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D E C I S I O N
of 6 February 2003

Case Number: T 0301/00 - 3.3.5

Application Number: 92118418.0

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Title of invention:
Method of making a heat treated coated glass

Patentee:
ASAHI GLASS COMPANY LTD.

Opponent:
SAINT-GOBAIN GLASS FRANCE

Headword:
Coated glass/ASAHI

Relevant legal provisions:
EPC Art. 123(2), 123(3), 84, 100(b), 54, 56

Keyword:
-

Decisions cited:
G 0010/91, G 0001/93, T 0371/88, T 0108/91, T 0673/89

Catchword:
-

Case Number: T 0301/00 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 6 February 2003

Appellant: (Proprietor of the patent)	ASAHI GLASS COMPANY LTD. 12-1, Yurakucho 1-chome Chiyoda-ku Tokyo 100-8405 (JP)
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Respondent: (Opponent)	SAINT-GOBAIN GLASS FRANCE 18, avenue d'Alsace F-92400 Courbevoie (FR)
Representative:	Renous Chan, Véronique Saint-Gobain Recherche 39, Quai Lucien Lefranc F-93300 Aubervilliers (FR)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 27 January 2000 revoking European patent No. 0 546 302 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: R. K. Spangenberg
Members: M. M. Eberhard
M. B. Günzel

Summary of Facts and Submissions

I. The appeal is from the decision of the opposition revoking European patent No. 546 302. The decision was based on two sets of amended claims filed on 26 October 1999. The patent was granted in response to European patent application 92 118 418.0 claiming the priority date of 30 October 1991 from the Japanese patent application JP 311723/91. Claim 1 as granted reads as follows:

"1. A method of making a heat treated coated glass comprising the steps of :
forming a solar control layer of an electroconductive layer on a glass substrate; forming a first protective layer whose major component is at least one selected from the group consisting of a boron nitride, a silicon nitride, a boronitride, a siliconitride, a carbonitride; or a nitride of at least two selected from the group consisting of silicon, boron, aluminum, zirconium and tin, which may be incompletely oxidized, which is transparent in a region of visible light, and which remains transparent even when oxidized, to provide a glass coated with a multi-layer comprising at least two layers including said solar control layer or an electroconductive layer and said first protective layer; and performing heat-treatment for said coated glass."

II. During the opposition proceedings, the respondent (opponent) relied *inter alia* on the following documents:

A EP-A-0 536 607

B WO-A-88/01568

C US-A-4 992 087

D Thin Solid Films, 83 (1981) pages 393 to 398

E US-A-4 780 372

G DE-A-4 006 029

L US-A-4 965 121

N US-A-5 000 528

In its decision the opposition decision took the view that the process of claims 1 and 2 of both requests lacked an inventive step. Starting from document B as the closest prior art, it would have been obvious, in view of the teaching of document N, to replace the protective silicon layer by a metal nitride layer in order to solve the problems of unsatisfactory mechanical resistance and possible oxidation of the silicon layer when subjecting the coated article to bending or tempering. The ranges of temperatures for the heat treatment were conventional in the art.

III. The appellant (proprietor of the patent) filed comparative tests with the statement of the grounds of appeal and on 5 February 2003. He submitted new sets of claims on 19 December 2001 and four documents in the Japanese language, one of them being accompanied by a partial English translation. In reply to a communication from the board questioning the allowability of the amendments in the said sets of claims, the appellant submitted three sets of amended claims on 30 December 2002. Oral proceedings took place on 6 February 2003. At the oral proceedings the appellant filed a set of amended claims as the main and sole request. Claim 1 of this request reads as follows:

"1. A method of making a heat treated coated glass comprising the steps of

(a) forming on a glass substrate

(i) a solar control layer wherein the major component of the layer is at least one metal (hereinafter defined as metal M) selected from stainless steel, titanium, chromium, zirconium, tantalum and hafnium, or a nitride of the metal M, or a boride of the metal M, or a carbide of the metal M, or a mixture of these, or wherein the major component of the layer is aluminum, or an electroconductive layer wherein the material of the layer is an indium oxide doped with tin, a tin oxide doped with antimony or fluorine, or a zinc oxide doped with aluminum, boron, or silicon, or wherein the material of the layer is ZnO, TiO_2, SnO_2, ThO_2, V_2O_5, Nb_2O_5, Ta_2O_5, MoO_3, WO_3, MnO_2, or $PbCrO_4$; and

(ii) a first protective layer whose major component is at least one selected from the group consisting of a boron nitride, a silicon nitride, a boronitride, a siliconitride, and a carbonitride; or a nitride of at least two selected from the group consisting of silicon, boron, aluminum, zirconium and tin, which may be incompletely oxidized, which is transparent in a region of visible light, and which remains transparent even when oxidized, to provide a glass coated with a multi-layer comprising at least two layers including said solar control layer or electroconductive layer and said first protective layer; and

(b) performing heat-treatment for said coated glass,

(b1) wherein the glass is heated at 580 to 700°C and bent, or

(b2) wherein the coated glass is heated at 500 to 700°C and rapidly cooled for tempering, or

(b3) wherein the tempering (b2) is performed continuously successive to the bending (b1)."

IV. The appellant requested that the decision under appeal be set aside and that the patent be maintained with the claims according to the main request filed during the oral proceedings. The respondent requested that the appeal be dismissed.

V. The appellant presented inter alia the following arguments:

The amendments in claim 1 met the requirements of Article 123(3) EPC. The wording "a solar control layer of an electroconductive layer" in granted claim 1 was grammatically and technically meaningless. The replacement of the word "of" by "or" was the obvious correction of a typing mistake. The correction was evident since the word "or" was used at the end of granted claim 1 and the two lists of materials cited in the patent in suit for the solar control layer and the electroconductive layer did not overlap. The respondent's objection that TiO_2, SnO_2 and ZnO were no electroconductive materials could not substantiate an allegation of lack of clarity. The patent referred to oxygen vacancies as a functional basis for electroconductivity, and the use of oxygen vacancies for providing electroconductivity was well-known in the art. The electroconductive properties of these oxides were evidenced by the new documents enclosed with the appellant's letter dated 19 December 2001. The patent in suit sufficiently disclosed how to prepare the electroconductive layer. A tin oxide underlayer was deposited by reactive sputtering in Example 1 and it was well-known in the art that the stoichiometry of the material could be adjusted in a reactive sputtering process in order to produce oxygen vacancies.

The claimed method was new with respect to document A. In Example 8 neither bending nor tempering was performed and no bending temperature was indicated in A. The forming temperature of 600 to 700°C concerned the prior art and was general. Starting from the closest prior art B, the problem of the invention was to provide a method for the mass production of a heat-treated coated glass, wherein the uniformity of colour properties and transparency hardly changed when the glass was heat-treated in an oxygen atmosphere after application of the coating. This problem was neither known from nor suggested by document B and its solution was not rendered obvious by document N. The latter concerned a different technical field and did not address the problem stated above. The stability of a coating at a temperature of 300°C did not allow any predictions about the stability at 500°C when the glass got softer. The comparative examples showed that the colour of the coated article of document N was unchanged at 300°C but changed considerably at 500°C. As document B already provided a solution to the problem of scratch resistance, namely the use of a tin oxide layer, the skilled person would have had no reason to replace this layer by another layer for obtaining a good scratch resistance. The respondent's second line of arguments based on document G was not acceptable since G did not represent the closest prior art. It was not suggested in G that tempering might be done after deposition of the coating instead of before.

V. The respondent's arguments can be summarised as follows:

Claim 1 contravened Article 123(2) EPC since the use of a boronitride, carbonitride or siliconitride for the protective layer was not disclosed in the application as filed. Furthermore, there was no disclosure of temperature ranges for step (b3) in the application as filed. The introduction of the word "**or**" in claim 1 resulted in the definition of two alternatives for layer (i), which contravened Article 123(3) EPC since granted claim 1 was limited to "**a solar control layer of electroconductive layer**". Two alternatives were disclosed for layer (I) in the patent in suit, however the solar control layer and the electroconductive layer were functionally associated at page 2, lines 50 to 51. The word "or" at the end of granted claim 1 was not inconsistent with the phrase "solar control layer of electroconductive layer" since the layers were equivalent. Claim 1 did not meet the requirement of clarity because some of the oxides stated therein for the electroconductive layer, in particular ZnO, TiO_2, SnO_2, were not electroconductive materials but dielectrics as confirmed by document L. The oxides were stoichiometric in claim 1, and it was thus not clear that they had to include oxygen vacancies. Furthermore it was not known how these electroconductive layers could be produced.

The method of claim 1 lacked novelty over Example 8 of document A. This document disclosed a temperature of 600 to 700°C for forming the glass and according to the method claim 21 the coated glass was heated for bending. The skilled person would implicitly have derived from the heating temperature in Example 8 and from claim 21 that the coated glass was intended to be bent. Temperatures of 580 to 700°C for a bending step were usual. In Example 11 of A, reference was made to the preparation of Example 10, therefore "stable with tempering" meant stable at 704°C for 3.5 minutes.

The subject-matter of claim 1 lacked an inventive step in view of the teachings of documents B and N. Document B represented the closest prior art. Although claim 1 proposed a combination of two very long lists of materials leading to several thousands of possible combinations, the desired objective, ie no substantial change of the optical properties of the coated glass after heat-treatment, had been shown to be achieved only for about ten combinations of layers. The respondent had serious doubts that the said objective had actually been achieved with a combination of layers having no chemical similarity to those tested, eg a functional layer of ITO and a protective layer of a carbonitride. Only ITO had been tested as material for the electroconductive layer. Document B taught that the silicon overlayer of the coated article was oxidised at its surface and that this surface oxide layer was not durable, ie not abrasion and scratch resistant. Document N taught that the sandwich structure with two silicon nitride layers had good mechanical properties, was scratch resistant and protected the metal film layer against oxidation, and that the optical properties did not change at a high temperature. In view of this teaching the skilled person would have been induced to test this silicon nitride as a protective layer in the coated article of B, all the more so as a silicon nitride layer was known as an anti-reflection layer and was usually associated with other kinds of films as shown by document D. Document E further taught its use as water diffusion barrier, and additional properties such as imperviousness, refractoriness and resistance to thermal shocks. The skilled person would thus have replaced the silicon layer by a silicon nitride layer in the process of B since he would have expected improved mechanical properties and he would have then checked whether or not the optical properties were changed when performing a bending or tempering step.

Alternatively, document G could also be considered to represent the closest prior art. It disclosed the same sequence of layers as in claim 1. Applying a coating onto an already bent glass substrate as disclosed in G was, however, not desirable because of the difficulties to obtain a uniform coating. The technical problem was thus to provide another method for producing the coated glass of G. As document N taught the beneficial effect of a silicon nitride layer for protecting the metal layer, the skilled person would have used a silicon nitride layer in the coating of G and bent the glass after application of the coating. Alternatively he would not have modified the multi-layer coating of G, but would have performed the bending step after application of the coating instead of before.

Reasons for the Decision

1. The appeal is admissible.

2. At the oral proceedings the respondent raised for the first time the objection that a boronitride, a carbonitride and a siliconitride were not disclosed as possible material for the first protective layer in the application as filed. Thus, claim 1 would contravene Article 123(2) EPC. The board observes that these materials were already cited in granted claim 1 in the list of components for the first protective layer. However no objection under Article 100(c) EPC had been raised by the respondent against granted claim 1 in its notice of opposition or during the opposition proceedings, and the respondent's objection at the oral proceedings does not arise out of the amendments introduced in claim 1. Therefore, the respondent's objection amounts to raising a new ground of opposition. According to opinion G 10/91 (OJ EPO, 1993, 420), fresh grounds of opposition may be considered in appeal proceedings only with the approval of the patentee. The appellant's representative having refused to give his agreement, the matter is not taken into consideration by the board.

2.1 Concerning the amendments introduced in claim 1 after grant, the lists of components for the solar control layer and for the electroconductive layer are disclosed on page 4, lines 16 to 23, and page 5, lines 2 to 11, of the application as filed respectively. The feature that layer (i) is either a solar control layer **or** an electroconductive layer finds support on page 3, lines 6 to 7, and in claim 1 of the application as filed. The heat-treatments as defined in (b1) and (b2) are disclosed on page 9, lines 12 to 16 and 20 to 23. The respondent's objection that there was no disclosure in the application as filed of the temperature ranges introduced in step (b3) by reference to the tempering (b2) and the bending (b1) are not convincing. On page 9, lines 23 to 25, of the original application it is indicated that "it is possible to perform **the** tempering continuously successive to **the** bending" (bold characters added by the board). Taking into account that this sentence follows those including the temperature ranges for the tempering and the bending operations and uses the definite article "the", the board can accept the appellant's arguments that feature (b3) is directly and unambiguously derivable from page 9, lines 12 to 25, of the application as filed. It was not contested that the subject-matter of dependent claims 2 to 6 is supported by the original application. Therefore amended claims 1 to 6 meet the requirements of Article 123(2) EPC.

2.2 The respondent's arguments that claim 1 contravenes Article 123(3) EPC because of the introduction of the word "or" in the definition of the layer (i) (see point V above) cannot be accepted by the board for the following reasons. Granted claim 1 is so drafted as to claim the steps of "forming a solar control layer **of** an electroconductive layer on a glass substrate" and "forming a first protective layer .....to provide a glass coated with a multi-layer comprising at least two layers including said solar control layer **or** an electroconductive layer and said first protective layer". In dependent claim 2 where the multi-layer coating further includes a second protective layer, the multi-layer coating is said to be "composed of at least three layers including the solar control layer **or** an electroconductive layer". When reading claim 1, it is immediately apparent that there are inconsistencies between the beginning of the claim stating by the use of the word "of" that the solar control layer is an electroconductive layer and the end of the claim where it is said that the multi-layer coating includes either a solar control layer or an electroconductive layer. Moreover, the wording "the solar control layer or an electroconductive layer" is used again in claim 2. In such a situation where there are inconsistencies in the formulation of the claims, the description and drawings of the patent have to be used to interpret what is meant by the claims (see Article 69 EPC). The feature "a solar control layer of an electroconductive layer" is nowhere disclosed in the patent in suit. According to the patent in suit, the solar control layer is a film having a solar energy absorbing function or reflection characteristics mainly in the near infrared region; and the invention is applicable to an electroconductive layer whose electroconductivity results from oxygen vacancies, **in place of the solar control layer**. Furthermore, the list of materials given on page 2, lines 40 to 43 for the solar control layer does not overlap with the materials listed on page 2, lines 47 to 50, for the electroconductive layer. These two lists do not have any material in common. It is also not derivable from the patent in suit that the solar control layer might be equivalent to the electroconductive layer. The respondent made reference in this respect to the sentence on page 2, lines 50 to 51, of the patent in suit which reads: "Hereinafter "solar control layer" represents not only the above solar control layer but also the above electro-conductive layer in this specification". This sentence read in the context of the patent specification does not mean that the layers are equivalent but that in the description following this sentence the same expression (solar control layer) is used to designate either the solar control layer or the electroconductive layer. It follows from the above that when considering the patent specification, there is no doubt that the functional layer is either a control solar layer or an electroconductive layer as stated at the end of granted claim 1 and in dependent claim 2. Therefore, the skilled person reading granted claim 1 and using the patent specification to interpret the inconsistent formulations in claim 1 would immediately recognize that claim 1 contains a clerical error and that the word "of" used in the second line thereof should read "or" in accordance with the end of claim 1, dependent claim 2 and the patent specification. The board further observes in this context that, in its notice of opposition and during the opposition proceedings, the respondent himself obviously construed granted claim 1 as indicated above, since he pointed out that the process of granted claim 1 comprised forming an electroconductive layer or a solar control layer on a glass substrate (see page 4, point 2, of the notice of opposition). Furthermore, it is also not derivable from the examination procedure that a limitation of the protection to a "solar control layer of an electroconductive layer" has ever been intended. For the preceding reasons and taking into account that granted claim 1 would be construed by the skilled person as relating to a method comprising the step of forming a solar control layer **or** an electroconductive layer, the introduction of the word "or" in amended claim 1 does not contravene the provisions of Article 123(3) EPC.

2.3 In decision G 1/93, OJ EPO 1994, 541, dealing with the possibly conflicting requirements of Article 123, paragraphs 2 and 3, EPC when originally undisclosed features had been added to a claim before grant, the Enlarged Board of Appeal held with respect to previous cases decided by the Boards of Appeal that these cases seemed to be uncontroversial insofar as support had been found in the original applications for replacing added undisclosed technical features by other features without violating Article 123(3) EPC (see point 4 of the reasons). In this context decisions T 371/88, OJ EPO 1992, 157, and T 108/91, OJ EPO 1994, 228 were *inter alia* cited by the Enlarged Board of Appeal.

In decision T 108/91 the Board, referring back *inter alia* to decision T 371/88, held that the amendment of a granted claim to replace an inaccurate technical statement, which was evidently inconsistent with the totality of the disclosure of the patent, by an accurate statement of the technical features involved, did not infringe Article 123(3) EPC (see headnote, and points 2.2 to 2.4 of the reasons). The reason given was that, when the description and the drawings of the patent specification were drawn upon to interpret the claims according to Article 69(1) EPC, it became immediately apparent that what was defined in the granted claim could not be that for which protection was sought and that the intended meaning must have been the equivalent of what was stated in this respect in the amended claim. In other words, on a fair interpretation of the claim in the light of the totality of disclosure of the patent the protection conferred by it had not in fact been extended by the amendment (point 2.3 of the reasons). According to decision T 371/88 the amendment of a granted claim to replace a restrictive term, which in its strict literal meaning did not clearly embrace a further embodiment of the description, by a less restrictive term clearly also embracing this embodiment, was permissible under Article 123(3) EPC if: (a) the restrictive term in the granted claim 1 was not so clear in its technical meaning in the given context that it could be used to determine the extent of protection without interpretation by reference to the description and the drawings of the patent, and (b) it was quite clear from the description and the drawing of the patent and also from the examination procedure up to grant that the further embodiment belonged to the invention and that it was never intended to exclude it from protection conferred by the patent (see headnote and points 2.3 to 2.5 of the reasons). The same principles were applied in decision T 673/89 of 8 September 1992 (unpublished in OJ EPO; point 3.1.2 of the reasons).

The situation in the present case might be considered comparable to that in cases T 371/88 or T 673/89 in that the inconsistencies regarding the solar control layer within granted claim 1 itself render this feature unclear. It is insofar comparable to the situation in T 108/91 as granted claim 1 is inconsistent with the entire disclosure in the patent specification. Moreover, in the present case granted claim 1 itself contains inconsistencies. Therefore, the preceding considerations of the present board in point 2.2 fall in the ambit of the general principles derivable from those decisions.

3. Concerning the objection under Article 84 (lack of clarity) raised by the respondent, it is correct that it is known to use in particular ZnO layers as dielectric layers in multi-layer coatings on a glass substrate. According to document L, materials for the

dielectric layers of the multi-layer coating for glass windows are *inter alia* tin oxide, titanium oxide and zinc oxide (see column 4, line 35). However, it cannot be concluded therefrom that layers of these materials are always dielectric layers or cannot have electroconductive properties when produced in a different way or under different conditions. It can be inferred for example from the translation of "Chemical of Semiconductor", Takeo Kawaguchi, 1974, pages 60 to 62, submitted by the appellant with his letter of 19 December 2001, that zinc oxide and titanium oxide can be electroconductive. Furthermore, the patent in suit refers to oxygen vacancies as a functional basis for electro-conductivity on page 2, line 46. Therefore, the board has no reason to doubt that tin oxide, zinc oxide and titanium oxide layers may exhibit electroconductive properties. The fact that these oxides are not designated by their complete name in claim 1 but by their formula SnO_2, ZnO and TiO_2 (ie a stoechiometric ratio of the elements) may not formally be in agreement with the teaching in the patent in suit that the electroconductivity is based on oxygen vacancies. However, this cannot justify a refusal of the claim on the basis of lack of clarity since the skilled person would understand, on the basis of the general knowledge, what an electroconductive layer of these materials is. The fact that claim 1 does not contain the feature that the electroconductivity is based on oxygen vacancies does not render this claim unclear. Therefore, the board is not convinced by the respondent's arguments that claim 1 does not meet the clarity requirement set out in Article 84 EPC.

4. The respondent further objected for the first time at the oral proceedings that the skilled person did not

know how to produce the electroconductive layers listed in claim 1 and in particular electroconductive layers of tin oxide, titanium oxide or zinc oxide which were known as dielectric layers. This amounts to an objection of insufficiency of disclosure under Article 100(b) EPC. The patent in suit does not disclose any example illustrating the preparation of an electroconductive layer of tin oxide, titanium oxide or zinc oxide, or the other non-doped oxides listed in claim 1. However, it teaches on page 2, line 46, that the invention is applicable to an electroconductive layer whose electroconductivity is caused by oxygen vacancies. Furthermore, Example 1 of the patent in suit, which describes the production of a five-layer coating including a solar control layer of chromium nitride, a second underlayer of tin oxide and a second protective layer of tin oxide, discloses the production of these layers by reactive sputtering. As pointed out by the appellant, the skilled person would infer from this teaching, without exercising inventive skill, that the oxygen vacancies in the electroconductive layer can be produced by reactive sputtering. This is because it is well-known that the composition of the deposited layer depends on the conditions and the sputtering atmosphere used for the reactive sputtering. Although the burden of proof rests on the respondent for his contested assertion, he did not provide any evidence showing that electroconductive layers of these oxides are not obtainable by reactive sputtering. For the preceding reasons, the board cannot accept the respondent's assertion concerning the insufficiency of disclosure.

5. Turning to the novelty issue, the appellant did not dispute at the oral proceedings that the subject-matter

of claim 1 is not entitled to the priority date of 30 October 1991 and that the date of filing of 28 October 1992 is thus the relevant date to be considered for assessing novelty with respect to the prior art. It results therefrom that document A which was published on 14 April 1993 and has a filing date of 25 September 1992 is a prior art document pursuant to Article 54(3) and that even the disclosure of A which is not entitled to the priority dates claimed in A forms part of the state of the art for the assessment of novelty.

5.1 Example 8 of A discloses depositing a layer of titanium nitride layer onto a glass substrate by sputtering and then applying a layer of silicon nitride also by sputtering. This combination of layers falls within the definition of the claimed process. The appearance of the sample is said to be unchanged after heating for 10 minutes at 625°C (see page 6, Example 8). However, it is not indicated in Example 8 that the coated sample is subjected to a bending or a tempering operation. The respondent's argument that the skilled person would implicitly have derived from the heating step of Example 8 and from the general disclosure of A, in particular from claim 21, that the coated glass was intended to be bent and, thus, that Example 8 destroyed the novelty of the claimed process are not convincing. To arrive at this conclusion the respondent in fact combines the teaching of Example 8 with the teaching of claim 21. However, claim 21 concerns a very broad method comprising heating the coated glass substrate to a temperature sufficient to bend the glass but it is not limited to the particular combination of layers disclosed in Example 8. Claim 21 even does not indicate any material for the metallic appearing metal-containing film nor for the protective layer. The latter is only defined as comprising a different metal from the metal-containing film and preventing oxidation of the metal-containing film upon heating. As argued by the appellant, Example 8 might be an example illustrating the heat processable coated article according to claim 1 of A. It should be noted in this context that the coated article disclosed in A is not necessarily subjected to a bending operation, since the further processing steps are "high temperature processes such as bending, laminating, and tempering" (see page 2, lines 3 to 5). In these circumstances, Example 8 even in combination with the more general disclosure in A cannot be considered as destroying the novelty of the claimed process.

5.2 Concerning Example 11 of A, it discloses a coated article having the configuration glass/Si-5%Al/Ti nitride/Si-5%Al nitride, ie a combination of layers falling within the definition of the claimed process. The coated article is prepared as in Example 10. Neither Example 10 nor Example 11 discloses a bending step or a tempering step as defined in the claimed process. It is merely indicated in Example 11 that the coated article is stable with tempering. It is not clear whether the coated glass was actually tempered and, in the affirmative, under which operating conditions, or whether a test simulating tempering was merely performed (see page 5, lines 37 to 45). Although the coated article of Example 11 is said to be prepared as in Example 10, it is not directly and unambiguously derivable therefrom that it was also tested under the conditions disclosed in Example 10. The two coated articles of Example 10, which do not have a layer configuration falling within the definition of claim 1 on file, were subjected to a thermal stability test consisting in heating the coated article at 704°C for 3.5 minutes or 1.75 minutes and comparing the solar properties before and after the heating step. Even if this heat treatment were performed to simulate tempering, this cannot destroy the novelty of the claimed process since no quenching of the glass was carried out after the heating step and, thus, no tempering. Furthermore, it cannot be derived therefrom at what temperature the coated glass would have been heated if it had actually been tempered. Therefore, the claimed process meets the requirement of novelty over the disclosure of Example 11 of document A. The preceding considerations apply likewise to the method disclosed in Example 14 of A.

The process of claim 1 is also new with respect to the remaining documents cited by the respondent. As this was not disputed, further considerations in this respect are not necessary.

6. The opposition division and the respondent considered that document B represents the closest prior art. Although this document does not deal with the problem of avoiding a substantial change of the optical properties on bending or tempering of the coated article but only discloses that the coated article is post-temperable, the board can follow this approach. In this context, the board observes that in document C the problem of oxygen diffusion to the reflective metal coating during bending or tempering is dealt with, however the bent or tempered articles produced in C contain an opaque coating.

6.1 Document B discloses a method of producing a heat reflecting glazing having a multi-layer coating on a glass substrate, comprising the step of forming a silicon layer on a hot glass substrate in a non-oxidising atmosphere, forming a titanium nitride layer over the first silicon coating, forming a second silicon coating overlying the titanium nitride coating, and optionally forming a metal oxide abrasion resistant coating in an oxidising atmosphere, which adheres to and covers the second silicon coating. The resulting coated article is post-temperable (see claims 13 and 14 on pages 17 to 18; pages 5 to 7, Examples 1 and 2).

Starting from this prior art, the technical problem underlying the claimed process can be seen in the provision of a process for manufacturing a heat-treated coated glass, wherein a coated flat glass can be bent and/or tempered in a normal oxygen-containing atmosphere without substantially changing the optical characteristics, in particular the colour and the visible light transmittance, of the coating.

It is proposed to solve this problem by the process as defined in claim 1. This process differs from that of document B by the different material used for the first protective layer and by the conditions of the heat treatment for the tempering step, alternatively by step (b1) or (b3). In view of the statement on page 4, lines 2 to 14, of the patent in suit, of the results reported in Examples 1 and 2 thereof and of the additional examples and comparative examples submitted by the appellant on 5 June 2000 and on 5 February 2003, it is credible, in the absence of evidence to the contrary, that the problem stated above has actually been solved by the claimed process.

The respondent expressed doubts as to whether the technical problem would be solved for all possible combinations resulting from the two lists of materials stated in claim 1 for layers (i) and (ii). The respondent's doubts seem to be based on the fact that the desired effect (optical properties not substantially changed on bending and/or tempering) was shown to be achieved for 10 combinations of materials from the two lists of layers (i) and (ii) but that other combinations encompassed by claim 1 could not be expected to lead to the same effect because of the lack of chemical similarity to the tested combinations. The board observes in this respect that Cr, Ti, CrN_x, TiN_x, ITO, have been used to illustrate the components of layer (i), ITO being an example of an electroconductive layer, and that these materials were combined with a protective layer of either SiN_x or $AlSiN_x$. Therefore, it has been shown that even with components of the layer (i) which are chemically very different, and a protective layer of a nitride such as SiN_x or $AlSiN_x$, the desired effect is achieved. Concerning the protective layer, only two different nitrides of the list were used, however the list of materials for this layer includes only nitrides and their incompletely oxidised form, ie the corresponding oxynitrides. The respondent has given no reasons why the nitrides of the list other than SiN_x or $AlSiN_x$ or the corresponding oxynitrides would not permit to achieve the desired effect. Furthermore, the burden of proof rests on the respondent for his assertion that the technical problem would probably not be solved within the whole ambit of claim 1. However the respondent's doubts were not supported by any evidence showing that a particular combination actually did not lead to the desired effect. In the present circumstances where the appellant himself has provided additional examples with very different kinds of materials for layer (i) and two different nitrides for the protective layer, the respondent's mere reference to a particular combination which is not expressly disclosed in the patent in suit, ie an ITO layer with a protective layer of carbonitride, without providing any experimental evidence confirming his doubts is not sufficient to reverse the burden of proof. For these reasons, the board cannot accept the respondent's arguments that the technical problem is probably not solved within the whole ambit of claim 1.

6.2 Document B itself does not deal with the problem of avoiding a substantial change in the optical properties when bending and/or tempering the coated article. It is disclosed that a silicon oxide film may be formed on the surface of the second silicon layer when the coated article travels through the oxidising atmosphere of the lehr. This surface oxide layer is said to inhibit the formation of pin holes in the coated article when a subsequent protective layer, such as a tin oxide layer, is formed over the second oxide layer to increase the durability of the coated article, ie its abrasion and scratch resistance (see page 6, lines 28 to 34; page 11, lines 28 to 36). Therefore, the oxidation of the surface of the second silicon layer is not disclosed as being a drawback in the process of B but, on the contrary, as being advantageous when the abrasion and scratch resistant tin oxide layer is further deposited.

6.3 The respondent's arguments that the skilled person would have combined the teaching of document B with the teaching of document N in view of the advantages of the protective layer of silicon nitride disclosed in N (see point V above) cannot persuade the board for the following reasons. It is first observed that the optical interference film of document N is applied on the surface of a lamp. This use is completely different from that disclosed in B (heat reflective architectural glass) and does not involve high temperatures of at least 500°C as indicated by the appellant and not contested by the respondent. Document N discloses that the optical characteristics of conventional optical interference films are reduced if these films are used at a temperature > 200°C for an extended period of time because the silver layer is crystallised or oxidised by oxygen atoms of the dielectric layer. Accordingly the invention in N aims at protecting the metal layer from oxidation, reduction, crystallization, etc.. This purpose is achieved by sandwiching the metal layer of Ag, Au, Pt in between two layers of a nitride selected from the group of aluminium nitride, silicon nitride and boron nitride. No oxidation or crystallisation of the metal layer occurs with this layer construction, even if the film is heated at a high temperature for an extended period in air (see column 1, lines 7 to 10 and 30 to 59; column 2, lines 19 to 66). However, the "high" temperature which is meant here (column 2, line 63) is not a temperature of at least 500°C as in the case of bending or tempering operations but a much lower temperature of 300°C. This can be derived from both the use disclosed in N and the tests which were carried out at 300°C for one hour to observe the changes in the optical characteristics after heating. Figure 3 and 4 show that the reflectance and transmittance characteristics of an interference film of three layers AlN/Ag/AlN deposited on a quartz glass are not changed when it is heated at 300°C for an hour in air, contrary to a conventional film composed of a titanium oxide layer, a silver layer and a titanium oxide layer formed on a quartz glass plate (see column 3, lines 54 to 60). Thus the skilled person would have inferred from N that films of aluminium nitride, silicon nitride and boron nitride can efficiently protect a reflective metallic layer of Ag, Au, and Pt from oxidation or crystallisation during a heat treatment at 300°C for one hour in air and that the optical characteristics are retained under these conditions. However, N is totally silent about the change of the optical properties at temperatures at which a coated glass substrate for architectural or automotive applications is usually bent or tempered. As pointed out by the appellant and not contested by the respondent at the oral proceedings, the skilled person could not have reasonably expected in view of this teaching that the optical properties might also be substantially retained at the much higher temperatures which are necessary for bending and/or tempering the coated glass, ie temperatures of at least 500°C depending on the composition of the glass. Furthermore, document N contains no information suggesting that the layer of aluminium nitride, silicon nitride or boron nitride would also be suitable for avoiding a substantial change of the optical properties of an article including a solar control layer of a material other than Ag, Au or Pt. Under these circumstances the skilled person would not have been encouraged to combine the teaching of documents N and B with the expectation of solving the problem stated above. As pointed out by the respondent, document N further discloses that the interference film is scratch resistant, has good mechanical properties compared with an interference film using zinc sulfide as the dielectric layer, and that cracks or peeling do not occur even when the interference film is heated repeatedly during the operational life of the lamp (see column 1, lines 38 to 45; column 2, lines 43 to 45 and 64 to 66; column 3, lines 1 to 5). However, starting from document B, the problem with which the skilled person was confronted was neither a problem of unsatisfactory scratch resistance and mechanical characteristics, nor a problem of peeling or formation of cracks, but the problem of avoiding substantial changes in the optical properties when the coated glass is subjected to a high temperature processing like bending and/or tempering. In this context it is observed that the coated article of B including a protective tin oxide layer has an excellent durability, e.g. scratch and abrasion resistance (see Example 4, page 9, lines 15 to 17). Therefore, the fact that document N discloses the said properties is not decisive for the question as to whether the skilled person would have combined the teaching of documents B and N. What the skilled person would **primarily** have looked for in N is whether this document contains information suggesting how substantial changes of optical properties during a heat treatment at temperatures of at least 500°C might be avoided. The fact that the interference film of N might exhibit a good scratch resistance, mechanical strength or resistance to peeling would not be of assistance to the skilled person confronted with the problem stated above.

6.4 The respondent relied on document D to show that a silicon nitride layer was known as an anti-reflection layer and had already been used in combination with materials other than Ag, Au or Pt. This document discloses a selective solar absorber comprising a titanium boride or zirconium boride layer and an anti-reflection coating of silicon nitride on a graphite substrate (see page 393, summary; page 394, line 12). However neither TiB_2 nor ZrB_2 are used as material for the solar control layer in the process of B or in the claimed method. The fact that the silicon nitride layer is an anti-reflection layer or has been used in combination with a TiB_2 layer or a ZrB_2 layer, which are neither mentioned in B nor in N, would not have given the skilled person any incentive to combine the teaching of documents B and N since even with this additional information he could not have expected such a combination to solve the problem stated above.

As pointed out by the respondent, document E further teaches that a silicon nitride layer deposited on a silver layer forms a diffusion barrier that is impervious to water and corrosive substance in the atmosphere. Silicon nitride is said to be an impermeable and refractory material which is thermally shock resistant (see column 2, lines 36 to 43, and column 3, lines 55 to 58). These additional properties do not suggest that the silicon nitride layer of the interference film of document N, when used in combination with a solar control layer of titanium nitride, might avoid substantial changes of the optical properties during the heat treatment at the high temperatures necessary for bending and/or tempering. Therefore, even in view of the additional disclosure in E the skilled person would not have contemplated combining the teachings of documents B and N in order to solve the problem stated above.

6.5 Concerning the respondent's second line of arguments based on document G as the closest prior art (see point V above), the board assumes in favour of the respondent and for the sake of argument that document G is an appropriate starting point for the assessment of inventive step. Document G discloses a heat reflecting product having a six-layer coating on one side of a transparent glass plate. The layers are applied to a glass substrate by sputtering. The glass substrate is a flat glass plate or a bent glass plate, it can also be a reinforced or a tempered glass plate. The multi-layer coating comprises a third layer of a metal selected from Ti, Zr, Ta, Cr, Cr-Ni and stainless steel and an outer layer (sixth layer) of an oxide or oxynitride of an alloy selected from a Si-Al alloy, Si-Ti alloy and Si-Ni alloy, or a nitride or oxynitride of aluminium. The multi-layer coating has for example the following structure

glass/Ta_2O_5/TaN_xO_y/stainless steel/TaN_xO_y/Ta_2O_5/Al.SiN_xO_y;
or glass/TiO_2/TiN_xO_y/stainless steel/TiN_xO_y/TiO_2/Al.SiN_xO_y
(see claim 1; page 3, lines 24 to 25, Examples 1, 4 and 9).

According to the patent in suit, when a coating is applied to a bent glass it is not possible to obtain a uniform coating unless the coating process and conditions are controlled in relation to the configuration of the bent glass. Starting from document G, the technical problem might be seen in the provision of another method for producing a heat treated coated glass having substantially the same optical properties, which, in the case of a bent glass, avoids the said drawback. It is proposed to solve this problem by the process as defined in claim 1. The latter differs from the process of G by performing the bending and/or tempering step after deposition of the multi-layer coating on the glass substrate, under the conditions stated in steps (b1), (b2) or (b3) of claim 1. In view of the examples of the patent in suit and of the additional examples submitted during the appeal proceedings, it is credible in the absence of evidence to the contrary that this problem has actually been solved (see also point 6.1 above).

The respondent's arguments that the skilled person would have performed the bending step after application of the coating on a flat glass plate instead of before are not convincing for the following reasons. As indicated in the patent in suit (page 2, lines 5 to 8), it was conventional before the filing date of the patent in suit either to apply the coating on a glass plate which is already bent, or to bent the glass plate already coated with a metallic film or a metal nitride film which is sandwiched in between layers of an easily oxidisable metal such as tantalum which is oxidised during the subsequent bending step, thereby protecting the metal film. Therefore, it was well-known to the skilled person that the bending step could be performed after deposition of the coating on a flat glass plate when the metal layer is protected by specific protective layers. However, the skilled person was also aware of the fact that in the said method the optical properties are changed on bending (see patent in suit, page 2, lines 14 to 15). Therefore, the skilled person faced with the problem stated above would on the basis of this background have contemplated bending the coated glass after application of the coating only if he could have expected the optical properties of the particular multi-layer coating of document G not to substantially change during the bending process. However, the respondent has given no reason why this could be reasonably expected and the board sees also no reason taking into account that document G itself contains no information suggesting that the optical properties of the multi-layer coating might be substantially retained after a heat-treatment at the high temperatures necessary for bending. The board thus comes to the conclusion that in the absence of a reasonable expectation of success, the skilled person would not have tried performing the bending step after the coating step. It therefore appears that the respondent's arguments regarding document G are based on an *ex-post facto* analysis.

6.6 The respondent's arguments based on the combination of the teachings of documents G and N can also not be followed by the board. As already indicated above, it could neither be inferred from document N, nor expected in view of its teaching that the protective layer of silicon nitride used in the interference film would have been suitable for avoiding a substantial change of the optical properties when heating the coated substrate at temperatures of at least 500°C for bending and/or tempering (see point 6.3 above). Under these circumstances the skilled person would not have been encouraged, in view of the teaching of N, to use a silicon nitride layer as a protective layer in the coating of G and to subsequently bend and/or temper the coated glass in order to solve the problem stated above.

6.7 The remaining documents, which were not relied upon at the appeal stage in connection with the issue of inventive step, do not contain additional information which would point towards the claimed solution in combination with the documents considered above.

It follows from the above that the subject-matter of claim 1 meets the requirement of inventive step set out in Articles 54(1) and 56 EPC.

7. Claim 1 being allowable, the same applies to dependent claims 2 to 6, whose patentability is supported by that of claim 1.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent with the claims of the main request filed during the oral proceedings and a description to be adapted.

The Registrar:	The Chairman:
U. Bultmann	R. Spangenberg