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D E C I S I O N
of 15 February 2001

Case Number: T 0591/99 - 3.2.1

Application Number: 93924936.3

Publication Number: 0664863 (WO 94/09302)

IPC: F16L 9/12, F16L 11/18

Language of the proceedings: EN

Title of invention:
Corrugated multilayer tubing having at least two dissimilar polymeric materials

Applicant:
ITT Manufacturing Enterprises, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0591/99 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 15 February 2001

Appellant: ITT Manufacturing Enterprises, Inc.
1105 North Market Street
Suite 1217
Wilmington
Delaware 19801 (US)

Representative: Dreiss, Fuhlendorf, Steimle & Becker
Postfach 10 37 62
D-70032 Stuttgart (DE)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 4 February 1999 refusing European patent application No. 93 924 936.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: F. Gumbel
Members: S. Crane
P. Mühlens

Summary of Facts and Submissions

I. European patent application No. 93 924 936.3 was refused by a decision of the Examining Division posted on 4 February 1999.

II. The reason given for the decision was that the subject-matter of claim 1 then on file lacked inventive step with regard to the state of the art represented by

(D1) DE-U-9 001 467

(D3) US-A-5 038 833.

III. An appeal against this decision was filed on 27 March 1999 and the fee for appeal paid at the same time. The statement of grounds of appeal was received on 19 May 1999.

IV. In a communication pursuant to Article 11(2) RPBA posted on 18 October 2000 the Board *inter alia* referred to EP-A-0 436 923 (D4) as constituting further relevant state of the art.

V. In response to this communication the appellants (applicants) submitted on 9 January 2001 sets of claims according to a main and first and second auxiliary requests.

Claim 1 of the main request reads as follows:

"A multi-layer tube (10) suitable for use on motor vehicles comprising a cylindrical wall,

(1) with a thick flexible outer layer (12),

(2) an intermediate layer (16) and

(3) an interior layer (14),

(4) the interior and outer layers (14, 12) are composed of an extrudable melt processible polyamide, being capable of being integrally laminated, and having an ability to withstand impacts of at least 2,71 J at temperatures below -20°C,

(5) the interior layer (14) is having a thickness less than the thickness of the outer layer (12),

(6) the intermediate layer (16) is composed of a non-polyamide thermoplastic material and

(7) the cylindrical wall itself comprising a first region (26) having an essentially uniform cross-sectional diameter in which the cylindrical wall has a flat longitudinal cross-section, the cylindrical wall oriented essentially parallel to the coaxial longitudinal axis (20),

characterised in that

(8) the cylindrical wall comprises a second region (28) in which the cylindrical wall has at least one convolution (30, 30') having a cross-sectional diameter which varies positionally depending on longitudinal location in the second region (28),

(9) the convolution (30, 30') having a cross-sectional diameter greater than the essentially uniform cross-sectional diameter of the first region (26),

(10) the polyamide of the outer layer has an elongation value of at least 150%,

(11) the polyamide of the interior layer has an elongation value greater than about 150%, and

(12) the material of the intermediate layer (16) is more elastic than the material of the interior layer (14)."

Claim 1 according to the first auxiliary request includes the further feature:

"(13) the intermediate layer (16) is of sufficient thickness to permit an essentially homogeneous bond between the inner and outer layers (14, 12)."

In addition thereto claim 1 of the second auxiliary request includes the following feature inserted between features (9) and (10):

"(9.1) the second region has a sufficient number of convolutions (30, 30') to accommodate bending of the tube at angles up to over 90° from vertical."

VI. On 13 February 2001 the appellants filed a new dependent claim to be added to the existing dependent claims of the main and first and second auxiliary requests. This claim (amended to correct a clerical error) reads as follows:

"Tubing of claim 1 wherein the material employed in the interior layer has a degree of expansion greater than

that of the outer layer."

VII. Oral proceedings before the Board were held on 15 February 2001.

At the oral proceedings the appellants requested that the decision under appeal be set aside and a patent granted on the basis of the claims according to the main and first and second auxiliary requests submitted on 9 January 2001 or in the alternative on the basis of the respective claim 1 of these requests combined with the feature of the new dependent claim submitted on 13 February 2001 (third, fourth and fifth auxiliary requests).

VIII. In support of their requests the appellants argued substantially as follows:

The multi-layer tube described in document D3 was insufficiently flexible for many applications. In order to overcome this problem the invention proposed two measures. The first was to provide at least one convolution in the tube wall as defined in features (8) and (9) of claim 1 of the main request and the second was to employ materials for the three layers of the tube having the special characteristics defined in features (10), (11) and (12) of the claim. These characteristics enabled the number of convolutions required to be kept to a minimum thus reducing the amount of increased flow resistance to be found with the extensive convolutions shown in documents D1 and D4. The importance of feature (12) was that it ensured bonding between the layers even when the polyamide material of the interior and outer layers was stretched beyond its elastic limit.

Feature (13) added to claim 1 of the first auxiliary request was intended to indicate that the thickness of the intermediate layer was kept to a minimum. This was important since the material involved was relatively expensive.

According to feature (9.1) added to claim 1 of the second auxiliary request it was indicated that the number of convolutions was held to the minimum required to achieve a flexibility of the tube adequate for practical purposes, thus providing a clearer distinction over the prior art shown in documents D1 and D4.

In each of the third, fourth and fifth auxiliary requests claim 1 had been further restricted by the requirement that the material of the interior layer had a degree of expansion greater than that of the outer layer. This reflected the different functions of the two layers, whereby the relatively thick outer layer was responsible for the mechanical strength of the tube and the innermost layer for resisting ingress and permeation of fuel into the tube wall.

Reasons for the Decision

1. The appeal complies with the formal requirements of Article 106 to 108 and Rules 1(1) and 64 EPC. It is therefore admissible.

2. *Main request*

The preamble of claim 1 is based on document D3. This discloses a coextruded, cylindrical walled, multi-layer

tube, in particular a fuel line for a motor vehicle, wherein the wall of the tube consists of an outer and interior layer of polyamide (Nylon 11 or 12) bonded together by an alcohol barrier layer of a copolymer of ethylene and vinyl alcohol. The thickness of the outer layer constitutes about 80% of the total wall thickness and that of the intermediate and interior layers each about 10%. The fuel line may be rigid or by the addition to plasticizers to the polyamide may be made flexible like a hose.

There is no indication in document D3 of the impact strength of the plasticized polyamide. However, the appellants have voluntarily conceded that the materials of the outer and interior layers suggested in the document would exhibit the cold impact resistance as set out in feature (4) of the preamble of the claim. In view of that concession, the Board sees no reason to dwell on the issue. Suffice it to say that, given the environment in which motor vehicle fuel lines operate, the choice of a polyamide having cold impact resistance comparable to that specified in the claim would, at the least, be an obvious measure.

According to features (8) and (9) of the characterising part of claim 1 the wall of the tube is provided with at least one "convolution" of increased diameter. The provision of convolutions or corrugations as they are more frequently termed is a very well known measure for increasing the flexibility of a tube. Both of the documents D1 and D4 relate specifically to coextruded multi-layer tubes for use in the automobile industry which have increased flexibility by virtue of the provision of convolutions. In the face of this state of the art the appellants no longer sought at the oral

proceedings to argue that the provision of at least one convolution in the wall of the tube according to document D1 could be seen as something which is itself involved an inventive step. Instead, they argued in essence that their invention lay in the use of polyamide material(s) for the outer and interior layer of increased inherent flexibility, thus enabling the number of convolutions required to be reduced below that taught by documents D1 and D4.

The Board cannot find this argument convincing. The values for maximum elongation given in features (10) and (11) of the characterising clause of the claim, i.e. "at least 150%" and "greater than about 150%" are in fact wholly conventional, indeed at the lower end of the range, for polyamides of the type envisaged. This can be confirmed by reference to any standard textbook. For example, on page 464, volume 10 of the "Encyclopaedia of Polymer Science and Technology", 1969 Edition, to which the attention of the appellants was drawn at the oral proceedings, the ultimate elongation of plasticized Nylon 11 is given as 300%. For the person skilled in the art who had taken the obvious step of providing the wall of the tube known from document D3 with convolutions in order to improve its flexibility it would run counter to common sense to choose a polyamide material for the outer and interior layers of the tube which had an elongation value lower then those of other polyamides readily commercially available to him.

Feature (12) of the characterising clause of claim 1 has been taken from page 14, lines 19 to 21 of the original application where it is suggested as being the choice that is generally preferred without, however,

any indication either here or elsewhere in the application of what advantages might be associated with it. At the oral proceedings the appellants argued that by being "more elastic", which meant in their view having a higher elastic limit, the intermediate bonding layer would stay in its elastic range even though the interior and exterior layers were plastically deformed. On removal of the deforming stress the intermediate layer would thus be fully capable of maintaining its bonding function. Even taking the arguments of the appellants as to the meaning of the feature and its imputed technical effect at face value, the Board has to note the following: the intermediate layer of preference according to document D3 is a copolymer of 65 to 95 weight% vinyl alcohol and 35 to 5 weight% ethylene; according to the present application, page 15, lines 16 to 27, one preferred material is a copolymer of 65 to 73 weight% vinyl alcohol and 35 to 27 weight% ethylene. Consequently it is apparent that the closest state of the art according to document D3 embraces an intermediate layer of the same composition and accordingly with the same physical characteristics as that envisaged by the presently claimed invention. Thus feature (12) cannot add anything of inventive significance to the subject-matter of the claim.

Having regard to the above the Board has therefore come to the conclusion that the subject-matter of claim 1 is derivable in an obvious manner from the state of the art and accordingly lacks the required inventive step (Articles 52(1) and 56 EPC).

3. *Auxiliary requests*

Feature (13) of the first auxiliary request says no

more in effect than that the intermediate layer has a thickness to perform an adequate bonding function. For the person skilled in the art this is a self-evident consideration of no inventive significance.

In the second auxiliary request it has been specified in feature (9.1) that the number of convolutions is sufficient "to accommodate bending of the tube at angles up to over 90° from vertical". In other words the tube should be capable of being bent to take at least a right-angled bend. The degree to which in practice the tube will need to be bent will vary from application to application. It is a trivial consideration for the person skilled in the art that the degree of bending permitted will be dependent on the number of convolutions. Nothing of inventive significance can be seen in setting a lower limit of 90° for the permitted degree of bending and choosing an appropriate number of convolutions, see in particular document D4, where a bend of substantially 90° is illustrated in the Figure 1.

There remains to be considered the requirement that the "material employed in the interior layer has a degree of expansion greater than that of the outer layer" which has been added to claim 1 of each of the main and first and second auxiliary requests to form claim 1 of the third, fourth and fifth auxiliary requests respectively. This feature has been taken from page 17, lines 4 to 6, of the original application where, similarly to feature (12) discussed above, it is indicated as being preferred but with no discussion of any advantage associated therewith. To some extent the feature appears at odds with the statement on page 11, lines 35 to 37 of the application that preferably the

material of the interior layer is similar or identical to that of the outer layer. Be that as it may, the appellants argued that by virtue of this feature, which they understood as meaning that the ultimate elongation value of the material of the inner layer was greater than that of the material of the outer layer, the two layers could be better adapted to their specific roles. The Board can in principle accept that evaluation. The considerations involved, however, do not go beyond those which would be routine for the person skilled in the art. Thus the addition of this feature cannot lead to a different conclusion with regard to invention step to that already reached with respect to the main and first and second auxiliary requests.

In summary, claim 1 of none of the auxiliary requests relates to patentable subject-matter.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Fabiani F. Gumbel