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Datasheet for the decision of 3 February 2021

Case Number: T 2521/19 - 3.3.10

Application Number: 14869106.6

Publication Number: 3081549

IPC: C07C43/23, C10M105/54, C10M107/38, G11B5/725, G11B5/84, C10N30/08, C10N40/18

Language of the proceedings: EN

Title of invention:
FLUOROPOLYETHER COMPOUND, AND LUBRICANT AND MAGNETIC DISC COMPRISING SAME

Applicant:
Moresco Corporation

Headword:
FLUOROPOLYETHER COMPOUNd/MORESCO

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 2521/19 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 3 February 2021

Appellant: (Applicant)	Moresco Corporation 5-3 Minatojimaminami-machi 5-Chome Chuo-ku Kobe-shi, Hyogo 650-0047 (JP)
Representative:	Winter, Brandl, Fürniss, Hübner, Röss, Kaiser, Polte - Partnerschaft mbB Patent- und Rechtsanwaltskanzlei Alois-Steinecker-Straße 22 85354 Freising (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 26 April 2019 refusing European patent application No. 14869106.6 pursuant to Article 97(2) EPC.**

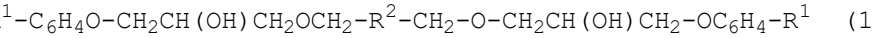
Composition of the Board:

Chairman	P. Gryczka
Members:	J.-C. Schmid
	W. Van der Eijk

Summary of Facts and Submissions

I. The appeal lies from the decision of the Examining Division refusing European patent application No. 14 869 106.6 on the basis of the claims filed on 15.02.2017, of which independent claim 1 reads as follows:

"1. A compound of the formula (1)



(1)

wherein R^1 is alkoxyl having 1 to 4 carbon atoms, amino or amido, R^2 is $-CF_2CF_2O(CF_2CF_2CF_2O)_zCF_2CF_2-$ or $-F_2CF_2CF_2O(CF_2CF_2CF_2CF_2O)_nCF_2CF_2CF_2-$, z is a real number of 1 to 15, n is a real number of 0 to 4."

Inter alia the following documents were cited in the examination proceedings:

(1) JP-A-2013-163667,
(2) JP-A-2013-18961, and
(3) P. H. KASAI el al.: "Disk lubricants for spontaneous adsorption and grafting to carbon overcoat by UV irradiation" Tribology Letters, vol. 38(3), pages 241-251, 2010.

II. In the communications dated 20 November 2018, 30 May 2018 and 4 January 2018, the examining division indicated that claim 1 did not meet the requirements of Article 56 EPC. According to the examining division, document (1) represented the closest prior art to the invention. This document disclosed fluoropolyether compounds for use as lubricants for magnetic recording

media. The claimed fluoropolyether compounds differed from those disclosed in examples 5 or 6 of document (1) only in that they were terminated on both sides with an alkoxy- substituted phenyl group. The technical problem to be solved by the invention was to increase the bonding strength to the magnetic disk and to decrease the rate of decomposition of the fluoropolyethers to Al_2O_3. Documents (2) and (3) revealed that alkoxyphenyl end groups led to an increase in binding strength and a decrease in the rate of decomposition to Al_2O_3 (see document (2); paragraphs 35, 48, 63, table 1, claims 1-6, and document (3); page 241, left-hand column, lines 12-19; page 243, compound Z-SA2; page 245, left-hand column, lines 5-8; page 248, paragraph 3.5). Therefore, the skilled person by combining document (1) with the teaching of document (2) or document (3) would have arrived at the compounds of claim 1. The claimed subject-matter therefore did not involve an inventive step (Article 56 EPC).

III. With a letter dated 8 April 2019 the applicant (appellant) requested a decision according to the state of the file. The application was therefore refused (Article 97(2) EPC).

IV. According to the appellant, document (1) was the closest prior art to the invention. This document aimed at reducing bulk of molecules while maintaining excellent resistance to decomposition similar to that of phosphazene compounds (paragraph [0009]). The compounds of document (1) had a fluoropolyether backbone comprising a phenoxy group at one end of the molecule. The claimed compounds differed from compounds 5 and 6 of document (1) only in that they had alkoxy-phenoxy groups at both ends of the molecule. The effect of this difference was that the compounds of the

present application showed considerably improved decomposition resistance to Al_2O_3 while the bonding strength was still excellent. The problem to be solved in view of document (1) was therefore the provision of compounds with improved decomposition resistance to Al2O3 combined with excellent bonding strength.

The data of Table A enclosed with the grounds appeal clearly demonstrated that the compounds of the present invention had a higher decomposition resistance than the compounds of document (1), while the bonding strength was at least maintained or even better. The Examining Division did not raise objections to the fact that this problem was solved by the presence of the additional terminal alkoxy-phenoxy group.

Document (2) disclosed fluoropolyether compounds of the formula C_6H_4-(O-Z-R-X)$_2$ wherein R represents a fluoropolyether chain and X represents the terminal groups optionally substituted with a p-methoxy-phenoxy group. The essential feature of the compounds of document (2) was the central phenylene group in the fluoropolyether molecule. Compound 4 of document (2) was the only compound having a p-methoxy-phenoxy group at both ends of the molecule. Compounds 2, 3 and 6 did not have p-methoxy-phenoxy groups at the ends of the molecule, but nevertheless showed a similar decomposition rate as compound 4 (see table 1 of document (2)). Accordingly, the person skilled in the art would not have attributed the effect of an improved decomposition resistance to the terminal methoxy-phenoxy groups. Furthermore, document (2) was silent on the bonding strength. Compound 4 of document (2) has a bonding strength lower than that of the compounds of the invention (see table A). Thus, the skilled person, starting from compounds 5 and 6 of document (1) would

not have combined selected structural moieties of the compounds of documents (1) and (2) to arrive at compounds having improved decomposition rate.

Document (3) was concerned with disk lubricants for spontaneous adsorption and grafting to a carbon overcoat by UV irradiation. This document disclosed that the interaction of PFPE lubricants with the carbon overcoat was the strongest when the lubricants had p-methoxy-phenoxy end groups.

Compound Z-SA2 of document (3) corresponded to lubricant 4 in Table 1 of the present application. This compound had a p-methoxy-phenoxy group at both ends of the molecule. The perfluoropolyether chain of this lubricant was based on the Fomblin Z backbone having the structure $-(CF_2CF_2O)_m(CF_2O)_n-$. The claimed compounds had better decomposition resistance and bonding strength than Z-SA2 of document (3).

Therefore the person skilled in the art would not have combined document (1) with document (3) to arrive at the claimed compounds.

The subject-matter of claim 1 of the main request therefore involved an inventive step.

V. The appellant requested that the decision of the Examining Division be set aside and that a patent be granted on the basis of claims 1 to 8 as filed with the letter dated 15 February 2017.

Reasons for the Decision

1. The appeal is admissible.

Inventive step

2. *Closest prior art*

The examining division considered document (1) as the closest prior art to the invention. This is not disputed by the appellant. This document relates to fluoropolyethers and their use as a lubricant for magnetic disks. The fluoropolyether compounds disclosed in this document have the formula R^1-C_6H_4O-$CH_2CH(OH)CH_2OCH_2$-R^2-CH_2-O-R^3 wherein R^1 is hydrogen, alkoxy having 1 to 4 carbon atoms, amino or amido, R^2 is $-CF_2O(CF_2CF_2O)_x(CF_2O)_yCF_2-$, $-CF_2CF_2O(CF_2CF_2CF_2O)_z-CF_2CF_2-$ or $-CF_2CF_2CF_2O(CF_2CF_2CF_2CF_2O)_nCF_2CF_2CF_2-$, x and y are each an integer of 0 to 15, z is an integer of 1 to 15, n is an integer of 0 to 4, R^3 is $-CH_2CH(OH)CH_2OH$, $-CH2CH(OH)CH_2OCH_2CH(OH)CH_2OH$ or $-(CH_2)_mOH$, m is an integer of 2 to 6.

The fluoropolyether compounds of document (1) thus comprise a substituted phenoxy group at only one end of the molecule.

3. *Technical problem*

According to the appellant, the technical problem to be solved by the invention was the provision of lubricants having improving decomposition resistance to Al_2O_3 while maintaining excellent bonding strength to the surface of the disk.

4. *Solution*

The proposed solution are the compounds of claim 1 characterized in that they are substituted at both ends with a R^1 substituted phenoxy group.

5. *Success*

It has not been contested by the examining division that this problem was solved by the claimed compounds. The Board is also satisfied that the technical problem is solved by the compounds of claim 1 in view of the results shown in table A on page 3 of the appellant's letter dated 4 September 2019.

6. *Obviousness*

It remains thus to be decided whether or not the proposed solution is obvious in view of the cited prior art, i.e. whether it is obvious to modify compound 5 or compound 6 of document (1) by derivatising the second end of these compounds with a R^1-substituted phenoxy group in order to improve its decomposition resistance to Al_2O_3

According to the examining division, the proposed solution was obvious in the light of either document (2) or (3).

6.1 Document (2) is concerned with improving decomposition resistance of fluoropolyether lubricants. This document teaches that resistance to Al_2O_3 is improved by compounds having a phenylene group in the perfluoropolyether backbone and hydroxyl groups at the ends of the molecule (see paragraph [0012], claim 1).

6.1.1 The examining division referring to paragraphs 35, 48, 63, table 1 and claims 1-6 stated that document (2)

disclosed that alkoxy-phenyl end groups resulted in increasing bonding strength and decreased the decomposition rate to Al_2O_3.

6.1.2 Paragraph [0035] of document (2) discloses that heat processing and ultraviolet treatment promote adsorption of the lubrication agent. Paragraph [0048] of document (2) discloses the preparation of compound 4, which is a perfluoropolyether derivatised with a p-methoxyphenoxy group at both ends of the molecule. Paragraph [0063] of document (2) reveals how the compounds are evaluated for their decomposition resistance to Al_2O_3.

Table 1 of document (2) gives the results of the decomposition resistance and mono-layer thickness measurements for the compounds 1 to 8 and comparative compound 9 and 10 (see paragraph [0071]).

According to paragraph [0070] of document (2), these results show that perfluoropolyether compounds comprising an aromatic group and having hydroxy groups at the end of the molecule have higher decomposition resistance and a smaller mono-layer thickness than compound 9 having a hydroxyl at the end of the molecule or compound 10 having hydroxyl groups in the middle and at the ends of the molecule.

Claim 1 of document (2) discloses compounds of having the formula C_6H_4-(O-Z-R-X)$_2$ (1),
wherein Z is $-CH_2CH_2O-$ or $-CH_2CH(OH)CH_2O-$,
R is -CH2CF2CF2CF2O$(CF_2CF_2CF_2CF_2O)_nCF_2CF_2CF_2CH_2-$ and n is a real number of 0-20, and X is -OH, -O$(CH_2)_m$OH, $-OCH_2CH(OH)CH_2OH$,$-OCH_2CH(OH)CH_2O-C_6H_5$, $-OCH_2CH(OH)CH_2O-C_6H_4-OCH_3$ and m are the integers of 1-6.

All terminal groups represented by X in the compound of formula (1) are disclosed to be equivalent. Furthermore table 1 of document (2) shows that compound 4 which is a compound of formula (1) wherein X is -$OCH_2CH(OH)CH_2O$-C_6H_4-OCH_3 has similar decomposition resistance to Al_2O_3 than compound 2 which is a compound of formula (1) wherein X is -$OCH_2CH(OH)CH_2OH$ (glyceryl).

6.1.3 Therefore document (2) does not disclose that alkoxy-phenyl end groups decrease the decomposition rate to Al_2O_3. Hence, the skilled person would not have found in document (2) the solution of derivatizing the glyceryl ending moiety of the compounds (5) or (6) of document (1) with an alkoxyphenoxy moiety in order to improve their resistance to decomposition.

6.2 Document (3) relates to the bonding strength of fluoropolyether lubricants on carbon surfaces.

The examining division referring to page 241, left-hand column, lines 12-19; page 243, compound Z-SA2; page 245, left-hand column, lines 5-8; page 248, paragraph 3.5 also stated that document (3) disclosed that alkoxy-phenyl end groups resulted in increasing bonding strength and decreased the decomposition rate to Al_2O_3.

Compound Z-SA2 is the compound having the formula $CH_3OC_6H_4OCH2CH(OH)CH_2OCH_2CF_2O$-$(CF_2CF_2O)_m(CF_2O)_n$-$CF_2CH_2OCH_2CH(OH)CH_2OC_6H_4OCH_3$ (see page 243). It has methoxyphenoxy groups at both ends of the molecule.

The section of page 241, left-hand column, lines 12-19 of document (3) teaches that PFPE lubricants possessing a phenoxy end-group, in particular a p-methoxyphenoxy end-group, adhere to the carbon overcoat more strongly

than PFTE lubricants possessing a phenyl end-group. Notwithstanding that compounds 5 and 6 of document (1) already possess a p-methoxyphenoxy end-group, this section is solely concerned with the bonding to the carbon overcoat and not with the decomposition resistance to Al_2O_3.

The sections on page 245, left-hand column, lines 5-8; and paragraph 3.5 on page 48 of document (3) are concerned with the resistance against catalytic degradation. It is explained that PFPE having R-O-CF_2-O-CF_2-R moiety has a propensity to undergo intramolecular disproportionation reaction with a Lewis acid and can be stabilized by an electron-donating group.

However, contrary to compound Z-SA2 of document (3), the claimed compounds and compounds 5 and 6 of document (1) do not possess any R-O-CF_2-O-CF_2-R moiety and therefore are not subjected to the disproportionation reaction as mentioned in these sections. Therefore, the skilled person wishing to improve resistance against catalytic degradation of compounds 5 and 6 of document (1) would not consider these sections of document (3) which relates to the stabilisation of PTFE lubricants having a R-O-CF_2-O-CF_2-R moiety when looking for a solution.

6.3 To summarise, document (1), in combination with document (2) or (3), does not render the subject-matter of claim 1 obvious. For these reasons, the Board concludes that the subject-matter of claim 1, and by the same token that of dependent claims 2 to 4 involves an inventive step.

Claims 5 to 8

7. Claim 5 is directed to a lubricant containing a compound of formula (1) and claim 7 is directed to a magnetic disk comprising at least a recording layer and a protective layer formed over a substrate, and a lubricating layer formed over the resulting surface, the lubricating layer containing a compound of formula (1).

As indicated above, the skilled person would not have arrived at the compounds of formula (1) in order to increase the decomposition resistance to Al_2O_3. Accordingly, the subject-matter of claim 5 and 7 and for the same reason that of dependent claims 6 and 8 involves an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with order to grant a patent in the following version:

Description:

Pages 1-14 filed with the letter of 15.02.2017

Claims:

No. 1-8 filed with the letter of 15.02.2017

Drawings:

Sheet 1/1 as filed with entry into the regional phase before the EPO

The Registrar: The Chairman:

C. Rodríguez Rodríguez P. Gryczka

Decision electronically authenticated