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D E C I S I O N
of 24 July 2002

Case Number: T 1004/98 - 3.2.5

Application Number: 91201011.3

Publication Number: 0443696

IPC: B29C 61/06

Language of the proceedings: EN

Title of invention:
Heat recoverable article

Patentee:
Tyco Electronics Raychem NV

Opponent:
Siemens Aktiengesellschaft

Headword:
-

Relevant legal provisions:
EPC Art. 123(3), 84, 56

Keyword:
"Extension of protection conferred (no)"
"Clarity (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 1004/98 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 24 July 2002

Appellant: Tyco Electronics Raychem NV
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 17 July 1998
revoking European patent No. 0 443 696 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: W. Moser
Members: P. E. Michel
W. Widmeier

Summary of Facts and Submissions

- I. The appellant (patentee) lodged an appeal against the decision of the Opposition Division revoking European patent No. 0 443 696.

Opposition had been filed against the patent as a whole based on Article 100(a) EPC (lack of inventive step).

The Opposition Division held that the subject-matter of claim 1 of a main request and a subsidiary request of the appellant did not involve an inventive step and therefore did not comply with the provisions of Articles 52(1) and 56 EPC.

- II. Oral proceedings were held before the Board of Appeal on 24 July 2002.

(i) The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the following documents:

(a) main request: claims 1 to 16 submitted during oral proceedings, or

(b) auxiliary request: claim 1 filed as auxiliary request on 24 June 2002, and claims 2 to 18 filed on 30 November 2001.

(ii) The respondent (opponent) requested that the appeal be dismissed.

- III. The following documents have been referred to in the appeal procedure:

D1: EP-B-0116393

D2: DE-A-3319120

D3: DE-C-3415465

D4: US-A-4016356

IV. Claim 1 of the main request of the appellant reads as follows:

"A method of making a heat-recoverable article (2) comprising a fabric (8) of fibres (10, 12) and a polymeric material (14,16), and a heat-activatable adhesive lining (25) activatable by the heat applied to recover the article (2) in use,

the method comprising the steps of:

- (a) providing a fabric laminate (8, 14, 16) by adhering the polymeric material (14, 16) to at least one surface of the fabric (8) of fibres (10, 12) or by providing the polymeric material (14, 16) through which the fabric of fibres (10, 12) extends; and
- (b) providing recoverability by a method which comprises:

- (i) providing in step (a) a fabric (8) from fibres (10) that are recoverable, or

- (ii) deforming the fabric (8) of fibres (10, 12); characterised by the fabric having an optical coverage of less than 90%; and by

- (c) laminating to the fabric laminate (8, 14, 16) a strengthening layer (22, 20) between the fabric laminate and the adhesive lining (25), the strengthening layer having

- (i) a tensile strength of at least 10 MPa at 100°C and at least 30 MPa at room temperature, and

(ii) a stiffness of at most 6 N/m at 100°C and less than 10 N/m at room temperature, and
(iii) a flow temperature at least 40°C higher than the fabric recovery temperature, and
comprising a metal layer (20) to reduce moisture vapour transmission through the strengthening layer to a value of less than 1 g/m²/day
thereby preventing the adhesive lining (25) from bursting through the fabric laminate (8, 14, 16) when the article (2) in use is heat recovered about an object with the adhesive lining (25) facing inwards toward the object."

V. In the written and oral proceedings, the appellant argued essentially as follows:

Since the strengthening layer can only be laminated to the fabric either "directly or via an intermediate member", the omission of this wording from claim 1 of the main request does not broaden the scope of claim 1 of the patent in suit as granted. The amendment thus complies with the requirements of Article 123(3) EPC.

The stiffness of the strengthening layer as defined in claim 1 is measured in accordance with the British Standard referred to in the patent in suit at page 5, lines 40 to 43. Claim 1 of the main request thus complies with the requirements of Article 84 EPC.

The closest prior art is represented by document D1. This document discloses a method of making a heat-recoverable article having the features of the pre-characterising portion of claim 1 of the main request.

Document D1 does not disclose the optical coverage of

the fabric and this cannot be calculated, since there is no disclosure of the denier of the warp fibres.

The use of a fabric laminate as opposed to a continuous heat shrinkable material has the advantage that a fabric laminate is more resistant to splitting. However, the presence of a close weave fabric requires a large amount of heat during recovery, which increases the time required for recovery and may cause damage to the object about which the article is shrunk. The use of an open weave allows adhesive burst through during recovery owing to softening of the matrix material.

The problem to be solved is therefore to provide a method of making a heat-recoverable article which results in a heat-recoverable article having an open weave fabric in which the adhesive lining is prevented from bursting through the fabric laminate when the article is heat recovered about an object.

Documents D2 to D4 do not address this problem, since they do not relate to the use of fabrics, but to heat-recoverable articles having a continuous heat shrinkable material, for example in the form of an extruded polymer.

Document D2 is concerned with the use of a flexible heat resistant liner which adapts to the form of the object and which may be formed of strips as shown in Figures 7 and 8. In addition, the adhesive may be present outside the liner.

Document D3 is concerned with improving adhesion between a metal liner and the object.

Document D4 provides a liner for shielding cables from external radio frequency interference which may also act as a barrier against water vapour.

Whilst it may be desirable that the polymer of step (a) of claim 1 of the main request has a degree of cross-linking, this is not sufficient to prevent adhesive burst through. The fact that claim 1 of the main request refers to "... thereby preventing the adhesive lining (25) from bursting through the fabric laminate (8, 14, 16) when the article (2) in use is heat recovered about an object with the adhesive lining (25) facing inwards toward the object" means that burst through would occur in the absence of the strengthening layer.

VI. In the written and oral proceedings, the respondent argued essentially as follows:

Claim 1 as granted specifies that the strengthening layer is laminated to the fabric "directly or via an intermediate member". In view of the fact that this wording is omitted from claim 1 of the main request of the appellant, the claim does not comply with the requirements of Article 123(3) EPC.

The unit "N/m" as used in claim 1 of the main request in connection with the stiffness of the strengthening layer does not make any technical sense. Stiffness is conventionally measured in N/mm^2 . The claim thus does not comply with the requirements of Article 84 EPC.

The closest prior art is represented by document D1. This document discloses a method of making a heat-recoverable article having the features of the pre-

characterising portion of claim 1. In addition, the fabric of document D1 has an optical coverage of less than 90% as shown in Figures 1 and 2 and as described at page 5, line 16 of the A-publication of document D1.

Claim 1 of the main request does not specify the nature of the polymeric material of the fabric laminate. In view of the passage at page 4, lines 22 to 24 of the patent in suit, claim 1 of the main request includes within its scope embodiments in which a cross-linked polymer including a heat shrinkable polymer is provided on both sides of the fabric. In such a construction, burst through of adhesive is not possible, such a construction being equivalent to the continuous heat shrinkable materials known from documents D2 to D4. The problem to be solved is therefore not that of preventing adhesive burst through, but the remaining problem of reducing water permeability.

The solution to this problem is known from documents D2 to D4, which teach the provision of an aluminium or composite foil between the fabric laminate and the adhesive lining.

The subject-matter of claim 1 thus does not involve an inventive step.

Reasons for the Decision

Main request of the appellant

1. *Amendments*

As compared with claim 1 as granted, claim 1 of the

main request of the appellant omits the phrase "directly or via an intermediate member". However, since it is only possible to laminate the strengthening layer to the fabric either directly or via an intermediate member, the omission of this phrase does not extend the protection conferred and the amendment complies with the requirement of Article 123(3) EPC.

The features introduced into claim 1 are disclosed in the application as filed, in particular at page 3, lines 40 to 43 and page 5, lines 12 to 42 of the published version of the application as filed. The amendments thus also comply with the requirement of Article 123(2) EPC. This was not contested by the respondent.

The definition of stiffness in feature (c)(ii) of claim 1 must be read in the light of page 5, lines 40 to 43 of the description of the patent in suit which passage indicates that the stiffness should be measured in accordance with British Standard test BS 2782 (Part 3 method 332A 1976). The person skilled in the art is thus able to determine whether or not a particular strengthening layer has the required stiffness by carrying out the prescribed test. A copy of the British Standard has not been provided, and it has not been established that the units "N/m" as used in the patent in suit are in any way incorrect. The claim is thus clear and complies with the requirements of Article 84 EPC.

2. *Novelty*

None of the cited prior art discloses a method of making a heat-recoverable article comprising a fabric

laminate of fibres and a polymeric material and an adhesive lining, comprising laminating to the fabric laminate a strengthening layer between the fabric laminate and the adhesive lining. The subject-matter of claim 1 is thus novel and complies with the requirements of Articles 52(1) and 54 EPC. This was not contested by the respondent.

3. *Inventive step*

3.1 Closest prior art

The closest prior art is represented by document D1. This document discloses a method of making a heat-recoverable article comprising the features of the pre-characterising portion of claim 1. Document D1 does not include any disclosure of the optical coverage of the fabric. The purely diagrammatic figures cannot be relied upon in this respect and the optical coverage cannot be calculated, since there is no disclosure of the denier of the warp fibres.

Document D1 relates to an improvement in the heat shrinkable tubular fabric known from US-A-3 669 157, as acknowledged at page 2, lines 45 to 51. This document discloses a woven fabric having heat shrinkable weft yarns, which is impregnated with a heat settable resin, so that when heat is applied to shrink the fabric about an object, the resin sets and the fabric becomes rigid. The invention of document D1 is based on a problem which occurs with such a construction, namely that the resin is squeezed out through the fabric mesh during shrinkage. This problem is referred to in document D1 as resin burst through.

This problem is solved in document D1 by providing a polymer matrix about the fabric which does not suffer from this problem. However, a layer of adhesive used to bond the fabric to the object can nevertheless burst through the fabric owing to softening of the polymer matrix when heat is applied. A further problem is that, whilst the use of a closely woven fabric provides more resistant to splitting, the presence of a close weave fabric requires a large amount of heat during recovery, which increases the time required and may damage the object about which the article is shrunk. Whilst the use of an open weave ameliorates these problems, the use of an open weave increases the problem of adhesive burst through during recovery owing to softening of the matrix material.

3.2 Object of the invention

The object of the invention is therefore to provide a method of making a heat-recoverable article which results in a heat-recoverable article having an open weave fabric in which the adhesive lining is prevented from bursting through the fabric laminate when the article is heat recovered about an object.

3.3 Solution

The above object is achieved by using a fabric having a comparatively open weave (an optical coverage of less than 90%) and providing a strengthening layer having the parameters specified in the characterising portion of claim 1 of the patent in suit between the fabric laminate and the adhesive lining.

The effect of the strengthening layer in achieving this

object is illustrated in Table 1 of the patent in suit, which shows that articles not including a strengthening layer allow burst through at best at 220 kPa, whilst articles including a strengthening layer are resistant to burst through up to 400 kPa.

The heat shrinkable articles of documents D2 to D4 all comprise a heat shrinkable sleeve provided with a lining including a metal layer. However, the heat shrinkable sleeve is in the form of an extruded polymer sheath and thus does not suffer from the problem of adhesive burst through which can only occur with the use of a fabric formed of fibres, between which the adhesive can pass. The metal layer is provided for other purposes, for example in order to shield a cable junction from external radio frequency interference or as a water vapour barrier in the case of document D4. In addition, the constructions disclosed are such that only some of them would prevent adhesive burst through if combined with a fabric laminate. The disclosure of these documents thus does not deal with the problem of adhesive burst through. The person skilled in the art would thus not turn to the disclosure of these documents in order to achieve the above object.

It was suggested on behalf of the respondent that claim 1 of the patent in suit includes within its scope a fabric laminate which does not suffer from the problem of adhesive burst through, so that it is necessary to formulate an alternative problem. This is not accepted. Claim 1 specifies that it is the provision of the strengthening layer which prevents the adhesive lining from bursting through the fabric laminate when the article in use is heat recovered about an object. It is thus excluded from the ambit of

the claim that it is the fabric laminate itself and not the strengthening layer which prevents the adhesive lining from bursting through the fabric laminate.

The subject-matter of claim 1 thus involves an inventive step.

- 3.4 Claims 2 to 15 are directly or indirectly appendant to claim 1 and specify preferred embodiments of the method of claim 1. Claim 16 is directed to a method of protecting a cable splice using a heat recoverable article which is made by the method of any of claims 1 to 15. These claims thus similarly involve an inventive step.
4. In these circumstances, it is not necessary to consider the auxiliary request of the appellant.
5. The description has been amended for consistency with the claims according to the main request of the appellant. The amendments largely have the effect of indicating that features which were disclosed in the patent in suit as granted as being preferable are, in fact, essential. The amendments do not have the effect of introducing subject-matter extending beyond the content of the application as filed, and thus comply with the requirement of Article 123(2) EPC. The description thus meets the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:

(a) claims 1 to 16 submitted during oral proceedings;
and

(b) description: pages 3, 3.1, 4 to 6 submitted during oral proceedings, and pages 2, 7 to 10 as granted;
and

(c) drawings: Figures 1 to 9 as granted.

The Registrar:

The Chairman:

M. Dainese

W. Moser