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17

Aktenzeichen / Case Number / N<sup>o</sup> du recours : T 44/84

Anmeldenummer / Filing No / N<sup>o</sup> de la demande : 80 100 672.7

Veröffentlichungs-Nr. / Publication No / N<sup>o</sup> de la publication : 014 930

Bezeichnung der Erfindung: Fluorine-containing polymer and composition  
Title of invention: containing same.  
Titre de l'invention :

Klassifikation / Classification / Classement : C 08 F 214/18

**ENTSCHEIDUNG / DECISION**

vom / of / du 21 October 1986

Anmelder / Applicant / Demandeur : Daikin Kogyo

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPO / EPC / CBE Art. 56 EPC

Kennwort / Keyword / Mot clé :

"Inventive Step - remote state of the art"

**Leitsatz / Headnote / Sommaire**



Case Number : T 44 /84

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.1  
of 21 October 1986

**Appellant :** Daikin Kogyo Co. Ltd.  
No. 1-12-39, Umeda  
Kita-Ku, Osaka-shi, Osaka-Fu  
Japan

**Representative :** von Kreisler, Alek  
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**Decision under appeal :** Decision of Examining Division 011 of the European Patent Office dated 13.07.1983 refusing European patent application No. 80 100 672.7 pursuant to Article 97(1) EPC

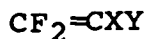
**Composition of the Board :**

**Chairman :** F. Antony  
**Member :** J. Arbouw  
**Member :** R. Schulte

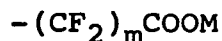
### Summary of Facts and Submissions

- I. European Patent Application No. 80 100 672.7 filed on 11 February 1980 and published on 3 September 1980 under publication No. 0 014 930, claiming Japanese priority of 14 February 1979, was refused by a decision of the Examining Division dated 13 July 1983 on the basis of 12 claims submitted 3 February 1983, of which Claim 1 had the following wording:

"A fluorine-containing cross-linkable polymer comprising (A) units derived from at least one of fluorine-containing olefins of the formula:



wherein X is a hydrogen atom or a fluorine atom and Y is a hydrogen atom, a chlorine atom, a fluorine atom, a trifluoromethyl group, a difluoromethyl group, a C<sub>1</sub>-C<sub>3</sub> perfluoroalkoxy group or a group of the formula:



wherein m is an integer of 0 to 3 and M is a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl group, a sodium atom or a potassium atom but when X is a hydrogen atom, Y is always a hydrogen atom, (B) units derived from one or more of C<sub>4</sub>-C<sub>8</sub> fluorine-containing dienes, (C) at least one iodine atom and (D) at least one saturated or unsaturated fluoro or chlorofluorohydrocarbon group, wherein the iodine atom(s) (C) and the group (D) are derived from a single compound in which one or more iodine atoms are bonded to the group (D), the molar ratio of the unit (B) and the unit (A) being from 1 x 10<sup>-4</sup> to 5 x 10<sup>-2</sup>, the iodine atom(s) (C) being from 0.001 to 10% by weight

based on the weight of the polymer and the molar ratio of the group (D) and the unit (A) being from  $1 \times 10^{-5}$  to  $5 \times 10^{-2}$ , wherein the polymer contains 60 to 85% by weight of an insoluble portion in dimethylacetamide at 25°C."

II. The application was rejected on the ground that the invention claimed therein lacked an inventive step with regard to

(1) DE-A-1 495 205.

According to the impugned decision (1) describes the preparation of fluorine-containing polymers by polymerization of a perfluoroolefin and a perfluorinated diene in the presence of an iodoperfluoroalkane. Although some of the properties of the fluoropolymers are described differently in (1) and in the application, the arguments for an inventive step supported by such differences were not accepted. Particularly the arguments dealing with the differences between "branching" and "cross-linking" were not held convincing, because a side-chain containing a double bond is necessarily suitable for cross-linking reactions.

III. On 10 September 1983 the Appellant lodged an appeal against the decision of 13 July 1983, with payment of the prescribed fee.

In the Statement of Grounds submitted on 3 November 1983 it was pointed out that document (1) deals with non-cross-linkable waxes, i.e. plastic polymers, whereas the polymers according to the application are cross-linkable elastomers. The starting materials of (1) are iodoperfluoroalkanes whereas the application in suit uses unsaturated iodo-substituted fluoro- or chlorofluorohydrocarbons as compound

C-D. Further, for better definition of the claimed products, the polymerization conditions have been included in the new claims. These conditions are totally different from those of (1).

Therefore the man skilled in the art reading (1) does not get any suggestion to prepare cross-linkable elastic fluorine-containing polymers.

IV. During oral proceedings held on 21 October 1986, the Appellant reiterated his above arguments and pointed out that the technical problem with respect to the state of the art has been to provide improved fluoroelastomers which can be stored in powder form and vulcanized under normal pressure, without foaming. It was further argued that starting from document (1), the following modifications must be made to obtain the product according to the application:

(a) polymerization at temperatures of  $-20^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  instead of at least  $200^{\circ}\text{C}$ ;

(b) the use of iodofluoroalkenes instead of iodofluoroalkanes; and

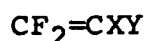
(c) the essential use of  $\text{C}_4\text{-C}_8$  fluorinated dienes whereas (1) only discloses an optional use of such dienes.

V. The appellant requests that the decision refusing the European patent application be set aside and the patent be granted on the basis of Claims 1 to 12 submitted during oral proceedings.

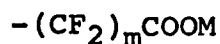
The present Claims 1 and 9 read as follows:

"1. A fluorine-containing cross-linkable elastic polymer comprising

(A) units derived from at least one of fluorine-containing olefins of the formula



wherein X is a hydrogen atom or a fluorine atom and Y is a hydrogen atom, a chlorine atom, a fluorine atom, a tri-fluoromethyl group, a difluoromethyl group, a C<sub>1</sub>-C<sub>3</sub> perfluoroalkoxy group or a group of the formula:



wherein m is an integer of 0 to 3 and M is a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> alkyl group, a sodium atom or a potassium atom or an NH<sub>4</sub>-group but when X is a hydrogen atom, Y is always a hydrogen atom,

(B) units derived from one or more of C<sub>4</sub>-C<sub>8</sub> fluorine-containing dienes,

(C) at least one iodine atom, and

(D) at least one unsaturated fluoro or chloro fluorohydrocarbon group wherein the iodine atom(s) (C) and the group (D) are derived from a single compound in which one or more iodine atoms are bonded to the group (D),

the molar ratio of the unit (B) and the unit (A) being from  $1 \times 10^{-4}$  to  $5 \times 10^{-2}$ , the iodine atom(s) (C) being from 0.001 to 10% by weight based on the weight of the polymer and the molar ratio of the group (D) and the unit (A) being from  $1 \times 10^{-5}$  to  $5 \times 10^{-2}$ ,

and wherein the polymer contains 60 to 85% by weight of a portion insoluble in dimethylacetamide at 25°C, and

whereby said fluorine-containing cross-linkable elastomer is obtainable by subjecting the fluorine-containing olefin from which (A) is derived and the fluorine containing diene from which (B) is derived to solution, suspension or emulsion polymerization in the presence of a radical producing source selected from light, inorganic and organic peroxides, azo compounds, organometallic compounds, and metals, and in the presence of the iodine compound (C) (D) at temperatures of -20 to 150°C.

9. A cross-linkable composition which comprises the fluorine-containing elastic polymer of any one of Claims 1-8 and at least one cross-linking agent selected from the group consisting of organic peroxide, polyamines, polyhydroxyl compounds and alkaline metal salts thereof and polythiol compounds and alkaline metal salts thereof the weight ratio of the cross-linking agent and the elastic polymer being from 0.2 : 100 to 10 : 100."

#### Reasons for the Decision

1. The appeal is in accordance with Articles 106-108 and Rule 64 EPC; it is therefore admissible.
2. There is no objection to the present claim on formal grounds since it is adequately supported by the specification as originally filed. The claim results essentially from a combination of the features of original Claims 1 and 6; page 1, lines 8 to 9; page 2, lines 21 to 25; page 6, line 22, to page 7, line 15; and page 15, line 12.
3. Document (1) represents the only relevant cited art. This

document discloses fluorine-containing polymers which are obtained, inter alia, by polymerizing perfluoroolefins in the presence of iodineperfluoroalkanes and optionally  $\alpha,\omega$ -perfluorodienes (cf. Claim 1).

The polymers according to (1) are plastic polymers (softening point 120°C-200°C, cf. page 1, last paragraph) and can be used as lubricants and as impregnating compounds for reducing the blocking-resistance and improving the antiadhesive properties of the substrates (cf. page 3, last paragraph and page 4).

4. The technical problem underlying the invention with respect to (1) is to provide elastomeric fluorine-containing polymers which can be vulcanised under atmospheric pressure without foaming.

To solve this problem, the application proposes polymers comprising

- (i) units (A) derived from fluorine-containing olefins essentially corresponding to those of (1);
- (ii) units (B) derived from fluorine-containing dienes essentially corresponding to the optional  $\alpha,\omega$ -perfluorodienes of (1);
- (iii) iodine atoms (C) and unsaturated fluoro- or chlorofluorohydrocarbon groups (D), said (C) and (D) originating from a corresponding compound C-D in whose presence the polymerization is performed;
- (iv) said (A), (B), (C) and (D) constituents being present in certain proportions defined in Claim 1;

(v) the polymer having the solubility characteristics specified in Claim 1.

The polymer can be obtained by polymerization in a temperature range from -20 to 150°C.

5. That the so-defined polymer does indeed solve the above-stated problem is credible in view of the examples (see particularly Table 1 on page 17).
6. A polymer so defined is not disclosed in the publications before the Board. The Examining Division had already stated (page 2, last three lines of impugned decision) that above feature (v) made the then prevailing Claim 1 novel. The same applies also to at least feature (iii) of the present Claim 1. Therefore, the application in suit is novel.
7. It is therefore to be examined whether the subject-matter of the application involves an inventive step.
  - 7.1 As independent Claim 9 is based on the same inventive concept as Claim 1, both claims can be jointly analyzed.
  - 7.2 Document (1) discloses plastic fluorinated polyolefin waxes with softening points from 120-200°C (page 1, last paragraph) which can be used as lubricants, antiblocking agents and impregnating agents (page 3, last paragraph, and page 4), and a method for their manufacture by polymerization of fluoroolefins - optionally together with  $\alpha,\omega$ -fluorodienes - in the presence of iodine compounds such as *inter alia* (saturated) iodoperfluoroalkanes (Claim 1).
  - 7.3 As against this, the products of the application-in-suit are totally different; they are elastomers which are cross-linkable under atmospheric pressure without foaming.

Document (1) does neither disclose, nor does it in the least suggest that such elastomers can be obtained by copolymerization of fluoroolefins and C<sub>4</sub>-C<sub>8</sub> fluorodienes in the presence of unsaturated iodofluoro- or iodochlorofluoro-hydrocarbons in the ratios given in Claim 1. In fact, (1) does not suggest any influence whatsoever of the choice of a particular group of iodine compounds on the properties of the polymer products; even less renders it obvious the very solution proposal claimed.

Thus the subject-matters of Claims 1 and 9 involve an inventive step, when compared with the cited prior art.

8. Claims 2 to 8 and 10 to 12 concern particular embodiments of the subject-matter of Claim 1 and 9 respectively, and are thus supported by the patentability of those claims.

#### Order

**For these reasons**

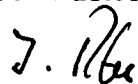
**it is decided that:**

1. The impugned decision is set aside.

2. The case is remitted to the first instance to grant a patent on the basis of Claims 1 - 12 as filed during oral proceedings and a description to be adapted.

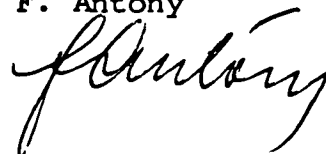
The Registrar

J. Rückerl



The Chairman

F. Antony



Schmidt 28.11.



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