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D E C I S I O N
of 6 August 2004

Case Number: T 1089/03 - 3.3.7

Application Number: 99972245.7

Publication Number: 1157082

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Language of the proceedings: EN

Title of invention:

Deep desulfurization of FCC gasoline at low temperatures to maximize octane-barrel value

Applicants:

EXXONMOBIL OIL CORPORATION

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 84, 111(1), 123(2)

Keyword:

"Amendments - allowable (yes)"
"Novelty (yes)"
"Remittal (yes)"

Decisions cited:

T 0068/85

Catchword:

-



Case Number: T 1089/03 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 6 August 2004

Appellants:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 2 June 2003
refusing European patent application
No. 99972245.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: G. Santavicca
B. J. M. Struif

Summary of Facts and Submissions

I. European patent application 99 972 245.7 is based on international patent application US99/24848, filed on 25 October 1999, claiming a priority in the U.S.A. of 16 November 1998 based on application US 09/192650 and published as WO 00/29510. The international application as filed contained the following independent claim:

"1. A process for reducing sulfur content of gasoline while substantially maintaining motor octane number and road octane number, comprising:

contacting a catalytically cracked olefinic gasoline stream comprising organic sulfur compounds and having an initial boiling point in the gasoline boiling range, an initial sulfur content and an initial road octane number with a catalyst comprising an alumina substrate impregnated with at least one metal selected from the group consisting of Group VI metals of the Periodic Table and Group VIII metals of the Periodic Table, under a combination of a temperature of from 300° to 650°F (149° to 343°C), a space velocity of from 0.1 to 10 LHSV and an atmosphere comprising hydrogen to convert the sulfur compounds to hydrogen sulfide;

wherein hydrogen sulfide is removed from the gasoline stream to provide a gasoline having a reduced sulfur content lower than the initial sulfur content, a less than 5% change in motor octane number from the initial motor octane number and a less than 10% change in the research octane number."

II. In a decision notified by post on 2 June 2003, the Examining Division refused the application.

That decision was based on Claims 1 to 10 enclosed in the applicants' letter dated 9 October 2002, Claim 1 reading as follows:

"1. A process for reducing sulfur content of gasoline while substantially maintaining motor octane number and road octane number, comprising:

contacting a catalytically cracked olefinic gasoline stream comprising organic sulfur compounds and having an initial boiling point in the gasoline boiling range, an initial sulfur content and an initial road octane number with a catalyst comprising an alumina substrate impregnated with at least one metal selected from the group consisting of Group VI metals of the Periodic Table and Group VIII metals of the Periodic Table, under a combination of a temperature of from 204.4° to 315.6°C (400° to about 600°F), within a pressure range of from 689.48 to 2757.92 kPa (100 to 400 psig), and a space velocity of from about 0.1 to 10 LHSV and an atmosphere comprising hydrogen to convert the sulfur compounds to hydrogen sulfide."

The Examining Division held that:

- (a) The amendments complied with Article 123(2) EPC;
- (b) The objection of lack of novelty over the disclosure of D1 (US-A-5 378 352), raised in the first communication of the Examining Division, was no longer maintained. Having regard to the process conditions disclosed in D1 and the arguments offered by the applicants, the claimed subject-matter represented a purposive selection. Hence,

the claimed subject-matter was not anticipated by the disclosure of D1.

(c) D2 (US-A-5 576 256) disclosed a process for upgrading a sulphur-rich heavy naphtha feedstock, in which a catalyst was used which contained Co, Mo, alumina and H-ZSM-5. In particular, the process of Example 6 was operated at 200 psig, 280°C, a H₂/HC feedstock molar ratio of 3 and a LHSV of 1-2 h⁻¹, and resulted in sulphur reduction and octane enhancement. In this respect, contrary to the applicants' argumentation that the catalyst of Claim 1 only included metals of Groups VIB and VIII of the periodic system, the Examining Division found that the wording of Claim 1, in particular the expression "... catalyst comprising ...", did not exclude the presence of further catalytic components, such as those contained in the catalyst of D2. Therefore, the subject-matter of Claims 1 to 10 was not new.

(d) In view of the above objection, the application was consequently to be refused (Article 97(1) EPC).

III. On 4 August 2003, the applicants lodged an appeal against that decision and paid the appeal fee. In their statement setting out the grounds of appeal, received on 2 October 2003, the appellants enclosed two sets of amended claims as the main request and the auxiliary request, respectively.

IV. In reply to a communication of the Board in preparation for the oral proceedings, the appellants enclosed five sets of amended claims as the main and the first to

fourth auxiliary requests, respectively; the main and the first auxiliary request replacing the requests then on file (letter dated 5 July 2004).

- V. During the oral proceedings, held on 6 August 2004, the appellants filed a set of amended Claims 1 to 10 as the new main request which, before deliberation, became the sole request and replaced the requests then on file. Claim 1 according to the main request reads as follows:

"1. A process for reducing sulfur content of gasoline while substantially maintaining motor octane number and road octane number, comprising:

contacting a catalytically cracked olefinic gasoline stream comprising organic sulfur compounds and having an initial boiling point in the gasoline boiling range, an initial sulfur content and an initial road octane number with a conventional desulfurization catalyst made up of an alumina substrate impregnated with a Group VI and/or Group VIII metal or a dual functional catalyst that performs desulfurization and cracking reactions made up of an intermediate pore size aluminosilicate zeolite having an alumina substrate impregnated with a Group VI and/or Group VIII metal, the contacting being carried out under a combination of temperature of from 400° to 600°F (204.44° to 315.55°C), a pressure of 100 to 400 psig (790 to 2859.35 kPaa), a space velocity of from 0.1 to 10 LHSV and an atmosphere comprising hydrogen to convert the sulfur compounds to hydrogen sulfide;

wherein hydrogen sulfide is removed from the gasoline stream to provide a gasoline having a reduced sulfur content lower than the initial sulfur content, a less than 5% change in motor octane number from the

initial motor octane number and a less than 10% change in the research octane number."

Dependent claims 2, 3 and 7 to 10 were brought into line with Claim 1 and, where necessary, the units of measure were amended in compliance with Rule 35(12) EPC.

VI. The arguments of the appellants can be summarised as follows:

(a) The claims had been amended as follows:

- (i) Claim 1 included the last part of Claim 1 as filed, which had been cancelled during the examination proceedings;
- (ii) Also, Claim 1 defined two alternative catalysts, conventional and dual functional, in line with the description as filed, and that definition was not in contradiction with dependent claim 2 (Article 84 EPC);
- (iii) Further, Claim 1 defined that only alumina and/or zeolite together with metal(s) of Groups VI and/or VIII made up the catalyst;
- (iv) Hence, the new claims complied with Article 123(2) EPC as well as with Article 84 EPC, clarity and support;
- (v) The dependent claims had been amended correspondingly;
- (vi) As regards the units of measure, the SI units, in brackets, followed the US units, in line with Rule 35(12) EPC. Therefore, it was clear which units were the original and which the corresponding conversion.

- (b) The gist of the invention underlying the application in suit was a process which did not only reduce the sulphur content but also prevented any substantial modification of the octane numbers. To achieve these goals, a fraction was treated under specific low temperature, low pressure and usual linear hourly space velocity (LHSV). As shown in the examples, although that process was conducted at low pressure and low temperature, it nevertheless was very advantageous and achieved substantial reduction of sulphur while maintaining the octane numbers. The invention did not lie in the catalyst but in a process to desulphurise the fraction with a known catalyst, under specific conditions, while maintaining the octane numbers. Therefore, a conventional catalyst, which was known for dewaxing, had been successfully put to use to a new situation for a new purpose.
- (c) As regards novelty, D1 disclosed a desulphurisation process operating at a temperature of at least 650°F and a pressure of 50 to 1500 psig. Since D1 showed improvements at and above 650°F, it led the skilled person away from the low temperature of the claimed process. Further, the combination of low temperature and low pressure was not contemplated by D1. Therefore, as acknowledged in the impugned decision, the claimed subject-matter was a purposive selection over D1.
- (d) D2 related to a hydro-isomerisation process of a heavy naphtha feedstock, by means of a catalyst system comprising a matrix, a support medium,

within or distributed through the matrix, and a catalytically active phase which included a Group IIIA metal, preferably gallium. Hence, that process used a different catalyst and aimed at a different purpose. Since the catalytic composition as defined in the amended claims did not contain any Group III metal such as gallium, the claimed subject-matter was novel.

In addition, when hydrodesulphurisation was referred to as such in D2, it was stated that conventional hydrodesulphurisation was frequently accompanied by loss of octane number. Moreover, it was apparent from the examples that the process of D2 was carried out under different operating conditions and/or provided different gasoline products having reduced sulphur content as well as large fraction of isomerised product and increased octane numbers. Therefore, D2 actually confirmed that conventional hydrodesulphurisation reduced the octane number and additionally taught the use of a catalyst different from the one defined by the claimed subject-matter, for a different purpose.

- (e) D3 (US-A-5 591 324) and D4 (US-A-5 770 047) were closely related to D2, addressed the same purposes and contained the same teachings and disclosures. D5 (US-A-4 696 732) related to dewaxing of petroleum residua.
- (f) Therefore, the claimed subject-matter was novel.

VII. The appellants requested that the impugned decision be set aside and that a patent be granted on the basis of Claims 1 to 10 submitted as the main request during the oral proceedings before the Board.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Compared to Claim 1 as originally filed, Claim 1 according to the present request contains the following amendments:

(a) "a conventional desulfurization catalyst made up of an alumina substrate impregnated with a Group VI and/or Group VIII metal or a dual functional catalyst that performs desulfurization and cracking reactions made up of an intermediate pore size aluminosilicate zeolite having an alumina substrate impregnated with a Group VI and/or Group VIII metal, the contacting being carried out";

(b) "temperature of from 400° to 600°F (204.44° to 315.55°C)";

(c) "a pressure of 100 to 400 psig (790 to 2859.35 kPaa)".

2.2 Amendment (a) has a basis in the original description: page 7, lines 4 to 11, 15 to 18 and 24 to 25; page 9, line 1.

- 2.3 Amendment (b) has a basis in the preferred range for the temperature disclosed on page 8, line 12.
- 2.4 Amendment (c) has a basis in the preferred pressure range disclosed on page 8, lines 13 to 14.
- 2.5 Compared to Claim 2 as originally filed, Claim 2 according to the present request contains the following amendments: the intermediate pore size zeolite is an intermediate pore size aluminosilicate zeolite, as defined in Claim 1. The basis for the intermediate pore size aluminosilicate is on page 9, first line, of the application as filed. That zeolite is selected from the group consisting of the zeolites defined in Claim 2 as filed, apart from the rectification of the original term M-41S to MCM-41S, in line with page 9, line 6, of the application as filed.
- 2.6 Compared to Claim 6 as originally filed, Claim 7 now comprises: a restriction of the hydrogen to hydrocarbon ratio, in accordance with page 8, line 18, of the application as filed; a correction of the conversion of the original US units into the SI units, which has the same basis as above; and an indication of the conversion of the original US units into the SI units in brackets, in line with Rule 35(12) EPC.
- 2.7 Claims 8, 9 and 10 were not present in the set of claims as filed. Claim 8 has a basis on page 9, lines 7 and 8, of the original description. Claim 9 has a basis on page 8, lines 15 to 16, of the description as filed. Claim 10 has a basis on page 5, lines 17 to 19, of the description as filed.

2.8 Therefore, the application under examination has not been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC).

3. *Clarity*

3.1 Although an objection based on the Guidelines, C-III, 4.7 was raised in the first communication of the Examining Division (dated 3 July 2002; Point 6.3), the applicants retained the last part of Claim 1 as filed. According to the cited passage of the Guidelines, claims which attempt to define the invention by a result to be achieved should not be allowed, in particular if they only amount to the underlying technical problem. However, the last part of Claim 1 as filed did not merely amount to the underlying problem, but contained further features, in particular that hydrogen sulphide is removed from the gasoline stream and that the obtained gasoline is specified by the allowable losses of RON and motor octane number (MON). These features are defined in concrete terms, which can positively be verified by tests known to the person skilled in the art and are thus acceptable, in line with decision T 68/85 (OJ EPO 1987, 228). Furthermore, the allowed losses of octane numbers provide a more specific definition of the vague term "substantially maintaining motor octane number and road octane number" in the first part of Claim 1. The fact that the magnitude of the loss of the RON may provide a clear distinction over a process of hydrodesulphurisation of cracked feedstock is apparent from Table 6 of D2. Therefore, the (cancelled) last part of Claim 1 as

filed has been reintroduced into Claim 1 to comply with Article 84 EPC.

3.2 Hence, the amendments to the claims, which essentially repeat the wording of the application as filed, do not affect the clarity of the claims (Article 84 EPC).

3.3 It follows from the above, that the sole request filed during the oral proceedings is admissible.

Novelty

4. According to the decision under appeal, the claimed process was considered to be not novel over the process of D2, because the catalyst used in the claimed process did not exclude further metals and could thus not be distinguished from the catalysts used in the processes of D2. Hence, before dealing with the disclosure of the cited documents, the question arises whether or not the amended definition in Claim 1 excludes further metals other than those of Groups VI and VIII of the Periodic Table.

4.1 According to present Claim 1, the conventional desulphurisation catalyst is made up of an alumina substrate that is impregnated with a Group VI metal, or with a Group VIII metal, or with a Group VI and a Group VIII metal. Since the term "made up" means formed, constituted, prepared by putting together the elements listed after that term, the definition of the conventional desulphurisation catalyst does exclude the presence of other substrates and/or metals of other Groups of the Periodic Table on the alumina substrate.

4.2 As to the dual functional catalyst which performs desulphurisation and cracking reactions, it is made up of an intermediate pore size aluminosilicate zeolite having an alumina substrate impregnated with a Group VI metal, or with a Group VIII metal, or with a Group VI and a Group VIII metal.

4.2.1 Since the term "made up" has the meaning as above (point 4.1), the definition of the substrate of the dual functional catalyst also excludes the presence of metals of other Groups of the Periodic Table.

4.2.2 As regards the zeolite, it has an intermediate pore size and it is an aluminosilicate. The terms "intermediate pore size" and "aluminosilicate" are further specified in the application as filed (paragraph bridging pages 8 and 9). According to those passages, no further metal other than aluminium, which is preferred, is incorporated in the aluminosilicate zeolite.

4.2.3 The mention that "other isostructural forms of the intermediate pore size zeolites containing other metals **instead** (emphasis added) of aluminum such as gallium, boron or iron can also be used" (last sentence of the first paragraph on page 9) relates to less preferred alternative zeolites, which, however, are now excluded from Claim 1. The above picture is not changed by the further mention in the description as filed (page 7, lines 29 to 30) that the zeolite used in the catalyst might include as other components of its structure, present in minor amounts, metals such as gallium, iron and boron. In that case, those optional other components such as gallium would be a constituent part

of the zeolite structure and it is not apparent from the description that that gallium would migrate to the alumina substrate where it would exhibit the claimed catalytic function, for which the metals of Groups VI and VIII are selected. Instead, according to the description as filed, the zeolite should merely fulfil the additional function of cracking the feedstock (page 4, line 21). In any case, the presence of gallium in the aluminosilicate is not required by the wording of Claim 1. Also, the applicants have declared that all the above passages in the description, which were not in line with the definition of the aluminosilicate zeolite of Claim 1, would be cancelled when adapting the description.

- 4.2.4 Similar considerations apply *mutatis mutandis* to the passage of the application as filed, which merely mentions that other metals (i.e. other than molybdenum and tungsten, or nickel and cobalt) possessing hydrogenation functionality are also useful in the service, i.e. hydrodesulphurisation (page 7, lines 4 to 8). Since the mentioned passage is not consistent with the definition of Claim 1, it could also be cancelled.
- 4.3 The above interpretation is in line with the purpose of the process of Claim 1 (to convert the sulphur compounds to hydrogen sulphide) as defined in the description as filed (page 1, line 4; page 2, lines 7 to 9; page 3, lines 13 to 17 and 24 to 32; page 7, lines 4 to 11 and 15 to 17; page 10, lines 1 to 12; page 11, lines 25 to 29; Examples 1, 5 and 6).

- 4.4 The adaptation of the description to the claims according to Claim 84 EPC, if any, is however left to the decision of the Examining Division.
- 4.5 In conclusion, on the proper interpretation of the amended feature in Claim 1, the catalytic composition used on the substrate for reducing the sulphur content while substantially maintaining motor octane number and road octane number only contains metals of Groups VI and VIII of the Periodic Table.
5. D1 concerns a process of upgrading a sulphur and olefin containing feed fraction containing at least 100 ppm S, and boiling in the gasoline boiling range which comprises:
contacting such sulphur and olefin containing gasoline boiling range feed fraction with a hydrotreating catalyst at temperatures of at least about 650°F, which comprises
- (a) a substantially acidic porous refractory solid having an intermediate effective pore size and the topology of a zeolitic behaving material corresponding to at least one member of the group consisting of ZSM-5, ZSM-11, ZSM-22, ZSM-23, ZSM-35, ZSM-50, MCM-22, and mordenite,
 - (b) a Group VI metal,
 - (c) a Group VIII metal, and
 - (d) a suitable refractory support, under hydrotreating conditions comprising a temperature of about 650° to 900°F, a pressure of about 50 to 1500 psig, a space velocity of about 0.5 to 10 LHSV, and a hydrogen to hydrocarbon ratio of about 500 to 5000 standard cubic feet of hydrogen per barrel of feed, which are sufficient to separate at least some of the

sulphur from the feed molecules and convert such to hydrogen sulphide, to produce a product comprising a normally liquid fraction boiling in substantially the same boiling range as the feed, but which has a lower sulphur content than the feed and which has a research octane number (RON) substantially no less than the feed; and recovering at least the gasoline boiling range fractions so produced (Claim 1).

The feed fraction comprises a light naphtha fraction having a boiling range within the range of C₅ to 330°F (Claim 2), or a full range naphtha fraction having a boiling range within the range of C₅ to 420°F (Claim 3), or a heavy naphtha fraction having a boiling range within the range of 330° to 500°F (Claim 4), or a heavy naphtha fraction having a boiling range within the range of 330° to 412°F (Claim 5). In particular, said feed can be a cracked naphtha fraction comprising olefins (Claim 6).

Preferably, the refractory support is at least one member selected from the group comprising silica-alumina (Claim 9) and the hydrotreating catalyst comprises cobalt, molybdenum and alumina (Claim 10).

The hydrotreating conditions preferably comprise a temperature of about 700° to 800°F, a pressure of about 300 to 1000 psig, a space velocity of about 1 to 6 LHSV, and a hydrogen to hydrocarbon ratio of about 1000 to 2500 standard cubic feet of hydrogen per barrel of feed (Claim 12).

In particular, the feed can contain 10,000 to 30,000 ppm S by weight, and the hydrotreating conditions can comprise a temperature of about 650° to 900°F, and the product has a research octane number (RON) greater than the feed (Claim 13).

- 5.1 It is apparent from the above that the process disclosed by D1 also relates to reducing sulphur content of gasoline while substantially maintaining motor octane number and road octane number. Further, that process also uses a dual functional catalyst within the definition of Claim 1 in suit. However, the process of D1 is carried out at a temperature of from at least 650°F to 900°F, compared to from at least 400 to 600°F for the claimed process.
- 5.2 Although Figures 2 and 3 of D1 show that both the conventional CoMo/Al₂O₃ catalyst and the dual functional catalyst CoMo/MCM-22 catalyst prepared in accordance with Example 1 of D1 have also been used at 450°F and 550°F, which temperatures fall within the definition in Claim 1 in suit, the pressure used in Example 1 (i.e. 600 psig, see column 9, line 30) lies outside the range of 100 to 400 psig defined in Claim 1 in suit.
- 5.3 It is apparent from the above that the process defined in present Claim 1 is operated at combined conditions of lower temperature and low pressure. Therefore, in line with the decision under appeal, the process disclosed by D1 does not prejudice the novelty of the subject-matter of Claim 1.
6. D2 and D3 relate to the same subject-matter, in fact they have the same description. Whereas the claims of

D2 are directed to a hydroconversion catalyst system, those of D3 instead are directed to a process of use of that catalyst. Since Claim 1 under examination concerns a process, document D3 will therefore be considered. The conclusions drawn from the analysis of D3 would of course also apply to D2.

- 6.1 D3 concerns a process for upgrading a sulphur rich heavy naphtha feedstock comprising the steps of: providing a heavy naphtha feedstock having an initial sulphur content and an initial octane number; and contacting said feedstock with a hydroconversion catalyst system under a hydrogen atmosphere at hydroisomerisation temperature and pressure so as to provide a final product having a final sulphur content which is less than the initial sulphur content of the feedstock, and having a final octane number which is substantially equal to or greater than said initial octane number of the feedstock, and wherein the final product has an increased isomerised component and substantially no increase in aromatic content with respect to said feedstock said hydroconversion catalyst comprises (1) a catalytically active matrix, (2) a support medium distributed through the matrix, said support medium comprising a silicious molecular sieve material, and (3) a catalytically active phase supported on the support medium, said catalytically active phase comprising a first metal selected from group IIIA of the periodic table of elements and a second metal selected from group VIB of the periodic table of elements (Claim 1).

The feedstock preferably has an initial sulphur content of between about 1 ppm to about 20,000 ppm (Claim 2),

and the final sulphur content is preferably between about 30% to about 60% less than said initial sulphur content (Claim 3). Hence, the process of D3 reduces the sulphur content.

The final octane number is greater than said initial octane number by between about 2 to about 40 (Claim 4). In particular, if the feedstock is a heavy straight run naphtha, the final octane number is greater than said initial octane number by between about 30 to about 40 (Claim 5); and, if the feedstock is a heavy cracked naphtha, the final octane number is greater than said initial octane number by between about 2 to about 10 numbers (Claim 6). Hence, the process of D3 may or may not be suitable for substantially maintaining the octane numbers.

D3 also concerns a process for upgrading a sulphur rich heavy naphtha feedstock, comprising the steps of: providing a heavy naphtha feedstock having an initial sulphur content and an initial octane number; contacting said feedstock with a hydrodesulphurisation catalyst under a hydrogen atmosphere and hydrodesulphurisation temperature and pressure to provide an intermediate product having an intermediate sulphur content less than said initial sulphur content and an intermediate octane number less than said initial octane number; and contacting said intermediate product with a hydroconversion catalyst system under a hydrogen atmosphere at hydroisomerisation temperature and pressure so as to provide a final product having a final sulphur content which is less than the intermediate sulphur content, and having a final octane

number which is greater than said intermediate octane number, and wherein the final product has an increased isomerised component and substantially no increase in aromatic content with respect to said feedstock said hydroconversion catalyst comprises (1) a catalytically active matrix, (2) a support medium distributed through the matrix, said support medium comprising a silicious molecular sieve material, and (3) a catalytically active phase supported on the support medium said catalytically active phase comprising a first metal selected from group IIIA of the periodic table of elements and a second metal selected from group VIB of the periodic table of elements (Claim 7). Hence, when a separate desulphurisation step is included in the process of D3, it is carried out on a conventional catalyst therefor and it substantially reduces the octane numbers.

6.2 The results of the examples of D3 can be summarised as follows:

6.2.1 In Example 1, the preparation of the following two catalysts is illustrated: CoMoP/Al₂O₃ + GaCrH-ZSM-5 and NiMoP/Al₂O₃ + GaCrH-ZSM-5 (Table 1). These catalysts include metals other than those of Groups VI and VIII of the Periodic Table.

6.2.2 In Example 2, to show the importance of both the active metals supported on the zeolite support medium and also on the alumina matrix, the following three catalysts have been prepared:

Catalyst A: CoMoP/Al₂O₃ + GaCrH-ZSM-5;

Catalyst B: CoMoP/Al₂O₃ + H-ZSM-5;

Catalyst C: Al₂O₃ + GaCr/H-ZSM-5.

These catalysts were tested in hydroisomerisation of n-octane at 350°C and 400 psi. Catalyst A, which has the active metal phases on both the matrix and zeolite support is the most preferred catalyst. Therefore, this example, although it does not disclose a feed and a temperature within the definition of Claim 1 in suit, shows that the catalyst should have active phases containing Ga+Cr as well as Co, Mo and P to provide the best results.

- 6.2.3 Example 3 concerns the use of Catalyst A in hydroisomerisation of a heavy virgin naphtha under hydroconversion conditions similar to those of Example 2 but with rising pressures. The process improves as pressure increases. The conclusions drawn from Example 2 apply *mutatis mutandis* here.
- 6.2.4 Example 4 illustrates a two-stage process using a commercial hydrodesulphurisation catalyst and process (first stage) followed by hydroconversion using Catalyst A of Example 2. The feed was a heavy cracked naphtha. In addition to the distinct constitution of Catalyst A of Example 2, hydrodesulphurisation was carried out at 340°C, hence outside the maximum temperature of Claim 1 in suit. Further, the Research Octane Number (RON) was reduced from 77 to 44 (Table 6), hence below the reduction limit specified in Claim 1 in suit. The hydroisomerisation, which was conducted at 330°C and 700 psig, did increase the RON from 44 to 81.
- 6.2.5 Example 5 also illustrates a two-stage process similar to that of Example 4 but applied to a heavy FCC naphtha feedstock and using Catalyst A of Example 2. However, in addition to the distinct constitution of Catalyst A

of Example 2, hydrodesulphurisation was carried out at 340°C, i.e. above 315.55°C as defined in Claim 1, and hydroisomerisation was carried out at 330°C and 700 psig.

- 6.2.6 In Example 6, an atmospheric straight run naphtha with low sulphur content (60 ppm) is treated with the catalyst of D3 to provide transformation to more suitable isomerised hydrocarbon products with high octane numbers (RON and MON values). The process is carried out at 280 to 320°C and 200 psig. Although those operating conditions such as pressure and temperature fall within the definition of Claim 1 in suit, the following distinctions should be noted: the feed; the composition of the catalyst is not disclosed; if the catalyst was any of those of Tables 1 and 2, it would contain metals other than those of Group VI and VIII of the Periodic Table; further, the RON is increased from 55 (feedstock) to 85 (product) (Table 8), which increase is outside the limitation of Claim 1 in suit.
- 6.2.7 Example 7 deals with light cuts of FCC (65°to 170°C) with moderate content of sulphur (600 ppm). However, the catalyst is not defined, as in Example 6. Further, the temperature conditions (320-350°C) are outside the claimed ones. Example 7 shows that when treating FCC cuts, compared to atmospheric straight run naphtha as in Example 6, the temperature is increased over that shown in Example 6.
- 6.2.8 The further examples of D3, which relate to the typology of the zeolite material, are less relevant and need not be considered in detail.

6.2.9 It follows from the above analysis that the process of D3 requires a catalyst and process conditions which are different from the claimed ones. Thus, the process of D3 is not prejudicial to novelty, which conclusion applies to D2 as well.

7. D4 is a continuation-in-part of D2, which contains further steps for decreasing the nitrogen content. D4 thus concerns a process for upgrading a nitrogen and sulphur rich heavy naphtha feedstock comprising the steps of:
providing a naphtha feedstock having an initial nitrogen content, an initial sulphur content and an initial octane number;
contacting said naphtha feedstock with an acid source so as to provide a reduced nitrogen feedstock having a reduced nitrogen content which is less than said initial nitrogen content;
contacting said reduced nitrogen feedstock with a hydroconversion catalyst system under a hydrogen atmosphere, temperature and pressure so as to provide a final product having a final nitrogen content which is less than said initial nitrogen content, a final sulphur content which is less than said initial sulphur content, and having a final octane number which is substantially equal to or greater than said initial octane number of the feedstock, and wherein said final product has an increased isomerised component and substantially no increase in aromatic content with respect to said feedstock (Claim 1).

The catalyst used in that process comprises:
a catalytically active matrix;

a support medium distributed through the matrix and comprising a silicious molecular sieve material; and a catalytically active phase supported on the support medium and comprising a first metal selected from group IIIA of the periodic table of elements and a second metal selected from group VIB of the periodic table of elements (Claim 2).

Hence, as far as desulphurisation is concerned, D4 is not more relevant than D3 and D2. The conclusions drawn from the analysis on D3 therefore applies *mutatis mutandis* to D4.

8. D5 concerns a process comprising the steps of simultaneous demetallating, hydrodesulphurising and dewaxing petroleum residua at least 50% of which boils above 750°F by contacting said residua with a catalyst, comprising: (a) a hydrogenation/dehydrogenation component supported on catalytically active alumina, said alumina having a controlled pore size whereby said catalyst has 75% of its pore volume in pores no greater than 100 Angstrom units in diameter, and about 20% of its pore volume in pores greater than about 300 Angstrom units in diameter; and (b) an intermediate pore zeolite, and zeolite beta as a large pore component and a large pore non-zeolitic inorganic binder (Claim 1).

The hydrogenation/dehydrogenation component preferably includes a catalytically effective amount of at least one metal selected from Group VIB and Group VIII of the Periodic Table (Claim 2) and the intermediate pore zeolite is ZSM-5 (Claim 3).

The process further comprises recovering an upgraded petroleum product characterized by fractions having pour points less than about 20°F and by kinematic viscosity less than about 500 centistokes (Claim 5).

The process further comprises reacting the catalyst at pressures between about 200 and about 3000 psig, temperatures between about 600° and about 900°F, and a space velocity between about 0.1 and about 10 LHSV (Claim 6).

The intermediate pore zeolite is preferably selected from the group having the structure of ZSM-5, ZSM-11, ZSM-12, ZSM-22, ZSM-23, ZSM-34, ZSM-35, ZSM-38, ZSM-48, TMA Offretite, Clinoptilolite and Erionite (Claim 8).

The process hydrogenation/dehydrogenation component preferably includes 1 to 10 wt% of Group VIII metal and 5 to 20 wt% of Group VIB metal, based on total catalyst weight and expressed in elemental form (Claim 9), whereby said Group VIII metal comprises nickel and said Group VIB metal comprises molybdenum (Claim 11), in particular wherein said Group VIII metal comprises 2 to 10 wt% nickel oxide and said Group VIB metal comprises 5 to 20 wt% molybdenum oxide (Claim 12).

The contacting is preferably carried out in the presence of hydrogen gas at a total pressure of about 500 to 3000 psig, a temperature of about 600° to 850°F, and a liquid hourly space velocity of 0.1 to 5, based on the total complement of catalysts in the system (Claim 10).

More particularly, the process is for hydrodesulphurisation, demetallising and dewaxing petroleum residua, and comprises contacting the residua, at least 50% of which boils above 750°F, with a catalyst comprising 5 to 50 wt% Zeolite Beta and 95 to 50 wt% alumina, based on the combined weight of Zeolite Beta and alumina, ZSM-5, and 10 to 25 wt%, based on total catalyst weight, of nickel oxide in an amount of 2 to 10 wt% and molybdenum oxide in an amount of 5 to 20 wt%, said catalyst having 75% of its pore volume in pores no greater than 100 Angstrom units in diameter and about 20% of its pore volume in pores greater than about 300 Angstrom units in diameter, said contacting being carried out in the presence of hydrogen gas at a total pressure of about 500 to 3000 psig, a temperature of about 600° to 850°F and a liquid hourly space velocity of 0.1 to 10, based on the total complement of catalyst in the system (Claim 13).

It follows from the above analysis, that apart from any analogy with the use of the catalysts, the process of D5 is carried out with a different feed (petroleum residua), under different combinations of temperature and pressure, to obtain a different product. Therefore, D5 cannot prejudice the novelty of the claimed process.

9. In view of the above, the amendments made have actually overcome the novelty objection, on which the refusal had been based (points 4 to 4.2 of the impugned decision). Thus, the appellants no longer seek grant of the patent with a text corresponding to that which was rejected by the Examining Division.

10. Therefore, since the examination has to be continued on a new basis and since inventive step has not been dealt with in the impugned decision, the Board consequently considers it appropriate to remit the case to the Examining Division for further prosecution, in compliance with Article 111(1) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance for further prosecution.

The Registrar:

The Chairman:

C. Eickhoff

R. Teschemacher