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D E C I S I O N
of 7 April 2005

Case Number: T 0224/01 - 3.3.1

Application Number: 93914295.6

Publication Number: 0644922

IPC: C10M 105/74

Language of the proceedings: EN

Title of invention:
Functional fluid

Patentee:
Solutia Inc.

Opponent:
EXXON MOBIL RESEARCH AND ENGINEERING COMP.,

Headword:
Hydraulic fluids/SOLUTIA

Relevant legal provisions:
EPC Art. 56
EPC R. 67

Keyword:
"Inventive step (yes) - non-obvious solution of the technical problem underlying the patent in suit - could/would approach"
"Reimbursement of the appeal fee (no) - no successful appeal to the extent requested"

Decisions cited:
-

Catchword:
-



Case Number: T 0224/01 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 7 April 2005

Appellant: EXXON MOBIL RESEARCH AND ENGINEERING COMP.,
(Opponent) P.O. Box 390
Florham Park, NJ 07932-0390 (US)

Representative: -

Respondent: Solutia Inc.
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St. Louis, MO 63166-6760 (US)

Representative: Colens, Alain
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 28 December 2000
rejecting the opposition filed against European
patent No. 0644922 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: J. M. Jonk
S. C. Perryman

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against the European patent No. 0 644 922 (European patent application No. 93 914 295.6), claim 1 after a correction allowed under Rule 88 EPC reading as follows:

"1. A fluid composition suitable for use as an aircraft hydraulic fluid, comprising:

- (a) a fire resistant phosphate ester base stock, the base stock comprising between 10% and 90% by weight of a trialkyl phosphate in which the alkyl substituents are substantially isoalkyl C₄ and C₅ and are bonded to the phosphate moiety via a primary carbon atom, between 0% and 70% by weight of a dialkyl aryl phosphate in which the alkyl substituents are as previously defined, and between 0% and 25% by weight of an alkyl diaryl phosphate in which the alkyl substituent is as previously defined;
- (b) an acid scavenger in an amount effective to neutralize phosphoric acid partial esters formed in situ by hydrolysis of any of the phosphate esters of the base stock;
- (c) an anti-erosion agent in an amount effective to inhibit flow-induced electrochemical or zeta corrosion of the flow-metering edges of hydraulic servo valves in hydraulic systems;

- (d) a viscosity index improver in an amount effective to cause the fluid composition to exhibit a viscosity of at least $3.0 \cdot 10^{-2} \text{m}^2/\text{s}$ at 99°C , at least $9.0 \cdot 10^{-2} \text{m}^2/\text{s}$ at 38°C , and less than about $4200 \cdot 10^{-2} \text{m}^2/\text{s}$ at -54°C ; and
- (e) an antioxidant in an amount effective to inhibit oxidation of fluid composition components in the presence of oxidizing agents."

II. The opposition was filed against the patent as a whole, and based on the grounds of lack of novelty and lack of inventive step (Article 100(a) EPC), lack of sufficiency (Article 100(b) EPC) and added subject-matter (Article 100(c) EPC). It was supported by several documents including:

- (1) "Synthetic Lubricants" ed. by Gunderson & Hart (1962), Chapter 4, "Phosphate esters" by R.E. Hatton,
- (2) US-A-4 206 067,
- (3) US-A-3-592 772,
- (4) US-A-3 983 046,
- (5) US-A-3 849 324,
- (6) US-A-3 487 020,
- (7) US-A-3 679 587, and
- (8) US-A-3 907 697.

III. The Opposition Division held that the requirements of Article 83 (sufficiency) and Article 123(2) EPC (added subject-matter) had been met. Moreover, it held that the subject-matter of claim 1 of the patent in suit was novel and involved an inventive step, since the cited prior art did not provide any incentive to choose

branched short-chained trialkyl phosphate esters over the preferred straight short-chained trialkyl phosphate esters in order to improve their hydrolytic stability.

IV. Oral proceedings before the Board were held on 7 April 2005.

V. During oral proceedings, the Respondent (Patentee) filed a new set of claims 1 to 28 in order to overcome objections with respect to inventive step raised by the Appellant.

The only independent claim 1 corresponded to claim 1 as granted, except that the phosphate ester base stock indicated in paragraph (a) of the claim was amended by restricting

- the amount of trialkyl phosphate to "between 50% and 72% by weight",
- the amount of dialkyl aryl phosphate to "between 18% and 35% by weight", and
- the amount of alkyl diaryl phosphate to "between 0% and 10% by weight",

and

by correcting the temperature of "-18°C" indicated in paragraph (d) to "-54°C" under Rule 88 EPC.

VI. The Appellant found that there had been a substantial procedural violation, since the decision under appeal did not comply with Rule 67 EPC in that it did not make

reference to the argument on lack of inventive step based on the closest prior art relating to the known commercial product Skydrol® LD-4.

With respect to the subject-matter of the new claim 1, he acknowledged that it met the requirements of Article 54 EPC (novelty), Article 83 EPC (sufficiency) and Article 123(2) EPC (added subject-matter).

Concerning inventive step, he argued by referring to document

- (11) "Hydrolysis of Phosphate-Based Aviation Hydraulic Fluids", Okazaki M.E. et al, in Technische Akademie Esslingen 8th International "Tribology 2000" Colloquim January 14-16, 1992 Proceedings, pages 19.4-1 to 19.4-10,

referred to by the Respondent during the opposition proceedings in support of his submission that hydrolysis occurred much faster at a temperature of about 150°C than at a temperature of about 125°C, that the problem underlying the patent in suit in the light of the closest prior art represented by the commercial product Skydrol® LD-4, namely, that of insufficient hydrolytic stability of aviation fluids, was a rather recent one at the time of the priority date of the present patent because of the development of higher performance aircraft being operated under conditions which expose hydraulic fluids to increasing temperatures of up to about 150°C. The solution of this problem by replacing n-butyl in the phosphates of the phosphate ester base stock of Skydrol® LD-4 by isobutyl according to present claim 1 of the patent in suit was,

however, obvious to the skilled person, since documents (2) to (8) taught that isobutyl was a useful alternative for n-butyl and because document (1) specifically taught that an n-alkyl phosphate isomer was less hydrolytically stable than its branched chain isomer and that viscosity problems would arise if the size of the alkyl group was increased.

VII. The Respondent disputed that the composition of present claim 1 lacked inventive step. He essentially argued that the cited state of the art did not provide any incentive to the skilled person that the technical problem underlying the patent in suit could be solved by replacing n-butyl in the phosphates of the phosphate ester base stock of Skydrol[®] LD-4 by isobutyl. In this context, he emphasised that document (1) rather suggested that the hydrolytic stability of the phosphates could be improved by the use of longer branched chain alkyl substituents.

VIII. The Appellant requested that the decision under appeal be set aside, that the patent be revoked, and that the appeal fee be reimbursed.

The Respondent requested that the patent be maintained on the basis of claims 1 to 28 submitted at oral proceedings on 7 April 2005.

IX. At the conclusion of the oral proceedings the Board's decision was pronounced.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments (Article 123(2) and (3) EPC)*
 - 2.1 Present claim 1 results from combining the subject-matter of claims 1, 16 and 17 as granted. Moreover, its subject-matter is also a combination of the subject-matter of claims 1, 17 and 18 of the patent application as filed. Furthermore, the correction under Rule 88 EPC of the temperature of "-18°C" to "-54°C" in paragraph (d) of the claim is allowable, since it concerns an obviously wrong conversion of "-65°F" to the corresponding temperature in °C (see page 3, line 25, of the patent and claim 1 of the application as filed).

Claims 2 to 14 correspond to claims 2 to 14 of both the patent in suit and the application as filed.

Claim 15 is supported by claim 17 of the patent in suit and claim 18 of the application as filed.

Claims 16 to 27 are based on claims 23 to 34 of the present patent and on claims 24 to 35 of the application as filed.

Claim 28 finds its support in the combination of claims 35 and 37 of the patent in suit and on claims 36 and 38 of the application as filed.

2.2 Therefore, the Board finds that the subject-matter of the present claims meets the requirements of Article 123(2) and (3) EPC.

3. *Novelty (Article 54(2) EPC) and sufficiency (Article 83 EPC)*

The Board has no objections concerning novelty and sufficiency. Since the Respondent did not maintain his objections in these respects, the Board sees no need to consider these matters in more detail.

4. *Inventive step*

4.1 For deciding whether subject-matter claimed involves an inventive step, the Boards of Appeal consistently apply the problem and solution approach, which essentially consists in identifying the closest prior art, determining in the light thereof the technical problem which the claimed invention addresses and successfully solves, and examining whether or not the claimed solution to this problem is obvious for the skilled person in view of the state of the art.

4.2 The Board considers, in agreement with the parties to the proceedings, that the closest state of the art with respect to the claimed subject-matter of the patent in suit is the known commercial product Skydrol® LD-4 described in the patent in suit.

This product contains 50 to 60% by weight tri(n-butyl) phosphate, 30 to 35% by weight di(n-butyl) phenyl phosphate, 5 to 10% by weight viscosity improvers, 0.13 to 1% by weight of a diphenyldithioethane copper

corrosion inhibitor, 0.005 to about 1% by weight of a perfluoroalkylsulfonic acid salt anti-erosion agent, 4 to 8% by weight of an acid scavenger and about 1% by weight of 2,6-di-tertiary-butyl-p-cresol as an antioxidant (see patent page 2, lines 40 to 45). Moreover, both parties to the proceedings agreed that this hygroscopic composition inevitably contains some water.

4.3 Starting from this closest state of the art, the Board considers, in agreement with the parties to the proceedings, that the technical problem underlying the patent in suit consists in providing a phosphate ester based functional fluid useful as aircraft hydraulic fluid having an improved hydrolytic stability, especially at higher temperatures (see also page 2, lines 45 and 46, and page 3, lines 3 to 5, of the patent as granted).

4.4 According to claim 1 of the patent in suit this technical problem is essentially solved by providing a composition, comprising a phosphate ester base stock, which comprises a trialkyl phosphate and a dialkyl aryl phosphate and optionally alkyl diaryl phosphate, in which the alkyl substituents are substantially isoalkyl C₄ and C₅ and are bonded to the phosphate moiety via a primary carbon atom.

In this context, the Board notes that in view of the patent as a whole the expression "substantially isoalkyl C₄ and C₅" must be interpreted as "substantially isoalkyl C₄ and/or C₅" (see e.g. page 4, lines 11 and 12, of the patent in suit).

Furthermore, having regard to the test-report submitted by the Respondent on 2 September 1999 and in particular Table 12 showing that in comparison with Skydrol® LD-4 the hydrolytic stability of compositions comprising a phosphate ester base stock mainly consisting of tri-isobutyl phosphate ester is improved, the Board considers it plausible that the technical problem as defined above has been successfully solved within the whole area claimed. This has not been disputed by the Appellant.

- 4.5 The question now is whether or not the proposed solution of the technical problem underlying the patent in suit is obvious in the light of the cited state of the art.
- 4.6 In challenging the inventive step of the functional fluid as claimed, the Appellant essentially contended that the replacement of n-butyl by isobutyl in the phosphate esters of the Skydrol® LD-4 base stock to improve the hydrolytic stability of the fluid was obvious to the skilled person in the light of document (1), since this document specifically taught that an n-alkyl phosphate isomer was less hydrolytically stable than its branched chain isomer, and because it was well known that isobutyl was a useful alternative to n-butyl as followed from the cited documents (2) to (8).
- 4.7 Document (1) relates to phosphate esters, particularly tertiary phosphate esters, and their use in the field of lubricants and hydraulic fluids such as those meeting the requirements of aircraft hydraulic systems (see page 130, line 8 to page 131, line 8).

4.7.1 Concerning the hydrolytic stability of the phosphate esters it firstly teaches that the hydrolytic stability is very dependent upon the structure and the molecular weight of the phosphate esters (see page 121, second paragraph under "Hydrolytic Stability").

4.7.2 Furthermore, it discloses in this respect on the basis of test results summarised in Table 4.13 on page 122 that several conclusions may be drawn concerning the effect of the structure of alkyl diaryl phosphates, namely:

- that, in general, an increase in the molecular weight of the alkyl group increases the resistance to hydrolysis;
- that the alkyl ditolyl phosphates are more hydrolytically stable than the corresponding alkyl diphenyl phosphates,
- that in a series of isomeric alkyl diaryl phosphates the n-alkyl isomer is less hydrolytically stable than the branched-chain isomer, and that the maximum resistance to hydrolyses was found in the ester where the alkyl part of the molecule had both hydrogen atoms on the number two carbon replaced by methyl groups (see page 121, fourth paragraph under "Hydrolytic Stability").

4.7.3 However, these conclusions only apply to the class of alkyl diaryl phosphates, so that the skilled person having regard to the facts that said prior art Skydrol® LD-4 product does not comprise an alkyl diaryl phosphate and that the hydrolytic stability of

phosphate esters is very dependent upon their structure and the molecular weight (see under point 3.7.1 above), would not have any reason to take the technical teaching of the conclusions in document (1) into consideration.

In this context the Board observes that even if the skilled person would consider that the conclusions could be applicable to the classes of trialkyl phosphates and dialkyl aryl phosphates, the findings indicated therein with respect to the effect of the molecular weight of the alkyl group and that of a two-fold substitution on its number two carbon (see point 4.7.2 above) would rather point away from a modification of Skydrol® LD-4 by a simple replacement of n-butyl in tri(n-butyl) phosphate and in di(n-butyl) phosphate by isobutyl to improve its hydrolytic stability.

- 4.7.4 Document (1) also contains the statement that the alkyl aryl phosphates are slightly less hydrolytically stable than the trialkyl and triaryl esters, although, as can be seen from Table 4.13, individual members have stabilities equivalent to both comparative classes (see page 121, fifth paragraph under "Hydrolytic Stability"). Said Table 4.13 discloses test-results with tri(n-butyl) phosphate, tri(2-ethylhexyl) phosphate and tritolyl phosphate showing that tri(2-ethylhexyl) phosphate and tritolyl phosphate have a twenty-fold and a tree-fold better hydrolytic stability than tri(n-butyl) phosphate, respectively. Of course, these test-results as such, in particular having regard to said teaching in document (1) that the hydrolytic stability of phosphate esters is very dependent upon the structure and the molecular

weight of the phosphate esters (see point 3.7.1 above), do not provide an incentive to the skilled person to the claimed solution of the problem underlying the patent in suit involving a replacement of n-butyl by isobutyl in the tri(n-butyl) phosphate and di(n-butyl) phosphate components of the Skydrol® LD-4 product.

4.8 It is true, that according to documents (2) to (8) phosphate ester base stocks for use in aircraft hydraulic fluids comprising trialkyl phosphates and possibly dialkyl aryl phosphates and triaryl phosphates may contain isobutyl selected from lists of numerous other suitable alkyl substituents including the normally preferred n-alkyl group. However, none of these documents addresses the technical problem underlying the patent in suit and, consequently do not give a pointer to its solution either.

4.9 In this situation, the Board observes that, according to the established jurisprudence of the Boards of Appeal for assessing inventive step, the decisive question is not whether the skilled person **could** have arrived at the claimed invention, but whether he **would** have done so with the reasonable expectation of arriving at the claimed solution **of the technical problem underlying the patent in suit to be solved**. However, as indicated above, the skilled person, when trying to solve this technical problem, would not have any reason to replace n-butyl by isobutyl in the tri(n-butyl) phosphate and di(n-butyl) phosphate compounds of the Skydrol® LD-4 product in order to achieve an improved hydrolytic stability.

4.10 In conclusion, the subject-matter of present claim 1, and by the same token, that of the dependent claims 2 to 28, involves an inventive step within the meaning of Articles 52(1) and 56 EPC.

5. *Reimbursement of the appeal fee*

5.1 According to Rule 67 EPC, reimbursement of the appeal fee shall be ordered where the Board of Appeal deems an appeal to be allowable and if such reimbursement is equitable by reason of a substantial procedural violation.

5.2 In the present case, the appellant has not been successful on appeal to the extent requested. Thus, already for this reason the reimbursement of the appeal fee has to be refused.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of claims 1 to 28 of the main request submitted at oral proceedings on 7 April 2005 and a description yet to be adapted thereto.
3. The request for reimbursement of the appeal fee is refused.

The Registrar:

The Chairman:

N. Maslin

A. Nuss