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DECISION
of 18 June 1998

Case Number:	T 0799/95 - 3.3.3
Application Number:	90902093.5
Publication Number:	0452405
IPC:	D01F 6/62

Language of the proceedings: EN

Title of invention:
Process for dimensionally stable polyester yarn

Patentee:
AlliedSignal Inc.

Opponent:
Akzo Nobel Fraser AG
Hoechst Aktiengesellschaft Zentrale Patentabteilung

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), (3), 100(b)

Keyword:
"Extension of protection conferred (no) - scope of protection
not extended by the use of a different unit of measurement"
"Sufficiency of disclosure (no) - undue burden"

Decisions cited:
G 0010/91, T 0032/95, T 0226/85, T 0014/83

Catchword:
-

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Boards of Appeal

Chambres de recours

Case Number: T 0799/95 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 18 June 1998

Appellant:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 25 July 1995
revoking European patent No. 0 452 405 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: P. Kitzmantel
           A. C. G. Lindqvist

Summary of Facts and Submissions

I.   European patent application No. 90 902 093.5,
corresponding to PCT/US89/05081 (WO 90/07592) in the
name of AlliedSignal Inc. (formerly Allied-Signal
Inc.), which had been filed on 17 November 1989,
claiming priority from a US application filed on
3 January 1989, resulted in the grant of European
patent No. 452 405 on 16 September 1992 on the basis of
9 claims, independent Claim 1 reading as follows:

"1.   A process for the production of a dimensionally
stable drawn polyethylene terephthalate multifilament
yarn having filaments of at least 2.5 denier per
filament (2.8 dtexpf) comprising the steps of:

a)   extruding a polyethylene terephthalate polymer
melt through a spinnerette having a plurality of
extrusion orifices to form filaments;

b)   advancing the extruded multifilament yarn first
through a delay zone then through a quenching zone to
solidify the filaments in a controlled manner;

c)   withdrawing the solidified multifilament yarn from
the quenching zone at a desired spinning speed V
(km/min);
       whereby the steps a) through c) are performed
under conditions to form a partially-oriented
multifilament yarn having an undrawn birefringence (Δn_u)
of at least 0.020 and wherein $\Delta n_u = R_f V^{2.0} IV^{2.4}$ where IV is
the intrinsic viscosity of the undrawn yarn and is at
least 0.80 and $R_f = R_r R_e$ is at least 9.0×10^{-3}, R_r being

a constant ($0 < R_r < 1$) for given process conditions of steps a) and b), and R_e is at least 10.5×10^{-2}, R_e being the relationship $D^{0.5}/Q^{0.7}$ (D = spinnerette capillary diameter, in cm; Q = polymer flow rate through the capillary, in cm³/min/capillary); then

d) hot drawing the partially-oriented multifilament yarn."

Claims 2 to 9 were dependent on Claim 1.

II.   Notices of Opposition were filed by

-    Akzo Faser AG, now Akzo Nobel Faser AG
     (Opponent I) on 9 June 1993 and by

-    Hoechst AG (Opponent II) on 15 June 1993

requesting revocation of the patent in its entirety, on the grounds of Article 100(a) and (b) EPC.

III. By its decision announced orally on 6 April 1995 and issued in writing on 25 July 1995 the Opposition Division revoked the patent.

(i)   The appealed decision held that the claimed subject-matter was not barred from protection by Article 52(2)(a) EPC.

(ii)   That decision furthermore held that the patent in suit met the requirements of Article 83 EPC, because
       (1) the temperature of measurement of the intrinsic viscosity of 25°C was within the implicit disclosure of the application,

(2) in view of the information contained in the description the meaning of the parameter R_r was not such as to inhibit the invention to be carried out by a person skilled in the art, and (3) the examples in the patent specification could be repeated.

(iii) However, in the Opposition Division's opinion, Claim 1 of the Main Request did not relate to novel subject-matter because the claimed functional relationship between the undrawn birefringence Δn_u, the spinning speed V, the intrinsic viscosity IV, the spinnerette capillary diameter D, the polymer flow rate Q and the quenching conditions was known from both documents

D2: EP-A-169 415 and

D5: EP-A-423 213.

(iv) Although novel because of the enhanced lower limit of the parameter R_f, the subject-matter of Claim 1 of the Auxiliary Request was not considered inventive over D2, because the modification of this factor was merely the result of routine experiments based on trial and error.

IV. Notice of Appeal against the above decision was filed by the Patentee (Appellant) on 25 September 1995. The fee for the appeal was paid on the same day and the Statement of Grounds of Appeal was submitted on 1 December 1995.

Further written submissions of the Appellant dated from 18 May 1998 and 5 June 1998.

Written submissions of the Respondent I (Opponent I)
dated from 13 October 1995 and 10 June 1996; of the
Respondent II (Opponent II) from 20 June 1996 and
14 May 1998.

V.   In the course of the oral proceedings held on 18 June
1998 the Appellant filed a new Main and a new Auxiliary
Request, both comprising a set of six claims each
consisting of an independent Claim 1 and five claims
dependent thereupon.

Claim 1 of the Main Request reads as follows:

"1. A process for the production of a dimensionally
stable drawn polyethylene terephthalate, multifilament
yarn having filaments of at least 2.5 denier per
filament (2.8 dtexpf) comprising the steps of:

a)   extruding a polyethylene terephthalate polymer
melt through a spinnerette having a plurality of
extrusion orifices to form filaments;

b)   advancing the extruded, multifilament yarn first
through a delay zone then through a quenching zone to
solidify the filaments in a controlled manner;

c)   withdrawing the resulting solidified-partially-
oriented multifilament yarn from the quenching zone at
a desired spinning speed V (km/min); and

d)   hot drawing the partially-oriented multifilament
yarn

characterised in that the conditions in steps a) to c)
are selected to form a partially-oriented multifilament
yarn having an undrawn birefringence (Δn_u) of at least
0.020 and wherein $\Delta n_u = R_f V^{2.0} IV^{2.4}$, where IV is the
intrinsic viscosity of the undrawn yarn and is at least

0.80 and $R_f = R_r R_e$ is at least 15×10^{-3}, R_r being a
constant ($0 < R_r < 1$) for given process conditions of steps
a) and b), and R_e is at least 13×10^{-2}, R_e being the
relationship $D^{0.5}/Q^{0.7}$ (D = spinneret capillary diameter,
in inches; Q = polymer flow rate through the capillary,
in cm^3/min/capillary), and D is at least 0.027 inches
(0.069 cm)." .

Claim 1 of the Auxiliary Request differs from the same
claim of the Main Request only by the introduction of
an upper limit of the intrinsic viscosity of the
undrawn yarn of 0.95.

VI.   The written and oral arguments of the Appellant may be
      summarized as follows:

(i)   Claims 1 of both requests did not contravene
      Article 123(2) and (3) EPC, because the change of
      the measurement unit for the diameter "D" from
      "cm" (version as granted) to "inches" was based on
      the disclosure as originally filed, and because no
      new subject-matter was brought into the scope of
      the patent by this amendment;

(ii) the patent specification complied with the
      requirement of Article 100(b) EPC, because the
      mathematical equation in Claim 1, in particular
      the parameter R_r therein, was sufficiently
      supported by the description to enable the skilled
      person to carry out the claimed invention within
      its full claimed scope; one skilled in the art was
      aware of the possible conditions of treatment of
      the extruded filaments in the delay and quench
      zones, which determine R_r, and it needed only a few
      routine experiments to find out the values of the
      other variables of the mathematical equation,

particularly the spinnerette diameter D and the polymer flow rate Q (which define the parameter R_e, the actual "core" of the invention) in order to arrive at a satisfactory value of birefringence Δn_u.

The many arguments of the Appellant with respect to the issues of novelty and inventive step need not be referred to here, because, irrespective of the possible outcome of these issues, the Board upheld the conclusion of the first instance to revoke the patent albeit on the different ground of non-compliance with the requirement of Article 100(b) EPC.

VII.   The arguments of the Respondents may be summarized as follows:

(i)   the change in Claims 1 of both requests of the unit "cm" to "inches" contravened Article 123(3) EPC, because it caused the parameter R_e to become smaller and thus extending to values below the lower limit of 10.5×10^{-2} in granted Claim 1; since it was not apparent from granted Claim 1 that the unit "cm" was "wrong", Rule 88 EPC could also not be invoked to justify this change;

(ii)   the parameter R_r was not a constant, but - as even admitted in the patent specification - was itself a function of several variables, whose interdependency was unknown; moreover the condition $0 < R_r < 1$ was of no technical significance because the mathematical equation in Claim 1 was not valid within this broad

range; since the patent specification did not comprise sufficient information to reduce the parameter R_r into practice, the patent in suit did not comply with the requirement laid down in Article 100(b) EPC;

(iii)   concerning the issues of novelty and inventive step, for the reason given in the last paragraph of the preceding Section there is no need to refer to the respective arguments of the Respondents; the same applies to the issue of Article 52(2)(a) EPC.

VIII.   The Appellant requested that the decision under appeal be set aside and the European patent No. 452 405 be maintained on the basis of the Main Request or the Auxiliary Request both submitted during oral proceedings.

The Respondents requested dismissal of the appeal.

Reasons for the Decision

1.   The appeal is admissible.

2.   *Article 123(2) and (3) EPC*

2.1   The process to be carried out according to Claim 1 of both requests requires i.a. that the following conditions be met:

that the undrawn birefringence Δn_u satisfies the equation $\Delta n_u = R_f V^{2.0} IV^{2.4}$, where $R_f = R_r R_e$ is at least 15 x 10^{-3}, R_r being a constant ($0 < R_r < 1$) for given process

conditions of steps a) and b), and R_e is at least 13 x 10^{-2}, R_e being the relationship $D^{0.5}/Q^{0.7}$ (**D = spinneret capillary diameter, in inches**; Q = polymer flow rate through the capillary, in cm^3/min/capillary).

As opposed to the above amended version, the granted Claim 1 required that the spinnerette capillary diameter D be measured in "cm", not in "inches" (see point I).

2.2   According to the application as filed the spinnerette capillary diameter D is to be determined in inches (Claim 8; sentence bridging pages 8 and 9; Examples 1 to 4: page 9, lines 25 to 27; page 10, lines 15 to 17 and 33 to 36; page 11, lines 6 to 8) and there is no reference to a measurement in "cm".

Consequently, the amendment to "inches" does not introduce subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC).

2.3   The issue whether this amendment contravenes Article 123(3) EPC depends on the influence it has on the size of the parameter R_e, which must not be lower than the numerical value of 10.5 x 10^{-2} when D is measured in "cm", as required by Claim 1 of the patent as granted.

The Respondents argued that the conversion of "cm" into "inches" led to a reduction of the numerical value of D (and thus R_e), because 1 cm corresponded to only 0.39 inch. However, this reasoning does not take proper account of the specific situation here.

Rather, in the Board's judgment, the amendment causes the value of R_e to go up, because a spinnerette capillary diameter of a certain numerical value in

inches, is **actually** 2.54 times **bigger** than when the
same numerical value is expressed in cm. Thus, since R_e
is directly proportional to $D^{0.5}$, R_e [D in inches] is, in
real terms, 1.6 times (square root of 2.54) bigger than
R_e [D in cm] which has the effect to increase by the
same factor the lower limit of R_f and Δn_u. As pointed
out by the Appellant during the oral proceedings, none
of these parameters can now have values which would
fall in substance outside the ranges arising from the
previous definition of D, which means that the change
to the measurement unit "inches" does not extend the
protection conferred.

2.4   Apart from the change of the measurement unit of the
       spinnerette capillary diameter, Claim 1 of the Main
       Request differs from its granted version only by some
       formal rearrangements and by the insertion of the
       feature that "D is at least 0.027 inches (0.069 cm)",
       which was disclosed in Claim 8 of the application as
       filed (= granted Claim 7).

       Claim 1 of the Auxiliary Request additionally comprises
       the upper limit of 0.95 for the intrinsic viscosity,
       which was disclosed on page 5, lines 35 to 37 of the
       application as filed (page 4, lines 1 to 3 of the
       granted patent).

       These amendments to Claims 1 do not extent the scope of
       the patent as granted.

       Claims 2 of both requests are based on Claim 5 of the
       application as filed (granted Claim 4), Claims 3 to 6
       of both requests correspond to Claims 6, 7, 9 and 10 of
       the application as filed (granted Claims 5, 6, 8 and
       9).

2.5   Thus, both requests comply with the requirements of
       Article 123(2) and (3) EPC.

Main Request

3.   *Sufficiency of disclosure (Article 100 (b) EPC)*

3.1   According to the Enlarged Board's decision G 10/91 (OJ
        EPO 1993, 420) only those grounds for opposition
        already cited at the opposition stage can be considered
        on appeal. New grounds can be introduced only with the
        Proprietor's consent.

3.1.1   In the present case, objections under Article 100(b)
        EPC concerning the nature of the parameter R_r have been
        raised in the opposition briefs of both Respondents,
        were dealt with in the decision under appeal (point C.1
        of the Reasons) and were brought up again during the
        appeal by Respondent I (Section II of the submission of
        10 June 1996).

3.1.2   The further objection under Article 100(b) EPC raised
        by the Opponents during the first instance opposition
        proceedings, namely the one concerning the measurement
        temperature of the intrinsic viscosity, was decided by
        the Opposition Division in the Proprietor's favour;
        that finding was not objected to by the Respondents
        during these appeal proceedings and also the Board
        concurs with that conclusion.

3.1.3   Considering the situation summarized in point 3.1.1
        supra and contrary to the Appellant's conflicting
        assertion, the Board is therefore empowered to examine
        and decide the issue of the sufficiency of the
        disclosure of the patent specification with respect to
        the meaning of the parameter R_r without the Appellant's
        (Proprietor's) consent.

3.2   Article 100(b) EPC states that an opposition may be
       filed on the ground that the "European patent does not
       disclose the invention in a manner sufficiently clear
       and complete for it to be carried out by a person
       skilled in the art".

       It is well established case law that a disclosure is
       regarded as sufficient only if it allows the invention
       to be reproduced without undue burden (cf. eg. T 226/85
       OJ EPO 1988, 336; T 14/83 OJ EPO 1984, 105; T 32/85 of
       5 June 1986, not published in the OJ EPO).

       As set out below, this is not the case here.

3.3   Steps a) to d) of Claim 1 describe in general terms a
       process for the production of PET yarns by melt
       extrusion (step a), solidification (step b), filament
       take-up (step c) and hot drawing (step d). The manner
       in which steps a), b) and c) are to be carried out is
       defined by the requirement that the undrawn yarn should
       have a birefringence (Δn_u) of at least 0.020, wherein
       $\Delta n_u = R_f V^{2.0} IV^{2.4}$, where $R_f = R_r R_e$ is at least 15×10^{-3}, R_r
       being a constant ($0 < R_r < 1$) for given process conditions
       of steps a) and b), and R_e is at least 13×10^{-2}, R_e
       being the relationship $D^{0.5}/Q^{0.7}$ (D = spinneret capillary
       diameter, in inches; Q = polymer flow rate through the
       capillary, in $cm^3/min/capillary$).

3.4   When carrying out this process with a PET having a
       certain IV of at least 0.80 it is, thus, necessary to
       select the spinning speed V, the spinnerette capillary
       diameter D, the polymer flow rate Q (which latter two
       parameters determine R_e) and the parameter R_r.

       While the meaning and the manner of manipulating the
       parameters V, D and Q is relatively straightforward,
       the parameter R_r is far from self-explanatory in that it
       is indeed a function of several variables.

3.5   According to page 4, lines 54 to 58 of the patent
       specification "R_r has a value which is related to the
       retention in orientation after thermally induced
       polymer relaxation within the constraint that $0<R_r<1$"
       and "increases with increasing severity of the
       quenching and decreases with increasing extruded
       polymer temperature and heated sleeve length and
       temperature".

       R_r is thus related to step b) of Claim 1, i.e. to the
       treatment of the extruded filaments after having left
       the spinnerette, finally yielding a solidified undrawn
       yarn. According to page 4, lines 23 to 29 of the patent
       specification the spun filaments are passed into a
       delay zone, which preferably is a quiescent zone or a
       heated sleeve of desired length, preferably 1 to 40
       inches, maintained at a desired temperature of
       preferably 100 to 450°C. From the delay zone the yarn
       passes into a quenching zone, preferably a radial
       inflow quench, e.g. having an elongated chimney of
       conventional length, for example 1 to 40 inches.

       According to all the four examples in the patent
       specification the delay zone is a heated sleeve of a
       certain length (Example 1: 1 inch; Example 3: 2 inches)
       and operated at a certain temperature (Examples 2 and
       3: 220 to 300°C). The quench zone is defined in
       Examples 1 and 2 as a "radial quench stack", but no
       information is given as to the technical features of
       its construction and operation.

3.6   From the disclosure of the patent in suit the skilled
       person confronted with the necessity to determine the
       parameter R_r within the scope it is defined in Claim 1,
       is therefore made aware of the following:

       (i) R_r is a constant ($0<R_r<1$) for given conditions of
              steps a) and b) of Claim 1,

(ii) R_r increases with increasing temperature of the extruded filament,

(iii) R_r depends on the kind of delay zone, preferably a heated sleeve,

(iv)   if the delay zone is a heated sleeve, then R_r decreases

(iv-1) with increasing sleeve length (preferably 1 to 40 inches) and

(iv-2) with increasing sleeve temperature (preferably 100 to 450°C),

(v) R_r depends on the severity of the quench.

The above feature (i) does not convey any teaching other than that R_r has a value which is peculiar to the respective concrete conditions of extrusion (including the spinnerette diameter D and the extrusion rate Q) and solidification (including the delay and quenching zones) and is thus different for different extrusion and/or solidification conditions. Thus, the term "constant", not appearing in the application as filed and regarded as not appropriate by the very Applicant in his letter of 5 March 1992, is a misconception.

3.7   The patent in suit does not disclose any precise information concerning the interdependence of the procedural steps referred to in points 3.6 (ii) to (iv) supra, and in particular the patent specification is completely silent on the concrete construction and operation conditions according to which the quenching (point 3.6 (v) supra) should be carried out in order to satisfy the condition $\Delta n_u = R_r . R_e . V^{2.0} . IV^{2.4}$.

3.8   The lack of information in the patent in suit with
        regard to the conditions of quenching (i.a. length of
        quench zone, temperature, velocity and flow pattern of
        cooling air) is, however, of particular importance for
        the determination of the parameter R_r, because it is
        well known that these conditions are of utmost
        importance for the orientation (which is reflected in
        the value of birefringence Δn_u) of filaments prepared
        according to the POY (partially oriented multifilament
        yarn) technology used according to the patent in suit.

        This fact is emphasized as follows on page 28, right
        column, 2nd paragraph of document

        D9:   Riehl, Chemiefasern/Textilindustrie, Jan 1985,
               pages 27 to 31 (cited by Respondent I, then
               Opponent I, in his Notice of Opposition):

        "The decisive area for the formation of the filaments
        is the plastic zone below the spinnerette, namely the
        zone where the filament changes from the liquid into
        the solid state. Since during solidification the
        filament is also under stress, this is the zone where
        all the processes of orientation and hence strength,
        elongation and shrinkage, but also the uniformity of
        the filament material itself, which expresses itself
        e.g. in the Uster value, are determined in all their
        data" (translation by the Board).

3.9   In the absence of any concrete guidance as to the
        design and operation of the quench zone the skilled
        person can only resort to trial and error
        experimentation in order to find out those conditions
        which will result in R_r values compatible with Δn_u as
        required in Claim 1. This situation is further
        aggravated by the very meagre information the skilled
        person has with respect to the other factors (cf.
        point 3.6 (ii) to (iv) above) that influence R_r. In

consequence thereof the skilled person, being without
information as to how to take account of and modify the
various interacting factors that determine R_r, is not in
a position to proceed towards success with a few
purposeful experiments. Rather he has to execute quite
an extensive screening program on the basis of which he
will than be able to supplement the present disclosure
with the information now missing.

3.10   When considering the issue of sufficiency of disclosure
it must also be borne in mind that R_r is not the only
parameter whose value has to be determined on an
experimental basis by trial and error. The mathematical
equation for determining the birefringence Δn_u comprises
the further variables D, Q and V (if IV is held
constant as property of the PET quality to be used),
which also have an important influence on this
equation. All these parameters have to be coordinated
on experimental trial and error basis.

This fact was not contested by the Appellant before the
first instance (cf. his submission of 28 January 1994,
page 3, last paragraph to page 4, third paragraph).
There the Appellant explained how the skilled person
should proceed if he wanted to prepare an undrawn yarn
having a birefringence $\Delta n_u = 0.16$ from a PET having an
IV of 1.0. According to this statement (1) the closest
worked example in the patent specification should be
chosen as a starting point (there Example 2), (2) the
take up-speed V should be enhanced, (3) the polymer
extrusion temperature should be lowered, (4) the
shortest and (5) coldest heated sleeve which gave good
yarn mechanical quality (few broken filaments) and (6)
the severest quench which did not cause excessive
filament turbulence should be used, and finally (7) the
spinnerette diameter D and (8) the polymer flow rate Q
should be adjusted to make R_f meet the value necessary
to achieve the desired birefringence of $\Delta n_u = 0.16$.

Thus, in a first approximation, eight steps have to be performed on a trial and error basis without even taking into account that some of the parameters are interdependent, with the consequence that further experiments will be required to find out the structure of these interdependencies. The influence of such interdependencies is illustrated by a comparison of the Δn_u, R_f and R_e values of Examples 2 and 4 of the patent in suit, which, apart from a reduction of the spinnerette diameter from 0.027 inch to 0.018 inch and of a moderate increase of the spinning speed from 2.95 km/min (cf. Table 2 on page 6 of the submission of the Respondent II dated 14 May 1998) to 3.50 km/min were carried out under identical conditions (particularly identical quench conditions). However, the respective values changed considerably from Example 2 to Example 4 (Δn_u from 0.082 to 0.088; R_f value from 11×10^{-3} to 9.8 $\times 10^{-3}$ and R_e value from 14×10^{-2} to 11×10^{-2}, with the consequential change of the "constant" R_r from 7.86 $\times 10^{-2}$ to 8.91×10^{-2}).

This highlights very well the amount of trial and error experimentation which is required in order satisfy the mathematical equation in Claim 1 of the patent under appeal and shows that the Appellant's allegation during the oral proceedings cannot be accepted that, in the case of an experimental failure, nothing more was required than to change the spinnerette.

3.11   In view of the foregoing the Board comes to the conclusion that the disclosure of the patent in suit is not sufficient for the skilled person to determine without undue burden the various conditions, particularly those defining the parameter R_r, which in combination establish the mathematical equation $\Delta n_u = R_f.V^{2.0}.IV^{2.4} = R_r.R_e.V^{2.0}.IV^{2.4}$ specified in Claim 1 of the Main Request.

3.12   Consequently, the Main Request fails to comply with the requirement of Article 83 EPC, implied by Article 100(b) EPC, that the patent shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

The fact that according to the worked examples in the patent specification the claimed invention could be carried out under certain, partly undisclosed conditions (cf. point 3.5 supra, last paragraph), cannot substitute this requirement which extends to the full claimed scope.

3.13   Since the Auxiliary Request differs from the Main Request only by an additional upper limit in Claim 1 for the intrinsic viscosity of the undrawn yarn (cf. point V, last paragraph), the difficulties for the reduction into practice of the mathematical equation $\Delta n_u = R_f . V^{2.0} . IV^{2.4} = R_r . R_e . V^{2.0} . IV^{2.4}$ remain the same as for the Main Request. Consequently, the Auxiliary Request too fails to comply with the requirement of sufficiency of disclosure reflected in Article 100(b) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier   C. Gérardin

1733.D