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**Datasheet for the decision
of 17 April 2018**

Case Number: T 1672/14 - 3.3.03

Application Number: 08160542.0

Publication Number: 2145923

IPC: C08L23/12, C08L23/14

Language of the proceedings: EN

Title of invention:

Pipe of high stiffness comprising a heterophasic polymer composition

Patent Proprietor:

Borealis AG

Opponent:

Lummus Novolen Technology GmbH

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - (no) - (Main request, first and second auxiliary requests)



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Case Number: T 1672/14 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 17 April 2018

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(Patent Proprietor)

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Decision under appeal:

**Interlocutory decision of the Opposition
Division of the European Patent Office posted on
22 May 2014 concerning maintenance of the
European Patent No. 2145923 in amended form.**

Composition of the Board:

Chairman D. Semino
Members: M. C. Gordon
 C. Brandt

Summary of Facts and Submissions

I. The appeal of the patent proprietor lies from the interlocutory decision of the opposition division posted on 22 May 2014 according to which European Patent number 2 145 923 could be maintained in amended form on the basis of the first auxiliary requests (claims 1-13), filed as fourth auxiliary request with letter of 31 March 2014 and renumbered at the oral proceedings before the opposition division.

II. The patent was granted with a set of 18 claims, whereby claim 1 read as follows:

"A heterophasic polymer composition comprising
- a matrix comprising a propylene homopolymer and/or a propylene copolymer having an amount of comonomer units of less than 1.0 wt%
- an elastomeric polypropylene which is dispersed within the matrix and comprises comonomer units derived from ethylene and/or a C4 to C12 alpha-olefin,

the heterophasic polymer composition having an amorphous fraction AM in an amount of 2.0-7.5 wt%, and the amorphous fraction AM having an amount of ethylene- and/or C4 to C12 alpha-olefin derived comonomer units of 20 to 45 wt%."

III. A notice of opposition against the patent was filed in which revocation of the patent was requested.

The following document, *inter alia* was cited in the opposition procedure:

D3: EP-A-1 632 529.

- IV. The decision of the opposition division was based on the claims of the patent as granted as the main request, in which set of claims a clerical error relating to claim 8 (omission of part of the wording thereof) had been corrected, and on a first auxiliary request, claim 1 of which differed from claim 1 of the patent as granted in that:
- the claim was directed to a pipe comprising a heterophasic polymer composition
 - the comonomer was restricted to ethylene
 - the amount of ethylene-derived monomer units in the amorphous fraction was restricted to 23 to 32 wt%.

According to the decision under appeal, the subject-matter of the main request lacked novelty, *inter alia* with respect to the disclosure of the aforementioned D3. The claims of the first auxiliary request were held to meet the requirements of Article 56 EPC, whereby D3 was considered by both parties to constitute the closest prior art.

- V. The patent proprietor (appellant) filed an appeal.

Together with the statement of grounds of appeal, four sets of claims were submitted (main request, first to third auxiliary requests).

The main request corresponded to the (corrected) claims of the patent as granted (see above).

Claim 1 of the first auxiliary request restricted the comonomer to ethylene and the amount thereof in the heterophasic composition to less than 2.0 wt%.

Claim 1 of the second auxiliary request differed from

the main request by restricting the comonomer to ethylene and the amount thereof in the amorphous fraction to 22 to 35 wt%.

The third auxiliary request corresponded to the set of claims as upheld by the opposition division. Because the patent proprietor is the sole appellant, this set of claims does not need to be considered by the Board.

Arguments in support of novelty and inventive step for the main request and first and second auxiliary requests were advanced.

- VI. The opponent (respondent) replied, maintaining objections of lack of novelty and/or inventive step in respect of all requests.
- VII. The Board issued a summons to oral proceedings and a communication setting out its preliminary position.
- VIII. The appellant made a further written submission.
- IX. Oral proceedings were held before the Board on 17 April 2018.
- X. The arguments of the appellant, insofar as relevant for the decision, can be summarised as follows:

- (a) Main request

- (i) Novelty

- Novelty over the disclosure of document D3 had to be acknowledged in view of the presence of a new selection within the general disclosure of that document. In

particular example 7 thereof differed from the composition of claim 1 by the ethylene content in the amorphous phase.

(ii) Inventive step

The problem addressed was to provide polymers suitable for preparing non-pressure pipes. Such pipes required in particular high stiffness whilst impact strength was of lesser significance. This property profile required a particular amount and constitution of the amorphous phase.

Closest prior art was D3, the examples of which all had higher (calculated) ethylene content in the amorphous phase than required by the operative claims. All examples of D3 had lower tensile strength than was shown in the examples of the patent. It had been discovered that the constitution and amount of the amorphous phase had to be adjusted in order to attain the required balance of properties. That this had been achieved was demonstrated by the data of the patent, and also by a direct comparison of these data with the results reported in D3, which comparison was possible in view of the similarities in the respective processes. In effect, the teaching of D3 was contrary to and hence taught away from the invention of the patent-in-suit by proposing higher contents of ethylene. Although D3 taught that, if the amount of the amorphous phase was

reduced, it was possible to get a good modulus, the teaching thereof required a minimum amount of ethylene comonomer. Thus if the amount of amorphous content in the compositions was reduced, then, in order to comply with the requirements of D3 regarding ethylene content, it would be necessary to increase the amount of ethylene comonomer to above the range now claimed. Thus it was in effect necessary, when seeking to modify the compositions disclosed in D3 whilst following the general teachings thereof, to make a double adjustment (content of amorphous phase, constitution of amorphous phase) which would necessarily result in either an ethylene content or an amorphous phase content, or both that was/were not within the claimed range of the patent in suit.

(b) First auxiliary request - inventive step

The examples of the patent demonstrated the effect of the limitation of the ethylene content. In the comparative examples the amount of amorphous phase was increased which had as a consequence that the amount of ethylene was increased commensurately to an amount above the maximum permitted. The evidence was that the higher amount of ethylene resulted in lower tensile modulus in particular in respect of ring stiffness. Thus it was shown that only with an ethylene content below 2 wt% was a good ring stiffness obtained.

D3 taught against such a modification since it

required an ethylene content of at least 2 wt%.

(c) Second auxiliary request - inventive step

The same arguments as for the main request applied.

XI. The arguments of the respondent can be summarised as follows:

(a) Main request

(i) Novelty

D3 was novelty destroying as the conditions needed to be satisfied to acknowledge novelty of a selection were not met.

(ii) Inventive step

The closest prior art was represented by Example 7 of D3, which disclosed all features of the operative claim apart from the ethylene content in the amorphous phase which was calculated to be 46.6 wt% compared to the upper limit of 45 wt% required by the claim. There was no indication that either the specific range of ethylene content in the amorphous phase or the combination of features of the content of the amorphous phase and the content of ethylene comonomer therein jointly had any influence on the properties of the composition, because all examples of the patent had an ethylene content of the amorphous phase within the claimed range. The data of D3 and the patent were not directly comparable due to the different

conditions used in the preparation. The problem solved was therefore simply the provision of an alternative composition.

Although the evidence appeared to show that modifying the amount of the amorphous phase influenced the tensile modulus, D3 already taught that the content of the amorphous phase should be restricted in order not to negatively impact on the modulus.

Furthermore the preferred range of amorphous phase content according to D3 corresponded largely to that of the operative claims. D3 also taught that the amount of the amorphous phase should not be too low, otherwise impact properties suffered. However neither the patent nor D3 defined a lower limit for the amount of amorphous phase and there was no evidence that the specified amount was associated with any technical effect. Consequently the subject-matter claimed represented an arbitrary modification of the teaching of D3 which furthermore gave rise to predictable, known effects. The compositions of D3 in their generality contained ca 5-8 g of the amorphous phase of which around 20-40 wt% was ethylene, an amount which was within the claimed range, meaning that there was in effect no distinguishing feature - any problem that could be formulated was merely an "fictive" or "artificial" problem. The contents of amorphous phase and ethylene within the compositions, respectively of D3 and of the patent were linked such that if one was

reduced the other had to be increased to compensate i.e. to maintain the required ethylene content in the respective heterophasic composition.

(b) First auxiliary request -inventive step

The restriction of the ethylene content constituted a notional difference but in practice did not provide any further distinction compared to the subject-matter of the main request, and there was no evidence to show otherwise. The examples of the patent did not demonstrate any effect associated with the threshold of 2 wt% ethylene. The restriction to this content thus had to be seen as arbitrary.

(c) Second auxiliary request - inventive step

Objections of lack of inventive step were maintained for this request, for essentially the same reasons as reported above.

XII. The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (rejection of the opposition) or, alternatively, that the patent be maintained on the basis of the first or second auxiliary request filed with the statement of grounds of appeal.

XIII. The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. Main request

1.1 Novelty

The composition of claim 1 is novel over example 7 of D3, which was not disputed by the respondent (see section 1.2.2 for a detailed analysis of example 7 of D3). As inventive step is not acknowledged starting from example 7 of D3 as the closest prior art (see Section 1.2.4 - 1.2.6 below), there is no need for the Board to decide on novelty over the general disclosure of D3 with regard to presence of a novel selection.

1.2 Inventive step

1.2.1 The patent in suit

The patent in suit is directed to heterophasic polymer compositions of improved stiffness which are in particular useful for the preparation of non-pressure pipes (paragraphs [0001]-[0004]). In paragraphs [0005] and [0007] it is explained that such pipes have to withstand external positive pressure e.g. due to earth load when the pipe is buried in soil, traffic load etc. with no internal pressure. For polypropylene pipes the stiffness is derived mainly from the pipe material and is quantified by the tensile modulus ([0007]). Since the pipes will be exposed to a wide range of temperatures they must exhibit impact strength ([0008]). Stiffness and impact strength are however conflicting properties meaning that it is difficult to increase the tensile modulus (stiffness) whilst maintaining impact strength at an acceptable level ([0009]). Known materials for non-pressure pipes, e.g.

concrete or ceramics are heavy and brittle. Polymers are also known for this use. Polypropylene has low weight and, compared to PVC, has better high and low temperature properties and is weldable ([0006]). Hence the problem addressed by the patent in suit was to provide a polymer composition useful for preparation of a pipe of high stiffness whilst at the same time having low temperature impact strength at an acceptable level ([0013]).

1.2.2 The closest prior art

According to the decision and both parties the most relevant teaching was provided by D3, which document is also directed to non-pressure pipes ("pressureless" in the terminology of D3).

In particular D3 aims at providing non-pressure pipes which combine high stiffness and low brittleness, i.e. high modulus and high impact strength at low temperatures (paragraph [0025] of D3).

This is achieved according to claim 1 of D3 by a heterophasic propylene composition having a matrix of propylene homopolymer and a dispersed phase of an elastomeric copolymer of propylene and at least one olefin comonomer.

The most relevant disclosure within D3 is example 7 which was explicitly referred to by the respondent (see section XI, above).

This example relates to heterophasic polypropylene wherein the matrix was propylene homopolymer and the content of amorphous fraction was 5.8 wt% (Table 5) and the (calculated) ethylene content of the amorphous

fraction was 46.6 wt %.

The ethylene content of the amorphous phase is not disclosed explicitly in D3 and was calculated by the opposition division (see decision of the opposition division, page 3, 5th complete paragraph). Neither party disputed the correctness of this calculation.

This example is thus considered to represent the closest prior art.

1.2.3 Distinguishing feature

The subject-matter of operative claim 1 is distinguished from the disclosure of D3, example 7 by the specified content of ethylene in the amorphous phase of 20-45 wt% (with respect to 46.6 wt% in example 7).

1.2.4 Evidence for a technical effect

The patent contains four examples the properties of which are summarised in Table 2:

Table 2: Properties of the materials according to E1-E2 and CE1-CE2

	E1	E2	CE1	CE2
MFR2 (g/10 min)	0.31	0.3	0.25	0.25
Intrinsic Viscosity(dl/g))	4.12	4.06	3.5	3.5
XS (w%)	5.2	5.6	9	11
Ethene content (%)	1.6	1.7	3.7	5.1
AM (w%)	4.2	4.5	8	12
Ethene of AM (%)	29	26	34	33
Intrinsic Viscosity of AM (dl/g)	4.3	3.9	3.6	3.5
Stress at yield (MPa)	38.3	37.4	33.1	31.9
Strain at yield (%)	6.5	6.6	7.7	8.5
Strain at break (%)	130	150	58	58
Tensile modulus (MPa)	2040	2010	1778	1685
Charpy notched, 0°C (kJ/m2)	4.1	5.3	6.7	14
Pipe properties				
Ringstiffness (N/m2)	9169	9197	11260	10590
Tensile modulus (MPa)	2228	2156	1812	1707
Mean wall thickness, mm	3.9	3.95	4.4	4.4
Resistance to external blows, H50 (mm), -10°C	1625	2393	>4000	>4000

As will be observed, in all examples the content of ethylene in the amorphous phase is within the claimed range, i.e. these data cannot provide any evidence for a technical effect associated with the sole distinguishing feature.

The appellant referred to the examples of D3 with respect to demonstrating the presence of an effect. Accordingly in the following these data are analysed to establish whether they provide any evidence for a technical effect associated with the distinguishing feature.

D3 provides a detailed overview of the influence of the various components of the system on the overall properties of the heterophasic composition.

It is taught to adjust the property balance of the composition, in particular that of impact resistance

and stiffness, by modifying the amount and constitution of the amorphous phase, of which the distinguishing feature - the ethylene content - is one factor to be adjusted. Thus D3 teaches in paragraphs [0089] and [0090] that the elastomeric copolymer (i.e. amorphous phase) provides impact strength and that the total amount of rubber should be "low" in order not to adversely affect the high modulus but should not be "too low" in order to provide sufficient impact strength.

Regarding the total amorphous phase content D3 discloses in paragraph [0050] that this ranges from 4 to 10 wt%, preferably 5 to 8 wt%.

The data of the patent in suit - as reported in the above Table show that when the amorphous phase content is within the range of the operative claims (4.2 and 4.5 wt% in examples E1 and E2) the heterophasic polymers and pipes made therefrom have improved tensile modulus but poorer impact strength than polymers and pipes produced from similar heterophasic compositions having a higher content of amorphous phase, CE1 having 8 wt% amorphous phase being above the range claimed and in the upper range of both the general and preferred ranges of D3 and CE2 with 12 wt% amorphous phase which is above the range claimed and also above both the preferred and general ranges of D3.

This "trade off" or "balance" between tensile modulus and impact strength is precisely what is taught by the above cited passages of D3.

The ring stiffness - a measure of the resistance of the pipe to deformation/bending - is lower for the pipes according to the claims, i.e. having a lower content of

amorphous material.

This is the same trend as seen in D3, which determines ring stiffness by the same standard ISO EN 9969 (D3 [0035], patent [0078]). This trend is apparent from comparison of the example pair 1 and 3 of D3 which have the same content of ethylene but a different split and the examples pair 1 and 2 which have approximately the same split but differing content of ethylene as is seen from Tables 1 and 2 of D3:



Table 1 Polymerization conditions and polymer properties

	Ex. 1	Ex. 2	Ex. 3
Stage (i)			
Loop			
Temp (°C)	80.0	80.0	80.0
Pressure (kPa)	5500	5500	5500
Split (%)	50.2	50.3	48.6
MFR (10/230) (g/10 min)	0.61	0.8	0.83
GPR1			
Temp (°C)	85.0	85.0	85.0
Pressure (kPa)	2050	2050	2050
Split (%)	49.8	49.7	51.4
MFR (2/230) (g/10 min)	0.34	0.37	0.33
Stage (ii)			
GPR2			
Temp (°C)	70.0	70.0	60.0
Propylene partial pressure (kPa)	413	551	456
MFR (2/230) (g/10 min)	0.31	0.31	0.30
XS (%)	6.3	6.2	7.0
AM (%)	6.3	5.5	5.8
Total ethylene (%)	3	3.1	3.0
SHI _{0/50}	16	15	12

Table 2 Polymer/Pipe properties

	Ex. 1	Ex. 2	Ex. 3
Inner diameter, D _i (mm)	101.80	101.85	101.96
Wall thickness, t (mm)	4.458	4.173	4.122
Ring stiffness, S (N/m ²) ¹⁾	11250	10420	9448
E modulus, E (MPa) ²⁾	1800	2050	1930
E modulus, E (MPa) ³⁾	1930	1880	1870
Impact strength, Charpy (ISO 179/1eA)			
0°C (kJ/m ²)	6.4	6.4	7.8
-20°C (kJ/m ²)	4	4	4.3
Impact strength, H ₅₀ (EN1411, OD 110 mm, -20°C) (m)	3.9	3.9	>4.0

From Table 2 of D3 it is also seen that the Young's modulus - tendentially - increases as the amorphous fraction is reduced. The same trend can be derived from the examples of the patent by calculating Young's modulus from the given values of stress and strain at yield.

The data of D3 thus show that as the amount of rubber (amorphous phase) increases the tensile modulus falls whilst the impact strength improves both on the "neat" polymer and on the resulting pipes. Similarly for the pipes the ring stiffness in the examples of D3 increases as the content of amorphous phase increases.

These are precisely the trends as seen in the examples of the patent in suit, which are in any case not related to the distinguishing feature.

Accordingly, there is no evidence for any unexpected or anomalous results associated with the distinguishing feature either alone or in concert with the other features of the claim.

1.2.5 Objective technical problem

In view of the absence of any data which are suitable to demonstrate the presence of any technical effect associated with the distinguishing feature, the objective technical problem with respect to D3, example 7 has to be formulated as the provision of further compositions.

1.2.6 Obviousness

D3 itself discloses an ethylene content in the amorphous phase (copolymer) in the range of 10-70% wt%, (paragraph [0089]), which encompasses the range defined in operative claim 1 (20-45 wt%).

Thus the claimed subject matter is the result of a routine modification of the teaching of the closest prior art, made following the more general indications provided by D3 when aiming to provide an additional composition for the production of non-pressure ("pressureless") pipes.

1.3 The requirements of Article 56 EPC are therefore not satisfied.

2. First Auxiliary Request - inventive step

As indicated above, claim 1 of this request differs from claim 1 of the main request by restricting the comonomer to ethylene and the amount thereof in the heterophasic composition to less than 2 wt%.

2.1 Distinguishing feature

The heterophasic composition of Example 7 of D3 has an ethylene content of 2.7 wt%. Thus as a result of the amendment there is now a further distinction.

2.2 Technical effect

As shown above, the examples of the patent are not suitable to demonstrate whether an effect can be ascribed specifically to the total content of ethylene since the content of amorphous phase in the inventive examples and the two comparative examples differs by a

factor of ca 2-3.

2.3 Technical problem to be solved

In the light of the absence of any evidence associated with the content of ethylene the problem to be solved with respect to example 7 of D3 can likewise only be formulated as providing further compositions.

2.4 Obviousness

Claim 1 of D3 discloses that the compositions can contain ethylene in an amount of 2-7 wt%. The modification of the composition of example 7 of D3 by employing an amount of ethylene which is formally outside but immediately adjacent to the general range disclosed is an obvious solution to the above formulated technical problem.

2.5 The first auxiliary request therefore does not meet the requirements of Article 56 EPC.

3. Second auxiliary request - inventive step

The appellant provided no additional arguments for this request referring explicitly to those submitted in support of the main request.

The Board can identify no reason to take a different position, with the consequence that the same conclusion as for the main request applies.

The second auxiliary request therefore does not meet the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



L. Stridde

D. Semino

Decision electronically authenticated