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Bezeichnung der Erfindung: Acrylomitrile polymer fiber and process for preparing same
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : D 01 F 6/38

ENTSCHEIDUNG / DECISION
vom / of / du 2 April 1985

~~Anmelder / Applicant / Requerant~~

Patentinhaber / Proprietor of the patent / Titulaire du brevet : American Cyanamid Corp. (appellant)

Einsprechender / Opponent / Opposant : Hoechst AG.

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art.52(1),56 EPC

"inventive step", "selection"

Leitsatz / Headnote / Sommaire

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Case Number: T 90 / 84

DECISION

of the Technical Board of Appeal 3.3.1

of 2 April 1985

Appellant: (Proprietor of the patent)
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Representative:

Decision under appeal:
Decision of the Opposition Division of the European Patent Office dated 16.02.1984 revoking European patent No. 8 849 pursuant to Article 102(1) EPC

Composition of the Board:

Chairman: K. Jahn
Member: G. Szabo
Member: F. Benussi

Summary of Facts and Submissions

I. European Patent No. 8849 was granted on 28 April 1982 on the basis of six claims in response to the European patent application No. 79 301 263.4 filed on 29 June 1979 claiming the priority of the earlier application of 30 August 1978 in the U.S.A. Claim 1 was worded as follows :

"1. A process for preparing an acrylonitrile polymer fiber, wherein there is provided an homogeneous fusion melt of an acrylonitrile polymer and water at a temperature above the boiling point of water at atmospheric pressure and at a temperature and pressure sufficient to maintain water and said polymer as an homogeneous fusion melt; said fusion melt is extruded through a spinnerette directly into a steam-pressurized solidification zone maintained under conditions which control the rate of release of water from the nascent extrudate as it emerges from the spinnerette to avoid deformation of said extrudate; and said extrudate is stretched while in said solidification zone; characterized in that said acrylonitrile polymer is a copolymer which contains at least 1 mol percent of comonomer and which has a number average molecular weight of at least 6,000 but less than 15,000, and in that said stretching of said extrudate in said solidification zone is conducted in two stages to provide a total stretch ratio of at least 25, the first stage of stretching being at a stretch ratio less than that of the second stage."

II. The Opponent filed opposition against the European patent on 26 January 1983, requesting that it be revoked on the ground of lack of inventive step. The opposition was supported by new references to the state of the art.

III. The Opposition Division revoked the patent in a decision of 16 February 1984. The reason for the revocation was that the subject-matter of any one of Claims 1 to 4 was lacking an inventive step. The only real difference between the main claim and the process specifically disclosed in DE-A-2 403 947 (I) was the choice of acrylonitrile copolymers with a number average molecular weight from 6 000 to 15 000 and of a two-stage stretching of the fibre, wherein the first stretch must have a stretch ratio less than that of the second one, within a specified range of total value of 25 to 250. However, the cited document (I) also mentions that the molecular weight range for acrylonitrile may extend from 10 000 to 200 000 or even beyond, and this statement is also applicable to fibres as well as foils. As to the refined stretching technique, the same citation already disclosed the possibility of a two-stage stretching within the same range of total values, and suggested that the first stretch should have a ratio from 5 to 150 and the second from 1.1 to 30. This meant that the choice of about 16 to 30 for the second stretch inevitably required a lower first stretch ratio. The skilled person would have recognized all three possibilities, implied by the disclosure, i.e. equal ratios and those two wherein one or the other is greater. To arrive at the invention by routine testing of the limited range of possibilities must be considered obvious.

IV. On 9 April 1984 the Patentee filed an appeal against the decision of 16 February 1984 paying the fee at the same time. The Statement of Ground, was filed on 22 June 1984. After a further exchange of comments an oral hearing was held on 2 April 1985. At the hearing the Appellant amended the claims by deleting product Claims 5 and 6, and also submitted a text which brought the specification in line with the claims.

V. The Appellant submitted during the procedure and the oral hearing substantially the following arguments :

a) The problem facing the inventor was to spin fibres with acceptable physical properties from low molecular weight acrylonitriles. The problem was solved in spite of bad experience with such material and of express statements in the literature suggesting to use material with considerably higher molecular weight.

b) The question is that of patentable selection. This is at hand when the invention could not have been easily arrived at by routine trial and error and there are unexpected advantages. In comparison with the cited art, two features are important : the choice of low molecular weight acrylonitrile polymers and the particular requirement of stretch ratios.

c) The cited patent only mentions a range for molecular weights from 10 000 and this could also mean shaped objects other than fibres. The examples with fibres were all using material with a molecular weight of 58 000. The related US-A-4 163 770 (II) is limited to fibres and the range only starts at 30 000. The relevant literature suggests 15 000 and 16 000 as minimum practicable values for polyacrylonitrile fibres. As regards the stretch ratios, the closest state of the art makes no recommendation about the use of lower ratio in the first stage. If anything the document refers to a range generally higher than that disclosed for the second stage. Only 20% of all possible choices within the state of the art would fall within the ambit of the invention in this particular respect.

d) The state of the art points in no way to the solution of the problem according to the invention. The technique suggested in the main citation only provides somewhat inferior material. The suggested conditions of the process claimed in the present patent are essential and at last produce material with acceptable quality with lower molecular weight acrylonitriles. To find the specified conditions would have required a major project of experimentation.

VI. The Respondent argues substantially as follows :

a) The difference between document (I) and its US counterpart (II), published after the priority date of the patent in dispute, could well be due to amendments necessitated by filing divisional or continuation applications for the matter. Furthermore, the comparisons of molecular weights are unfair since some of those in the literature, and most likely in document (I), are expressed in weight averages and not in numerical averages. The former could be 4 to 5 times the value of the latter. In view of this, there is nothing unusual in using material which is based on low molecular weight acrylonitriles provided the values are expressed in terms of the lower numerical averages as it has been done by the Appellant.

b) In selection cases the result must represent unexpected advantages or improvements. The alleged savings in energy etc. could be easily foreseen in view of the reduced viscosities whenever lower molecular weight acrylonitriles are employed. In face of the stated problem, the claimed measures are obvious and necessary, in view of normal practice to seek improvements.

VII. The Appellant requests that the contested decision be set aside and that the patent be maintained on the basis of Claims 1 to 4 and the adapted description. The Respondent requests that the appeal be dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. The relevant closest state of the art is described in document (I) which concerns the preparation of filaments, fibres and foils by melt spinning from acrylonitrile copolymers having a molecular weight from 10 000 to 200 000. Although 20 000 and 40 000 are also mentioned, the specific examples rely on material with a molecular weight of 58 000. Characteristically the method involves a total stretch ratio from 25 to 250 (page 20, line 4), and this may either be carried out in one stage or in two stages wherein the first stage represents a ratio from 5 to 150 and the second a ratio from 1.1 to 30 (page 20, lines 23 to 28).

3. The technical problem in respect of this state of the art was to apply the known process to acrylonitrile copolymer fibres with low molecular weights so that the expected loss of quality is reduced, which means that the quality is relatively improved and the product thereby represents acceptable physical properties. The solution of the problem involves, in addition to the choice of material with a number average molecular weight of at least 6 000 and less than 15 000, a two stage stretch within the known total stretch ratio of at least 25, wherein the first stretch has, characteristically, a lower ratio than the second one. According to the examples, the resulting fibres have a straight tenacity from 2.9 to 4.7 g/denier, a straight

elongation from 27 to 35%, a loop tenacity from 1.8 to 2.4 g/d and a loop elongation from 13 to 23%. This should bring the quality of the fibres within the ranges of values provided by commercial acrylic fibres.

4. As to the technical relevance of the particular manner of carrying out the two stretches, i.e. using a lower ratio in the first stretch than in the second one, the Appellant presented comparative results in the opposition proceedings (16.8.83). The values for the above mentioned four relevant properties improve significantly in 13 out of 16 instances in the case of the four different fibres made according to the invention, in comparison with fibres processed under the same total stretch wherein the second stretch ratio was equal with or lower than the first one. In two of the remaining three instances the loop elongation showed no superiority and in one case the straight elongation was marginally less than in the comparisons. Nevertheless, straight tenacity and loop tenacity improved in all instances. The figures have remained unchallenged in these proceedings and can be taken as evidence to the effect that the alleged improvement has been achieved.

5. As to the question of novelty, this depends to some extent whether or not the cited art contained instructions which directly implied that two stage stretching is to be carried out by selecting a stretch with a lower ratio first. The Opposition Division came to the conclusion that this particular feature was also disclosed in document (I) because the choice of a second stretch with a ratio higher than 16 (exactly from 15.8 to 30), i.e. in nearly half the cases, would inevitably require a first stretch ratio with a lower value in view of the maximum for the total stretch.

6. The Board cannot accept this as being tantamount to a specific disclosure of the required relationship of the stretch ratios. There was no compelling reason to chose the upper half of the available range for the second stretch, let alone to consider this first. If anything, the careful selection of the ratio for the first stretch first might have been more sensible. This would have meant a higher first stretch ratio within 15.8 to 150, i.e. in 92% of available choices of a ratio within the range. It is also relevant that the broad range given for the first stretch starts and ends higher than the corresponding end-points of the narrow range of second stretch ratios. This gives the impression of a signpost rather pointing to a higher first stretch ratio, in the direction opposite to that now recommended by the patent in suit. The area of selection is no more than about 20% of that originally available, without a single specific example disclosed in the state of the art even for a two-stage processing.

7. The Opposition Division was in error when it considered a particular feature of the claim, i.e. the relatively smaller first stretch ratio, within the general area of two-stage stretching, as disclosed specifically in the cited art on the basis that the skilled man could recognise this as a sub-group. However, such reasoning would destroy the novelty of the selection in most cases since all features needed to distinguish a particular sub-group are usually mentioned in the parent document and the selection may then be derivable as a formal exercise. Against this, the Board holds the view that no sub-group is disclosed in an individualised manner by implication, unless it is directly recognisable by the skilled person on the basis of some relevant specific grounds according to the disclosure which would compel him to become aware of the same, and which would not be applicable to other sub-groups. Since there is no hint in the disclosure leading to the required kind of

combination of stretches, the skilled person would have had no reason to take notice of this in particular, out of the three possibilities. The specified selection on this basis is therefore novel in the given context, and this is additionally confirmed by the distinctive results which are associated with it (cf. Decision T 198/84, "Thiochlorformiate/BASF", 28.2.85, to be reported).

8. In view of the above, the question of the proper interpretation of various kinds of references to molecular weight, i.e. whether or not they are numerical or weight averages, becomes irrelevant for the assessment of novelty. In any case, document (I) refers to 10 000, 20 000 and 40 000 specifically. Either does the first of these fall within the terms of the claim in the patent or would one of the others do the same when converted through division by a factor of 2 to 5 to a numerical average. Whilst the use of a relatively low molecular weight copolymer was thus not excluded by the broad statements of the cited earlier specification, such disclosure was not coupled with the concept of processing the same in a two-stage stretching in a peculiar manner either. The novelty of Claim 1 in the patent is therefore unaffected.

9. As regards the inventive step, it should first be noted that the mere fact that certain possibilities are available to the skilled person and that he could have therefore acted in a certain manner does not necessarily mean that he would have done so in the light of the problem to achieve a relative improvement in quality and in the absence of expectations of such results or in view of fear that some predicted disadvantages might outweight any small advantage. (cf. T 2/83, "Simethicone Tablet/RIDER", OJ. 6/1984, 265. II. Headnote). Although any use of low molecular weight material would have entailed a lower energy requirement, an increased productivity and the like advantages in con-

sequence of lower viscosity, the expected loss of quality overshadowed the idea. The authoritative statement by Walczak, relying on the much earlier publication by Mark (cf. col. 1, lines 4-20 in the specification), suggests that the lower limit for the numerical molecular weight was 15 000 for acrylonitrile polymer fibres of any value. This has been confirmed by a very recent review of the position (Masson, J.C., et al. Fibre Producer, June 1984, 34-41). The article refers to commercial fibres form acrylic polymers as practicable from a weight average molecular weight of 99 000 onwards, which should of course correspond to at least 20 000 or more in numerical average terms. Although US-A-2 585 444 and DE-2 318 609 also mention low molecular weight polyacrylonitriles, such materials were processed by methods other than melt spinning and are therefore further removed from the invention than (I). The specification itself mentions (col. 5, line 20) Dralon as the closest commercially available product with a numerical average molecular weight of 16 000. Thus the skilled person was somewhat discouraged to explore the lower ranges further in the hope that with some modification the position might be improved.

10. Document (I) relates to shaped articles in general (cf. Claims 1 and 9) and includes foils in addition to fibres in the examples, whilst the related U.S. document (II), published much later on, is only concerned with fibres. The argument that the former mentions material with 10 000 whilst the latter has 30 000 as the lowest value and therefore the former statement must only be attributed to foils and not to fibres, cannot be accepted. In a series of continuation applications the amendments can have reasons other than a recognition of distinction in this respect. The cited document (I) also relates to fibres (cf. Examples 1 and 2) and the statements as to possible molecular weights must be construed to refer to them too in the absence of anything to

the contrary. The fact that there may thus be produced a fibre of somewhat inferior quality which might nevertheless be useful for certain purposes, should not detract from the general belief that the best qualities are obtained with higher molecular weight material. Nor should such situation prevent the skilled man from trying to improve the less-than-perfect types of material, in an ingenious manner, in spite of the discouraging background.

11. The Board relies on the comparative tests submitted on behalf of the Patentee on 16 August 1983. There is nothing on record which suggests that the Respondent has challenged the contention that an improvement against other arrangements of the stretch ratios was thereby demonstrated. The Opposition Division also accepted this as a fact and only remarked that all samples, i.e. irrespective of the alleged inventive distinction, have been shown to have at least useful commercial properties. Whilst this is true, it must also be remembered that the problem to be solved was to obtain relatively improved products in this range and not products which are already superior to those on the market and rely on high molecular weight material. There is also an allegation in the Statement of Grounds that the comparative tests benefited somewhat from the results of 10 years development and the difference in favour of the invention alone would have been more pronounced had the earlier methodology been applied. The onus was actually on the Opponent to make it credible that there is no improvement associated with the selected conditions specified in the claim. In the absence of anything contrary from the Respondent to what the Appellant provided, the Board is bound to come to the conclusion that the claimed process obtains unexpectedly improved results.

12. In view of the expected drop in quality caused by any use of low molecular weight copolymers, the skilled man could have embarked on major experimentation to investigate the numerous process conditions which together influence the melt spinning process. The choice of selecting the feature of stretch and within that the two-stage variant was only one of many possibilities. This and the fact that the inventor acted against the main trend implied in the conditions for the two stretches in the citation show that the invention is not a result of routine measures for optimisation in the most promising obvious directions. Claim 1 therefore involves an inventive step and the same applies to dependent Claims 2 to 4 since these fall fully within its scope.

Order

It is decided that :

1. The decision of the Opposition Division of 16 February 1984 is set aside.

2. The matter is remitted to the first instance with the order to maintain the patent in an amended form as follows :

   a) Claims 1 to 4, as submitted on 2 April 1985,

   b) Title and specification, as submitted on 2 April 1985.

The Registrar The Chairman