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**Datasheet for the decision
of 2 July 2009**

Case Number: T 0472/07 - 3.4.02

Application Number: 96942885.3

Publication Number: 0875008

IPC: G02B 5/124

Language of the proceedings: EN

Title of invention:

Dual orientation retroreflective sheeting

Patentee:

MINNESOTA MINING AND MANUFACTURING COMPANY

Opponent:

REFLEXITE CORPORATION
Nippon Carbide Industries Co. Inc.
LG CHEM. LTD. LG TWIN TOWER
AVERY DENNISON CORPORATION

Headword:

-

Relevant legal provisions:

EPC Art. 123(2)

Relevant legal provisions (EPC 1973):

EPC Art. 54, 56

Keyword:

"Interpretation of claim"

Decisions cited:

T 0190/90

Catchword:

-



Case Number: T 0472/07 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 2 July 2009

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 4 January 2007
revoking European patent No. 0875008 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: A. G. Klein
Members: F. Maaswinkel
B. Müller

Summary of Facts and Submissions

I. European patent No. 0 875 008 (based on application No. 96942885.3) was revoked by the decision of the opposition division dated 4 January 2007. In the division's opinion, the claims of the main request, i.e. the claims of the patent as granted, did not comply with the requirements of Article 123(2) EPC and the claims of the auxiliary request did not involve an inventive step (Article 56 EPC), starting from the embodiment in document P20 (WO-A-96/42023), Fig. 14, considered as closest prior art. Furthermore, the following documents were relied on by the parties in the proceedings:

P7: US-A-4 202 600

P10: US-A-4 588 258

P19_P10: Graphs showing the calculated geometrical efficiency of a "Stimsonite Series 4500 Metallized Retroreflective Sheeting" (2 pages)

P19_P11a: Picture having a higher magnification of the three pages product sheet P19_11 of "Stimsonite Series 4500 Metallized Retroreflective Sheeting".

II. On 6 March 2007 the patent proprietor filed an appeal against this decision and paid the appeal fee on the same day. In the statement setting out the grounds of appeal received on 14 May 2007 the appellant requested that the decision of the opposition division be set aside and that the patent be maintained on the basis of the set of claims of the main request filed therewith or, as a further auxiliary request, that oral proceedings be arranged.

- III. In its reply received on 30 November 2007 opponent 4, Avery Denison Corporation, hereinafter: "the respondent", requested that the appeal be dismissed and also, as auxiliary request, oral proceedings. The further respondent and opponent 3, LG Chem. Ltd., did not file any observations. Former opponents 1 and 2 had withdrawn their oppositions during the opposition proceedings.
- IV. In a summons pursuant to Rule 115(1) EPC sent on 23 February 2009 the board invited the parties to oral proceedings.
- V. In a letter received on 29 May 2009 the respondent filed further observations.
- VI. In a letter received on 2 June 2009 the appellant also filed observations and in a subsequent letter filed on 29 June 2009 submitted auxiliary requests, which, however, are of no relevance for the purpose of this Decision.
- VII. Oral proceedings were held on 2 July 2009. During the oral proceedings the appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request filed during the oral proceedings.
- VIII. The respondent requested that the appeal be dismissed.
- IX. The wording of claim 1, the only independent claim of the appellant's main request, reads as follows (*the numbering of features "1A" to "1M" is not part of the claim, but had been introduced at the respondent's*

suggestion and is reproduced only for easier reference in the following):

- " A retroreflective sheeting (10) comprising
- 1A a substrate (14) having a base surface (21) and a structured surface (20) opposite said base surface (21),
- 1B said structured surface (20) comprising a plurality of zones (6,8) of cube corner elements (12), including:
- 1C a first zone (6) comprising an array of cube corner elements (12),
- 1D' the optical axes of said cube corner elements (12) in the first zone (6) being canted to define a first primary plane of improved retroreflective performance at increased entrance angles;
- 1H the first zone (6) having a length extending longitudinally along the length of the sheeting and a width
- 1J wherein the first zone length is longer than the width; and
- 1E a second zone (8) comprising an array of cube corner elements (12),
- 1F' the optical axes of said cube corner elements (12) in the second zone (8) being canted to define a second primary plane of improved retroreflective performance at increased entrance angles,
- 1G said second plane being perpendicular to said first plane,
- 1M wherein said retroreflective sheeting (10) exhibits substantially similar retroreflective performance in response to light incident on said sheeting across a range of entrance angles in said first plane and said second plane ".

Claims 2 to 36 are dependent claims.

VI. The arguments of the appellant may be summarised as follows.

Amendments

With regard to the terms "array" and "zone", a skilled person reading the patent application as originally filed clearly understands the meaning of these terms. Specifically, from the description in page 7, lines 3-8, it is clear that a sheeting according to the present invention includes a first zone which, in turn, includes an array of cube corner elements which are disposed in a first orientation on the sheeting. Further, the second zone comprises an array of cube corner elements disposed in a second orientation on the sheeting. It is further explained in page 7, lines 21-24 of the description that the second zone extends substantially parallel to the first zone and includes an array of cube corner elements which is substantially identical to the array disposed in the first zone but disposed at a 90° orientation. It is thus clear from these passages of the description that "zone" and "array" do not refer to the same thing but describe distinct features. As can be clearly understood from the description, in particular when read in combination with Fig. 1, the term "array" refers to a certain arrangement or pattern of cube corner elements, the pattern being of indeterminate spatial extent. This is why col. 6, lines 18 - 23 of the patent can state, in connection with Fig. 1, that the array in the second zone is disposed at a 90° orientation relative to the array in the first zone. The term "zone", on the other

hand, refers to the region that bounds a given single area of cube corner elements. This is why the cited passage can state that the second zone extends substantially parallel to the first zone along the length of the sheeting. Thus, from the description, a skilled person would understand the meaning of "zone" and "array" in the above explained way, and he would perceive no inconsistency in the quoted passages.

Furthermore, the wording used in independent claim 1 as granted, i.e., that the first zone has a length extending longitudinally along the length of the sheeting and a width wherein the first zone length is longer than the width (features 1H and 1J), is clearly and unambiguously supported by Fig. 1 and the corresponding description: for instance, in the context of Fig. 1, page 10, line 15 of the original description discloses that the sheeting is made from replicas of a mold which have been sliced into thin strips. Also on page 9, line 27 and 28 it is disclosed that the zones extend longitudinally along the length of the sheeting. Moreover, page 7, lines 9 and 10; and lines 21 and 22, disclose that the first zone extends substantially parallel with a longitudinal edge of the sheeting; and that the second zone extends substantially parallel to the first zone along the length of the sheeting. Finally, by inspection of Fig. 1 it may readily be appreciated that, in contrast to the checkerboard patterns of the prior art, in the sheeting according to the invention the first and second zones are arranged in an alternating way (see page 5, line 1 of the original description). In its Communication of 23 February 2009 the board observed that, whereas claim 1 included conditions for the length and width of

the first zone (features 1H and 1J) no such limitation was defined for the second zone, which raised the question of intermediate generalisation. In this respect it is pointed out that these features had been included in the independent claim during the examining proceedings in order to establish novelty over document P20, which had been considered by the examining division to anticipate the subject-matter of claim 1 under Art. 54(3) EPC. Since, as reasoned before, these features for the first zone are clearly disclosed and are sufficient for establishing novelty and since the further limitations for the second zone were only defined in the original dependent claims 4 and 5, dependent claims 2 and 3 only defining limitations for the first zone, it is felt that the introduction of features 1H and 1J for only the first zone should not create an inadmissible intermediate generalisation.

With respect to the objected feature 1D' and similarly feature 1F' it is totally clear from the expression "said cube corner elements" that the defined properties apply to all cube corner elements in the first, respectively the second zone: this is also evident because there is no indication whatsoever in the patent specification that anything else could have been meant, any other interpretation being purely linguistic, however, this is not the way the skilled person reads a patent specification. In fact, if the first zone, or similarly the second zone, would contain anything else than the arrays defined in claim 1 the gist of the invention, namely the sheeting exhibiting substantially similar retroreflective performance in said first plane and said second plane (see page 6, line 3) would not be

obtained. Therefore the objections under Art. 84 and Art. 123(2) EPC are unfounded.

Patentability

With regard to the objection of lack of novelty raised by the respondent against claim 1 it remains the appellant's position that since P19_xx is a collection of various documents it has not been proven that all of these are pre-published prior art. With respect to document P20, the respondent's argumentation is based on an incorrect interpretation of claim 1. For instance from inspection of Fig. 14 of P20 it immediately follows that that sheeting does not have zones of cube corner elements which extend along the length of the sheeting, such as strips. To the contrary, P20, Fig. 14, discloses only square tiles.

With respect to inventive step, the appellant does not share the position of the respondent that, when starting from the sheeting of Fig. 14 of document P20, the technical problem underlying the difference between the sheeting defined in claim 1 and that sheeting would reside in modifying the sheeting of P20 for improving the retroreflectance in only two specific directions instead of six planes. Such a formulation of the technical problem would involve a strong hindsight. Instead, the objective problem solved by the present invention may be regarded as providing an alternative sheeting for use in specific applications. In particular, in the Stimsonite sheetings in documents P19_xx and the one in Fig. 14 of document P20, which, according to page 22, last paragraph of this document, corresponds to a Stimsonite sheeting and has the same

checkerboard structure with tiled zones of cube corner reflectors, the arrangement under six angular different orientations had been chosen on purpose in order to obtain the best uniformity of retroreflectance in all directions, therefore the skilled person would not have any reason for reducing the number of angular orientations. Furthermore the arrays are tiled and have a square shape, which is advantageous for a checkerboard arrangement. The respondent's allegation that it would be obvious to replace the square shape by rectangular arrays because these would be easier to manufacture is rebutted with the observation that all prior art retroreflective articles, for instance P20, P7 and P10, were based on square tiles to be arranged in a square checkerboard pattern. Therefore, although it is true that an elongated sheeting may be easier to produce in long strips, the appreciation of this advantage is a result of having invented it, which clearly was not the prior art situation. Therefore a skilled person would not have arrived at the claimed subject-matter if starting from document P20, Fig. 14, at least not without hindsight.

The respondent has also suggested that the skilled person would have combined the teachings of P20 and P7. In the appellant's firm conviction, if starting from the disclosure from P20, Fig. 14, a combination with document P7 would be completely artificial, since that document was published 16 years before P20 and, in addition, discloses a retroreflective sheeting in which the cube corner elements are not canted, in contrast to the present invention and the sheeting in P20, therefore these sheetings represent a completely different retroreflective behaviour. Furthermore, as in

P20, the main emphasis in document P7 is on a sheeting in checkerboard pattern, see Fig. 6 and col. 6, lines 5 - 6, and also the "detailed" example is for square cells (see col. 5, lines 4 - 9). In any case, the aim of the arrangement in Fig. 6 of P7 is to obtain an appearance of uniform brightness, when viewed at high angles of incidence, see col. 6, lines 4 - 10. This is achieved by mixing many zones with different orientations. Therefore, apart from the observation that the skilled person would a priori not consider to implement the teaching of P7 for addressing the technical problem of providing an alternative sheeting to the one in P20, Fig. 14, for use in specific applications, even such a hypothetical combination would not result in the subject-matter of claim 1.

When starting from the single orientation cube corner sheeting disclosed in P10, the objective technical problem solved by the present invention may be regarded as overcoming the limitations of single orientation cube corner retroreflective sheeting. As to the combination of documents P10 and P7 the following is observed. Document P10 discloses square tiles sheeting that has a uniform array of cube corner elements canted in a single plane to provide good entrance angularity in two perpendicular planes but having a single preferred orientation. On the other hand, P7 discloses multi-orientation sheeting comprised of uncanted square tiles aligned in two or four different directions. There is simply no incentive for the person skilled in the art to combine the multi-orientation approach of uncanted square tiles of P7 with the canted, single plane approach of P10. In any case, neither P10 nor P7

discloses to arrange the cube corner elements in elongated zones, see Fig. 6 of P7.

Therefore, the subject-matter of independent claim 1 involves an inventive step in view of the prior art.

VII. The arguments of the respondent may be summarised as follows.

With respect to the issue of "zone" and "array" in features 1C and 1D' of claim 1, the relation between these terms will be understood by the skilled person from the description on page 7, lines 3 - 8 of the published patent application: the retroreflective sheeting includes a first zone which, in turn, includes an array of cube corner elements which are disposed in a first orientation on the sheeting. Thus, the array of cube corner elements is comprised in the first zone and the cube corner elements within said (at least one array) have a specific orientation ("first orientation").

The array is further specified by the condition that the optical axes of the cube corner elements within said (at least one) array are canted to define a specific plane of improved retroreflective performance. These conditions have several implications that clearly confirm the interpretation of the terms "zone" and "array". In particular, it is clear that "zone" and "array" do not refer to the same thing but describe distinct features. Moreover, although the array of cube corner elements lies within the first zone it does not necessarily constitute the first zone as a whole. The expression "comprise" clearly indicates that the first zone may further comprise one or more other arrays of

cube corner elements having the same or different orientations of the cube corner elements, for example. Also it does not follow that the first zone would necessarily contain only one array of cube corner elements, since neither the original application nor the granted patent supports this limitation. In fact, the patent does not define a size or shape of the array within the first zone. Therefore, each array in the first zone is just understood as a group of cube corner elements or a region within the first zone such that the cube corner elements within said group or region have a specific orientation and are canted to define a specific plane of improved retroreflective performance and the first zone may have further arrays of cube corner elements, possibly with different orientations. Finally, with respect to the expression in feature 1D' "the cube corner elements in the first zone" it is noted that the original application only discloses that these elements in the (at least one) array comprised in the first zone are canted in a specific way. Thus feature 1D' allows different interpretations, which, resulting from the amendment of the granted claim, are either not allowable under Art. 84 EPC 1973 or even do not comply with Art. 123(2) EPC.

Furthermore, features 1J together with 1H give rise to objection because the interpretation of the "length" of the first zone is unclear, the patent not providing any support for this feature at all. As long as this term "length" in connection with the first zone is just derived from the term "longitudinally" in the original description, it may not extend the scope of protection over the original disclosure. However, if the term "length" is associated with a specific additional

limitation such as a value or size, the introduction of this term clearly constitutes an inadmissible extension of subject-matter, contrary to Article 123(2) EPC. Actually, if consulting the original patent application on page 7, lines 9 - 17, one finds:

- i) The first primary plane of improved retroreflective performance extends perpendicular to the primary groove 30 (line 14 - 16) and therefore in a horizontal direction in Figure 1, because the primary groove 30 is orientated vertically in this Figure;
- ii) However, according to the subsequent part of this sentence, this first primary plane of improved retroreflective performance extends perpendicular to the longitudinal edge of the sheeting 10. Since, by the definition of the groove direction the direction of this primary plane is unambiguously defined, namely in the displayed Figure 1: horizontal, it can only be concluded that the direction of the "longitudinal edge of the sheeting" which is perpendicular to this horizontal plane must be vertical, i.e. the longitudinal edge of the sheeting is vertical.

From this it follows immediately that the longitudinal edge of the first zone is not longer than the width (which is in the horizontal direction). Therefore features 1H and 1J are not originally disclosed.

With respect to the issue of novelty, it is maintained that in view of the above interpretations of claim 1, its subject-matter lacks novelty over the public prior use documents (P19_10 and P19_11a) and equally over the cube corner reflector shown as "Prior Art" in Fig. 14 of P20, which document itself constitutes prior art

according to Art. 54(3) EPC. Figures 13 and 14 of P20 indicate that the structured surface comprises a plurality of zones (columns/strips of square shaped arrays in Fig. 13 or 14) of cube corner elements (feature 1B). This plurality of zones comprises a first zone (e.g. the left most strip of arrays arranged along the longitudinal edge 152), where the first zone comprises an array (array 154 in Fig. 13) of cube corner elements (feature 1C). Similar arrays are also shown in Fig. 14. The optical axes of said cube corner elements of said array in the first zone are canted to define a first primary plane of improved retroreflective performance at increased entrance angles (see page 3, lines 24 - 30, page 7, lines 2 - 7, feature 1D'). The first zone (e.g. the left most strip of arrays in Fig. 13 or 14) has a length extending longitudinally along the length of the sheeting (along the longitudinal edge 152 in Fig. 13 and the longitudinal edge 172 in Fig. 14, respectively) and a width (e.g. the horizontal width of the left most strip of arrays in Fig. 13 or 14) (feature 1H). The first zone length (along the longitudinal edge 152) is longer than the width (as can be seen from Figs. 13 and 14) (feature 1J). A second zone (second strip of arrays next to the left most strip in Fig. 13 or 14) comprises an array (such as the second array in the second strip from the upper edge of the depicted sheeting in Fig. 13 or 14) of cube corner elements (feature 1E). Analogous to the first array (array 154 in Fig. 13 as discussed above) the optical axes of the cube corner elements in the second array are canted to define a second primary plane of improved retroreflective performance at increased entrance angles (feature 1F'). As can be further seen from Figs. 13 and 14, said second plane is

perpendicular to said first plane (feature 1G).
Finally, due to the arrangement of the cube corner elements, the sheeting has substantially similar retroreflective performance as defined in feature 1M.

Furthermore, the retroreflective sheets disclosed in these documents render the subject-matter of claim 1 obvious for the following reasons. The skilled person, when considering the retroreflectance of the cube corner sheeting shown in Figure 3 of P20 (which shows a contour graph of a Stimsonite Series 4200 sheeting), and, even more pronounced, the contour graph on page 1 of P19-P10 (showing the retroreflectance of a metalized Stimsonite Series 4500 sheeting) observes that the angular dependence of the retroreflectance of this sheeting is small and that the pattern has a high uniformity. The reason for this uniformity is readily visible from Fig. 14 of P20, wherein the arrays have six different orientations, which is advantageous for a high uniformity, but at the same time reduces the peak retroreflectance in any specific plane, hence a trade-off between the peak and the uniformity of the retroreflectance. The prior art therefore differs from the arrangement in the patent in suit in that the arrangement of the cube corner arrays is in six orientations compared to an arrangement in only two perpendicular orientations in the patent. The underlying objective technical problem may therefore be seen in modifying the conventional sheeting for improving the retroreflectance in only two specific directions. It is noted that this formulation of the technical problem does not contain any pointer towards the solution. Since the sheeting in Fig. 14 of P20 comprises in its most left zone, in addition to arrays

orientated parallel to the longitudinal edge 172, further arrays at 60° and 120° , and in the second zone has, in addition to arrays orientated at 90° (i.e. perpendicular to the parallel orientated arrays in the first zone) further arrays at 30° and -30° , it would be a straightforward measure for the skilled person to omit all other arrays, c.q. to replace these in the first (most left) zone by arrays orientated parallel to the longitudinal edge 172 and in the adjacent zone by arrays orientated perpendicular to the arrays in the first zone. Furthermore, with respect to the length of each array it would be obvious to provide longer arrays within each zone instead of the square arrays employed in the sheeting of Fig. 14 of P20, because such longer (rectangular) arrays are advantageous for manufacturing sheeting in the shape of long strips. In any case the provision of a retroreflecting sheet with two arrays at perpendicular orientation is known from document P7, see Fig. 3A and 3B, which gives a clear teaching to the person skilled in the art that, in order to obtain improved retroreflective performance at increased entrance angles in both X- and Y-plane or, in other words, in two perpendicular planes, the retroreflective sheeting should be divided in at least two zones, the second zone being angularly displaced from the first zone so that the second primary plane of improved retroreflective performance at increased entrance angles does not overlap with the first primary plane of improved retroreflective performance at increased entrance angles and, in particular, that these two planes should be perpendicular with respect to each other. The shapes of these arrays may be rectangular, see col. 5, line 3 of document P7.

For the same reasons the skilled person would arrive at the subject-matter of claim 1 by starting from document P10, which discloses a retro-reflective sheeting comprising a substrate having a base surface and a structured surface having a plurality of cube corner retroreflective elements, wherein the axes of the elements are tilted or canted in the same way as the sheeting defined in claim 1. The subject matter disclosed in document P10 differs from the present invention in that the structured surface does not comprise a plurality of zones of cube corner elements, but is rather constructed as a single sheeting having cube corner elements in the same orientation. Furthermore, P10 does not disclose that there are two zones characterized by mutually perpendicular primary planes of improved retroreflective performance at increased entrance angles. Although the retroreflective sheeting disclosed in document P10 has two planes of increased angular performance at high entrance angles, namely an X-axis plane parallel to the plane of cant and an Y-axis plane perpendicular to the plane of cant, as seen clearly from Fig. 6 and 7, there is still a difference between the retroreflective performance at increased entrance angles in the two planes. This results in the fact (as has also been indicated in the patent in dispute column 2, lines 43 to 45) that the sheeting in accordance to document P10 still has a single preferred orientation in the plane of cant and does not have two perpendicular planes of improved retroreflective performance, which for many applications, such as marking of trucks is not desirable. Therefore, the technical problem of the patent in dispute can be identified as improving the

retroreflective sheeting known from document P10 so that it exhibits improved retroreflective performance at two perpendicular orientations (compare col. 3, lines 29 to 32 of the patent at dispute), i.e. two primary, mutually perpendicular planes of improved retroreflective performance at high entrance angles. Starting from document P10 and looking for a solution to the problem, a person skilled in the art would immediately recognize that a well-known technique is known in the art to deal with exactly this problem. This technique is commonly known as "tiling" of cube corner elements of the refractive sheeting into a plurality of zones with different angular orientation. Such "tiled" cube corner element arrays are known for example from document P7. Thus, the person skilled in the art would immediately adopt this well known method of tiling of the retroreflective sheeting into a plurality of zones, which is simple and effective to realize. It is to be noted, in this context, that document P7 addresses substantially the same technical problem as the patent in dispute, namely to increase the uniformity of the brightness of the retroreflective sheeting when viewed at high angles of incidence (see for example the Abstract of P7). Therefore, it would have been obvious to apply the teaching of document P7 to the retroreflective sheeting disclosed in document P10 in order to arrive at the subject matter of claim 1 of the patent in dispute.

Reasons for the Decision

1. The appeal is admissible.

2. *Interpretation of claim 1*

2.1 Since in the present proceedings the parties disagreed on several features in claim 1 it appears expedient to first address the respective expressions and give the board's interpretation:

2.2 With respect to the expressions "zone" and "array" both parties have referred to page 7, lines 3 - 23 of the original description. Furthermore the appellant had pointed out that these terms are known in the art, for instance see document P7, Abstract, and see col. 4, line 44, according to which a "zone" is a "region". This meaning conforms with the one in the cited passage on page 7 of the original patent application, where with reference to Fig. 1 a "first zone 6" and "a second zone 8" extending substantially parallel to the first zone are disclosed. Thus a "zone" is a region with outer borders or an area with certain geometrical restrictions. Furthermore, the term "array" relates to a regular or ordered arrangement of its constituting elements, see, for instance, document P7, which, with reference to its Fig. 1, discloses that a section of retroreflective sheeting includes an array of triangular based cube corner prisms, which array, as a result of the ordered arrangement of the prisms, has six sets of parallel planes of symmetry. Also the arrangements in Figs. 3A and 3B are designated "hexagonal arrays of cube corner elements" (col. 3, line 25). Therefore the board concludes that the terms "zone" and "array" have well-established meanings in the art.

2.3 The respondent has objected that the expression "a first zone comprising an array..." (feature 1C) does not exclude that the first zone may comprise further arrays, for instance arrays with different orientations of the cube corner elements. According to the appellant, in the context of feature 1D', there is no teaching in the original patent application that the first zone would include any other arrays, and that the skilled person would not expect any further arrays since this would be in conflict with the gist of the invention. In this respect reference is made to the Case Law of the Boards of Appeal, 5th Edition, Chapter II.B.5 and in particular to Decision T 190/90, Catchword and point 2.4 of the Reasons, which reads: "The skilled person when considering a claim should rule out interpretations which are illogical or which do not make technical sense. He should try, with synthetical propensity i.e. building up rather than tearing down, to arrive at an interpretation of the claim which is technically sensible and takes into account the whole disclosure of the patent (Article 69 EPC). The patent must be construed by a mind willing to understand not a mind desirous of misunderstanding".

2.4 Considering the original patent application, in the discussion of the "Background of the Invention" the prior art in US-4,588,258 is acknowledged, which corresponds to document P10 in the present proceedings. According to page 2, lines 18 - 29 of the original patent application, document P10 discloses retroreflective sheeting employing canted cube corner elements of opposing matched pairs, as a result of which the sheeting exhibits a principal primary plane of improved retroreflective performance at high

entrance angles (x-plane) and a further, but less pronounced, second plane of improved retroreflectance (y-plane). Thus the sheeting in document P10 has a single preferred orientation (page 3, lines 1 and 2 of the original patent application). The concept of the patent application is to provide a sheeting which exhibits improved retroreflective performance at high entrance angles in exactly two primary planes (page 6, lines 1 - 3). Therefore, the skilled person understands that:

- i) the starting point of the present sheeting, or its "generic" structure is the one of document P10, for instance, Figure 3 which shows an array (col. 4, line 36) of pairs of matched, canted, retroreflective cube-corner elements. Clearly, since this article "comprises" (see claim 1 of P10) the cube corner elements of Fig. 3 of P10, there is only one active area or "zone" and one primary plane of improved retroreflective performance.
- ii) In order to obtain a similar high retroreflectance in two orthogonal directions it is proposed in the patent to add to the first area or zone, known from P10, a second zone in which the cube corner elements are canted to define a second primary plane of improved retroreflective performance perpendicular to the first plane.

2.5 It would appear to the board that the skilled person "with synthetic propensity" as explained in T 190/99 would, first by consulting the Background of the Invention and the reference to document P10 and subsequently by following the further description of the original patent application, understand without any doubt that the intended technical effect, an improved

retroreflective performance at high entrance angles in exactly two primary planes can only be obtained if the optically active parts of the respective first and second zones are defined by the respective cube corner arrays as defined in claim 1. In other words: a successful realisation of the intended technical effect relies on the presence of the respective orientated arrays of canted cube corner elements in the first and second zones. Hence, the board understands and interprets the term "comprises" in claim 1 in this sense, i.e. that the optically active parts of the zones are defined by the respective arrays. Whether the sheeting "comprises" further areas, for instance, tags or markings, is irrelevant for the interpretation of the claim and the subsequent discussion of the patentability requirements as long as such areas are not detrimental to the intended technical effect.

3. *Article 123(2) EPC*

- 3.1 As elaborated above, the board interprets claim 1 in that both first and second zones comprise optically active structures formed by arrays of respective cube corner elements. Therefore the optically active part of the first zone (and similarly the second zone) is formed of, or comprises, an array of cube corner elements (feature 1C of the granted claim 1 and the identical wording of original claim 1), with the optical axes of these (or: said) cube corner elements in the first zone being canted, as defined in feature 1D'. In the opinion of the board, the meaning of the wording in original claim 1 "the optical axes of said cube corner elements" does not differ from the wording in claim 1 as granted "the optical axes of said cube

corner elements in the first zone" (*emphasis by the board*), since, by the referring term "said", in any case the cube corner elements in the array of the first zone are defined. Therefore the board does not share the respondent's objections concerning features 1A - 1D' and the corresponding objections for the second zone.

- 3.2 With respect to the respondent's objections concerning features 1J together with 1H, the board makes reference to the passage on page 7, lines 9 to 24 and Fig. 1 of the published patent application. According to lines 9 and 10 of this passage, the first zone 6 extends substantially parallel with a longitudinal edge of sheeting 10. In Fig. 1 the first zone is clearly indicated with the reference sign "6". Already at first glance it appears that whereas this zone 6 in the vertical direction extends only approximately over two cube-corner pairs, in the horizontal direction at least five prism pairs are shown, and the wavy outlines of the Figure at its left and right side suggest that the sheeting continues there. Therefore in the board's opinion there is no doubt that the "longitudinal edge" in Figure 1 is the upper edge of the sheeting. By defining the edge of the sheeting in this longitudinal direction as the sheeting "length" it also follows from the above that the vertical extension of the zone is the "width", which, in the embodiment of Fig. 1, is clearly smaller than its length. Furthermore, a major application of the retroreflective sheeting of the patent in suit is in the field of conspicuity, and in particular of full contour marking of commercial vehicles (marking the entire perimeter of a vehicle's side and/or rear walls), see page 3, lines 23 and 24 of

the published patent application. Therefore in such application a typical length of a sheeting will correspond to the length/height of a vehicle, which is in the order of several meters. This is to be compared with a typical width of a zone which is in the order of 3 - 25 millimetres (page 9, line 26). Hence a skilled person, when observing the shape of the first zone in Fig. 1, and furthermore considering a typical length and width for the intended use of the sheeting, would readily conclude that the length of the first zone of the sheeting is longer than the width. This is confirmed by the passage on page 10, lines 14 - 19 of the published patent application. For this reason the board does not find that the introduction of features 1H and 1J in claim 1 is an amendment introducing subject-matter extending beyond the content of the application as filed.

With respect to the argumentation of the respondent that the passage on page 7, lines 9 - 17 of the original description would disclose that in the sheeting shown in Fig. 1, the longitudinal edge would be vertical, and therefore the length of the first zone would be smaller than its width, it appears that this argument relies on the sentence in lines 14 - 17 which reads "...Accordingly, the cube corner array in first zone 6 exhibits a primary plane of improved retroreflective performance which extends perpendicular to primary groove 30 and perpendicular to the longitudinal edge of the sheeting 10". From this it was concluded that this implies that the longitudinal edge was vertical in Fig. 1. The board does not share this interpretation: to its understanding this sentence discloses:

i) the primary plane of improved retroreflective performance extends perpendicular to the primary groove 30, which plane, in Fig. 1 is therefore in horizontal direction; and

ii) this plane of improved retroreflective performance extends perpendicular to the longitudinal edge of the sheeting, i.e. if the plane of the sheeting in Fig. 1 is the xy-plane, the plane perpendicular to the longitudinal edge referred to in this passage is the z-plane (perpendicular to the plane of the drawing). Therefore this primary plane is fully determined in its extension perpendicular to the groove 30 (i.e. the horizontal direction in the drawing) and perpendicular to the plane of the drawing.

3.3 Finally the board is satisfied that the introduction of these features 1H and 1J which specify the shape of the first zone without any similar restriction being set out for the second zone appears allowable on the basis of the original claims, which in dependent claims 2 and 3 exclusively defined further restrictions for the first zone, whereas further restrictions for the second zone were only introduced in dependent claims 4 and 5. Therefore there is no issue of intermediate generalisation.

4. *Patentability*

4.1 *Novelty*

4.1.1 *Documents P19_xx and P20*

During the oral proceedings the respondent had repeated its prior objections that the subject-matter of claim 1 was anticipated by the public prior use as documented

by the bundle of citations P19_xx, which concern "Stimsonite Series 4200, resp. Series 4500" sheetings; these have identical arrangement structures and orientations of cube corner elements and differ in that the 4500 Series has an additional specular Al-coating applied to the prism surfaces. Furthermore in the opinion of the respondent, this subject-matter was also known from document P20, which itself is a document with an earlier priority date than the present patent, but had been published after the date of priority of the patent. Therefore document P20 represents prior art within the meaning of Art. 54(3) EPC. Its Figure 14, shows, according to page 5, line 20 a "commercially available cube corner retroreflective sheeting" and according to page 20, lines 24 - 29 is "commercially available from Stimsonite Corporation of Niles, Illinois and is manufactured and distributed under the trade name STIMSONITE High Performance Grade Reflective Sheeting (Lot 1203W, Product Number 8432170)". Document P20 is a document from the appellant's company and is designated to partly the same inventors. Furthermore, at the oral proceedings the appellant has not refuted that the particular sheeting shown in Fig. 14 of P20 constitutes prior art within the meaning of Art. 54(2) EPC 1973. Therefore the sheeting in this Figure may be considered in the discussion of inventive step. With respect to the disclosure in the bundle of publications P19_xx it is observed that the Stimsonite sheeting in Fig. 14 of P20 has the same tiled arrangement of the cube corner elements as the structure of the Stimsonite sheeting in the bundle of publications P19_xx, therefore for the question of novelty the board considers the structure in Fig. 14 of P20.

In its argumentation the appellant has identified in this structure the most left strip along the longitudinal edge 172 as a "first zone comprising an array of cube elements". Also, in the respondent's opinion, this "zone" (the most left strip) has a length longer than its width. However, in the interpretation by the board (see point 2 *supra*) claim 1 requires more than the zone comprising inter alia one or more arrays of different orientations: rather the cube corner elements in the first zone are arranged in an array with proper canting and orientation to define a first primary plane of improved retroreflective performance at increased entrance angles. As is readily observed for the arrangement of Fig. 14 of document P20, the most left strip or zone comprises a repeating pattern of three arrays under different angular rotations, therefore it does not define "a first primary plane of retroreflective performance", rather it defines a plurality (three) of such planes. The same applies to the subsequent strip or second zone of the sheeting in Fig. 14, which also comprises a repeating pattern of square tiles orientated at again different angles and therefore does not define a "second primary plane of improved retroreflective performance". Therefore, in inspecting the prior art sheeting the skilled person would not be able to identify any unambiguous primary planes as defined for the first and second zones of the claimed device.

- 4.1.2 The other documents disclose less relevant subject-matter. It is therefore concluded that the retroreflective sheeting defined in claim 1 is novel.

4.2 *Inventive step*

4.2.1 For the question of inventive step the respondent had identified the Stimsonite retroreflective sheeting as one possible piece of closest prior art. According to the respondent, Fig. 3 of document P20 showed the typical retroreflectance of a Stimsonite Series 4200 sheeting with a rather broad distribution peaking at two directions at oblique angles. An even broader and still less peaked retroreflectance was shown by a (metalized) Stimsonite Series 4500 sheeting, see the Figure in the publication P19_P10. Furthermore, according to the respondent, this broad, uniform retroreflectance is caused by the typical Stimsonite structure illustrated in Fig. 14 of P20: this sheeting comprises tiled arrays arranged at six angular orientations. The skilled person would realise that the trade-off of this structure is that incident light is uniformly retroreflected in all directions with simultaneous reduction of the peaked directions. Therefore the objective technical problem could be seen in modifying this sheeting in order to improve the retroreflectance in only two specific directions. The appellant, on his part, sees the objective problem in providing an alternative sheeting for use in specific applications.

4.2.2 In the interpretation of claim 1 as set out in point 2 *supra*, the sheeting defined in this claim is distinguished from the sheeting in Fig. 14 of P20 in the following features:

- i) the cube corner elements in the array of the first zone being arranged with their canted optical axes to

define a first primary plane of retroreflective performance at increased entrance angles;

ii) the first zone having a length extending longitudinally along the length of the sheeting and a width, wherein the length is longer than the width;

iii) the cube corner elements in the array of the second zone being arranged with their canted optical axes to define a second primary plane of retroreflective performance at increased entrance angles;

iv) wherein the second plane is perpendicular to the first plane and wherein the sheeting exhibits substantially similar retroreflective performance in response to light incident on the sheeting across a range of entrance angles in the first plane and the second plane.

4.2.3 The board does not concur with the formulation of the technical problem by the respondent, because, by a priori including the requirement that the retroreflectance should be optimised in only two specific directions an element of the solution is introduced. Instead, by defining the problem as providing an alternative sheeting as proposed by the appellant the solution is not prejudiced.

4.2.4 The skilled person, seeking to provide an alternative sheeting to the one in Fig. 14 of P20, would have numerous ways to further develop this sheeting. For instance, although the remainder of document P20 cannot be used for inventive step, the skilled person could vary the orientation of the tiled sections, which in the prior art sheeting of Fig. 14 of P20 are at 0°, 30°, 60° and 90° relative to the longitudinal edge 172 (see

P20, page 23, lines 2 - 4), to be at slightly different angles (as shown in Fig. 13 of P20) which might result in some performance gains, as shown in Fig. 15 of P20. However, in varying the orientation angles of the tiled arrays, the sheeting would still be composed of square tiled arrays oriented at six distinct orientations. Therefore the board is unable to see how a skilled person would, without hindsight or further documents leading him, modify this sheeting and arrive at the subject-matter of claim 1.

4.2.5 The board in this respect notes the convincing explanations given in the introduction of the present patent to the effect that the claimed sheeting with both its two perpendicular primary planes of improved retroreflective performance and its elongate zone shaping is particularly well suited for specific applications in connection with road signs or for truck conspicuity marking, since it allows for equally good performance in either a horizontal or a vertical placement on road signs or large vehicles (see paragraphs [0006] to [0009] of the patent specification). The respondent did not provide any evidence that such considerations had already been made in the prior art. Quite on the contrary, Figures 4 and 5 of document P7 to which it made reference, and the corresponding passage of the description (see column 4, lines 24 to 39) illustrate the confused appearance of a sign obtained by piecing together strips of a prior art retroreflective sheeting extending at a right angle. In contradistinction to the present invention which uses only two types of zones, the first of which having a length extending along the length of the sheeting, the solution offered by the document is to dispose the

retroreflective prisms into a plurality of zones of prisms, the prisms in each zone having differing azimuthal orientation with a preferred angular displacement between adjacent zones of about 30° , and the zones being of such small size as to be substantially below the limit of resolution of the human eye at the expected minimum viewing distance of the sheeting (see the "summary of the invention" bridging columns 2 and 3).

4.2.6 With respect to document P7, the respondent also referred to Figures 3A and 3B which disclosed two hexagonal arrays of cube corner elements where the array in Figure 3A has been rotated over 90° with respect to the array in Figure 3B. Furthermore, from this document also the possibility of using rectangular arrays - amongst various other shapes like square, round, hexagonal, triangular or pentagonal - was disclosed in col. 5, line 3. However, to the board's understanding, the rotation of the array of Fig. 3A in document P7 has a completely different purpose: as is shown in Fig. 2 of P7, the array in Fig. 1, from which Fig. 3A shows just a cut-out portion, has a retroreflectance pattern wherein the maxima are spaced from the minima by 90° (col. 4, line 1), or, by inspection of Fig. 2, at 30° . The problem addressed in this document is to fill in the gaps in the retroreflectance pattern, this being solved by rotating a number of the arrays by 90° , as shown in Fig. . However, the rotation of an array by 90° effectively results in a rotation of the angular displacement by 30° , which is the intended amount of rotation (see col. 4, lines 13 - 21). Furthermore a rotation of the tiled array by 90° occurs naturally if pieces of sheeting

having square cells are assembled with care taken only to align the sides of the cells (col. 3, lines 20 - 23). It is therefore concluded that according to P7 the addition of further arrays at 90° is beneficial for obtaining a 30° angularly rotated retroreflectance pattern, which compensates and fills in the gaps of the pattern of the first array (Fig. 2) and furthermore that, even if in col. 5, lines 1 - 3 a plurality of other shapes for the zones are mentioned, the preferred shape for the respective tiles are square shapes, because these are easily arrangeable, even if used at two different orientations. It is finally added that document P7 does not disclose retroreflective sheets with canted cube corner reflectors, which may be the reason why its retroreflectance pattern in Fig. 2 differs substantially from the patterns of e.g. Stimsonite sheetings. Moreover this document discloses prior art 17 years before that of P20, therefore it appears doubtful that the skilled person would have had a reason for combining the teachings of these documents at all. In any case the combination of P20 and P7 does not lead to the subject-matter of claim 1.

4.2.7 As a further prior art document suitable as a starting point for the discussion of inventive step the respondent has mentioned document P10. As discussed in point 2.4 *supra*, this document discloses retroreflective sheeting employing canted cube corner elements of opposing matched pairs. The sheeting in P10 has a single preferred orientation. The respondent has pointed to the retroreflectance graphs in Figs. 6 and 7 of P7, which show that this sheeting has a primary plane (parallel to the plane of cant) of increased performance and a second, less pronounced plane

perpendicular to the first plane. According to the respondent, the objective technical problem in this case may be seen in improving this retroreflective sheeting so that its retroreflective performance in the two perpendicular directions is comparable. The appellant sees the technical problem in overcoming the limitations of canted single orientation cube corner retroreflective sheeting.

4.2.8 The respondent has argued that the solution of the technical problem is to increase the uniformity by the concept of tiling of zones of cube corner elements, for which he referred to document P7. However, as set out in point 4.2.6, the board is not convinced that the skilled person would consider the teaching of document P7 because it relates to the elder type of uncanted retroreflective sheeting with consequently rather different retroreflectance characteristics (see Fig. 2 of P7, compared to Figures 6 and 7 of P10). Furthermore, as mentioned before, in case of the uncanted arrays of P7 the addition of a second tiled zone orientated at 90° to the first zone results in an angular rotation of the retroreflectance characteristics of 30° , and in any case, in the examples shown in P7 (Figures 6 and 7) every tile is alternately arranged between tiles of perpendicular orientation, therefore a "first" and "second" zone with the features as defined in claim 1 is not conceivable. Finally it is noted that the emphasis of the disclosure in P10 is on the principle of matched pairs of canted retroreflective cube corner elements and that the only example of such a sheeting is an array provided by embossing a diamond shape pattern (Example 2). Therefore neither of these documents disclose the zones

as defined in claim 1. Also none of the documents in the proceedings suggest the additional manufacturing advantage of producing the sheeting with elongated zones as described in page 10, lines 14 - 19.

4.2.9 Since neither the technical problem nor the claimed solution is defined or suggested in the available documents the board concludes that the subject-matter of claim 1 according to this request involves an inventive step. Claims 2 to 10 according to this request are dependent claims and therefore similarly involve an inventive step.

4.2.10 At the oral proceedings the description of the patent specification has been adapted to the new set of claims.

5. Accordingly, taking into consideration the amendments made to the patent, the patent and the invention to which it relates meet the requirements of the Convention. The patent as so amended can therefore be maintained (Article 101(3) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as amended in the following version:

Description:

Pages 2, 4 and 6 to 14 of the patent specification.
Pages 3 and 5 submitted in the oral proceedings of
2 July 2009.

Claims: No. 1 to 36 submitted in the oral proceedings
of 2 July 2009.

Drawings:

Sheets 1/4 to 4/4 of the patent specification
(Figures 1 to 5).

The Registrar:

The Chairman:

R. Schumacher

A. G. Klein