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D E C I S I O N
of 18 January 2006

Case Number: T 1344/04 - 3.3.06

Application Number: 97937512.8

Publication Number: 0914405

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Language of the proceedings: EN

Title of invention:
Process for the gasolines production

Patentee:
Amadei, Roberto

Opponent:
ENI Spa Divisione Refining and Marketing

Headword:
Splitting unit/AMADEI

Relevant legal provisions:
EPC Art. 56, 57, 83
EPC R. 68(2)

Keyword:
"Sufficiency of disclosure (yes) "
"Inventive step (yes) "

Decisions cited:
T 0226/85

Catchword:
-



Case Number: T 1344/04 - 3.3.06

D E C I S I O N
of the Technical Board of Appeal 3.3.06
of 18 January 2006

Appellant: ENI Spa Divisione Refining and Marketing
(Opponent) Via Laurentina, 449
I-00142 Roma (IT)

Representative: Pistolesi, Roberto
Dragotti & Associati srl
Via Turati 32
I-20121 Milano (IT)

Respondent: Amadei, Roberto
(Proprietor of the patent) Via G. Bruno, 28/8
I-16146 Genova (IT)

Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 22 October 2004
rejecting the opposition filed against European
patent No. 0914405 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: P. Krasa
Members: G. Raths
A. Pignatelli

Summary of Facts and Submissions

I. This appeal is from the decision of the Opposition Division to reject the opposition against the European patent No. 0 914 405 relating to a process for the gasolines production.

II. Claims 1 to 4 of the patent as granted read:

"1. High yield process for the production of high-octane and low benzene content gasolines according to a cycle where a crude oil is fed into an atmospheric distillation unit from which a fraction is obtained called virgin naphtha sent in turn to a splitting unit that produces a fraction called light tops and a fraction called heavy naphtha, respectively sent to a processing unit called isomerization and to a processing unit called catalytic reformer, characterized in that the heavy naphtha fraction has a six carbon atoms (C6) hydrocarbons content no greater than 0.5% volume, and the light tops fraction has a seven plus carbon atoms (C7+) hydrocarbons content no greater than 4% volume.

2. Process according to claim 1 characterized in that the heavy naphtha C6 content must be no greater than 0.3% volume.

3. Process according to any one of the preceding claims, characterized in that the light tops C7+ content must be no greater than 2% volume.

4. Process according to any one of the preceding claims, characterized in that said composition limitation of

the light tops and heavy naphtha fractions is obtained by choosing in the splitting unit such a cutting temperature that the initial boiling temperature (ASTM IBP) of the heavy naphtha fed into the reformer results comprised between 92 and 102°C."

III. The opposition had been filed on the grounds of Article 100(a) EPC, in particular, for lack of novelty and inventive step relying, *inter alia*, on the following documents:

- (5) "Economic consequences of limiting benzene/aromatics in gasoline", report n° 89/57, CONCAWE, July 1989;
- (9) Effects of new environmental legislation on catalytic reforming, Erdöl, Kohle & Erdgas Petrochemie 41 (12), December 1988, pages 491 to 496;
- (11) Reformulated gasoline market affected refineries differently, Zyren et al. Petroleum Marketing Monthly, January 1996 and
- (14) US-A-5 003 118.

The patent proprietor filed, *inter alia*, document

- (R2) Letter dated 20 February 2002 with its three enclosures in reply to "Communication pursuant to Article 96(2) EPC".

During the opposition proceedings, with a letter dated 16 December 2003, the opponent also submitted a ground

of opposition under Article 100(b) EPC for lack of sufficiency of disclosure (Article 83 EPC).

In support of its arguments it filed, *inter alia*, documents

(26) Removal of benzene precursors from heavy naphthas obtained by splitting virgin naphthas European Patent EP 0 914 405, Rome, July 2004;

(27) Vigevano Law Suit, Fourth Technical Report in favour of Agip Petroli, Dragotti, G, excerpt, 17.01.2000 [TRIBUNALE DI VEGEVANO, (R.G. 464/1997)].

IV. In its decision the Opposition Division held that the invention was sufficiently disclosed even if the description did not contain any example; the mode of operation of the splitting unit had not to be specified since said mode of operation was part of the common general knowledge of the skilled man; the cut temperature, one of other possible measures to run the splitting unit, was an optional but not a mandatory feature.

A skilled person's knowledge would be sufficient to design a fractionation column with the appropriate number of trays and reflux ratio in such a way that - after the splitting unit - the respective concentrations of C6 and C7+ in the top lights and the heavy naphtha, respectively, could be obtained.

With respect to novelty, the Opposition Division found that the claimed concentration limits of C6 in the heavy naphtha sent to catalytic reforming and of C7+ in

the light naphtha sent to isomerization were not disclosed in any of the cited prior art documents.

In respect of inventive step, the Opposition Division held that in the light of document (9) - representing the closest prior art - the problem underlying the patent in suit was to provide a process having a better performance of the higher boiling C6 marginal stream and simultaneously a better performance of the catalytic reformer feed consisting in a strong increase of the gasoline octane number which could not have been obtained by the process disclosed in document (9).

The Opposition Division accepted the increase of octane numbers i.e. RON and MON (Research Octane Number and Motor Octane Number) of the combined reformate/isomerase end mixture (document (R2), case B) as evidence of the solved technical problem in view of case A representative of the closest prior art document (9).

An amount of up to 2 vol.% of C7+ in the light tops of the isomerization feedstock would have no effect on the isomerase and above 4 vol.% C7+ in the light tops fraction would be detrimental to the isomerization unit because of a severe octane number reduction, what was proved by experiments made by the proprietor in the refinery in La Spezia in 1970.

- V. The opponent (hereinafter appellant) filed an appeal against this decision.

In its grounds for appeal, to which, *inter alia*, document

(29) Università degli Studi di Roma, Effects of the operating conditions suggested by European Patent EP-A-0 914 405 B1 on the quality of the final gasolines, Rome, Prof. Ing. Sergio Di Cave, February 2005.

was enclosed, the appellant argued as follows:

Sufficiency of disclosure

(a) According to document (26), with derivatives from crudes like Forcados, Gullfaks and Troll, it was not possible to get the calculation convergence i.e. to achieve the results obtained by the respondent, even with a column having more than 100 trays. The appealed decision did not contain any technically supported reasoning explaining why the Opposition Division was convinced of the contrary; hence the requirements of Rule (68)(2) EPC were not met.

(b) Simulations of refining processes (hereinafter process simulation) presented in document (29) showed

- that with virgin naphthas from Forcados, Gullfaks and Troll crudes, the C7+ hydrocarbon content in the light tops can never be ≤ 2.0 if the C6 hydrocarbons content is 0.3 at the bottom in the heavy naphtha stream;
- that with virgin naphtha from Arabian Light crude, the C7+ hydrocarbon content in the light tops can never be ≤ 0.78 if the C6 hydrocarbons content is 0.3 at the bottom in the heavy naphtha stream.

(c) Therefore, the invention not only could not be performed in the whole range claimed, but the invention also contained embodiments which could not be performed at all since their performance was inherently impossible as being contrary to the laws of physics.

Consequently, also the criterion of industrial application would not be fulfilled (Article 52(1) and 57 EPC).

Inventive step

The Opposition should not have accepted the increase of octane numbers of reformate-isomerate of case B of document (R2) as evidence for the solution of the technical problem (see point IV, paragraph 4); while document (R2) disclosed a reduction of the C6 concentration in the reforming feed to less than 0,5%, it did not provide any indication about the C7+ concentration in the isofeed.

The process simulation could only be carried out with software not available to the public what shadowed some doubts on the data available from tests run in the unit of La Spezia which was not equipped with isomerization and reforming units.

The results of a process simulation provided by Universal Oil Products (UOP) (document (27)) demonstrated that there was no increase in terms of yield and octane number.

The Opposition Division did not give reasons why it did not accept the arguments provided by the opponent on the basis of document (27) (pages 22 to 23) and, therefore, the requirements of Rule 68(2) EPC were not met.

As was shown in document (29), the claimed process did not provide the alleged increase of octane numbers. Only a reduction of the benzene content could be found, but this reduction was obvious since the C6 removal from the reformer implied that the benzene precursors could no longer be transformed into benzene; furthermore, respecting the claimed ranges would lead to an increase of production costs.

The appellant did not contest novelty.

- VI. The proprietor (respondent) refuted the arguments of the appellant.

As far as the simulations presented in document (29) are concerned, the appellant overlooked that it did not base its reasoning on Claim 1 but on the requirements of claims 2 and 3 according to which the C7+ hydrocarbon concentration should not be greater than 2 vol.% in the light tops when the concentration of the C6 in the heavy naphtha stream at the bottom is not greater than 0.3 vol.%. This argument should not be accepted because according to Claim 1, in the fraction to be charged to the isomerization unit, the maximum C7+ content is not restricted to 2 vol.% but allowed to be 4 vol.%.

Also instead of respecting the maximum of 4 vol.% of C7+ in the fraction to be charged to the isomerization unit, the appellant showed effects obtained when raising this maximum concentration to 30.3 wt.% (document (27), page 22, bottom of last column) what would make no sense.

Contrary to the appellant's allegation, the technical problem underlying the patent in suit was solved because the higher boiling C6 feed, when charged to the reforming unit, would decrease the full reformat octane; however, the removal of the higher boiling C6 from the reforming feed to the isomerization feed - while not neglecting even low amounts of virgin naphtha, called "last molecules of the higher boiling C6" - resulted in an increase of the reformat octane number, hence also in an increase of the octane number of the isomerase-reformat blend heavy fraction; the iso-feed quantity maximization therefore maximizes also the full gasoline octane.

VII. Oral proceedings took place on 18 January 2006.

VIII. The appellant requests that the decision under appeal be set aside and that the patent be revoked.

The respondent requests that the appeal be dismissed.

Reasons for the Decision

1. *Industrial application*

1.1 The appellant's objections can be summarized as follows:

An industrial distillation column having more than 100 trays would economically not be worthwhile and technically not realistic. The claimed invention would include embodiments violating physical laws thus clashing with the required industrial applicability.

1.2 The Board does not agree.

According to Article 57 EPC the requirements of industrial application are fulfilled if the invention is made or used in any kind of industry.

The gasoline production is a well known activity in the field of petrochemistry.

The question relating to the technical feasibility of a distillation column having more than 100 trays - raised under the notion of "industrial applicability" - is treated under Article 83 EPC, whereas economical aspects, although of importance in business, are not a patentability requirement.

The requirements of Article 57 EPC are met.

2. *Sufficiency of disclosure*

2.1 The appellant argued that the claimed concentration ranges of C6 and C7+ could not be met with more than

100 trays with certain virgin naphthas, the number of 100 trays being a limit beyond which the construction of a splitting unit would no more be realistic.

Simulations (see point V, b) would show not only that the claimed invention would contain embodiments which cannot be performed at all, but also the disclosure of the patent in suit would not allow the invention to be performed in the whole range.

The appellant argued that the process should be operable with any pair of values, i.e. any combination of a C6 concentration (between 0 and 0.5 vol.%) and of a C7+ concentration (between 0 and 4 vol.%).

2.2 The Board does not agree.

2.2.1 In order to meet the Article 83 EPC requirements, it is sufficient that the skilled person has at his disposal, either in the specification or on the basis of common general knowledge, adequate information leading necessarily and directly towards success through evaluation of initial failures (T 226/85, OJ 1988, 336).

In this case, the skilled person is a process engineer in the field of petrochemistry, who is familiar with the different kinds of crude oil available on the world market and with distillation technology.

The splitting unit has two outgoing streams, one going through the isomerization unit, the other through the reformer. Claim 1 requires that the heavy naphtha fraction (passing through the reformer) has a six carbon atoms (C6) hydrocarbons content no greater than

0.5% volume, and the light tops fraction (passing through the isomerization unit) has a seven plus carbon atoms (C7+) hydrocarbons content no greater than 4% volume.

The operation conditions of the splitting unit lead to the above mentioned concentrations; a detailed guidance as to the mode of operation was not necessary since the reduction of the benzene content in the gasoline leaving the reformer was known; evidence for this had been submitted by the appellant itself (documents (5) and (9) - increase of the initial boiling point of the reformer feed; (11) - elimination of the C6 cyclics; (13) - benzene (precursors) stream through the isomerization unit; and (14) - cut point adjustment (see grounds of appeal, page 5, lines 11 to 28, see also point 4.6 herein below)).

Therefore, the skilled person was able to obtain the embodiments falling within the ambit of the claims; the requirement - postulated by the appellant - that the invention has to be achieved with each and any combination of a pair of values of both concentrations has no basis in the EPC. According to the interpretation of Article 83 EPC given by the Case Law of the Boards of Appeal, it is only requested that the skilled person, in case of failure has at his disposal sufficient information to take the necessary measures for transforming failure into success. Occasional failures do not impair the reproducibility of the process.

It is sufficient that the skilled person availing himself of the common general knowledge is able to

carry out the invention with couples of concentrations "not greater than 0.5 vol.% for C6 and not greater than 4 vol.% for C7+", each of the values meeting the requirements of Claim 1.

In this case the skilled person is able to achieve the envisaged result within the whole ambit of the claim without undue difficulty.

The Board concludes that the disclosure is reproducible without undue burden.

- 2.2.2 The appellant had submitted results (tables VN 1 and VN 9 of document (26); tables in document (29); grounds of appeal, table on page 4) in order to show that the claimed process did not provide the alleged increase of octane numbers.

These results were obtained with process simulations run in so-called standard isomerization/reformer units (grounds of appeal, page 4, paragraph below the table); the isomerization and reformer units used in the software program correspond to the ones manufactured by UOP.

The appellant confirmed during oral proceedings that there is no officially recognized definition of said standard units; hence, apart from the fact that the sensitiveness of the mutual influence of all the parameters can not be encoded or translated in a virtual process, the results of the process simulations, while possibly true for the UOP units for which the respective software was developed, are not necessarily to be expected in other industrial plants, where the

skilled person could have run the process. There was no evidence on file that such other industrial plants were not at disposal to the skilled person.

Consequently, the results submitted by the appellant are not adequate for invalidating the maximum limits of C6 and C7+ defined in Claim 1 of the patent in suit.

As to the design of the distillation column, the Board notes that the patent in suit does not require a particular number of trays.

- 2.2.3 In appeal proceedings against the decision of the Opposition Division to maintain a patent, the burden of proof is upon the appellant/opponent to establish on the balance of probabilities that a skilled reader of the patent, using his common general knowledge, would be unable to carry out the invention (T 182/99, OJ 1991, 391).

The appellant has not discharged his burden of proof by running process simulations since data obtained from process simulation are, in this case, not appropriate to invalidate the respondent's data resulting from tests made in another refinery (see point 2.2.2).

There was no evidence on file that the tests run by the respondent in the refinery in La Spezia had not the proper equipment (see Facts and Submissions, inventive step, paragraph 2).

Therefore, the requirements of Article 83 EPC are met.

3. *Inventive step*

- 3.1 The invention concerns a process for the gasoline production.

According to the patent in suit, the objective was to increase the production yield and the octane number while reducing the benzene quantity produced (column 1, lines 5 to 10).

- 3.2 Document (9) deals with a similar process and, *inter alia*, with the increase of the octane number:

"...the octane improvement by isomerisation will be caused by the tendency to go towards total recycling units" (right column, II.2, paragraph 2).

Therefore, document (9) is a reasonable starting point for evaluating inventive step.

- 3.3 Having regard to the comments on the data obtained by process simulation (see point 2.2.2), acceptable comparative tests were not available.

Even if the simulation data obtained by computer simulation were taken into consideration, they were not appropriate for invalidating the arguments submitted by the respondent.

The appellant's evidence (document (29), tables SPL) that the C7+ limit (not greater than 4 vol.%) would not be critical fails; the simulation tests showed only that at concentrations of 1, 2 and 4 vol.% of C7+ in the light tops, the corresponding C6 concentrations in

the heavy naphtha were either inside or outside the range of 0 to 5 vol.%.

According to the respondent the correct appraisal of the effect, while respecting the upper limits of the concentrations of C6 and C7+, depends from the total amount of feedstock to be sent through the splitting unit and through both the reformer and the isomerization unit.

The respondent had credibly shown that the end octane number increases if the concentration of the C6 in the reformer feed is lowered (at constant C7+ in the isomerization feed) (letter dated 16 June 2005, page 12, line 14 to page 13, line 2).

As already said, the appellant's data obtained from the process simulation are not appropriate (see point 2.2.2) to show that the upper limit of 4 vol.% would not be critical.

- 3.4 In absence of reliable comparative data, the problem underlying the patent in suit in the light of document (9) was to find an alternative solution, in other words to find an alternative high yield process for obtaining high-octane gasoline.

The adjusting of the concentrations in the heavy naphtha fraction and the light tops, the heavy naphtha fraction having a six carbon atoms (C6) hydrocarbons content no greater than 0.5% volume, and the light tops fraction having a seven plus carbon atoms (C7+) hydrocarbons content no greater than 4% volume proves

that this technical problem is plausibly solved by the claimed process.

3.5 The question is whether this technical solution involves an inventive step, in other words, whether there was prior art giving the skilled person a pointer to the mode of adjusting the above mentioned two concentrations.

3.6 Document (9) mentions that the reformat density increases with octane number (page 492, left column, II.4, lines 4 and 5 from the bottom) and comments on the catalyst choice and other options like replacing semi regenerative reformers by new continuous catalytic reformers (page 493, right column, II.7, lines 1 to 9); also, the increase of the initial boiling point by topping off the C6 fraction is envisaged in order to reduce the benzene precursors in the reformer feed (page 494, right column, III,4. lines 1 to 3).

It is further mentioned that the benzene content can substantially be reduced in a gasoline pool by topping off the light ends of the reformer feed and by reforming only the remaining C7+ fraction in the catalytic reformer (page 496, right column, paragraph 4, first sentence).

Document (9) however is silent on the criticality of the maximum C6 concentration in the C7+ reformer feed and of the C7+ concentration in the isomerization feed.

Documents (5), (11) and (14) are concerned with the reduction of the benzene content in gasolines (document (5), page 10, lines 3 to 4; document (11), page XVI,

left column, paragraphs 1 and 2; document (14), column 2, lines 23 to 27) but contained no pointer to the skilled person to the respective C6 and C7+ hydrocarbon contents as claimed.

None of the cited prior art documents did advocate to limit the concentration of the six carbon atoms (C6) hydrocarbons content to no greater than 0.5% volume in the heavy naphtha fraction, and the seven plus carbon atoms (C7+) hydrocarbons content to no greater than 4% volume in the light tops fraction.

3.7 Consequently, the subject-matter of Claim 1 involves an inventive step. The requirements of Article 56 EPC are met.

The dependent claims 2 to 4 derive their patentability from that of Claim 1.

4. *Rule 68(2) EPC*

4.1 Without raising explicitly an objection regarding a procedural violation, the appellant argued that the decision of the Opposition Division was not reasoned in respect of the following two arguments:

(a) A column having more than 100 trays for performing the invention process would not be realistic.

(b) The results of a simulation provided by UOP (document (27)) demonstrated that there was no increase in terms of yield and octane number.

4.2 The Board does not agree.

4.2.1 As to (a), the Opposition Division was of the opinion that the skilled person can design a fractionation column in order to obtain the desired operation; so the number of trays and the reflux ratio necessary at operating conditions could be determined.

As to (b), the Opposition Division was of the opinion that the opponent's arguments could not be accepted for proving lack of inventive step; the decision continued to say that said arguments were additional evidence confirming that isomerisation feed stocks according to the invention work correctly whereas feedstock outside the claimed range of compositions do not work at all.

4.2.2 In other words, the Opposition decision did not overlook an argument. The reasons put forward by the Opposition Division bore a direct connection to the arguments of the appellant.

The extent of substantiation is not necessarily the decisive factor for deciding whether the decision was reasoned or not.

As it was apparent upon reading the decision under appeal why the arguments presented by the opponent did not succeed, the requirements of Rule 68(2) EPC are satisfied.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

G. Rauh

P. Krasa