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**Datasheet for the decision
of 12 September 2006**

Case Number: T 0003/05 - 3.2.01

Application Number: 96906165.4

Publication Number: 0804700

IPC: F16L 11/12

Language of the proceedings: EN

Title of invention:

Elongated fuel and vapor tube having multiple layers and
method of making the same

Patentee:

ITT MANUFACTURING ENTERPRISES, INC.

Opponent:

Veritas AG

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0003/05 - 3.2.01

DECISION
of the Technical Board of Appeal 3.2.01
of 12 September 2006

Appellant: ITT MANUFACTURING ENTERPRISES, INC.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 13 December 2004
revoking European patent No. 0804700 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: S. Crane
Members: C. Narcisi
G. Weiss

Summary of Facts and Submissions

- I. The European patent Nr. 804 700 was revoked with the decision of the Opposition division posted on 13 December 2004. An appeal against this decision was filed by the patentee on 22 December 2004 and the appeal fee was paid at the same time. The statement of grounds of appeal was filed on 22 April 2005.
- II. Oral proceedings took place on 12 September 2006. The appellant requested that the patent be maintained in amended form according to its main request or alternatively according to its first or second auxiliary request, where the main request, apart from the correction of a clerical error (see the main request filed at the oral proceedings), and the second auxiliary request correspond respectively to the first and second auxiliary request filed by fax on 15 August 2006, while the first auxiliary request was filed at the oral proceedings. The main and the first auxiliary requests include two independent claims, 1 and 15, whereas the second auxiliary request includes only one independent claim, that is claim 15 as granted.

Claim 1 according to the main request reads as follows:

"An elongated fuel and vapor tube used in conjunction with an internal combustion engine in a motor vehicle system to handle fluids containing hydrocarbons comprising:

a first layer (12) disposed radially innermost and having an inner surface capable of prolonged exposure to a fluid containing hydrocarbon and an outer surface spaced a first predetermined radial thickness from the

inner surface, the first layer composed of an extrudable, melt processible terpolymer consisting essentially of :

a fluorinated alkylene having between 2 and 4 carbon atoms and between 2 and 4 fluorine atoms;

an alpha-fluoro olefin having between 2 and 6 carbon atoms and between 2 and 6 fluorine atoms; and

a fluorinated vinyl compound selected from the group consisting of vinylidene fluoride, vinyl fluoride and mixtures thereof; and

a second layer (14) having a second predetermined thickness greater than the thickness of the first layer (12), the second layer (14) uniformly connected to the first layer and consisting of a melt processible thermoplastic capable of sufficiently permanent laminar adhesion to the first layer to prevent delamination during desired lifetime of the tube wherein the melt processible thermoplastic resin is selected from the group consisting of polyamides, bromoisobutene-isoprene resins, polybutadiene, chlorinated butylrubber, chlorinated polyethylene, polychloromethoxirane, chloroprene, chlorosulfonopolyethylene, ethyleneoxide, terpolymers of ethylenepropylenediene, copolymers of ethylenepropylene, isobutene-isoprene, polyvinylchloride, styrenebutadiene, polysulfide, polyphenolsulfide and polysulfones."

Claim 1 according to the first auxiliary request reads as follows:

"An elongated fuel and vapor tube (10) used in conjunction with an internal combustion engine in a motor vehicle system to handle fluids containing hydrocarbons comprising:

a first layer (12) disposed radially innermost and having an inner surface capable of prolonged exposure to a fluid containing hydrocarbon and an outer surface spaced a first predetermined radial thickness from the inner surface, the first layer composed of an extrudable, melt processible terpolymer consisting of: a fluorinated alkylene having between 2 and 4 carbon atoms and between 2 and 4 fluorine atoms; an α -fluoro olefin having between 2 and 6 carbon atoms and between 2 and 6 fluorine atoms; and a fluorinated vinyl compound selected from the group consisting of vinylidene fluoride, vinyl fluoride and mixtures thereof; and, optionally, conductive material; and

a second layer (14) having a second predetermined thickness greater than the thickness of the first layer (12), the second layer (14) uniformly connected to the first layer (12) by directly contacting the innermost portion of the outer layer (14) with the outer surface of the inner layer (12) and consisting of a melt processible thermoplastic capable of sufficiently permanent laminar adhesion to the first layer to prevent delamination during desired lifetime of the tube;

wherein the melt processible thermoplastic is selected from the group consisting of polyamides, bromoisobutene-isoprene resins, polybutadiene, chlorinated butylrubber, chlorinated polyethylene, polychloromethoxirane, chloroprene, chlorosulfonopolyethylene, ethyleneoxide, terpolymers of ethylenepropylenediene, copolymers of ethylenepropylene, isobutene-isoprene, polyvinylchloride, styrenebutadiene, polysulfide, polyphenolsulfide and polysulfones."

Claim 15 according to the main request reads as follows:

"An elongated fuel and vapor tube (10) for connection to a motor vehicle system to handle fluids containing hydrocarbons comprising:

a first layer (12) disposed radially innermost and having an inner surface capable of prolonged exposure to organic fluid and an outer surface spaced a first predetermined radial thickness from the inner surface, the first layer (12) composed of an extrudable, melt processible fluoroplastic terpolymer consisting essentially of:

a polyfluorinated alkylene selected from the group consisting of tetrafluoroethylene,

polytetrafluoroethylene and mixtures thereof;

an α -fluoro olefin selected from the group consisting of hexafluoropropene, perfluorobutene,

perfluoroisobutene and mixtures thereof; and

vinylidene difluoride;

a second layer (14) having a second predetermined thickness, an inner face directly contacting and bonded to the first layer (12) and an opposed outer surface adapted to directly contact environment external to the elongated fuel and vapor tube (10), the second layer (14) composed of a melt processible thermoplastic selected from the group consisting of

Nylon 11, Nylon 12, zinc chloride resistant Nylon 6, and nylon 6.6, the thermoplastic capable of

sufficiently permanent laminar adhesion to the first layer (12) to prevent delamination during desired lifetime of the tube;

wherein the elongated fuel and vapor tube (10) has a passive hydrocarbon permeation rate less than about 0,5 g/m² in a 24 hour interval."

Claim 15 according to the first auxiliary request differs from above claim 15 only in that the wording "melt processible fluoroplastic terpolymer consisting essentially of" is replaced by "melt processible fluoroplastic terpolymer consisting of"; and the wording "and vinylidene difluoride;" is replaced by "and vinylidene difluoride; and, optionally, conductive material;".

Claim 15 according to the second auxiliary request has the same wording as claim 15 according to the main request.

The respondent requested the dismissal of the appeal.

III. The appellant's arguments may be summarized as follows:

The invention discloses a fuel tube formed by two layers without interposition of any further intermediate layer. This results from the specific wording of claim 1 of the main request, i.e. (i) "..the second layer (14) uniformly connected to the first layer and consisting of a melt processible thermoplastic capable of sufficiently permanent laminar adhesion to the first layer to prevent delamination during desired lifetime of the tube..". This implies a direct and purely physical adhesion of the two layers to each other, as emphasized in the patent specification (page 6, lines 32-33), where no use is made for instance of any cross-linking agent to produce

a chemical bond between the two layers. Thus, the subject matter of claim 1 according to the main request is new over E2 (EP-A-523 644), given that this document discloses an intermediate layer interposed between the first and the second layer and welded to both these layers. The subject matter of claim 1 is likewise new over E1 (DE-A-40 17 273), since in E1 the second layer is composed of nitrile butadiene, which is not one of the polymer substances explicitly indicated in claim 1 as possible constituents for the second layer. Finally, E3 (EP-A-551 094) also does not disclose the combination of the features of claim 1, the first layer not being composed of a terpolymer as specified in claim 1.

The subject matter of claim 1 is also inventive over the cited prior art since there is no obvious combination of the cited documents which leads to this subject matter. In fact, in E1 and E3 the connection between the first and the second layer is obtained by very different methods, namely by using cross-linking agents in E1 and by using corona discharge in E3, and neither of these methods imply moreover purely physical laminar adhesion within the meaning of the invention; these methods rely respectively on the creation of additional chemical bonds and on the activation of specific polymeric sites. Thus, even though E1 discloses a specific terpolymer as indicated in claim 1 (see E1, page 2, line 67-page 3, line 2), the skilled person would not envisage combining E1 with E3 and even the combination of these documents would not lead to laminar adhesion between the first and the second layer in the sense of the invention. Further, E3 is clearly not suitable as a starting point for the skilled person

and could not possibly help him to arrive at the subject matter of claim 1, since in E3 terpolymer substances are not considered at all as possible constituents for the first and innermost layer. In addition, on account of the use of an intermediate layer E2 does not appear to be an appropriate starting point. Thus, in conclusion, a combination of E2 and E3 would also not be obvious for the skilled person.

The arguments set out above likewise apply to the subject matter of claim 1 according to the auxiliary request, and this all the more so since the replacement of the wording "consisting essentially of" by "consisting of" further limits the composition of the terpolymer in the first layer and the composition of the second layer. Moreover the wording of claim 1 now indicates explicitly that direct contact between the first and the second layer is implied.

Finally, the subject matter of independent claim 15 according to the second auxiliary request also meets the requirement of inventive step for the same reasons already mentioned above. In particular this subject matter implies with respect to that of claim 1 a further, improved inventive selection of terpolymeric compounds, in that the fluorinated vinyl compounds to be employed in the terpolymer of the first layer have been restricted to vinylidene difluoride and the choice of polymeric materials used in the melt processible thermoplastic of the second layer has been likewise considerably restricted.

IV. The respondent's arguments may be summarized as follows:

The subject matter of claim 1 according to the main request lacks novelty over the disclosure of E2. The above mentioned feature (i) of claim 1 does not necessarily exclude the presence of an intermediate layer interposed between said second and said first layer since it merely indicates the specific property of the melt processible material itself of being apt to provide sufficiently permanent laminar adhesion to the first layer, without necessarily indicating that a direct contact between the first and the second layer is actually formed. Indeed, other parts of the description in the patent specification appear not to exclude the presence of further layers (page 4, lines 12-13; lines 37-39). Moreover, since independent claim 15 expressly states that the second layer has "...an inner face directly contacting and bonded to the first layer..", then the omission of this feature from claim 1 cannot be the result of an error.

An inventive step is anyway not involved in the subject matter of claim 1. In fact, it is undisputed that E1 discloses all of the features of claim 1 except insofar as the polymer material for the second layer is preferably nitrile butadiene, whereas in present claim 1 nitrile butadiene has been deleted from the list of polymeric compounds which were expressly indicated in granted claim 1 as possible constituents of the second layer. However, this difference cannot involve an inventive step since E3 clearly discloses (page 4, lines 4-16) that nitrile butadiene is merely one polymer out of a long list of thermoplastic materials which can be extruded on top of the

fluoropolymeric materials forming the first layer. This list includes, for instance, polyamides, bromoisobutene-isoprene resins, polybutadiene and other resins which are also included in claim 1. Thus, E3 renders evident to the skilled person that the mentioned thermoplastic materials can alternatively be extruded, in place of nitrile butadiene, on top of the fluoropolymeric material forming the first layer and the skilled person would thus arrive in an obvious manner at the subject matter of claim 1. The fact that E1 uses cross-linking means whereas E3 uses corona discharge in order to obtain permanent adhesion of the first and second layer would not be an obstacle since both methods are commonly and alternatively used by persons of ordinary skill in the art depending on specific circumstances. The same result would be obtained through the obvious combination of E1 with E4 (WO-A-93/25835).

Furthermore, the skilled person would also arrive in an obvious manner at the claimed subject matter when considering either the disclosure of E2 or of E3. In fact, the fuel tube of E2 clearly has, due to the presence of the additional intermediate layer, the disadvantage of a cumbersome and costly manufacturing process. Therefore, the skilled person would look for a simpler solution allowing to obtain permanent adhesion of the fluoropolymers forming the first layer to the thermoplastic polymeric compounds forming the second layer and this solution is evidently provided by E3. Alternatively, the skilled person would recognize that the material properties of the fluoropolymers constituting the first layer according to E3 could be improved by taking instead copolymers thereof.

Terpolymers consisting of these fluorinated monomers were already known , e.g. from E2 or E1, and their properties, as shown for instance in table 1 of the patent specification, were likewise already known. Hence again the subject matter of claim 1 would ensue in an obvious manner in view of E3.

Finally, neither the subject of claim 1 according to the first auxiliary request, nor the subject matter of claim 15 according to the second auxiliary request can be regarded as inventive, since the above arguments are still valid given that both these claims contain well known polymeric and terpolymeric compounds.

Reasons for the Decision

1. The appeal is admissible since it meets the requirements of Articles 106 to 108 EPC in conjunction with Rules 1 (1) and 64 EPC.

2. Prior art E2 discloses undisputedly an elongated fuel and vapour tube used in conjunction with an internal combustion engine in a motor vehicle to handle fluids containing hydrocarbons (see E2, abstract; description, page 2, lines 10-14; page 3, lines 54,58). The fuel tube is formed by an innermost layer consisting of a terpolymer of vinylidene fluoride (VDF), hexafluoroproene (HFP) and tetrafluoroethylene (TFE) (E2, page 4, lines 2-3), an intermediate layer formed of a resin blend of a polyamide resin and a fluorine containing copolymer (E2, page 2, lines 30-31) and an outer surface layer formed of a polyamide resin (E2, page 2, lines 27-28), such as nylon 6, nylon 6.6, nylon

11 and nylon 12 (E2, page 3, lines 11-12). The second layer has a predetermined thickness greater than the thickness of the first layer (E2, page 4, lines 22-25).

Thus feature (i) mentioned above, i.e. "the second layer (14) uniformly connected to the first layer (12) and consisting essentially of a melt processible thermoplastic capable of sufficiently permanent laminar adhesion to the first layer to prevent delamination during desired lifetime of the tube", is the only contentious feature of claim 1 on which consequently the novelty of its subject matter over E2 exclusively depends. The Board judges that the wording of this feature already gives a very strong indication that the first and the second layer are directly connected to each other, as it appears from the fact that the second layer is "uniformly connected to the first layer" and consists of a material "capable of sufficiently permanent laminar adhesion to the first layer". Additionally, the description of the patent specification explicitly states (page 6, lines 32-33) that "in the present invention, the innermost portion of the outer layer 14 directly contacts the outer surface of the inner layer 12 and is attached thereto". Pursuant to Article 69 EPC the description shall be used to interpret the claims for determining the extent of protection and in view of the mentioned passages in claim 1 and in the patent specification there appears to be no reasonable doubt that the claim should be construed such that there is indeed direct contact between the first and the second layer.

The fact that independent claim 15 indicates explicitly, contrary to claim 1, a direct contact between the first

and the second layer does not contradict the above conclusions given that on a fair assessment of the mentioned passage in the patent specification in conjunction with the corresponding wording in claim 1 there appears to be no need for any further specification of said feature (i) in claim 1.

For these reasons the subject matter of claim 1 according to the main request is new over E2 (Article 54 EPC).

3. As is apparent from the prior art described above, known fuel tubes of the kind to which the present invention relates generally comprise an innermost layer of a fluoropolymer substance and a thicker outer layer of a thermoplastic material, e.g. a polyamide polymer. This general structure is present in each of E1, E2 and E3 albeit in E2 an intermediate layer is present. This structure is chosen on account of the specific properties of fluoropolymers on the one hand, i.e. their excellent chemical resistance to components contained in conventional fuel mixtures and their heat resistance, and on the other hand to provide a weather resistant outer layer which is also less costly than commonly used fluoropolymer substances (E2, page 2, lines 15-16).
4. In E1 the fluoropolymer of the innermost layer, as may also be the case in E2, is made of a terpolymer consisting of vinylidene fluoride, hexafluoropropene and tetrafluoroethylene (VDF-HFP-TFE terpolymer) while the outer layer is composed of a polymer consisting of nitrile butadiene directly bonded to the inner layer (E1, page 2, line 67-page 3, line 7). Both the inner

and the outer layer additionally contain a cross-linking agent in order to improve laminar adhesion of the two layers which is known to be unsatisfactory due to generally poor compatibility of fluororesins with other resins (E1, page 2, lines 23-28; E2, page 2, lines 17-19). This appears to be just one possibility for obtaining "sufficiently permanent laminar adhesion" mentioned in contested claim 1. Given that in the patent specification it is not further detailed how the claimed adhesion is obtained, this leads to the conclusion that the subject matter of claim 1 according to the main request solely differs from the disclosure of E1 in the choice of said thermoplastic polymer forming the outer layer, since nitrile butadiene included in granted claim 1 has now been deleted.

5. E3 on the contrary, while disclosing the same two layer structure consisting of an inner fluoropolymer in direct contact with a thicker outer layer of a melt processible thermoplastic as E1, offers the choice between a wide variety of different thermoplastic resinous materials, preferably a polyamide and most preferably nylon 12 (E3, page 4, lines 4-16), to be employed for the outer layer which is extruded on top of the inner layer. For the inner layer E3 uses fluoropolymers such as polytetrafluoroethylene, polyhexafluoropropene, perfluorobutene, perfluoroisobutene, polyvinylidene-fluoride and polyvinylfluoride (E3, page 3, lines 38-49). The second layer is formed on top of the first layer after previous treatment of the first layer by a corona discharge method (E3, e.g. page 5, lines 19-27).

6. The skilled person would infer from the prior art described heretofore that a ternary fluoropolymer such as VDF-HFP-TFE is particularly apt to form the inner layer of the fuel tube (see e.g. E1; E2, page 3, line 54-page 4, line 4) since it has the required resistance to fuel components and heat. However, the skilled person would equally notice that, due to its known poor compatibility with different resins, in the prior art further measures have to be taken to obtain the desired adhesion between the layers. These additional steps, such as employing cross-linking agents in conjunction with a specific type of polymer for the outer layer as in E1, or using an intermediate layer as in E2, either restrict the choice of available materials for the outer layer or are cumbersome and expensive. Consequently the skilled person would envisage using a VDF-HFP-TFE terpolymer for the inner tube layer but he would nevertheless look for simpler ways of forming the melt processible thermoplastic layer of his preferred polymeric material on its outside. This would naturally lead him to consider the technical teaching of E3 which avoids such additional steps. Furthermore, since this document discloses the use of polyvinylidene fluoride, polyhexafluoropropene or polytetrafluoroethylene polymers for the first layer, the skilled person would be unlikely to have any sound technical reason to suspect that the bonding method proposed there would not be applicable to a terpolymer comprising the three respective monomers involved, viz. VDF, HFP and TFE. The skilled person would thus arrive in an obvious manner to the subject matter of claim 1 according to the main request and would moreover obtain a fuel tube wherein a direct contact is established

between the fluoropolymer of the first layer and the thermoplastic polymer of the second layer.

7. The appellant's submissions concerning the meaning to be given to the wording "sufficiently permanent laminar adhesion" according to the claimed invention cannot be accepted by the Board. In particular it appears that nowhere in the patent specification it is specified by which means said laminar adhesion is obtained. For this reason the Board judges that the mentioned wording does not exclude that the adhesion between the first and the second layer is obtained by the methods which are commonly used in the art, such as by a corona discharge process as taught in E3. Moreover, even if said wording were interpreted as restricting said adhesion to purely physical adhesion, as alleged by the appellant, nevertheless corona discharge would still clearly fall within the scope of this definition since specific polymeric sites are physically activated by this method, leading to an increase in surface energy of the fluoropolymer (E3, page 7, example 1; page 8), which is, by contrast to the use of cross-linking agents producing chemical bonds, the main effect permitting laminar adhesion of the thermoplastic polymer.

8. The subject matter of claim 1 of the auxiliary request merely clarifies that the possible choice of fluorinated monomers to be used in the terpolymer compound is exclusively restricted to the list specified in the claim and further states that the second layer is uniformly connected to the first layer "by directly contacting the innermost portion of the outer layer with the outer surface of the inner layer..". In view of the facts and the reasons given

under point 6 the above conclusions are not affected by these amendments since there account was already taken of the fact that the terpolymer constituting the inner layer is actually formed exclusively of vinylidene fluoride, hexafluoropropene and tetrafluoroethylene as disclosed in E2 and E1, and that the first and the second layer are in direct contact with each other according to E3. Therefore, the subject of claim 1 according to the auxiliary request lacks an inventive step in view of the cited prior art E2, E1 and E3 (Article 56 EPC).

9. The subject matter of the sole independent claim 15 of the second auxiliary request restricts the choice of fluorinated vinyl compound for use in the terpolymer to vinylidene difluoride only and also indicates explicitly the further two groups of fluorinated compounds to be selected to form said terpolymer. Claim 15 likewise restricts the choice of thermoplastic polymers for use in the second layer to nylon 11, nylon 12, zinc chloride resistant nylon 6 and nylon 6.6. In respect of these features it is noted that "vinyledene difluoride" is commonly used as an alternative designation for "vinylidene fluoride", that both E2 (e.g. page 3, lines 10-12; page 5, lines 42-57) and E3 (page 4, lines 4-16) disclose the use of nylon 11 and/or nylon 12 for the outer layer and that the known VDF-HFP-TFE terpolymer already used in E2 and E1 is one of the terpolymers which can be possibly employed according to claim 15. Finally, the hydrocarbon permeation rate mentioned in claim 15 merely results from commonly known regulations (see e.g. E4, page 1; patent specification, page 2) with which the skilled person is well acquainted and whose fulfilment

apparently results from the use of the claimed polymer substances. This feature cannot thus contribute to inventive step. Consequently, on account of the facts and reasons given under point 6 above it is concluded that the subject matter of claim 15 according to the second auxiliary request is obvious for the skilled person in view of the cited prior art E2, E1 and E3 (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

A. Vottner

S. Crane