject-matter obvious.

7.7.2 D2 cannot supplement the disclosure of D3 since it does not describe any process for the preparation of catalysts.

7.7.3 The information of D1 does not refer to the objectives of the application in suit. Also, the lack of teaching in D1 to add the solutions of reagents, sodium aluminate and precipitant simultaneously to a vessel do not point the skilled person in the direction of the process now being claimed.

7.7.4 Therefore, a combination of D3 with any or both of D2 and D1 would not render the claimed subject-matter obvious.

7.7.5 Also if D1 were to be used as the starting point, the conclusion would not be any different, since none of the other cited documents discloses a procedure for the production of hydrogenation catalysts whereby the aluminum salt is present in the precipitant solution and the two solutions are added simultaneously to a reaction vessel.

7.8 It follows from the above that the subject-matter as defined in claim 1 of the present request involves an inventive step.

7.9 The dependent claims contain all the features of claim 1 and similarly involve an inventive step.

8. Since the revised fourth auxiliary request is allowable, it is not necessary to consider the further auxiliary requests.

9. *Reimbursement of the appeal fee*

According to Rule 67 EPC, the reimbursement of the appeal fee is to be ordered if the appeal is deemed to be allowable and the reimbursement is equitable by reason of a substantial procedural violation.

However, in the present case, the Board notes that:

(a) The Examining Division rectified the first decision to refuse the application to the extent that the subject-matter of claim 1 was found to be novel over D1, in compliance with the case law.

(b) By a communication issued on 21 July 1997 in preparation for oral proceedings to be held on 3 February 1998, the Examining Division informed the applicant of further objections that still existed, to which the applicant had the opportunity to react either in writing or during the oral proceedings, which it however did not attend.

(c) In view of these facts, the second refusal was the consequence of the applicant's conduct of proceedings. Hence, a refund of the appeal fee is not considered equitable.

Therefore, the request for reimbursement of the appeal fee is refused.

Order

For these reasons it is decided:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the set of claims 1 to 17 submitted as revised fourth auxiliary request during the oral proceedings and a description yet to be adapted.

3. The request for reimbursement of the appeal fee is refused.

The Registrar:

C. Eickhoff

The Chairman:

R. Teschemacher

19/12/2002

19/12/2002