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**Datasheet for the decision
of 12 September 2022**

Case Number: T 0023/20 - 3.3.06

Application Number: 13708881.1

Publication Number: 2817151

IPC: B32B17/10, C09K21/14, C09K21/00

Language of the proceedings: EN

Title of invention:
Fire resistant glazing unit

Patent Proprietor:
Pyroguard UK Limited

Opponent:
SAINT-GOBAIN GLASS FRANCE

Headword:
Fire resistant glazing unit / PYROGUARD UK

Relevant legal provisions:
EPC Art. 54, 56, 100(a), 100(c), 123(2)

Keyword:
Compliance with the requirements of Article 123(2) EPC - yes
Novelty - yes
Inventive step - yes

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0023/20 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 12 September 2022

Appellant: SAINT-GOBAIN GLASS FRANCE
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 24 October 2019
rejecting the opposition filed against European
patent No. 2817151 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: L. Li Voti
C. Heath

Summary of Facts and Submissions

- I. The appeal of the opponent is against the decision of the opposition division to reject the opposition against European patent no. 2 817 151.
- II. The granted patent contains 15 claims, with the independent ones reading as follows:

"1. A gelling composition for forming a transparent fire-resistant hydrogel interlayer within a glazing unit, the gelling composition obtained by mixing together:

*5-40% w/w of a curable hydrogel-forming component;
one or more salts; and*

40-90% w/w of an aqueous vehicle;

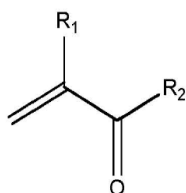
characterised in that:

*the composition has a pH between 3 and 6.8; and
the one or more salt(s) comprise monovalent or divalent metal cations or a combination thereof and are present within the composition at a concentration of 20-60% w/w; and*

the curable hydrogel-forming component comprises:

a polymerisable hydrophilic monomer selected from the group consisting of acrylic acid, methacrylic acid, itaconic acid, vinylsulfonic acid, allylsulfonic acid, methallylsulfonic acid, styrenesulfonic acid, 2-acrylamide-2-phenylpropanesulfonic acid, 2-acrylamide-2-methyl-propanesulfonic acid, vinyl phosphoric acid, (meth)acrylate of ethylene oxide-modified phosphoric acid, N,N-dimethylaminoethyl methacrylate, N,N-diethylaminoethyl methacrylate, N,N-dimethylaminoethyl acrylate, N,N-dimethylaminopropyl-methacrylamide, N,N-dimethylaminopropylacrylamide; or

a polymerisable hydrophilic monomer defined by
Formula (I):



(I)

wherein

*R*₁ is H, or (1-2C)alkyl;

*R*₂ is selected from OH, OR₃, NH₂, NHR₃, and NR₃R₄; and

*R*₃ and *R*₄ are independently (1-2C)alkyl;

or a salt thereof."

"13. A glazing unit comprising a first transparent pane and a second transparent pane with an interlayer disposed therebetween, wherein the interlayer is a hydrogel formed by curing the gelling composition as claimed in any of claims 1 to 12."

"14. A process for forming a glazing unit, the process comprising:

- i) providing a first and a second transparent pane;
- ii) partially assembling the glazing unit such that the first and second transparent panes are spaced apart from one another and a sealing means holds the first and second panes in position;

wherein:

the sealing means comprises an opening; and

the first and second panes and the sealing means together define an internal space;

iii) delivering a gelling composition as claimed in any of claims 1-12 into the internal space through the opening in the sealing means;

iv) closing the opening in the sealing means to provide a sealed internal space; and

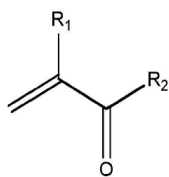
v) curing the gelling composition to provide a hydrogel gel interlayer within the internal space; wherein the gel is bonded to the inner surfaces of the first and/or second transparent panes by either coating at least one of the internal surfaces of the first and/or second panes with a coupling agent prior to step (iii) or incorporating the coupling agent into the gelling composition."

"15. A method of manufacturing a gelling composition for forming a transparent fire resistant hydrogel interlayer within a glazing unit, comprising mixing together:

5-40% w/w of a curable hydrogel-forming component;
20-60% w/w of one or more salts comprising monovalent or divalent metal cations or a combination thereof;
40-90% w/w of an aqueous vehicle;
to form a gelling composition with a pH between 3 and 6.8;

wherein the curable hydrogel-forming component comprises:

a polymerisable hydrophilic monomer selected from the group consisting of acrylic acid, methacrylic acid, itaconic acid, vinylsulfonic acid, allylsulfonic acid, methallylsulfonic acid, styrenesulfonic acid, 2-acrylamide-2-phenylpropanesulfonic acid, 2-acrylamide-2-methyl-propanesulfonic acid, vinyl phosphoric acid, (meth)acrylate of ethylene oxide-modified phosphoric acid, N,N-dimethylaminoethyl methacrylate, N,N-diethylaminoethyl methacrylate, N,N-dimethylaminoethyl acrylate, N,N-dimethylaminopropyl-methacrylamide, N,N-dimethylaminopropylacrylamide; or
a polymerisable hydrophilic monomer defined by Formula (I):



wherein

R₁ is H, or (1-2C)alkyl;

R₂ is selected from OH, OR₃, NH₂, NHR₃, and NR₃R₄; and

R₃ and R₄ are independently (1-2C)alkyl;

or a salt thereof."

Dependent claims 2 to 12 concern specific embodiments of the claimed gelling composition.

III. With its grounds of appeal, the appellant argued that the granted patent did not comply with the requirements of Articles 100(a) and (c) EPC, and it filed an Annex A ("pH-Wert", Die freie Enzyklopädie, edited on 4 February 2020). Its novelty and inventive step objections were based on following documents:

D1: EP 2 330 174 A1

D2: CN 101279822A and its English translation D2a

D2b: Test report for Example 3 of D2

D3: US 5,061,748

D9: WO 02/090458 A2

D10: Langmuir 2011, pages 2997-3005

D11: Acta Pharm., 57, 2007, pages 301-314

D14: EP 0 524 786 A1

D15: DE 102 37 395 A1.

IV. With its reply, the patent proprietor (also respondent) defended the patent as granted and filed two new sets of claims as auxiliary requests 16 and 17.

V. Following the board's provisional opinion that the main request appeared to comply with the requirements of Articles 123(2), 54 and 56 EPC, the appellant informed the board that it would not attend the oral proceedings. The parties were then notified that the oral proceedings had been canceled.

VI. From the parties written submissions, their requests are established to be as follows:

The appellant requests that the decision under appeal be set aside and the patent be revoked.

The respondent requests that the appeal be dismissed (main request) or, alternatively, that the patent be maintained in amended form on the basis of one of auxiliary requests 1 to 15 filed during opposition proceedings, or of one of auxiliary requests 16 and 17 filed with letter of 15 July 2020.

Reasons for the Decision

Main request (patent as granted)

1. Compliance with the requirements of Articles 100(c) and 123(2) EPC

Since the appellant did not reply in the substance to the board's communication of 14 April 2022, the board has no reason to depart from its preliminary opinion which is restated in the following.

1.1 Claim 1 requires that the claimed gelling composition has a pH between 3 and 6.8 and claim 15 requires that the gelling composition formed by the claimed method has such a pH.

In the appellant's view this pH range would not be supported by the application as filed.

- 1.1.1 The board notes that the application as filed (reference being made to WO 2013/124661 A1) discloses in the first sentence of paragraph [0095] that the gelling composition has suitably a pH between 3 and 7. The immediately following sentence discloses suitable upper limits for such a pH range, for example that the pH is suitably less than or equal to 6.8.

Therefore, this part of the description directly and unambiguously discloses that the gelling composition suitably has a pH lower limit of 3 and a pH upper limit of less than or equal to 6.8, so that the claimed pH range between 3 and 6.8 is directly and unambiguously disclosed in the application as filed.

- 1.1.2 The substitution in the description of the pH range of 1 to 7, originally disclosed in paragraph [0094] of the application as filed, with the range of between 3 and 6.8 (paragraph [0086] of the patent in suit) is thus also supported by the same disclosure, and so cannot contravene Article 123(2) EPC.

- 1.2 Dependent claim 11 differs from claim 1 insofar as it requires:

- as curable hydrogel-forming component one comprising a monomer of formula (I),
- that the gelling composition has a pH between 4 and 5.5 and
- that the one or more salts (present within the composition at a concentration of 20-60% w/w according to independent claim 1) comprise divalent metal cations.

According to the appellant, this combination of features would not be supported by the application as filed.

- 1.2.1 The board however notes that independent claim 1 as originally filed requires that the gelling composition includes 20-60% w/w of one or more salts, and claims 3 and 11, both dependent on all preceding ones, disclose a gelling composition having a pH in the range between 4 and 5.5 and comprising a hydrogel-forming component containing a monomer of formula (I). Furthermore, paragraph [0073] of the description discloses that the one or more salts may comprise monovalent or divalent cations, which generic teaching is applicable to all embodiments of the claimed gelling composition, including that identified above. Therefore, a combination of the above features with one or more salts comprising divalent cations is also directly and unambiguously disclosed.

The combination of features of claim 11 is thus supported by the application as filed.

- 1.3 It follows from the above considerations that the claims as granted comply with the requirements of Article 123(2) EPC.

2. Novelty (Articles 100(a) and 54 EPC)

- 2.1 Claim 1 as granted concerns a gelling composition obtained by mixing together:
- 5-40% w/w of a curable hydrogel forming-component comprising specified monomers;
 - 20-60% w/w of one or more salts comprising monovalent or divalent cations or a combination thereof; and
 - 40-90% w/w of an aqueous vehicle; wherein

the gelling composition has a pH between 3 and 6.8.

It is directly apparent from the wording of claim 1 that all mixed components may add up to more than 100% w/w. Since it is however not possible to derive therefrom or from the description which are the erroneous figures, claim 1 can only be construed as relating to a composition obtained by mixing the listed components at amounts within the given ranges but adding up at most to 100% w/w.

Moreover, the wording of the claim requires that the added salts comprise monovalent and/or divalent cations but it does not exclude that trivalent or higher cations might also be present, provided that the total amount of salts does not exceed 20-60% w/w.

Finally, also other curable hydrogel-forming components in addition to those specifically listed in the claim may be comprised, provided that their total amount does not exceed 5-40% w/w.

- 2.2 The appellant cited example 3 of D2 (reference is made in the following to its English translation D2a) against the novelty of claim 1.

However, in the board's view, it is clear from the illustrated method of preparation of example 1 (page 8 of D2a) that the amounts in kg reported in the table (D2a, page 7) for the compositions of examples 1 to 4 relate to the amounts used during preparation, but not to those necessarily contained in the final composition. Further, step 2 of the preparation method of example 1 requires the use of only one third of the solution of aluminium phosphate, boric acid and ethanolamine obtained in step 1. Therefore only one

third of the amount of aluminium phosphate reported in the table is mixed with the other salts and water.

Last but not least, it is not explicitly stated that the method of preparation of example 1 is also the one used for the other examples. In any case, if the method of preparation of the composition of example 3 were carried out like in example 1, namely by using in step 2 only one third of the mixture obtained in step 1, then the amount of salts used (sodium chloride, magnesium chloride and aluminium phosphate) would be necessarily about 18% w/w, and thus less than 20% w/w as observed by the respondent. Further, there is no reason to believe that the skilled person reading D2a would round up the salt percentage explicitly disclosed in D2a to the value of 20% w/w.

Therefore already for this reason D2 cannot disclose directly and unambiguously a composition having all the features of claim 1 at issue.

- 2.3 As regards the reworking of example 3 filed as D2b by the appellant, the board notes that it does not correctly reproduce a possible method of preparation of example 3, since it adds initially more aluminium phosphate and water than indicated in the table and, diverging from example 1, it uses in step 2 only one fifth of the initial mixture of aluminium phosphate with boric acid and ethanolamine. Furthermore it results in a composition having clearly less than 20% w/w of salts.

Therefore and independently of the measured pH (and the consideration of Annex A), this reworking cannot support the alleged lack of novelty.

- 2.4 It follows from the above considerations that the subject-matter of claim 1 is novel over D2.
- 2.5 While claims 2 to 12 are dependent on claim 1, claim 13 concerns a glazing unit comprising as an interlayer a hydrogel formed by curing the gelling composition according to any of claims 1 to 12, claim 14 concerns a process for forming a glazing unit comprising a step of delivering a gelling composition as claimed in any of claims 1 to 12, and claim 15 concerns a method of manufacturing a gelling composition having all features of claim 1. Thus all the granted claims are also novel.

3. Inventive step (Article 56 EPC)

- 3.1 According to the patent (paragraphs [0007] and [0009]), fire-resistant glazing in which the internal space between the transparent glass panes is filled with an interlayer of aqueous fire-resistant gel are known in the art, but there remains a need for improved fire resistant glazing that meets the most stringent fire resistance criteria.

It is thus an object of the invention (paragraph [0010]) to provide glazing units that not only meet these stringent criteria but also have excellent insulation and integrity, and radiation barrier extending beyond the duration of insulation. As stated in paragraph [0018], the claimed hydrogel interlayer exhibits also good stability in terms of transparency.

- 3.2 The appellant cited documents D1, D3 and D9 as suitable starting points for the evaluation of inventive step.
- 3.2.1 The board notes that D1 concerns (paragraph [0012]) a fire-retardant material having excellent physico-

chemical properties such as long-term durability and weather resistance, as well as the properties required for the fire retardant glass such as long-term transparency, flame-retardant performance and thermal insulation performance. Therefore it deals with a similar technical problem as the patent in suit and is a suitable starting point for the evaluation of inventive step.

- 3.2.2 D3 concerns (column 2, lines 24-27; 55-57) an intumescent gel which can be utilised in glazing units between layers of transparent sheet to provide fire resistance with optical clarity at low temperature. This document having however been published in 1991 it cannot plausibly be considered to deal at least explicitly with the more stringent fire resistance criteria considered in the patent in suit and it does not appear to deal with any of the goals cited in the patent in suit, in particular the high durability and stability in terms of transparency. D3 thus appears to be a less suitable as D1.
- 3.2.3 D9 concerns (page 3, lines 10-16) fire-resistant protective gels and construction materials having improved fire-resistive protection and the production of such transparent materials that are sufficiently thin and are made in larger sizes than conventional ones. Thus D9 does not concern at least the goal of stability in terms of transparency addressed to in the patent in suit and therefore it is a less suitable starting point for the evaluation of inventive step than D1.
- 3.2.4 For the sake of completeness, the board notes that even if D1 represents the most suitable starting point, all the lines of attack will be discussed in the following.

3.3 Inventive step starting from D1

3.3.1 The closest embodiment, and thus the closest prior art is represented by a combination of claims 1, 2 and 5 of D1, which disclose a transparent hydrogel for fire retardant glass comprising i) 3-10 wt% of a polymerisable acrylic monomer such as acrylamide, ii) 5-30 wt% of a monovalent or divalent water-soluble salt such as sodium chloride or magnesium chloride, iii) 0.5 to 5 wt% of a phosphorous compound such as phosphoric acid (see claim 6), and iv) 40-85 wt% water. The appellant accepted that compositions comprising phosphoric acid will have necessarily a pH below 3, so that the claimed composition differs therefrom in that it has a higher pH.

3.3.2 Bearing in mind that D1 has a similar goal as the claimed invention, in the absence of comparison between the latter and the compositions of D1, the technical problem underlying the invention is thus to be reformulated in less ambitious terms, namely in the provision of an alternative stable transparent hydrogel interlayer for glazing units.

3.3.3 As stated in D1 (paragraph [0026]), the presence of the phosphorus component in the gelling composition is essential for reducing the flammability, improving the intumescent property and controlling the reaction time and gel strength of the resin (hydrogel) composition, thus also preventing the formation of haze affecting transparency.

In the board's view, already for this reason, D1 leads away the skilled person from adjusting a composition comprising phosphoric acid to higher pH values, because this modification might possibly neutralise the

beneficial effects of the phosphorus component, and thus it would have not been motivated to depart from this specific teaching of D1.

The board further notes that the appellant has not provided any evidence that the alternatives to phosphoric acid disclosed in D1 (see claim 6) would provide a higher pH within the limits of the patent in suit.

- 3.3.4 Since the skilled person would not have departed from the teaching of D1, the board sees no reason as to why it would have taken into consideration the teaching of D3 or D9, which concern very different and slightly basic hydrogels.
- 3.3.5 In the board's view, the skilled person would also not have taken into consideration the teaching of D10, since this scientific article deals mainly (see abstract) with the properties of a specific copolymer hydrogel prepared from an aqueous micellar solution of a non-ionic surfactant monomer (surfmer) and acrylic acid, which is a very different hydrogel from that disclosed in D1. Also the cited parts of D10 (namely page 3000, figure 7 and right column, last paragraph) illustrating the transparency of the surfmer/acrylic acid hydrogel and of a pure polyacrylic acid hydrogel at various pHs also including values within the range of claim 1 at issue, are not relevant since they concern hydrogels which are not at all similar to those of document D1 comprising phosphorus compounds and consistent amounts of water-soluble salts, which components also affect transparency (see paragraphs [0025] and [0026] of D1).

3.3.6 Finally, the skilled person would also not have taken into consideration the teaching of D14, which concerns (see claim 1) very different acrylamide-based hydrogels comprising neither phosphorous compounds nor consistent amounts of water-soluble salts like those disclosed in D1, but comprising instead particulate metal oxides which are responsible in combination with a specific pH range for obtaining particular effects. For example, it teaches (page 7, lines 42-43) to adjust the suspension of particulate metal oxides at a pH between 7 and 13 (outside the limits of claim 1 at issue) in order to produce a stable transparent gel and at a pH between 2 and less than 7 for achieving improved gel elasticity (see page 7, line 54 to page 8, line 8), a goal which is not at all part of the technical problem posed.

3.3.7 Therefore the board concludes that the claimed subject-matter is not obvious starting from D1 taken alone or in combination with any of documents D3, D9, D10 or D14, and so involves an inventive step within the meaning of Article 56 EPC.

3.4 Inventive step starting from D3

3.4.1 The board agrees that its Example III represents in this case the closest prior art, as the hydrogel is prepared therein by mixing the listed ingredients including 14 wt% of a curable monomer (acrylamide), 20 wt% of a salt (sodium formate) and about 58 wt% water. The pH of this composition is not specified, but the appellant accepted that it would be around 9 because of the presence of sodium formate and the absence of a buffer.

As explained above, it cannot be plausibly accepted in the absence of any evidence that this document provides

glazing units complying with the more stringent fire resistance criteria considered in the patent in suit. Therefore the technical problem underlying the claimed invention would have to be formulated in the present case as the provision of a hydrogel for glazing units which provides better fire resistance and higher durability and stability of transparency.

- 3.4.2 In the board's view, even considering the theoretically possible replacement of sodium formate, used as freezing point depressant in D3 (column 3, lines 40-43) with the less preferred sodium chloride (column 3, lines 37-39), it has not been convincingly shown that such a replacement would necessarily bring about a pH according to claim 1 at issue not exceeding 6.8. Moreover, the skilled person faced with the technical problem posed would not have considered such a replacement as suitable for solving the technical problem, as D3 does not contain any suggestion to adjust the pH for improving the fire resistance, the durability and the stability in terms of transparency of the composition (as stated in paragraphs [0086] and [0090] of the patent according to which, when the pH of the gelling composition is too low or too high, the hydrogel lacks sufficient transparency to be useful in glazing units, and the pH is important for having the required physical and fire-resistance properties).
- 3.4.3 Also the teaching of D1 that concerns very different strong acidic compositions comprising a phosphorous compound, or that of D9 concerning different slightly basic compositions comprising specific fire retardant materials, and not comprising a freezing point depressant like in D3, could not have motivated the skilled person to adjust the pH of the different composition of D3/example III within the pH range of

the patent in suit in order to solve the technical problem posed.

- 3.4.4 In the board's view, the skilled person would also not have considered the teaching of D10 for the same reason as exposed above. Moreover, it would not have considered the teaching of D11, which concerns (see abstract) a specific drug delivery system, and thus it would not have considered any of these documents in the attempt of improving the properties of the composition of D3.
- 3.4.5 D14, as discussed above concerns different acrylamide-based hydrogels that comprise necessarily particulate metal oxides, which are not contained in D3. D14 furthermore only teaches to use a pH between 7 and 13 for the disclosed compositions comprising such particulate metal oxides in order to produce a transparent gel (page 7, lines 42-43), and a pH between 2 and less than 7 for improving its elasticity (see page 7, line 54 to page 8, line 8). Therefore, the skilled person would not have considered this document in the attempt to improve the composition of D3.
- 3.4.6 D15 concerns glazing units comprising a hydrogel comprising a salt solution having preferably a basic pH greater than 10 (see claim 6 and paragraph [0017]). The generic teaching contained in said paragraph that it would also be possible to use an acidic solution is not supported by any further explicit disclosure. To the contrary, the use of higher pHs is clearly preferred (paragraph [0021]). Therefore the skilled person would not have found in D15 any motivation for modifying the pH of the compositions disclosed in D3 to an acidic range as required in the patent in suit with the expectation of solving the technical problem posed.

- 3.4.7 It follows from the above considerations that the claimed subject-matter is also not obvious starting from D3 even considering a combination with any of D1, D9, D10, D11, D14 or D15, and so involves an inventive step over this prior art.
- 3.5 Inventive step starting from D9
- 3.5.1 For the board, the closest prior art is in this case represented by the gel compositions of table 5, comprising 5-30 wt% acrylamide (Bio-Acrylamide and NMA 2820), 5-20 wt% MgCl, about 50 wt% water and having a pH of 7.5 to 9, especially 8.6 to 9.
- 3.5.2 The technical problem over this prior art can thus be formulated at least as the provision of an alternative gel composition for glazing units having improved durability and stability of transparency.
- 3.5.3 In the board's view, as D9 teaches on page 11 that increased pH values may be of value in order to increase lag time, which allows a better polymerisation and thus better fire-resistant properties and transparency, this document clearly takes the skilled person away from lowering the pH.
- 3.5.4 Moreover, the skilled person attempting to improve the properties of this prior art would not have considered the teachings of either of documents D10, D11, D14 and D15 for the same reasons exposed above.
- 3.5.5 It follows that the claimed subject-matter is also not obvious starting from this state of the art, and so involves an inventive step starting from D9.

3.6 The conclusion above applies for similar reasons to all remaining claims.

4. It follows from the above considerations that none of the objections raised by the appellant prejudices the maintenance of the patent as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



A. Pinna

J.-M. Schwaller

Decision electronically authenticated