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D E C I S I O N
of 11 May 2004

Case Number: T 0131/02 - 3.3.5

Application Number: 91901462.1

Publication Number: 0570367

IPC: A62C 2/00

Language of the proceedings: EN

Title of invention:

Fire extinguishing composition and process

Applicant:

E.I. DU PONT DE NEMOURS AND COMPANY

Opponent:

SOLVAY SOLEXIS S.p.A.

Headword:

Fire protection/DU PONT

Relevant legal provisions:

EPC Art. 54(1), 56

Keyword:

"Novelty - yes, no implicit disclosure"
"Inventive step - yes, non-obvious improvement"

Decisions cited:

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Catchword:

-



Case Number: T 0131/02 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 11 May 2004

Appellant: E.I. DU PONT DE NEMOURS AND COMPANY
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 3 December 2001
revoking European patent No. 0570367 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: M. M. Eberhard
Members: G. J. Wassenaar
S. U. Hoffmann

Summary of Facts and Submissions

I. European patent No. 0 570 367, based on European patent application No. 91901462.1, filed on 15 November 1990, was granted with 6 claims. A notice of opposition was filed by the respondent (opponent). The opposition grounds were lack of novelty, lack of inventive step, and insufficient disclosure. The opposition grounds were supported, *inter alia*, by the following documents:

D1: WO 91/02564,

D2: US-A-3 715 438,

D3: Environ. Sci. Technol. Vol. 23, No. 10,
1989, pages 1203-1207,

D4: National Advisory Committee for Aeronautics,
Technical Note 3565/1955,

D5: US-A-2 494 064,

D6: EPA-Report 600/9-88-009, April 1988,
Sections 2 to 4, Appendix K,

D8: Nat. Fire Protection Ass. Quarterly, Vol.
45(2)/1951, pages 119-131,

D9: ACS Symp. Ser. 1975, 16, pages 376-402,

D13: US-A-1 926 396,

D15: "Halon alternatives extinguishment testing",
By J. P. Moore et al, presented at the
International Conference on CFC & Halon
Alternatives on October 10-11, 1989,
Washington, DC,

D16: WO 91/04766.

- II. The opposition division revoked the patent on the ground of lack of inventive step in view of D2 in combination with either D4 or D5 and D6.
- III. The appellant (proprietor) lodged an appeal against this decision. With the statement of the grounds of appeal, the appellant filed two new sets of claims. During the appeal proceedings an affidavit by Mr Howard S. Hammel was filed comprising comparative examples. During oral proceedings, which took place on 11 May 2004, further sets of claims with correspondingly adapted descriptions were filed. At the end only one set of two claims was maintained as the sole request. Claim 1 thereof reads as follows:

"A method of preventing fire by establishing in an enclosed space an oxygen-containing atmosphere but which does not sustain combustion, which comprises introducing into the enclosed space the fluoro-substituted propane $\text{CF}_3\text{-CFH-CF}_3$ (HFC-227ea) in an amount so as to impart a heat capacity of from 40 to 55 cal/°C per mol of oxygen in said enclosed space excluding the co-use of CHF_3 "

Claim 2 is a method as claimed in claim 1 comprising additional components.

- IV. The arguments of the appellant with respect to inventive step can be summarized as follows:

Starting from D2 as the closest prior art document, the problem to be solved was finding a new fire protecting agent having at least as good fire protecting capacity as the perfluoroalkanes used in D2, but which would have at the same time a lesser global warming potential (GWP). It was surprisingly found that HFC-227ea solved this problem. The effect was proved by the comparative examples in the affidavit filed during the appeal proceedings. None of the prior art documents suggested the use of said compound for the claimed purpose, let alone its improved fire preventing capacity. According to D2 it was imperative that fire preventing agents should be highly stable and inert. It was therefore not obvious to consider hydrogen substituted compounds which were known to be substantially less stable than the perfluoroalkanes.

- V. The respondent (opponent) refuted the arguments of the appellant and submitted a new prior art document

D23: US-A-1 926 395.

With respect to novelty it was argued that although D1 was directed to fire extinguishing methods, the tests disclosed in the examples

were similar to the tests according to example 1 of the patent in suit. According to the patent in suit these tests would demonstrate the invention, ie a method of preventing fire according to claim 1 as granted. Thus D1 implicitly disclosed the same method as now claimed.

The arguments of the respondents with respect to inventive step may be summarized as follows.

Because of its known high GWP there was a need to replace perfluoropropane, disclosed in D2, with a fire preventing agent having a lower GWP. The GWP problematic was discussed in D6, which document also disclosed HFC-227ea as a potential substitute for chlorinated fluorocarbons (CFC). It was known from D2, D8, D13 and D23 that fire preventing agents were also fire extinguishing agents. It was further known from D5 that heptafluoropropane was a fire extinguishing agent. Moreover it followed from D4 that such a compound would have fire extinguishing properties. It was thus obvious to use HFC-227ea as a substitute for perfluoropropane in a method according to D2. The improved fire preventing capacity shown in the affidavit was a mere bonus effect, which could not render an obvious method inventive.

VI. The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the sole request (claims 1 and 2) and an amended description both filed during oral proceedings.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. Claim 1 of the present request is limited with respect to claim 1 as granted to the selection of only the first of the fluorine-substituted propanes mentioned therein. The heat capacity requirement is further limited to the range indicated in claim 2 as granted. The combination of the present features of claim 1 is also present in the original application on which the patent is based; see the published version WO 92/08519, page 6, lines 16 to 28 and page 7, line 33 to page 8, line 16. The respondent's argument that in the original application HFC-227ea is mentioned as being suitable in hand-held fire extinguishers, so that the present selection of its use as fire prevention agent is not disclosed cannot be accepted. The fact that HFC-227ea has also been disclosed as a fire extinguishing agent does not take away the clear disclosure that the low boiling points of the particular preferred four fluoropropanes, of which HFC-227ea is mentioned, make them especially suitable as fire preventing agents (page 6, lines 23 to 26 of the patent). The subject-matter of claim 2 is based on claim 3 as granted in combination with page 3, lines 25 to 31 of the patent as granted and on claim 4 of the published application in combination with page 5, lines 5 to 17 of the published application. The disclaimer "excluding the co-use of CHF₃" was introduced into claim 1 to restore novelty against the disclosure of D16, published on

18 April 1991, ie a state of the art in the sense of Article 54(3) and (4) EPC. D16 discloses a process for preventing, controlling and extinguishing fire in an enclosed air-containing, mammalian-habitable enclosed area, which contains combustible materials of the non-self sustaining type, wherein CHF_3 is introduced into the air in said enclosed area in an amount sufficient to impart a heat capacity per mol of total oxygen that will suppress combustion of the combustible materials. According to page 9 of D16 a heat capacity of from 40 to 55 cal/°C per mol of oxygen is adequate to prevent or suppress the combustion. At least 1% of 111,2,333 heptafluoropropane (HFC 227ea) is blended with the CHF_3 introduced into the enclosed area (see claims 1 and 5 of D16). The disclaimer does not remove more than necessary to restore novelty against the disclosure of D16. It was not disputed that the disclaimer met the requirements set out in decision G 1/03 of 8 April 2004, available on the internet and to be published in OJ EPO. The present claims, therefore, fulfil the requirements of Article 123(2) and (3) EPC.

2. Arguments concerning the original objection of insufficient disclosure were not put forward during the appeal proceedings. The board cannot see any reason why a skilled person would not be able to perform the invention as now claimed and concludes that it fulfils the requirements of Article 83 EPC.
3. By disclaiming the use of CHF_3 it is uncontested that the original novelty objection with respect to D16 is removed. D1, published on 7 March 1991, and thus, like D16, also a prior art document as defined in Article 54(3) and (4) EPC, discloses the

heptafluoropropane HFC-227ea as a fire extinguishing agent, but D1 is silent about fire prevention. It is true that some of the experiments in D1 are similar to the cup burner tests of example 1 of the patent in suit, but all these experiments are clearly directed to the determination of the fire extinguishing properties. Taking into consideration that the patent as granted comprises not only claims relating to a method of preventing fire (claims 1 to 3) but also claims to a fire extinguishing composition (claims 4 and 5), the mentioning in the description of the patent in suit (page 6, line 48) that the invention will be more clearly understood by referring to the examples does not necessarily mean that the experiments in these examples are methods according to claim 1 as granted. Moreover the respondent's conclusion that since example 1 of the patent in suit illustrates the invention the experiments of D1 must disclose the same invention could only have been drawn after having read the patent in suit. Without the knowledge of the patent in suit a skilled person could not have drawn this conclusion. It is also true that at the end of the description of D1 it is indicated that the hydrofluorocarbons may be used for the protection of electrical equipment, computer facilities and control rooms (page 18, lines 16 to 22). Taking into account that in the preceding paragraph it is indicated that saturated higher fluorinated C2 and C3 hydrofluorocarbons like the presently employed chlorine and bromine-containing Halons, are non-destructive agents, the skilled person will interpret said reference to protection as meaning a protection in case of fire, whereby the fire fighting with the hydrofluorocarbons is not harmful for sensitive

equipment. In the board's view, therefore, D1 neither explicitly nor implicitly discloses a method of preventing fire according to present claim 1. The subject-matter of claim 1 is thus new with respect to D1.

4. It is undisputed that D2 represents the closest prior art with respect to the issue of inventive step. It discloses a process for preventing and controlling fire in an enclosed air containing mammalian habitable compartment which contains combustible materials of the non-sustaining type which comprises introducing into the air in said compartment a perfluoroalkane selected from carbon tetrafluoride, hexafluoroethane and octafluoropropane or mixtures thereof in an amount sufficient to impart a heat capacity of at least 45 cal/°C per mol of oxygen to suppress combustion of combustible material present in said enclosed compartment (claims 10 to 18). It is also undisputed that at the priority date of the patent in suit it was generally known in the art, that because of their high GWP perfluoroalkanes were considered to be potentially harmful for the environment (see eg D6, page 2-7, first paragraph). Starting from D2, the problem to be solved can be considered to provide, in a method of preventing fire, a substitute for the perfluoroalkanes having at least as good fire preventing properties but at the same time having lower GWP and little or no ozone depletion potential (ODP). The appellant proposes to solve this problem by using the fluorine-substituted propane $\text{CF}_3\text{-CFH-CF}_3$ (HFC-227ea) in a method according to claim 1. According to the test results in the affidavit by Mr Hammel, the minimum amount of HFC-227ea needed to prevent the ignition of the fuel (4.9 vol.%) is lower

than the minimum amount of 8.1 vol.%, reported for perfluoropropane (FC-218). Thus HFC-227ea has even an improved fire preventing effectiveness compared to FC-218. The respondent did not dispute these results but argued in writing that this late filed evidence should not be taken into consideration. During oral proceedings, however, this objection was no longer maintained. Because of its relevance the board accepts said test results as evidence in these proceedings. Because of these test results and the undisputed fact that HFC-227ea has a lower GWP than FC-218 and no ODP the board is satisfied that the method according to claim 1 actually solves the said problem underlying the invention.

5. D2 does not comprise any indication that compounds other than the perfluoroalkanes might serve the purpose of preventing a fire in an oxygen comprising atmosphere. The only other pre-published document relating to that problem is D23, which was published in 1933. According to D23 aliphatic organic derivatives containing fluorine are suitable for that purpose (claim 2). Two charts (Figures 1 and 2) specifically disclose methane and ethane derivatives. The text does indeed comprise the sentence that the method of charting may be employed with other groups of compounds coming within the general formula halo-derivatives of hydrocarbon compounds containing fluorine and including groups having a higher carbon content (page 1, lines 89 to 93), but there is no clear lead to heptafluoropropane, let alone to the isomer HFC-227ea and to its improved fire preventing effectiveness compared with octafluoropropane.

6. D8 relates to halogenated extinguishing agents. This document comprises a table with flammability tests (Table X on page 122). These tests were performed to screen compounds for their effectiveness as fire extinguishing agents. It is indicated below that table that "it was realized, however, that the flame inhibition method of screening compounds with respect to fire extinguishing effectiveness was open to some question, ie from the flame inhibition test at agent concentrations where no flame was propagated, it could not be safely assumed that the given agent concentrations could extinguish a flame which had been initiated before application of the agent". According to Table XV on page 128 some of the compounds from Table X have also been tested in a fire extinguishing test. That fire extinguishing agents may also have fire preventing properties also follows from D2, wherein it is indicated that perfluoroalkanes have fire extinguishing properties (column 1, lines 51 to 55), and from a comparison of D23 with D13. The latter documents disclose the same compounds, whereby according to D13 the compounds are used to extinguish a fire (claim 7), whereas according to D23 the compounds are used to prevent a fire (claim 3). The board, therefore, is willing to accept in the respondent's favour that a skilled person looking for a suitable fire preventing agent, will consider compounds known as fire extinguishing agents. D8, however, does not disclose hydrofluorocarbons, let alone HFC-227ea.
7. In fact, none of the other pre-published documents discloses HFC-227ea as a fire extinguishing agent. D5 discloses the preparation of fluorocarbon monohydrides having the formula $C_nF_{2n+1}H$ (claim 1).

The preparation of C_3F_7H is not specifically disclosed. With respect to this compound it is only mentioned that it has a higher boiling point than C_3F_8 (column 2, line 8). It is further indicated that compounds having the formula $C_nF_{2n+1}H$ have utility as refrigerants, solvents, dielectrics, fire extinguishing fluids, hydraulic mechanism fluids and heat exchange fluids, depending upon the boiling point, etc (column 2, lines 9 to 12). From this observation it follows that not all the compounds having the formula are suitable for each of the listed utilities. It cannot be derived therefrom that C_3F_7H is a suitable fire extinguishing agent and certainly not that HFC-227ea would solve the problem underlying the invention.

8. D4 relates to halogenated fire extinguishing agents and discusses the chemical action of such compounds in fire extinguishing. One of the conclusions drawn in this article is that the presence of hydrogen in an agent does not necessarily reduce its fire-fighting ability and may actually enhance it, provided there is enough halogen to make the agent non-flammable (page 17, point 2 of the conclusions). Almost 50 halogenated compounds were tested, of which there was only one hydrofluorocarbon, namely CHF_3 (Table I). In the board's view, the average skilled person would not without hindsight derive from the information in D4 that HFC-227ea was a suitable fire preventing agent, which would solve the problem underlying the invention.

9. D15 is an article relating to fire fighting agents. It discusses the environmental impact of the use of traditional halons (halogenated carbons comprising bromine) because of their high ODP and GWP. Cup-burner tests have been developed for screening alternative compounds (see page 1). The compounds to be screened are listed in Table 3. To this list of approximately 90 compounds belong fluorocarbons (FCs) and hydrofluorocarbons (HFCs). To the list of HFCs belong methane, ethane and propane derivatives. Four propane derivatives are listed, ie 2-fluoropropane, 1,1,1,2,3,3-hexafluoropropane, 2,2-difluoropropane and 1,2-difluoropropane. Heptafluoropropane is not in the list although their homologues trifluoromethane and pentafluoroethane are listed. From this presentation the skilled person must have obtained the impression that heptafluoropropane was not considered worthwhile testing as an extinguishing agent. Moreover, the screening list was set up to find alternatives for halons. Since both FCs and HFCs are in the list, the list is no guide for replacing perfluoropropane, a FC, with a HFC in order to solve the problem underlying the invention. The use of HFC-227ea to solve the problem is therefore not rendered obvious by D15.

10. D9 is an article in which the flame suppression mechanism of halogenated fire extinguishants is discussed. The only halogenated propane mentioned therein is perfluoropropane. There is no suggestion to replace it with heptafluoropropane.

11. The other documents relied on by the respondent with respect to the issue of inventive step during oral proceedings do not relate to fire fighting. D3 is an

article relating to the impact of chlorofluorocarbons (CFCs) on the ozone layer and mentions also the global warming problem caused by these compounds. It discusses alternatives to CFCs and concludes that about 10% of the demand for CFCs could be met with HFCs in 2000, primarily in the refrigeration applications and that for 30% of the CFC demand HCFCs appear to be the best option, whereby the primary uses of the latter compounds will probably be in expanding plastic foams for insulation, cleaning of critical electronic and metal components, refrigeration, and air conditioning (page 1206, right hand column, last paragraph and page 1207 left hand column, 3rd and 4th paragraphs). A possible utility of HFCs for fire fighting is not mentioned and there is no pointer to heptafluoropropane.

12. D6 also concerns the ozone depletion and global warming problem caused by CFCs. It indicates that suitable alternative compounds should comprise at least one hydrogen and/or only fluorine present as a halogen in the compounds (page 2-7, first paragraph). Lists of potential substitutes are given, classified as category A, B and C compounds. HFCs are only listed as category C compounds in Table 4-3, ie potential substitute compounds for which minimal or no information is presently available (page 4-1). Among these HFCs are mentioned HFC-227ea and the four hexafluoropropanes. There is, however, no reference or suggestion to their possible utility as fire extinguishing or fire prevention agents. Without any relation to the art of fire fighting the skilled person, trying to solve the above mentioned problem, would have had no reason to look for a solution in D3 or D6, but even if he would

have done so, he could not have found therein a hint to select HFC-227ea as substitute for perfluoropropane.

13. The other prior art documents on file are less relevant for the issue of inventive step. Since the respondent did no longer rely thereon during oral proceedings there is no reason to discuss them here. It follows from the above that the solution according to claim 1 of the problem underlying the invention does not follow in an obvious manner from the state of the art. For these reasons the board holds that the subject-matter of claim 1 involves an inventive step. Because of its dependency upon claim 1, the same applies to the subject-matter of claim 2.

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 with the following documents:
 - claims 1 and 2 according to the sole request submitted during the oral proceedings,
 - description pages 2 to 8 submitted during the oral proceedings.

The Registrar

The Chairman:

A. Wallrodt

M. M. Eberhard