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D E C I S I O N
of 10 July 2003

Case Number: T 0042/00 - 3.3.6

Application Number: 94928879.9

Publication Number: 0722478

IPC: C10G 65/12

Language of the proceedings: EN

Title of invention:
Hydrocracking and hydrodewaxing process

Patentee:
Akzo Novel N.V., et al

Opponent:
Chevron U.S.A. Inc.

Headword:
Hydrocracking and hydrodewaxing/AKZO

Relevant legal provisions:
EPC Art. 54, 56
EPC R. 57a

Keyword:
"Amendments to the claims originated by grounds for opposition (yes)"
"Novelty (main request) - no - all features disclosed in combination"
"Novelty (auxiliary request) - yes"
"Inventive step (auxiliary request): no - technical advantage over closest prior art not proven for all process conditions encompassed by claim 1 - burden of proof on the Appellants"

Decisions cited:
T 0511/92, T 0585/92, T 0412/91

Catchword:
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Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0042/00 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 10 July 2003

Appellants: (Proprietors of the patent)
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and

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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 16 November 1999 revoking European patent No. 0722478 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Krasa
Members: L. Li Voti
C. Rennie-Smith

Summary of Facts and Submissions

I. The present appeal is from the decision of the Opposition Division to revoke the European patent No. 0 468 016 relating to a hydrocracking and hydrodewaxing process.

II. A notice of opposition was filed against the patent, wherein the Respondent (Opponent) sought revocation of the patent on the grounds of Article 100(a) EPC, in particular because of an alleged lack of novelty and inventive step of the claimed subject-matter.

The opposition was based *inter alia* upon the following documents:

(1): WO-A-92/03519

(2): US-A-3758402

(3): US-A-4921594

(4): US-A-4743354

III. In its decision, the Opposition Division found that the subject-matter of the claims according to the Appellants' (Patent Proprietors') then pending main and auxiliary request was novel, but lacked inventive step in the light of the cited prior art.

In particular it found *inter alia* that:

– document (1) did not disclose a process comprising a hydrocracking step with a large pore zeolite

catalyst followed by a hydrodewaxing step with a catalyst as defined in the claims of the patent in suit;

– documents (1) and (3) did not disclose a middle distillate product having a boiling point range as required in the patent in suit;

– it was obvious for the skilled person to replace the preferred amorphous hydrocracking catalyst used in the process of document (1) with the less preferred, but equally disclosed, large pore zeolite catalyst, which had been used, for example, in the process of document (2);

– no credible improvement had been shown over the preferred process in document (1), which makes use of an amorphous hydrocracking catalyst.

IV. An appeal was filed against this decision by the Patent Proprietors.

During the oral proceedings, held before the Board on 10 July 2003, the Appellants filed two new amended sets of claims to be considered, respectively, as main and auxiliary request.

Claim 1 of the **main request** reads as follows:

"1. A process for converting a wax-containing hydrocarbon feedstock at least 20 wt% of which boils above 343 °C into a middle distillate product with a reduced wax content with at least 50 wt% of the product boiling below 371 °C, which process comprises

(a) contacting the feedstock in the presence of hydrogen with a hydrocracking catalyst containing a carrier, at least one hydrogenation metal component selected from group VIB and Group VIII of the Periodic Table, and a large pore zeolite having a pore diameter in the range of 0.7-1.5 nm, in a hydrocracking zone under conditions of elevated temperature and pressure,
(b) contacting the entire effluent from the hydrocracking zone in the presence of hydrogen with a dewaxing catalyst containing a crystalline intermediate pore size molecular sieve selected from the group of silicoaluminophosphates and aluminosilicates with a silica:alumina molar ratio of 12-500 and having a pore diameter in the range of 0.5-0.7 nm, in a hydrodewaxing zone under conditions of elevated temperature and pressure, and
(c) recovering the middle distillate product having a reduced wax content."

This claim differs from the granted claim 1 only insofar, as the wording "metallosilicate" of the granted claim has been replaced by "aluminosilicates with a silica:alumina molar ratio of 12-500".

Claim 1 of the **auxiliary request** differs from claim 1 of the main request only insofar as the dewaxing catalyst is limited to a crystalline intermediate pore size molecular sieve selected from the group of aluminosilicates with a silica:alumina molar ratio of 12-500.

Both requests contain 5 dependent claims relating to specific embodiments of the process of the respective claim 1.

V. The Appellants submitted in writing and in the oral proceedings before the Board that:

- document (1) does not seriously contemplate use of a zeolite as a hydrocracking catalyst and suggests different possibilities for the disposition of the catalyst beds in the reactor;

- document (3) does not disclose at least step (b) of the claimed process, according to which the entire effluent from step (a) must be submitted to the subsequent dewaxing step;

- document (2) does not disclose the use of a feedstock having the characteristics of that used in the patent in suit and relates to the preparation of a gasoline and not of a middle distillate;

- none of the cited documents discloses all the features of the claimed process in combination;

- therefore, the claimed subject-matter is novel over the cited prior art.

As regards inventive step they submitted that

- document (4), disclosing a process differing from that of the patent in suit only insofar as the feedstock enters the dewaxing catalytic zone before the hydrocracking zone, had to be considered as the starting point for evaluating inventive step;

– the skilled person, starting from the teaching of document (4), would not have expected that an improvement of the pour point of the middle distillate product could be achieved by reversing the sequence of the catalytic reaction steps;

– this improvement was shown in the examples of the patent in suit by comparing a process as claimed with a similar process wherein only the sequence of the catalytic reactions had been reverted, i.e. with a process representing the teaching of document (4);

– since document (1) warned that zeolite hydrocracking catalysts had insufficient midbarrel selectivity and provided products having a poor low temperature fluidity and that the process of document (2), according to which a middle distillate could be prepared by first hydrocracking the feedstock on a large pore zeolite catalyst and then dewaxing the effluent on an intermediate pore size aluminosilicate, could lead to a product having an undesirable high viscosity, the skilled person would have not reversed the sequence of the catalytic reaction steps suggested in document (4);

– the claimed subject-matter thus also involved an inventive step over the cited prior art.

VI. The Respondent argued in writing and in the oral proceedings *inter alia* that:

– the amendments to the claims as granted did not appear to originate from the grounds of opposition;

– claim 1 of both requests lacked novelty in the light of documents (2) or (3) and claim 1 of the main request also in the light of document (1);

– it was obvious for the skilled person to replace the preferred amorphous hydrocracking catalyst used in document (1) with a zeolite hydrocracking catalyst, equally suggested in this document, and to optimize the obtained products by modifying the used process conditions according to the catalyst used;

– moreover, it was obvious to reverse the sequence of catalytic reactions in the process of document (4), since it was known from the teaching of document (1) that the process of document (2), involving such a reversed sequence of reactions, could be equally applied for obtaining a middle distillate product having a low cloud point and pour point;

– the experimental reports contained in the patent in suit were not relevant, since the compared processes were carried out at different conversion rates and the pour point and cloud point had been measured on the 180°C+ fraction and not on the pure middle distillate product; moreover, the products obtained by means of the comparative process contained a greater amount of material having a higher boiling point and it was thus to

be expected that they would present a higher cloud point;

– no evidence had been submitted that the technical improvement claimed by the Appellants had been achieved under any set of process conditions encompassed by the claims.

VII. The Appellants requested that the decision of the first instance be set aside and that the patent be maintained on the basis of the main request or alternatively of the auxiliary request, both filed during the oral proceedings.

The Respondent requested that the appeal be dismissed.

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VIII. At the end of the oral proceedings, the chairman announced the decision of the Board.

Reasons for the Decision

1. *Procedural issues*

The Board is satisfied that the amendments to the claims originate from a discussion about the meaning of the word "metallosilicate", which was also considered in the decision of first instance (see point III.2 of the reasons for the decision); therefore, the amendments have been filed as a response to objections considered to be valid in the decision under appeal and are therefore admissible.

2. *Main request*

2.1 Article 123(2) EPC

The Board is satisfied that the amended claims according to this request comply with the requirements of Article 123(2) EPC.

Since this request fails on other grounds further details are unnecessary.

2.2 Novelty

2.2.1 Claim 1 of this request relates to a process for converting a wax-containing hydrocarbon feedstock into a middle distillate product with a reduced wax content with at least 50 wt% of the product boiling below 371°C, involving the steps of hydrocracking the feedstock on a hydrocracking catalyst containing a carrier, at least one hydrogenation metal component selected from group VIB and Group VIII of the Periodic Table, and a large pore zeolite and dewaxing the entire effluent on a crystalline intermediate pore size molecular sieve catalyst selected from the group of silicoaluminophosphates and aluminosilicates.

According to the established jurisprudence of the Boards of Appeal, a prior art disclosure is novelty destroying if it discloses directly and unambiguously the subject-matter in question when also taking account of everything which would be considered by a skilled person as part of the common general knowledge in connection with the disclosed subject-matter at the publication date of the cited document in the case of prior art cited under Article 54(2) EPC, or at the

priority date of the cited document in the case of an Article 54(3) document (see e.g. T 511/92, unpublished in OJ EPO, point 2.2 of the reasons for the decision).

Document (1) describes a process for the preparation of a middle distillate product of low pour point at least 50%, or even 60%, of which has a boiling point between 149 and 385°C, i.e. a middle distillate having a range of boiling points very largely overlapping with that of claim 1, which requires at least 50% of the product to have a boiling point below 371°C. This process comprises the step of contacting a feedstock, at least 90% of which has a boiling point between 371 and 649°C, with a bed of a large pore size hydrocracking catalyst positioned on the top of a bed of an intermediate pore size silicoaluminophosphate dewaxing catalyst of the same type as used in the patent in suit (see page 5, line 28 to page 6, line 10; page 9, lines 16 to 18; page 25, lines 31 to 34; page 27, line 30 to page 28, line 3; claim 40 read in combination with claims 24 and 39). Therefore in such a process, the entire effluent exiting the hydrocracking catalyst bed enters the dewaxing catalyst bed.

In the Board's finding the above mentioned passages of document (1) unambiguously disclose all the features of claim 1 of the patent in suit in combination, apart from the specific hydrocracking catalyst.

According to the general teaching of document (1), any conventional large-pore hydrocracking catalyst can be used in the described process (see page 10, lines 21 to 23 and page 24, lines 9 to 12). Such hydrocracking catalysts have a hydrogenation-dehydrogenation

component, which is a metal selected from Group VI-B or Group VIII of the periodic table (page 24, lines 13 to 14 and 25 to 28) and an active cracking support (page 24, lines 14 to 15). The list of suitable active cracking supports is reported in the passage on page 24, from line 15 to line 20, and includes zeolite Y or zeolite X, i.e. a zeolite catalyst according to claim 1 of the patent in suit (see page 3, lines 26 and 27 of the patent in suit).

Even though document (1) indicates non-zeolitic carriers as being preferred (see page 24, lines 21 to 22), the general teaching of the document is unambiguous that any conventional hydrocracking catalyst, and thus any of the carriers specifically listed, can be used.

Moreover, even though the discussion of the prior art in document (1) considers large pore zeolite catalysts as being insufficiently selective for the production of a middle distillate or as leading to a product having poor fluidity properties (page 2, lines 1 to 11 and page 2, line 26 to page 3, line 2), the skilled person would not have understood this information, in the Board's judgement, as a warning against the use of such a zeolite catalyst in the disclosed process, since the prior art discussed in document (1) related in this context to processes wherein the feedstock was contacted only with the zeolite hydrocracking catalyst and not in a sequence with a further dewaxing catalyst as taught in document (1).

Thus, considering the whole content of document (1), the skilled person would have taken therefrom the clear

technical teaching to use zeolites X and Y in the hydrocracking catalyst of the disclosed process.

Therefore, the Board concludes that document (1) discloses directly and unambiguously all the features of claim 1 in combination. Claim 1 lacks thus novelty.

Since the main request must be dismissed on these grounds, there is no need to deal with the other novelty objections raised by the Respondent against this request.

3. *Auxiliary request*

3.1 Novelty

Claim 1 of this request differs from claim 1 of the main request insofar as the dewaxing catalyst is a crystalline intermediate pore size molecular sieve selected from the group of aluminosilicates with a silica:alumina molar ratio of 12-500.

Therefore, document (1), disclosing a process using a different dewaxing catalyst, i.e. a silicoaluminophosphate, does not anticipate the subject-matter of such a claim, as was conceded by the Respondent.

Document (2) discloses a process involving hydrocracking a feedstock with a catalyst comprising a large pore zeolite and treating the resulting products, i.e. the entire effluent, with an aluminosilicate of the ZSM-5 type, i.e. an intermediate pore size zeolite (see column 11, lines 27 to 33 read in combination with

column 7, lines 13 to 21 and 57 to 58 and column 9, line 64 to column 10, line 8), which process comprises identical catalytic steps in claim 1 of the patent in suit. However, this document concerns the preparation of a gasoline and not of a middle distillate and does not disclose that a middle distillate can be recovered following the process disclosed therein (see column 2, lines 3 to 9 and column 11, lines 34 to 37). Therefore, it cannot be considered to be novelty destroying for the claimed subject-matter.

Document (3) discloses in its examples a process wherein the effluent of the hydrocracking step is fractionated before being contacted with the dewaxing catalyst (see e.g. column 10, lines 1 to 3 as well as column 4, line 67 to column 5, line 2), which process is thus different from that of claim 1 which requires that the entire effluent from the hydrocracking step is contacted with the dewaxing catalyst.
The description of this document suggests that both the hydrocracking and the dewaxing step can be carried out in the same reactor and thus that the whole effluent of the first step could be brought into contact with the dewaxing catalyst (see column 7, lines 37 to 39); however, it does not teach that a middle distillate fraction is recovered from the resulting product. The goal of document (3) is in fact the preparation of a lubricating oil stock, which has a greater amount of components having higher a boiling point than a middle distillate. Furthermore, contrary to the Respondent's submissions, the above mentioned embodiment (in column 7 of document (3)) cannot be read in combination with the results of the illustrative examples, which relate to a different embodiment of the process of

document (3), i.e. to a process wherein the effluent of the hydrocracking step is fractionated before being contacted with the dewaxing catalyst, a process which would necessarily lead to different results because of the different process conditions used.

The Board concludes therefore that the subject-matter of claim 1 is novel over the cited prior art.

3.2 Inventive step

3.2.1 Claim 1 of the patent in suit relates to a process for the preparation of a middle distillate product having a reduced wax content, such as a jet fuel having a low freeze point and a diesel fuel and heating oil having a low pour point and cloud point, by contacting a wax-containing hydrocarbon feedstock with a hydrocracking catalyst containing a carrier, at least one hydrogenation metal component selected from group VIB and Group VIII of the Periodic Table, and a large pore zeolite, and thereafter contacting the entire effluent of that first step with a crystalline intermediate pore size molecular sieve selected from the group of aluminosilicates with a silica:alumina molar ratio of 12-500 as dewaxing catalyst (see page 2, lines 3 to 6 and 38 to 51 and page 4, lines 11 to 15).

According to the description of the patent in suit, processes which lead to an efficient conversion of the high molecular weight waxy feedstock components to give a middle distillate product having a low freeze or pour and cloud points were already known; for example, document (4) described a process involving hydrodewaxing a waxy feedstock on a crystalline

intermediate pore size zeolite and thereafter contacting the entire effluent of the dewaxing step with a hydrocracking catalyst comprising a large pore zeolite (see page 2 of the patent in suit, lines 20 to 30).

3.2.2 The Board finds that document (4), cited in the patent in suit, represents the most appropriate starting point for evaluating inventive step, since it deals with the preparation of a middle distillate having a low freeze or pour point and cloud point from a feedstock containing waxy components and discloses a process involving both a hydrocracking and a hydrodewaxing step with the same catalysts used in the patent in suit and without any fractionation between these two process steps.

All the other documents cited by the Respondent appear in this respect to be less suitable as a starting point, since they either relate to processes using a different pair of catalysts or do not explicitly deal with the production of a middle distillate or involve a fractionation between the hydrocracking and dewaxing steps.

3.2.3 The technical problem underlying the claimed invention is said in the description of the patent in suit to be the provision of a process which improves the results obtained by means of the process of document (4) and thus leads to a lower freeze point or cloud and pour point than that of the prior art process (page 2, lines 30 to 34).

In the light of the results of the comparative tests contained in the patent in suit (see table 4 on page 8) it appears that reversing the sequence of process steps of document (4), i.e. carrying out the hydrocracking step before dewaxing, under the process conditions used in example 2, leads to a further reduction of the pour and cloud point of the resulting middle distillate product.

As to the validity of these comparative tests, the Respondent objected that the compared processes had not been carried out up to the same conversion rate and that the cloud point and pour point had been measured on the fraction 180°C+ and not on the pure middle distillate fraction (see point VI above).
However, these tests compare a process as claimed with a similar process to that carried out in document (4), the only difference in process conditions being also the only difference between the process of the prior art and that claimed in the patent in suit. Therefore, these tests represent in the Board's finding a valid comparison with the prior art. Moreover, both the process of the invention and the comparison lead to the recovery of a middle distillate, at least 50% by weight of which has a boiling point below 371°C; therefore, the cloud and pour points reported in table 4 for the fraction 180°C+, which points are influenced by the presence of the components boiling above the middle distillate range, show the effect of the modification of the process steps on the reduction of the quantity of undesirable components having a high boiling point in the resulting product.

The Appellants have argued that the same effect as shown in table 4 of the patent in suit will be achieved under all possible process conditions encompassed by claim 1, i.e. other conditions of temperatures or pressure or the use of other types of feedstock or other pairs of catalysts. This was contradicted in the appealed decision in which it was decided that, for example, not all the catalysts encompassed by the claims could be expected to produce similar results (last three lines of paragraph III.3 of the reasons for the decision).

The Board also notes that it is undisputed that a slight variation in the process conditions, e.g. in temperature, can have a dramatic effect on the conversion rate and therefore on the pour point of the resulting product and that a variation of the catalyst used also necessitates an adjustment of the process conditions (see e.g. page 4, lines 52 to 57 of the patent in suit or page 26, lines 19 to 33 and page 27, lines 12 to 24 of document (1)).

In view of the facts that claim 1 does not specify any process conditions, such as the temperature, to be used during the process, that any kind of intermediate pore aluminosilicate can be used as dewaxing catalyst and that the quantity of large pore zeolite contained in the hydrocracking catalyst is not specified and can be very small in respect to amorphous catalysts, which can also be contained in the hydrocracking catalyst, or can represent almost the whole of the catalyst (see e.g. example 2 of the patent in suit; page 6, line 56 to page 7, line 1 and page 3, line 51), it is the Board's judgement that a variation in these process features

could dramatically affect the results in an unpredictable way and would not guarantee that the improvement obtained by the specific sets of conditions used in example 2 of the patent in suit would be equally obtained for any possible combination of the process features encompassed by claim 1.

According to the jurisprudence of the Boards of Appeal of the EPO, the burden of proof in such a situation rests on the Appellants (see e.g. T 585/92, point 3.2 of the reasons for the decision).

Since the Appellants have not credibly demonstrated that the desired reduction of freeze or cloud and pour points can be achieved under any process condition covered by the claim, this alleged improvement must be disregarded in defining the technical problem underlying the claimed invention, which thus must be reformulated in less ambitious terms as the provision of an alternative hydrocracking and dewaxing process leading to a middle distillate having a low freeze or pour point and cloud point.

In the light of the indications contained in the patent in suit, the Board is satisfied that the above technical problem has been successfully solved by reversing the sequence of catalytic process steps of document (4).

3.2.4 Even though document (2) relates to the preparation of a gasoline and not of a middle distillate and does not disclose that a middle distillate can be recovered following the process disclosed therein (see point 3.1 above), document (1) teaches that the process of

document (2), wherein the feedstock is first subjected to hydrocracking using a large pore size zeolite hydrocarbon cracking catalyst and then the entire effluent is subjected to dewaxing on an intermediate pore zeolite dewaxing zeolite catalyst, such as ZSM-5, in a continuous process, i.e. a process comprising identical catalytic process steps as claim 1 of the patent in suit, can be used for preparing a middle distillate having a low pour point and low cloud point (page 3, lines 3 to 16).

In the Board's view this teaching cannot be considered, as argued by the Appellants, an erroneous interpretation of the content of document (2) which in fact relates to the preparation of a gasoline and not of a middle distillate; on the contrary it makes available to the public the knowledge of the inventor of document (1) that a process as disclosed in document (2) can be applied for preparing a middle distillate having a low pour point and cloud point.

It is in fact established jurisprudence of the Boards of Appeal of the EPO that a prior art disclosure must be read as giving to the information it contains the meaning that a skilled person would have given it at its publication date and disregarding information which would be understood by a skilled person to be wrong; however, any teaching which would not be recognized as wrong by a skilled person has to be accepted as state of the art (see T 412/91, unpublished in the OJ EPO, point 4.6 of the reasons for the decision). This board has no reason to deviate from these considerations and therefore decides that the above mentioned passage of

document (1), relating to document (2), is state of the art.

The following passage on page 3 of document (1), warning that the process of document (2) could be not particularly favourable to the viscosity of the final product (see lines 16 to 28), cannot have any bearing on the evaluation of the inventiveness of the claims of the patent in suit, since the viscosity of the final product is not a feature of such claims and the preparation of a middle distillate of good viscosity is not part of the technical problem dealt with in the patent in suit.

A similar consideration applies to the discussion of the prior art in document (1), according to which large pore zeolite catalysts are insufficiently selective for the production of a middle distillate or lead to a product having poor fluidity properties (page 2, lines 1 to 11 and page 2, line 26 to page 3, line 2), since the prior art there discussed related to processes wherein the feedstock was contacted only with the zeolite hydrocracking catalyst and not in a sequence with a further dewaxing catalyst.

Therefore, the Board finds that a skilled person, faced with the technical problem identified in point 3.2.3 above, would have been aware that the reversion of the sequence of catalytic process steps of document (4) would have also led to a middle distillate having a low freeze or pour point and low cloud point as taught in document (1).

The skilled person would have thus considered the reversion of the catalytic steps of the process disclosed in document (4) as the easiest modification of the process of this prior art to be carried out with a minimum of effort and it would thus have been obvious for him to try this modification as a first step when looking for an alternative hydrocracking and dewaxing process leading to a middle distillate having a low freeze or pour point and cloud point.

For these reasons, the Board concludes that the subject-matter of claim 1 lacks inventive step.

Since this request is to be dismissed on these grounds there is no need to deal with the other issues raised by the Respondent.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar : The Chairman:

G. Rauh P. Krasa