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D E C I S I O N
of 27 October 2004

Case Number: T 0222/03 - 3.2.1

Application Number: 95109548.8

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IPC: B60R 1/06, G 02B 5/08,
G02B 1/10

Language of the proceedings: EN

Title of invention:
Vehicle mirror

Patentee:
MURAKAMI KAIMEIDO CO., LTD.

Opponent:
TOTO LTD
Dr. Hans-Friedrich Klunker

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0222/03 - 3.2.1

DECISION
of the Technical Board of Appeal 3.2.1
of 27 October 2004

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 8 January 2003
revoking European patent No. 0689962 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
A. Pignatelli

Summary of Facts and Submissions

I. The appeal is directed against the decision posted 8 January 2003 to revoke European patent No. 0 689 962.

II. The following evidence cited against the patent during the opposition procedure played a role also during appeal:

E1: JP-A-61 91042 (translation into English)

E16: H. Kobayashi, "Sputtered Thin Films - Basics and Applications", 2nd edn., Nikkan Kogyo Shimbun Ltd, sections 5.1, 5.1.1 (translation into English)

E19: Li-Jian Meng *et al*, "Investigations of titanium oxide films deposited by d.c. reactive magnetron sputtering in different sputtering pressures", Thin Solid Films, 226, 1993, 22-29

The following prior art was cited by the respondent during the appeal procedure:

E20: J. Thornton, "The microstructure of sputter-deposited coatings", J. Vac. Sci. Technol., 4 (6), Nov/Dec 1986, 3059-3065.

III. The Opposition Division had found that the subject-matter of claim 1 according to the patent proprietor's auxiliary request did not involve an inventive step in the light of a combination of the disclosures of E1 and E19.

IV. During oral proceedings held on 27 October 2004 the appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of an amended claim 1 as filed on 7 May 2003, identical to that of the auxiliary request filed during the opposition procedure. The respondents requested that the appeal be dismissed.

V. Claim 1 according to the appellant's request reads:

"A vehicle mirror (10;26;30) having a hydrophilic film (22) formed on the front surface thereof, characterized in that the hydrophilic film (22) consists of an inorganic oxide film of a porous structure obtained by a PVD method, wherein the hydrophilic film (22) has a porous surface formed by the PVD method."

Claims 2 to 11 define features additional to those of claim 1.

VI. The respondents essentially submitted that:

There was no original disclosure of the term added to claim 1 that the film is "of a porous structure". In the illustration in figure 2 of the application no pore passes through the film and the reference to that figure in the description described only a porous surface.

Claim 1 is unclear because, whereas the appellant states that the porous film according to the patent is a film within zone 1 of the Thornton diagram, the

skilled person knows according to E20 that a zone T film is also porous. These two definitions of the term "porous" result in a lack of clarity of the claim. According to E14, E16 and E19 the film is porous when it falls within zone 1 of the Thornton diagram but the claim fails to define the porosity in this way.

The subject-matter of claim 1 lacks novelty with respect to the disclosure of E1 which relates to a vehicle mirror having a film deposited by sputtering. The patent specification states that a hydrophilic material is one exhibiting a water contact angle of 40° . E1 discloses this same angle for an untreated, sputtered film and describes the film's structure as having columnar crystals and grain boundaries; in the light of the general knowledge disclosed in E20 it is clear that this structure belongs to zone 1 or zone T of the Thornton diagram and is therefore porous. Even if E1 teaches subsequent etching of the surface of the film, the subject-matter of present claim 1 nevertheless has been disclosed.

In the event that the subject-matter of present claim 1 were to be found novel with respect to the disclosure of E1 it would not involve an inventive step. If the skilled person were satisfied with the 40° contact angle obtained by the untreated material in E1 he would simply omit the subsequent etching operation; according to case law the achievement of a simplification by accepting a disadvantage does not involve inventive activity. Moreover, E16 discloses that a zone 1 structure has low specular reflectance to light and causes moisture to adhere over a wide area; the skilled person would be encouraged by this teaching to produce

the film of E1 with a zone 1 structure and thereby render the etching step superfluous. The subject-matter of present claim 1 is rendered obvious also by a combination of E1 and E19, the latter disclosing that the porosity of the sputtered film may be varied by changing the process conditions.

VII. The appellant's case may be summarised as follows:

The original description contains the wording "porous structure ... in figure 2" which figure also illustrates voids throughout the body of the film. The description refers to "such ... film of a porous structure". It follows that there is a clear disclosure of the film having a porous structure.

The respondents' objection that the added wording "porous structure" renders the claim unclear is not valid. The skilled person is aware of the meaning of the term "porous" in the context of the technical field of the patent and the result to be achieved. Each of E14, E16 and E19 uses the term to describe the structure in zone 1 of the Thornton diagram. E20 does not use the term "porous" and the smooth surface of a zone T structure as referred to therein will not result in capillary action.

As regards novelty, it is visible from figure 3 of E1 that the film as sputtered has a flat surface and the subsequent etching which preferentially attacks the grain boundaries affects only the surface porosity; there is no disclosure of a porous structure. The surface of the glass when installed in the vehicle mirror is obtained not by sputtering but by etching.

The reference in the patent specification to a 40° contact angle relates to hydrophilic material before sputtering, not when in a film according to present claim 1. Results achievable according to present claim 1 are the subject of figure 5 which covers contact angles down to about 10°. Moreover, the Thornton model is not universally applicable and it is incorrect to deduce from the process conditions stated in E1 that they would result in a structure falling within a particular zone.

E1 forms the closest prior art for consideration of inventive step and requires that the surface of the sputtered film be etched in order to achieve satisfactory wetting performance and concerns itself with optimising the results obtainable by the etching process. In fact, the etching process is problematic but no cited document teaches that the need for etching may be avoided by controlling the sputtering process in such a way as to achieve similar wetting performance. A porous film is considered in each prior art document as deficient. In summary, there is nothing in the cited prior art to encourage the skilled person to arrive at the subject-matter of present claim 1.

Reasons for the Decision

1. The patent relates to a vehicle mirror in which the external surface of the mirrored member, normally glass, is covered with a film of hydrophilic material. This material reduces the contact angle of water on the surface, thereby preventing the formation of droplets and helping the water to evaporate and so minimising

disturbance of the visibility of reflected images. The porous nature of the film in accordance with present claim 1 further helps to minimise the disturbance by reducing the amount of water which remains on the surface. The claim refers generally to a "PVD" method but all examples in the cited prior art relate to sputtering which is acknowledged in the patent specification as being such a method. The microstructure of a sputtered film varies according to process parameters and, at least for metals, is generally accepted as being characterised by the "Thornton diagram" which characterises the degree of isotropy of the structure as zone 1, 2, 3 or T (a transitional zone T between zones 1 and 2), shown *inter alia* in E20. According to each of E14, E16 and E19 a zone 1 structure is porous.

2. The subject-matter of present claim 1 is "a vehicle mirror". The only other features specified in the claim relate to the film. Nevertheless, the designation "vehicle mirror" implies features additional to the mirrored member, such as a housing and/or mounting means. This interpretation of claim 1 is consistent with the overall content of the patent specification, for example column 4, lines 10 to 14 according to which the "vehicle mirror" comprises a mirror housing and a mirror assembly which includes the mirror substrate carrying the hydrophilic film.

Objection of addition of subject-matter (Article 123(2) EPC)

3. The respondents object that there was no original disclosure of the feature that the film is of a "porous structure". The sections of the application as

originally filed which are relevant to this matter are the first full paragraph on page 9, figure 2 and the brief description thereof. Since in the application as originally filed the lines of the description were not numbered the Board will refer to the corresponding text in the patent specification, which is identical with that as originally filed.

3.1 Figure 2 shows a sectional view of a "porous hydrophilic film" on the surface of a mirror glass (column 3, lines 49, 50). The figure shows a series of voids extending from the outer surface of the film into the body thereof, many extending over more than half of its thickness. Additional voids are shown in the body of the film. When figure 2 is compared with figure 5.2 of E16, which is a schematic sectional view of a zone 1 sputtered film of unspecified material, the extension of voids from the surface into the body of the film is generally similar in each case whilst figure 2 shows more, small voids spread throughout the body. In the light of this combination of description and illustration the skilled person would understand that the porosity extends beyond the surface, thereby rendering the "structure" also porous.

3.2 According to the description of the detailed embodiment "the surface portion ... [has] a porous structure" (column 4, lines 42, 43) and by forming the film by a PVD method "such hydrophilic film of a porous structure" (column 4, lines 47 to 49) can be obtained. In the light of the description of the figure as showing a "porous ... film" (*supra*) and the illustration in figure 2 of pores throughout the structure, the skilled person would not understand the

wording "porous structure" in lines 47 to 49 as referring merely to the surface portion but to the film as a whole. Moreover, in column 4, lines 49 to 52 it is explained that by forming the film with a thickness of at least 0.1µm "a sufficiently porous structure can be obtained". This is a teaching to the skilled person that the thickness of the film influences its porosity. Logically, this would not be the case if the porosity were restricted only to the surface portion.

- 3.3 The Board concludes from the above that the introduction of the feature that the film is of a "porous structure" does not offend the provisions of Article 123(2) EPC.

Objection of lack of clarity (Article 84 EPC)

4. The first aspect of the respondents' objection is that whereas according to the appellant the film according to present claim 1 is a zone 1 structure as determined by the Thornton diagram, it is derivable from E20 that also a zone T structure is porous. As a result, the respondents contend that the claim is unclear in defining the form of the structure. However, the clarity of the claim results from its wording in the context of the content of the remainder of the patent specification and the knowledge of the skilled person. Any statement made by the appellant as regards the meaning or effect of the claim cannot influence that situation.
5. The second aspect of the respondents' objection is that the meaning of the term "porous" is inexact with the result that it cannot be determined where the

boundaries of the claimed subject-matter lie. In particular, they take the view that since it is derivable from E20 that voids exist in both zone 1 and zone T structures and that the difference is merely one of scale, it cannot be determined whether the "porous" structure according to present claim 1 falls into one or both of those zones. The Board, however, finds this line of argument unconvincing with respect to the objection of lack of clarity. Firstly, the delimitation between zones 1 and T is not an exact one; indeed, zone T itself is a transition zone between zones 1 and 2. More importantly though, it is not relevant to the clarity of the claim in which zone the film might be classified. The important matter is the porosity of the structure of the film in the context of its duty, namely to increase by capillary effect the intrinsic hydrophilic nature of the material of the film.

6. The Board therefore concludes that the addition to the claim of the feature that the film is of a porous structure does not render the claim unclear (Article 84 EPC).

Novelty

7. The parties are in agreement that E1 discloses a vehicle mirror having a hydrophilic film formed on the front surface thereof and which consists of an inorganic oxide film. According to E1 a film of silica is deposited by sputtering on the mirror substrate (glass) and the surface of the film is then etched chemically, for example using hydrofluoric acid, in order to increase its roughness. Table 1 shows the contact angles achieved after etching a series of films

produced at given values of the process parameters which form the basis of the Thornton diagram.

- 7.1 It is implicit in E1 that the mirror glass having a sputtered but unetched film is not a "vehicle mirror" within the meaning of present claim 1 (see 2 above) but merely an intermediate product. The mirror glass coated with the film is built into a housing or the like in order to form a vehicle mirror only after the etching process has been carried out. It follows that in the vehicle mirror according to E1 the surface of the hydrophilic film is not "formed by the PVD method", as required by present claim 1.
- 7.2 According to case law of the Boards of Appeal a product defined by its process of manufacture is regarded as novel only if the product itself is novel. As a consequence, if the etched surface according to E1 would not differ from the surface defined in present claim 1 then the reasoning in 7.1 above would not determine novelty of the subject-matter of claim 1 with respect to E1. However, it is stated in E1 that the etching process preferentially attacks the grain boundaries, resulting in the desired increased roughness of the surface. It is apparent that this etched surface would differ from that produced directly by the sputtering process and it therefore differs also from that according to present claim 1. Consequently, even if it could convincingly be shown that a sputtered film surface produced according to conditions described in E1 would satisfy the porosity requirements of present claim 1, the subject-matter of the claim nevertheless would be novel by virtue of the differing form of the surface.

7.3 E1 contains no explicit indication regarding porosity of the silica film. Nevertheless, the respondents argue that by plotting on the Thornton diagram particular process parameters specified in E1 it can be derived that E1 discloses a silica film which is implicitly porous. The respondents' argument relies on the possibility of applying the Thornton diagram to the disclosure of E1. In this respect the board notes that the Thornton diagram, whilst being held to be widely applicable to sputtered films, is explicitly stated as being applicable to metal films, see the caption to figure 7 of E19, which relates to titanium oxide films, and the caption to figure 2 of E20. According to E16 "various dielectric thin films" also exhibit similar properties ([C-8], penultimate sentence). Nowhere in the cited prior art is the Thornton diagram used in the context of a silica film. Furthermore, as Thornton himself states at page 3060 of E20: "Nevertheless, it is important to note that the universality, and indeed the utility, of the zone models comes from their simplicity. They were meant to provide general guidelines in selecting deposition conditions and not to be used in a detailed quantitative way." There remains some doubt, therefore, whether the degrees of porosity of the films mentioned in Table 1 of E1 can be reliably derived by applying the stated process conditions to the Thornton diagram, as has been argued by the appellants.

7.4 In E1 it is stated that a glass plate having a sputtered silica film thereon has a contact angle of 40° prior to etching. In the patent specification it is stated that "the hydrophilic film is made ... of a

hydrophilic material having a waterdrop contact angle of, e.g. 40° or below and has a function to spread a waterdrop ..." (column 4, lines 33 to 37). The respondents consider the latter statement as meaning that a 40° contact angle is hydrophilic within the meaning of present claim 1 and conclude that since the teaching of E1 arrives at this same contact angle by means of a sputtered film without etching, E1 discloses a film according to claim 1. However, the respondents' argument neglects the fact that the statement in the patent specification is followed by a further statement that "by constructing the surface portion ... in a porous structure ... wetting ... and the hydrophilic property of the film ... is improved" (column 4, lines 42 to 47). It is clear from the overall context of the patent specification that the specified contact angle of 40° is due to the inherent hydrophilic property of the film material and that the contact angle exhibited by a porous film according to present claim 1 would be lower by virtue of the capillary action.

- 7.5 The Board concludes from the foregoing that the subject-matter of present claim 1 is novel (Article 54 EPC). Since claims 2 to 11 contain all features of claim 1 this conclusion applies equally to those claims.

Inventive step

8. As derivable from the assessment of novelty above, the subject-matter of present claim 1 differs from that of E1 by the following features:

- the film is of a porous structure; and

- the porous surface of the film is formed by the PVD method.

The porous structure has the effect of increasing the capillary action, thereby further reducing the contact angle resulting from the inherently hydrophilic nature of the film material. The formation of the porous surface by the PVD method has the effect of rendering the etching process superfluous, thereby simplifying manufacture with all attendant benefits.

- 8.1 E1 discloses in table 1 that films sputtered under various conditions and each subjected to the same etching operation exhibit differing contact angles. Moreover it is explicitly stated that the "nature" of the film can be changed by selecting the process conditions and it may be that one or more of those sets of conditions would produce a porous structure. However, the etching step is nevertheless taught as an essential step in achieving the desired hydrophily. Nowhere is it suggested to the skilled person that in the case of some films it might be possible to forego the etching step before building the glass into a housing or the like to form a vehicle mirror.
- 8.2 The respondents argue that if the skilled person were satisfied with the 40° contact angle obtainable according to E1 merely by sputtering, then it would be an obvious act to omit the etching. However, as set out under 7.4 above, a 40° water contact angle cannot be taken as an indication of a film having both a porous surface and a porous structure and the respondents have provided no experimental evidence to support their case.

8.3 The respondents relied on E19 essentially to show that the porosity of the film can be varied according to process parameters, whereby this teaching together with that of E1 would lead the skilled person to arrive at the subject-matter of present claim 1 in an obvious manner. However, E1 aims at achieving particular contact angles and is silent regarding porosity. Since E1 already teaches how to arrive at a required result defined in terms of contact angles the skilled person would have no incentive to consider it in combination with E19 which concerns itself with other parameters.

8.4 E16 discusses the microstructure of sputtered coatings with reference to the Thornton diagram. It discloses that a zone 1 structure has voids and pores leading to such properties as "moisture adherence in a wide area" and low specular reflectance to light. It is these properties which the respondents see as encouraging the skilled person to modify the teaching of E1 and to rely on the zone 1 structure to provide the desired hydrophily. However, there is no teaching in E19 to the effect that proper selection of the film structure may equal or better the results obtainable by etching the film surface. Indeed, if the respondents' assertion that E1 does in fact disclose a film having a zone 1 structure were correct, then the teaching of that document would be that such a structure nevertheless requires etching in order to achieve acceptable results. The disclosure of E16 would bring no information of value to the skilled person seeking to improve on the teaching of E1.

8.5 On the basis of the foregoing the Board concludes that the subject-matter of present claim 1 also involves an inventive step (Article 56 EPC). Since claims 2 to 11 contain all features of claim 1 this conclusion applies equally to those claims.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent with:
 - claim 1 as filed on 7 May 2003
 - claims 2 to 11 as granted
 - description columns 1, 2 and 7 as filed in the oral proceedings
 - description columns 3 to 6 as granted
 - drawings as granted.

The Registrar:

The Chairman:

A. Vottner

S. Crane