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Datasheet for the decision of 22 September 2016

Case Number: T 2210/13 - 3.3.03

Application Number: 07756194.2

Publication Number: 2016127

IPC: C08L23/04, H01B3/44, B65D41/00

Language of the proceedings: EN

Title of invention:
HIGH-DENSITY POLYETHYLENE COMPOSITIONS, METHOD OF MAKING THE SAME, ARTICLES MADE THEREFROM, AND METHOD OF MAKING SUCH ARTICLES

Patent Proprietor:
Dow Global Technologies LLC

Opponent:
Borealis AG

Relevant legal provisions:
EPC Art. 100(b)

Keyword:
Sufficiency of disclosure - (no)

Decisions cited:
T 2222/09

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Case Number: T 2210/13 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 22 September 2016

Appellant: (Patent Proprietor)	Dow Global Technologies LLC 2040 Dow Center Midland, MI 48674 (US)
Representative:	Boult Wade Tennant Verulam Gardens 70 Gray's Inn Road London WC1X 8BT (GB)
Respondent: (Opponent)	Borealis AG IZD Tower Wagramerstrasse 17-19 1220 Wien (AT)
Representative:	Kador & Partner Corneliusstraße 15 80469 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 1 July 2013 revoking European patent No. 2016127 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	D. Semino
Members:	D. Marquis
	C. Heath

Summary of Facts and Submissions

I. European Patent No. 2016127 was granted on the basis of 43 claims, independent claim 1 reading as follows:

"1. A high-density polyethylene composition comprising:

a first component, said first component being a high molecular weight ethylene alpha-olefin copolymer having a density in the range of 0.915 to 0.940 g/cm^3, and a melt index ($I_{21.6}$) in the range of 0.5 to 10 g/10 minutes; and
a second component, said second component being a low molecular weight ethylene polymer having a density in the range of 0.965 to 0.980 g/cm^3, and a melt index (I_2) in the range of 50 to 1500 g/10 minutes;
wherein said high-density polyethylene composition having a melt index (I_2) of at least 1 g/10 minutes, a density in the range of 0.950 to 0.960 g/cm^3, and g' of equal or greater than 1."

II. A notice of opposition was filed in which revocation of the patent on the grounds of Article 100(a) and 100(b) EPC was requested.

III. During opposition proceedings, inter alia the following documents were cited:

D2: B.Hagstrom, Prediction of melt flow rate (MFR) of bimodal polyethylene based on MFR of their components , Conference of Polymer Processing, Gotenburg (Sweden), August 19-21, 1997
D3: R. N. Haward et al., Journal of Polymer Science, part A, Vol 2, pp. 2977 to 3077 (1964)
D5: JP58-103542 (including translation into English)

D7: EP0778289
D12: W093/08221

IV. The decision of the opposition division to revoke the patent was announced at the oral proceedings on 12 June 2013. It was based on two sets of claims filed with letter of 31 May 2013 as main request and as auxiliary request.

The opposition division found that the claimed subject matter was not sufficiently disclosed in the patent in suit because the skilled person could not fulfil the requirement relating to the parameter g' in claim 1. It was in particular held that the patent in suit lacked guidance for an accurate determination of g' as a result of an error in the formula given in the description for the calculation of intrinsic viscosities needed to obtain g'. For this reason, both the main and the auxiliary request lacked sufficiency of disclosure.

V. The patent proprietor (appellant) lodged an appeal against that decision and requested remittal of the case to the opposition division on the basis of the main or auxiliary requests as filed on 31 May 2013.

VI. In its reply to the statement of grounds of appeal, the respondent provided arguments relating to the lack of sufficiency of disclosure of both requests. In particular, it was put forward that the patent in suit did not provide sufficient guidance to perform the preparation process of the claimed composition.

VII. With letter of 27 February 2015, the appellant filed a new main request and and two auxiliary requests. The main request corresponded to the claims of the patent

as granted, while auxiliary requests 1 and 2 corresponded to the main and auxiliary requests as filed with the statement of grounds of appeal.

VIII. In a communication sent in preparation of the oral proceedings, the Board summarised the points to be dealt with, and provided a preliminary view on the disputed issues pointing out that beyond the discussion concerning the error in the formula of the intrinsic viscosity, it had to be considered whether the skilled person could perform a polymerization with the guidance provided in the patent description and arrive at the claimed compositions.

IX. With letter of 30 August 2016, the appellant withdrew his main request filed on 27 February 2015 and indicated that auxiliary requests 1 and 2 filed on 27 February 2015 now constituted its main request and its auxiliary request. Claim 1 of the main request was identical to granted claim 1:

Claim 1 of the auxiliary request differed from claim 1 of the main request only in that the density range of the high molecular weight ethylene alpha-olefin copolymer first component was limited to 0.915 to 0.936 g/cm^3.

X. Oral proceedings were held on 22 September 2016.

XI. The arguments of the appellant, as far as relevant to the present decision, can be summarised as follows:

Sufficiency of disclosure - Main and auxiliary requests

The preparation of high-density compositions as claimed was known to the skilled person. All that was needed to

perform the polymerization like the hydrogen concentration and the comonomer was taught in the description of the patent in suit. The decision T 2222/09 of 20 March 2014 also showed that the determination of the density and melt index of the second component in the course of the preparation of the claimed composition was not an issue of sufficiency of disclosure but rather of clarity. As to the adjustment of these parameters, it was common general knowledge to adjust the density of a polymer fraction by controlling the amount of alpha-olefin comonomer built into the ethylene polymer and it was widely practiced to control the hydrogen concentration in the reactor in order to control the melt index, as illustrated in the examples and tables of the patent in suit. The density and melt index of the second component could also be calculated as shown in D5 and D7. The parameter g' was known for a long time as an indicator for long chain branching. The fact that the exact nature of the Ziegler-Natta catalyst used in the examples was not disclosed was not relevant as shown by D12. The skilled person knew that by using conventional catalysts he would normally make conventional linear polymers which were expected to have a g' of around 1 when corrected for comonomer content. Furthermore, dual polymerization was not the sole route to the claimed compositions, as the claimed subject matter could alternatively be achieved by blending the first and second components. The same arguments applied to the auxiliary request. Claim 1 of the main and auxiliary requests was therefore sufficiently disclosed.

XII. The arguments of the respondent, as far as relevant to the present decision, can be summarised as follows:

Sufficiency of disclosure - Main and auxiliary requests

It was nowhere disclosed in the general description of the patent, the examples or the claims how the claimed high-density polyethylene composition could be obtained. For instance, for each type of catalyst only a very general disclosure of suitable compositions was given in the general description without teaching especially suitable single catalyst compositions. Also, although almost any kind of polymerization reactions was disclosed in the patent in suit, the reaction conditions such as temperature, pressure, amount of reaction gases, inert gases, chain transfer agent were not at all mentioned in the description. The catalyst that was used in all the examples of the patent in suit was not identified, nor were the density and the melt index of the second component. The parameter g' was only given for the composition of example 1. As a result of the missing polymerization conditions, it was not possible to rework any of the examples provided to gain knowledge on how the combination of features in the claim was obtained. The patent in suit therefore did not properly describe the process for the production of the high density polyethylene composition of claim 1. Claim 1 of both requests was therefore insufficiently disclosed.

XIII. The appellant requested that the decision under appeal be set aside and that the case be remitted to the opposition division for further consideration on the basis of the claims of the main request or the auxiliary request, both filed with letter dated 27 February 2015 as auxiliary requests 1 and 2, respectively.

XIV. The respondent requested that the appeal be dismissed or that the case be remitted to the opposition division

for consideration of the remaining grounds of opposition.

Reasons for the Decision

Main and auxiliary request

1. Sufficiency of disclosure

1.1 Claim 1 of the patent in suit pertains to a high-density polyethylene composition comprising a first component being a high molecular weight ethylene alpha-olefin copolymer and a second component being a low molecular weight ethylene polymer, the composition as well as both first and second components being characterized by a combination of seven conditions of parameters defined by numerical ranges (density, melt index $I_{21.6}$, melt index I_2 and g').

1.2 The description of the patent in suit contains the following general information concerning the preparation of the claimed high-density polyethylene composition:

- Suitable alpha-olefin monomers forming part of the first component are disclosed in paragraph 48.

- According to paragraph 60, any catalyst or catalyst system can be used that can lead to the first and second component having the narrow densities and melt index as well as the high-density polyethylene composition having the density, melt index and g' within the claimed ranges. Transition metal catalysts systems based on magnesium/titanium, Ziegler-Natta or metallocene catalyst systems are

disclosed in general terms in paragraphs 60 to 66. According to paragraphs 67 to 72, the cocatalysts or activators that are used are conventionally comprised of aluminum, lithium, sodium and potassium, alkaline earth metals, as well as compounds of other earth metals than aluminum compounds usually as hydrides, organometal or halide compounds.

- According to paragraphs 78 to 82, any conventional ethylene homopolymerization or (co)polymerization reactions may be employed to produce the inventive high-density polyethylene composition. As such, conventional ethylene homopolymerization or (co)polymerization reactions include, but are not limited to, gas phase polymerization, slurry phase polymerization, liquid phase polymerization, and combinations thereof using conventional reactors, for example gas phase reactors, loop reactors, stirred tank reactors, and batch reactors in series, or in series and parallel.

1.3 The preparation of the claimed high-density polyethylene composition including the preparation of the first and second components is therefore only disclosed in very general terms in the description of the patent in suit. The combination of seven conditions on parameters necessary to obtain the claimed composition is however not trivial, as can be derived from the passage in paragraph 88 of the patent in suit. A guidance describing how the steps of the preparation have to be performed specifically so as to obtain the high-density polyethylene composition as claimed is however not provided in the patent in suit. It has also not been made plausible that the claimed specific combination of conditions on the parameters of the

composition could be achieved with any comonomer as defined in paragraph 48, through the use of any of the catalysts and cocatalysts disclosed in paragraphs 60 to 77 and all polymerization reactions disclosed in paragraphs 78 to 82.

1.4 Alternatively, the patent in suit discloses that the claimed compositions can be be produced from polymers made in two or more independent reactors (each using the same or different catalyst) with post reaction blending (paragraph 83). There is no guidance as to how the individual components have to be chosen and blended so as to provide a composition fulfilling the set of conditions set out in claim 1. As a result, even the disclosure of the preparation of the claimed compositions by blending of a first and second component is insufficient in the patent in suit.

1.5 Also, the patent in suit does not provide any information on how a skilled person has to modify the preparation of the claimed composition should a high-density polyethylene composition be obtained that would not fulfil the combination of conditions on the parameters as set out in claim 1. As the description of the patent in suit contains only general, unspecific information about the preparation steps of the claimed composition, the skilled person is not provided with adequate information leading necessarily and directly towards success through the evaluation of initial failures. While it may be true that the density of the first component may be controlled through the amount of comonomer and the quantity of hydrogen may be changed to influence the individual molecular weights and therefore the individual melt indexes, what is required here goes well beyond these qualitative individual observations, as the skilled person is required to

control numerous parameters, which interact with each other, including a specific, much less common parameter (g') for which no guidance is given and which is required to remain in a specific range. The skilled person must consequently resolve to establish by trial and error whether or not his particular choice of numerous preparation steps will provide a high-density polyethylene composition fulfilling the combination of conditions as set out in claim 1. As a result, the skilled person is compelled to conduct a research programme in order to find out which set of catalyst, activator, comonomer, polymerization type, polymerization conditions (*inter alia* temperature and pressure) must be used for that purpose.

1.6 The teaching of the description of the patent in suit is further illustrated by the examples 1 to 6 wherein a dual-sequential polymerization system with a first gas phase reactor and a second gas phase reactor operating in series is described (paragraph 90). In the polymerization of these examples, ethylene, one or more alpha-olefin comonomers, hydrogen, a catalyst, for example a Ziegler-Natta catalyst, N_2, and isopentane were fed continuously into the first reactor. Subsequently, a cocatalyst, for example triethylaluminum (TEAL), was fed continuously into the first reactor to activate the catalyst. The first polymerization reaction of the ethylene in the presence of 1-hexene was carried out in the first reactor under the conditions shown in Table I, thereby producing the first component-catalyst complex that was continuously transferred to the second reactor wherein the second polymerization reaction of ethylene was carried out, thereby producing the first component-catalyst-second component complex then continuously removed from the second reactor in batches to provide the claimed high-

density polyethylene composition.

1.7 The properties of the components and composition produced according to that polymerization process are reported in Table I of the patent in suit. However, neither the identity of the catalyst is disclosed nor are the density and the melt index I_2 of the second component in the examples 1 to 6. Also, the value of g' is only provided for the composition of example 1. Consequently, none of the examples provided in the patent in suit actually teaches how to obtain a composition according to claim 1 of the main request, both because crucial details are missing and because it is not even verified whether the combination of the seven parameters is obtained. Neither can a teaching be derived from the compositions of the comparative examples since these are only commercially available products the preparation of which is not provided in the patent in suit (paragraph 91).

1.8 The data provided in the examples of the patent in suit does therefore not provide the teaching necessary to guide the skilled person to obtain the claimed composition.

1.9 The additional documents cited by the appellant as evidence of common general knowledge available to the skilled person do not change the conclusion reached on the basis of the information in the patent. Even if the skilled person were to consider the teachings of D2 and D3 relating to the prediction of the melt flow rate of a composition on the basis of the melt flow rate of their components, these documents do not provide a teaching relating to the polymerization conditions describing how the claimed composition could be prepared. As to D12, that document relates to

substantially linear olefin polymers characterized as having: a) a melt flow ratio, $I_{10}/I_2>5.63$, b) a molecular weight distribution, Mw /Mn, defined by the equation: $M_w /M_n<(I_{10}/I_2)-4.63$, and c) a critical shear rate at onset of surface melt fracture of at least 50 percent greater than the critical shear rate at the onset of surface melt fracture of a linear olefin polymer having about the same I_2 and M_w/M_n, and wherein the olefin polymer is further characterized as a copolymer of ethylene with a C_3-C_{20} alpha-olefin (see in particular claims 2 and 10). It has not been shown how D12 could provide the necessary teaching for the preparation of high-density polyethylene compositions made of a first and second component according to claim 1 of the patent in suit. The examples of D12 only disclose the preparation of substantially linear ethylene/alpha-olefin copolymers by a continuous solution polymerization process. The examples of D12 do not pertain to compositions of two polymeric components as in the patent in suit. The information derived therefrom cannot therefore supplement that of the patent in suit. D12 does not provide a teaching as to how the polymerization process of the first and second components of the patent in suit has to be performed in order to obtain a composition according to claim 1 of the main request.

1.10 For these reasons, the Board concludes that the high-density composition according to claim 1 is not sufficiently disclosed in the patent in suit. The main request does not fulfil the requirement of sufficiency of disclosure.

1.11 The Board considers that the conclusion reached in the present case does not contradict the conclusion in T 2222/09 (*supra*) due to the profound differences in

the facts of the two cases.

1.11.1 In decision T 2222/09, claim 1 related to a screw cap comprising a composition based on a multimodal ethylene polymer defined by its density and melt flow index comprising a fraction of ethylene polymer (A) and a fraction of a copolymer (B) of ethylene and at least one alpha-olefin containing from 3 to 12 carbon atoms, both fractions also defined by their melt flow index. The first point made by the respondents in that case was that the value of the melt flow index was not an accurate value because it depended on factors not described in the patent in suit. The Board considered that the respondents had thereby merely shown the existence of an ambiguity due to a lacking definition of the model used to calculate the melt flow index of the polymer obtained in the second polymerization stage. The respondents had not shown that the skilled person would not be able to obtain or produce a polymer as defined in claim 1 simply because there was a lack of accuracy of the melt index value obtained by calculation. It had therefore not been shown how that lack of accuracy would lead to a lack of sufficiency of disclosure of the claimed subject matter. As a consequence, the ambiguity regarding the calculation of the melt index of the second component was not regarded as establishing insufficient disclosure (see points 3.7 and 3.8 in the grounds of the decision). That is, however, not the question raised in the present decision.

1.11.2 In another line of argument regarding insufficiency, the respondents in case T 2222/09 had submitted that it was impossible to make the claimed composition meet all the melt index requirements over the whole range. However, the Board held that as shown in the examples

of the patent of that case, it was possible to obtain a polymer falling within the definition of claim 1 (see points 3.9 and 3.10 in the grounds of the decision). Both points raised in case T 2222/09 differ substantially from the present case in that the objection of the present case is not that of a lack of accuracy of the determination of a claimed parameter but rather that of a lack of guidance in the general description as well as in the examples regarding the preparation of a composition that needs to satisfy a combination of several parameters.

1.12 Claim 1 of the auxiliary requests differs from claim 1 of the main request only in that the upper limit of the range corresponding to the density of the first component was lowered from 0.940 to 0.936 g/cm^3. The appellant indicated that the same arguments relating to the sufficiency of disclosure would also apply to claim 1 of the auxiliary request. It was neither shown, nor argued that that limitation of the density of the first component provided a remedy to the lack of sufficiency of disclosure of the patent in suit. For the same reasons as detailed for the main request, the patent in suit does not provide the necessary guidance to arrive at the subject matter claimed in the auxiliary requests. The auxiliary request shares therefore the same fate as the main request, namely it does not fulfil the requirement of sufficiency of disclosure.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

B. ter Heijden D. Semino

Decision electronically authenticated