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**Datasheet for the decision
of 13 March 2007**

Case Number: T 0764/05 - 3.4.02

Application Number: 01920269.6

Publication Number: 1272876

IPC: G02B 5/128

Language of the proceedings: EN

Title of invention:

Dielectric mirror retroreflective appliques having excellent repetitive laundering performance

Applicant:

3M Innovative Properties Company

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 56, 84

Keyword:

"Combination of two compounds, from two respective lists known for more than 20 years"

"Trial and error"

"Mo clear teaching"

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0764/05 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 13 March 2007

Appellant: 3M Innovative Properties Company
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 18 January 2005
refusing European application No. 01920269.6
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. Klein
Members: A. Maaswinkel
M. Vogel

Summary of Facts and Submissions

I. The present appeal was lodged by the applicant on 11 March 2005 against the decision of the examining division, dispatched on 18 January 2005, refusing the European patent application 01920269.6. The fee for the appeal was paid on 11 March 2005 and the statement setting out the grounds of appeal was received on 25 May 2005. In its decision the examining division had objected to the subject-matter of claim 1 according to the main or auxiliary requests then on file as not involving an inventive step in the light of the teaching of document D2 (Articles 52(1) and 56 EPC). Furthermore in the decision reference was made to documents D1 and D3:

D1: US-A-5 837 347

D2: US-A-4 763 985

D3: US-A-5 645 938.

II. In the statement setting out the grounds of appeal the appellant requested that this decision be set aside and that a patent be granted on the basis of the set of claims of the main or the auxiliary requests on file. Also oral proceedings were requested if the board was unable to allow the main request.

III. In a Communication annexed to the summons to oral proceedings the board raised objections under Article 84 EPC. As to the issue of patentability (Articles 52(1) and 56 EPC) document D2 was considered the closest prior art, in agreement with the position

of the examining division. Starting from the disclosure in this document the technical problem addressed in the patent application might be identified as optimising the durability of the retroreflective applique under repetitive laundering conditions.

IV. At the oral proceedings of 13 March 2007 the appellant filed a new main request and requested that a patent be granted in the following version:

- claims 1 to 9, filed at the oral proceedings;
- description, pages 1 to 4 and 6 to 14, as published;
page 5, as filed during the oral proceedings;
- drawings, as published.

V. The board gave its decision at the end of the oral proceedings.

VI. Independent claim 1 of the main request filed at the oral proceedings reads as follows:

"An exposed lens retroreflective applique, comprising:
a monolayer of beads partially embedded in a first layer; and
a dielectric mirror disposed proximate the monolayer of beads such that the beads and the dielectric mirror cooperate to retroreflect light, the dielectric mirror including at least one layer of relatively high refractive index material and at least one layer of relatively low refractive index material, wherein the relatively high refractive index material

consists essentially of zinc sulfide and the relatively low refractive index material consists essentially of a material selected from the group consisting of calcium fluoride and silicon dioxide;

wherein the applique exhibits an initial reflectivity and, if subjected to fifty home laundering cycles, a second reflectivity, and wherein the second reflectivity is at least 75 % of the initial reflectivity".

Claims 2 to 9 are dependent claims.

VII. The arguments of the appellant can be summarised as follows:

In order to overcome the objection under Article 84 and Rule 29(2) EPC in the decision under appeal the present set of claims only includes one independent claim. With respect to the expression "wherein the applique exhibits an initial reflectivity ...at least 75 % of the initial reflectivity" this had been included in the claims as originally filed to distinguish over what may have previously been thought to be launderably durable and to specify the requirements of the appliques of the present invention. This feature is the result of the inventive selection of the dielectric materials defined in claim 1 and the choice of the further coat and barrier layers for the applique which are within normal craftsmanship and are not subject of the invention. The expression "home laundering cycle" is explained in more detail in the description and also defined in claim 4 and should therefore be comprehensible.

In the decision the examining division had identified document D2 as the closest prior art. This document discloses a retroreflective sheet with enhanced brightness. For the technical problem addressed in this document the examining division had made reference to a passage in column 2, lines 36-41, from which it concluded that the problem of providing a good durability was recognised in D2. However, although launderability is mentioned in this passage this is not the gist of the invention as disclosed in this document; rather, as clearly defined in claim 1, feature C, and immediately visible from the description in column 2, lines 18-21; and in particular in column 3, lines 3-6, the object of D2 is to provide a retroreflective sheet with enhanced brightness which is obtained by the "essentially additively cooperating" dielectric mirrors and reflective nacreous pigment flakes. For the compounds to be used in the dielectric mirrors D2 reproduces in column 5, lines 11-20, lists of some twenty high refractive index materials and of some ten low refractive index materials, which would therefore result in more than 200 theoretical possible combinations for a dielectric mirror. At this column 5, lines 42-49, D2 mentions that the preferred compositions for transparent mirrors for a particular application can be determined by trial and error, but there is no indication in D2 that the compositions claimed in claim 1 of the present invention would result in a launderably durable applique, much less an applique having a second reflectivity after fifty home laundering cycles that is at least 75% of the initial reflectivity. In fact, the materials that are taught in D2 as being typically more durable and resistant to laundering than Na_3AlF_6 and ZnS are MgF_2 and CeO_2 , the

only disadvantage of the latter combination being that these materials are more expensive. Furthermore, in all examples disclosed in D2 (Examples 1-8) the selected compounds were Na_3AlF_6 and ZnS , and in "Comparative Example 1" Na_3AlF_6 and Bi_2O_3 were selected. However, in these Examples the focus was not on improving the durability or resistance to laundering but in improving the brightness of retroreflective appliques while avoiding the disadvantages associated with metal specular reflectors. Furthermore, by recommending MgF_2 and CeO_2 as the best materials for durability and resistance to laundering document D2 in fact leads away from the technical teaching of the present invention.

It is also noted that document D2 had been filed in 1986 and was published in 1988, i.e. long before the other prior art documents D1 and D3. Although these documents are also concerned with retroreflective transfer sheets having dielectric mirror layers on the microspheres and which sheets should be launderable, the compounds used for the dielectric layers are in fact the same as in document D2, see column 11, lines 5-17, of D1; and column 7, lines 51-63, of D3. Both D1 and D3 contain the statement that "a preferred dielectric mirror contains succeeding layers of cryolite (Na_3AlF_6) and zinc sulfide". Therefore, this shows that more than 10 years after the publication date of document D2 the skilled person did not have an incentive to investigate other compounds for the dielectric layers, because the preferred known composition was cryolite and zinc sulfide (D1, D2 and D3) and if the issue of durability and launderability was crucial the skilled person would have been led by

document D2 to applying MgF_2 and CeO_2 (albeit at higher cost).

Finally in order to appreciate the spectacular improvement by the present invention reference is made to Table 3 of D1, Example 42, in which the relative reflectivity after 50 washings was 26%. This was the best value achieved for a dielectric mirror and according to column 26, lines 47-51, for this (best) Example "the improvement in wash durability was dramatic". This value should be compared with the relative reflectivity value of the applique after fifty laundering cycles in claim 1 of "at least 75%" and the values shown in Figures 4 and 8 of the patent application, which implies a threefold improvement over the best prior art value. As described in the "Brief Summary" at page 5 of the published application, it was an important concept of the invention to retain the initial reflectivity. As can be seen from the absolute initial reflectivity data in the Comparative Examples and in the Inventive Examples which, for the selected compounds of the invention may even be lower than that of the prior art compounds, the emphasis in the invention is, unlike the prior art, not on obtaining the highest possible initial reflectivity, but on retaining the highest possible reflectivity after performing a large number of laundering cycles. This teaching is not known or rendered obvious by the known prior art, therefore the subject-matter of claim 1 should involve an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
 - 2.1 Claim 1 finds its support in claims 1, 4 and 5 of the application as published. This similarly holds for the dependent claims. The amendment in claim 4 in accordance with Rule 35(12) EPC is supported by page 14, line 1, of the published description. Finally the minor amendments in page 5 of the description are not objectionable. Therefore the amendments comply with Article 123(2) EPC.
 - 2.2 Furthermore the expression in claim 1 "wherein the applique ...at least 75% of the initial reflectivity" does not lead to a lack of clarity. As explained by the appellant, this feature is the result of selecting the compounds for the dielectric mirror as defined in the claim, together with a judicious choice of the layer thicknesses and further layers of the applique, for which the patent application provides sufficient information and which is well within the routine skill of a normal craftsman. This feature may therefore not be regarded as a "result to be achieved", rather it is an intrinsic property of an applique having the features of claim 1 and designed according to the disclosure of the patent application. Hence the expression is not objectionable under Article 84 EPC.

3. *Patentability*

3.1 Document D2, see Figure 1, discloses an exposed lens retroreflective applique (sheet 1) comprising a monolayer of beads 12 partially embedded in a first layer (base layer 15); and a dielectric mirror including one layer of a relatively high refractive index (layer 14) and one layer of relatively low refractive index material (layer 12). In column 5, lines 11-20, two lists of possible high and low refractive index materials are disclosed, amongst which are the compounds ZnS, CaF₂ and SiO₂. Document D2 discloses the following material combinations of low and high refractive index compounds: MgF₂ and CeO₂; Na₃AlF₆ and ZnS; and Na₃AlF₆ and Bi₂O₃. Furthermore D2 only gives the data of the retained reflectivity after twenty-five home laundering cycles. Therefore the subject-matter of claim 1 differs from the retroreflective sheet disclosed in document D2 in the following features:

- (i) in that the dielectric layers are a combination of zinc sulfide and calcium fluoride; or of zinc fluoride and silicon dioxide; and
- (ii) in that the applique exhibits an initial reflectivity and, if subjected to fifty home laundering cycles, a second reflectivity, and wherein the second reflectivity is at least 75 % of the initial reflectivity.

3.2 Therefore the subject-matter of claim 1 is novel over the disclosure in document D2. Feature i) is also not known from documents D1 and D3, both documents

disclosing the preferred combination of Na_3AlF_6 and ZnS . As to feature ii), in document D1 the number of laundering cycles was fifty (Table 3), however, the best value of retained reflectivity was 26% (Example 42); in document D3 the maximum number of laundering cycles was twenty-five. Therefore the features (i) and (ii) are not disclosed in the known prior art. The subject-matter of claim 1 is therefore novel (Articles 52(1) and 54 EPC).

3.3 The technical problem addressed by the features (i) and (ii) can be considered to reside in the optimisation of the durability of the retroreflective applique under repetitive laundering conditions. Although the board agrees with the appellant that this problem is not the main issue in D2, which document is rather more concerned with providing a retroreflective sheet with enhanced or high reflective brightness, the aspect of the article's durability under laundering conditions is addressed (see column 2, lines 36-39; and column 5, lines 47-49) and its reflectivity values after plural (here: up to twenty-five) laundering cycles are listed (see Examples 2 and 6). Therefore the technical problem of the durability of a retroreflective applique under repetitive washing conditions is a known issue in this technical field and the formulation of the technical problem *as such* does not involve an inventive activity.

3.4 In the decision under appeal it was argued that the skilled person seeking to optimise the durability of the retroreflective applique would apply the teaching of document D2 and determine the durability of appliques having different high and low refractive index material combinations suggested by the lists of

compounds in this documents. In varying these material combinations by trial and error as disclosed in D2, column 5, lines 42-47, the skilled person would amongst others obtain the dielectric layer combinations ZnS/SiO₂ and ZnS/CaF₂. Since the parameter "durability" is to be optimised he would inevitably discover that these material combinations have a better durability than, for example, the combination ZnS/Na₃AlF₆ and hence arrive at the subject-matter of claim 1 without an inventive step being involved. At the oral proceedings the appellant had argued that this passage in D2 is nothing but an empty statement because neither the remainder of this document nor the other prior art gives any clues to optimising the material combination in this respect except for the very clear teaching in the subsequent lines in column 5 that the combination MgF₂ and CeO₂ are more durable and resistant to laundering.

- 3.5 In the view of the board the passage in column 5, lines 11-57, in document D2 must be read in the context of the remainder of the disclosure of this document. In the Section "Background" of document D2 it is disclosed that in the prior art retroreflective articles typically specularly reflecting metal (e.g. aluminium) layers were arranged behind the microspheres. These have the disadvantage that it is not possible to obtain a coloured appearance other than gray. In this context reference is made to US-A-3,700,305 in which patent a retroreflective construction containing microspheres with adjacent dielectric mirrors was disclosed. According to the Section "Summary of the invention" in D2 a novel retroreflective sheet is disclosed comprising dielectric mirrors and reflective nacreous

pigment flakes which cooperate to provide an enhanced brightness (column 3, lines 3-7); these features are also defined in independent claim 1 of D2. This sheet can be made very durable and retain high retroreflective efficiency even after several launderings or dry-cleanings (column 2, lines 36-39).

- 3.6 Addressing again the above passage in column 5 of D2, the first paragraph in this passage (lines 11-20) reproduces a list of possible compounds having the desired high and low refractive index ranges. In the subsequent paragraph (lines 21-34) general rules for the thickness of each dielectric layer are given. In the next paragraph numerical values of the layer thicknesses for the particular combination of materials Na_3AlF_6 and ZnS are disclosed. In this paragraph the alternative combination MgF_2 and CeO_2 is mentioned in passing which, according to D2, is more durable and resistant to laundering but also more expensive. Finally, in the paragraph in lines 50-57 it is disclosed that a reflective sheet comprising four alternating layers of Na_3AlF_6 and ZnS "may attain over 90% retroreflective efficiency". Having regard to the object addressed in document D2 to obtain a retroreflective sheet with enhanced or high reflective brightness, this sentence indicates that, to the understanding of the inventors, the desired performance is fully met by this combination of materials. It is furthermore noted that in the Examples equally the combination of materials Na_3AlF_6 and ZnS for the dielectric layers is disclosed and that, according to Example 2 (column 11, lines 13-26) the sample "showed excellent wash durability", which is confirmed by its reflectivity retained after 25 washing cycles.

3.7 It therefore appears that the overall teaching of D2 can be summarised as follows:

(i) a retroreflective sheet comprising Na_3AlF_6 and ZnS as dielectric materials meets the objects of this document in terms of initial and retaining reflectivity and wash durability;

(ii) Furthermore, should the skilled person not be satisfied with this performance with respect to durability and resistance to laundering it is expressly recommended to apply the material combination MgF_2 and CeO_2 ;

(iii) In column 5, lines 11-20, possible further suitable materials are listed.

3.8 In order to assess the relevance of this part of the disclosure the board has compared these data in document D2 (published in 1988) with comparable teachings in the later documents D1 (published in 1998) and D3 (published in 1997). It is striking that, with the exception of the compound SiO_2 which is not listed in these later documents, the respective lists in D1 and D3 are identical to the list in document D2. Furthermore an identical list to the ones in D1 and D3 already appears in the earlier patent US-A-3,700,305 (cited in D2 and in the present patent application) which dates back to 1972. Therefore, with the exception of SiO_2 , the list of suitable dielectric materials had been known since 1972, i.e. 28 years before the priority date of the present patent application. In document D2 the compound SiO_2 was listed among many

alternatives and D2 does not provide any information as to its relevance. Finally this alternative does not even appear in the lists in D1 and D3, which are published some 10 years after D2.

- 3.9 From this the board concludes that the relevance of the list in column 5, lines 11-20, of document D2 should not be overemphasised: apparently this is rather an "omnibus" list which may have been included in the respective prior art documents to disclose the commonly known dielectric materials. Hence, the board does not consider this part of D2 as a clear indication or hint to the skilled person, in particular because D2 is quite unambiguous over the combination Na_3AlF_6 and ZnS ("over 90% retroreflective efficiency"; "excellent wash durability") and offers the clear alternative of combination of the materials MgF_2 and CeO_2 in case an even more durability and resistance to laundering was required.
- 3.10 At the oral proceedings the appellant presented the further argument in favour of inventive step, which the board found persuasive, that the selection of the material combinations defined in claim 1 had not been based on choosing the highest initial reflectivity but, rather, on retaining the maximum reflectivity after a large number of washing cycles. This is indeed visible from the values of the initial reflectivity of the Examples 1 - 5 of the present invention which are all below $200 \text{ cd}/(\text{lux}\cdot\text{m}^2)$, mostly even below $100 \text{ cd}/(\text{lux}\cdot\text{m}^2)$, in contrast to the Comparative Examples 1, 2 and 4 using cryolite and zinc sulfide in which the initial reflectivity is $200 \text{ cd}/(\text{lux}\cdot\text{m}^2)$ or more. Since in document D2 it is the value of initial reflectivity

which is emphasised, the skilled person, even if looking for alternative material combinations in the list of materials in column 5, would not have readily found the combinations defined in claim 1 in the absence of any realisation that for certain applications maintenance of a constant reflectivity after a number of laundering cycles should be given precedence over absolute reflectivity. Such applications include the use of appliques of different types or colours on a single piece of clothing, as was submitted by the applicant at the oral proceedings, for which maintenance of a uniform aspect is important, or the use of identical appliques on different portions of an equipment, which are not laundered together or are laundered at different frequencies.

3.11 The board finally agrees with the appellant that the combination of selected materials in claim 1 also results in a remarkable higher value of the retained reflectivity after fifty washing cycles (75%) as compared to the known value after fifty washing cycles (26%, document D1, Example 42). It is therefore concluded that this selection results in a clear technical effect, for which the prior art documents did not provide any teaching or hints.

3.12 As to the further documents D1 and D3, these neither disclose features i) and ii) (see point 3.2) and their contents are not more relevant than the disclosure in document D2.

3.13 It is therefore concluded that the subject-matter of claim 1 involves an inventive step and thus meets the requirements of Article 52(1) and 56 EPC.

3.14 Claims 2 to 9 are dependent claims and equally fulfil the requirements of the Convention.

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 grant a patent on the basis of the following documents:
 - claims 1 to 9, filed during the oral proceedings;
 - description, pages 1 to 4 and 6 to 14, as published;
page 5, as filed during the oral proceedings;
 - drawings, Figures 1 to 8, as published.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein