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**Datasheet for the decision  
of 4 February 2010**

**Case Number:** T 0143/07 - 3.4.02

**Application Number:** 99936943.2

**Publication Number:** 1102963

**IPC:** G01B 11/24

**Language of the proceedings:** EN

**Title of invention:**

Imaging a three dimensional structure by confocal focussing an array of light beams

**Patentee:**

Cadent Ltd.

**Opponent:**

Sirona Dental Systems GmbH

**Headword:**

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**Relevant legal provisions:**

-

**Relevant legal provisions (EPC 1973):**

EPC Art. 123(2), 100(c)

**Keyword:**

"Added subject matter (yes)"  
"Light rays in drawings"  
"Example of draughtsman artistic freedom"

**Decisions cited:**

T 0261/90, T 0748/91, T 0666/07

**Catchword:**

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Case Number: T 0143/07 - 3.4.02

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.02  
of 4 February 2010

**Appellant:** Cadent Ltd.  
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**Representative:** Sommer, Peter  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 28 November 2006  
revoking European patent No. 1102963 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** A. G. Klein  
**Members:** M. Rayner  
M. J. Vogel

## Summary of Facts and Submissions

I. The patent proprietor appealed against the decision of the opposition division revoking European patent No. 1 102 963 (application number 99 936 943 2 corresponding to International Publication WO 00/08415). The patent concerns a probing member and apparatus for determining surface topology.

II. During the appeal proceedings, reference was made to the following documents:

D3	DE-A-196 50 391
A1	US-A-5 519 532
A2	US-A-4 119 980

III. In the application documents as filed, the following three sections are part of the description and Figures 2A and 2B shown below are contained in the figures:

(a) first section (last paragraph page 7 and first paragraph page 8)

"Fig. 2A is a top view of a probing member in accordance with an embodiment of the invention; Fig. 2B is a longitudinal cross-section through line II-II in Fig. 2A, depicting also some exemplary rays passing therethrough;"

(b) second section (page 9, line 26 to page 10, line 4)

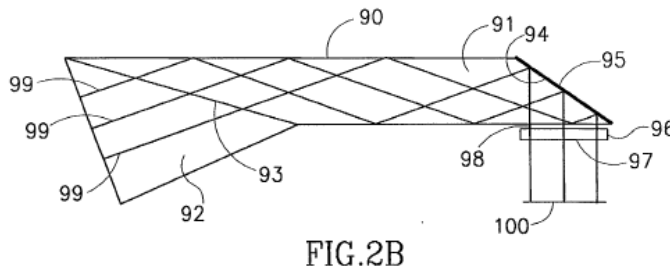
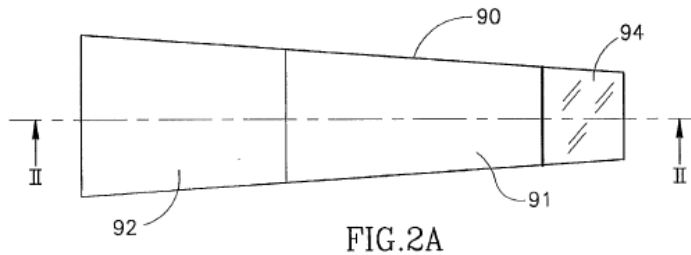
"The endoscopic probing member typically comprises a rigid, light-transmitting medium, which may be a hollow object defining within it a light transmission path or an object made of a light transmitting material, e.g. a glass body or tube. At its end, the endoscopic probe typically comprises a mirror of the kind ensuring a total internal reflection and which thus directs the incident light beams towards the teeth segment 26. The endoscope 46 thus emits a plurality of incident light beams 48 impinging on to the surface of the teeth section."

(c) third section (paragraph bridging pages 12 and 13)

"Reference is now being made to Figs. 2A and 2B illustrating a probing member 90 in accordance with one, currently preferred, embodiment of the invention. The probing member 90 is made of a light transmissive material, typically glass and is composed of an anterior segment 91 and a posterior segment 92, tightly glued together in an optically transmissive manner at 93. Slanted face 94 is covered by a totally reflective mirror layer 95. Glass disk 96 defining a sensing surface 97 is disposed at the bottom in a manner leaving an air gap 98. The disk is fixed in position by a holding structure which is not shown. Three light rays are 99 are represented schematically. As can be seen, they bounce at the walls of the probing member at an angle in which the walls are totally reflective and finally bounce on mirror 94 and reflected from there out through the sensing face 97. The light rays focus on focusing plane 100, the position of which can be

changed by the focusing optics (not shown in this figure)."

(d) Figures 2A and 2B



IV. Independent claim 1 of the patent as granted is worded as follows:

"1. A probing member (90) for use in an apparatus for determining surface topology of a teeth portion (26), having a sensing end face (97) for placing proximal to the teeth portion and said probing member (90) being in the form of an elongated transparent body having a front face, an end mirror (95), and top, bottom and side walls extending therebetween, said sensing end face (97) being associated with said bottom wall's outer surface adjacent said end mirror (95), said bottom wall having a front section extending inwardly from said front face transversely to said top wall and

a rear section substantially co-directional with said top wall, said front face being inclined relative to said top wall so as to ensure that light beams incident on the front face **perpendicularly** thereto impinge said top wall at an angle providing their total internal reflection therefrom and further bouncing, by means of total internal reflection, between the top wall and said rear section of the bottom wall towards said end mirror (95) to be redirected thereby towards said sensing end face (97)." {N.B. Bold type added by the board.}

- V. In the decision under appeal, the opposition division reasoned as follows.

Independent apparatus claim 1 of the patent specification contains subject matter which extends beyond the content of the application as filed concerning its feature worded as follows, "light beams incident on the front face perpendicularly thereto". In particular the opposition division pointed to the disclosure of the application as filed and published set out in sections II(c) and II(d) above, referring to a probing member (90) and three light rays (99) which are representing schematically. It is therein disclosed that the light rays bounce off the walls of the probing member at an angle in which the walls are totally reflective and finally bounce onto mirror (94) and reflect from there out through the sensing face (97). These two paragraphs which are the only passages of the description as filed which deal with figures 2A and 2B do not explicitly disclose the feature mentioned above, which is thus not clearly and unambiguously derivable from the description as filed. Furthermore, the

structure and the function of the feature as such is not clearly, unmistakably and fully derivable from the schematic figures 2A and 2B as filed because: no incident light beams are represented in the figures 2A and 2B; no symbolic indication is given for a perpendicularity of the beams (99) in the figures 2A and 2B; the measurement of the schematic figure 2B does not precisely lead to an angle of 90°; and only light rays which bounce off the walls of the probing member at an angle in which the walls are totally reflective and finally bounce onto mirror (94) and reflect from there out through the sensing face (97) for a particular but unknown incidence angle are disclosed. Finally, no explicit indication is given in the rest of the application as filed to support the view that the given angle should be 90°.

- VI. The appellant requested that the decision under appeal be reversed and the patent maintained on the basis of a main request or auxiliary request 1 or 2. Oral proceedings were also requested on an auxiliary basis.
- VII. The respondent (=opponent) requested that the appeal be dismissed and on an auxiliary basis oral proceedings.
- VIII. Consequent to the auxiliary requests of the parties, the board appointed oral proceedings.
- IX. The case of the appellant can be summarised as follows.

(i) Disclosure of the documents as filed

Having regard to decision T0261/90, it can be concluded that Figures 2A and 2B are at least constructional-like

drawings rather than schematic drawings. As the refracted ray shown is at least so close to perpendicular, the skilled person would have no reason to assume it to be anything other than perpendicular, thus the incident ray is also perpendicular. Furthermore, human perception does not register a difference  $3^\circ$  because of the Goldmeier effect. Moreover, even if not exactly perpendicular, a skilled person knows that for perpendicular incidence, the feature the "front face being inclined relative to said top wall so as to ensure that light beams incident on the front face impinge said top wall at an angle providing their total internal reflection therefrom and further bouncing, by means of total internal reflection, between the top wall and said rear section of the bottom wall towards said end mirror to be redirected thereby towards said sensing end face" is also valid. This is illustrated by figure 2 of document A2, which teaches that even when there are rays significantly diverging from a main ray incident perpendicularly on a prism of even smaller wedge angle than that of Figure 2B of the revoked patent, these diverging rays are still internally reflected. In fact, the wedge angle cannot be smaller than the critical angle, otherwise the ray progresses out of the prism instead of being internally reflected by it. Thus, given the knowledge of document A2, the relatively larger wedge angle of Figure 2B, and the fact that the rays 99 in Figure 2B appear even less non-perpendicular to the front face than is the case with the diverging rays in document A2, a person skilled in the art would understand that the wedge angle ensures perpendicular rays impinging on the front face would be internally reflected by the top wall.



Any allegation that "drawings have only an explanatory character and can by no means be used for deriving any measurements therefrom", is clearly contradicted by the "Case Law of the Boards of Appeal of the EPO", fifth Edition, December 2006 (III.A.1.3, page 247, bottom), which states that:

"In T0748/91 the board reached the conclusion that size ratios could be inferred even from a schematic drawing as long as the delineation provided the relevant skilled person with discernible and reproducible technical teaching. In the board's view, schematic drawings depicted all the essential features."

In the present case, Figures 2A and 2B are constructional-type drawings sufficiently accurate to allow information of the angular relationship in the probing member to be derived. In the art, drawings of prisms and light paths therein are usually sufficiently accurate in as much as angles are shown in high accuracy. Thus, at least relative sizes between angles can be inferred from such drawings, for instance, whether an angle is greater or less than 45 degrees. In the particular case of Figures 2A and 2B, the figures are sufficiently delineated so that a wedge angle of well over 45 degrees (about 70 degrees) is derivable from Figure 2A.

The default condition for rays entering a prism is, moreover, perpendicular as is illustrated by document A1. This document concerns an endoscope having a prism at its end, in which the front face of the prism is perpendicular to the optical axis of the probe. In the absence of any disclosure to the contrary, a

person skilled in the art would thus have understood that the proximal surface is normal to the optical axis, even without being explicitly told so.

Moreover, referring to document D3 – the respondent stated in its submission of 30 March 2006 in the proceedings before the opposition division:

"On page 8, last paragraph to page 9, first paragraph Patentee asserts that the prior art does not disclose a perpendicular incidence of light on a front face and a reflection on a top wall and a bottom wall. To this end, reference is made to Figure 8 of document D3 in which light beams hit a front face perpendicularly and are reflected between bottom and top walls."

Thus, the respondent is clearly and unambiguously stating that, in its opinion, Figure 8 of document D3 discloses that "light beams hit a front face perpendicularly". It is irrelevant whether this statement was made to make a point on patentability. The clear position of the respondent was that Figure 8 of document D3 shows perpendicular incidence, even though the respondent appears to have missed the fact that there are no special geometrical markings to indicate this in the Figure and that this fact is not explicitly mentioned in document D3. The respondent concluded this from the figure 8 itself which lends support to the argument that Figure 2A also shows perpendicular refracted rays, which in turn suggests perpendicular incident rays.

(ii) The Condition

The feature "so as to ensure that light beams incident on the front face perpendicular thereto impinge said top wall at an angle providing their total internal reflection" is a condition to be satisfied by the inclination between the front face and the top wall, which condition does not restrict the light beams through the probe to having to be perpendicular to the front face. It is not necessary for the figures to show any perpendicular rays at all. It is self evident to the skilled person that the wedge angle of the prism must be equal to or greater than the critical angle. The critical angle depends only on the refractive index of the probe member material, typically glass. Thus a skilled person knows immediately that when presented with a prism made of glass and having a wedge angle greater than  $42^\circ$ , light rays perpendicular to one wall will always be reflected internally by the other wall. With reference to the phrasing in claim 1 "said front face being inclined relative to said top wall so as to ensure that light beams incident on the front face perpendicularly thereto impinge said top wall at an angle providing their total internal reflection therefrom", as far as the claim is concerned, there is defined the structural feature of the wedge angle, which has to be such as to comply with the condition that incident perpendicular rays are internally reflected at the top wall. That is all. The claim does not require incident rays to be perpendicular to the front face, though if there are such rays they would, of course, be internally reflected from the top wall. Claim 1 is a device claim, and the manner of its use, including how the incident light beams should impinge

the front face, is actually irrelevant with respect to the claim.

The question is thus whether or not such a condition is supported by the patent disclosure, in particular paragraph [0022] (=text in section II(c) above) and Figure 2B of the patent. The condition is met when the wedge angle is greater than the critical angle for the probe member material, which in turn depends on its refractive index. The wedge angle shown in Figure 2B is clearly well over 45 degrees (in fact it is about 70 degrees), as can be ascertained from the figure). Paragraph [0022] in the patent discloses that the probe material may be glass, which can have a refractive index between about 1.5 and about 2.0, which in turn provides a critical angle range between about 42 degrees to about 30 degrees. Thus, indisputably, paragraph [0022], Figure 2A, and common knowledge in the art of optics, together disclose that the probing member of Figure 2B will internally reflect any incident rays that are perpendicular to the front face. Thus, the condition is clearly and unambiguously derived from the specification as filed, in the context of common knowledge to a man of ordinary skill in the art. This derivation is independent of whether or not perpendicular incident rays are or are not shown in Figure 2B, or whether the material of the probe member is included in claim 1.

In the context of the apparatus of the invention, an array of light beams is generated and the beams pass through the probing member to impinge on a surface to be measured. The beams are laterally spaced from one another by a spacing due to a microlens array. If the

probe were arranged to receive the beams at an angle other than perpendicularly to the front face, the probing member would need to be larger (since the beams are received obliquely) than the case of beams incident perpendicularly to the front face. There are also potential aberration problems that may be minimized when the incident rays are orthogonal. There is nothing stopping a user from using the claimed probe with incident beams at angles other than perpendicular. However, there will come a point off-perpendicular, when the incident beams pass through the top wall.

(iii) Oral Proceedings

During the oral proceedings, the appellant added the following.

It can be seen from Figure 2B that the light rays leaving the front face are very near to perpendicular thereto, which means that the incoming rays are also near to perpendicular. All the phrase in dispute really means is that there is no refraction at the front face, which is the default supposition as were there another angle, this would be mentioned. As can be seen from column line 53 et seq. of the patent, the skilled person is taught simply to ensure total internal reflection takes place with an appropriate angle. It is more a condition than a definition of structure, the disclosure being entirely consistent.

Responsive to the chairman, the appellant explained that where the rest of the light path changes if the incoming angle changes, even an angle of say 85° would work, the exit angle from the member not needing to be

90°. While the draftsman had a certain freedom creating a schematic drawing, Figures 2A and 2B are not schematic like Figure 1 and the draftsman is not free to draw as he wished because he has to give the skilled person a teaching.

Concerning the auxiliary requests, the appellant pointed out that the limitation to glass fitted to the relative dimensions showed in the figures. The second auxiliary request is more limited. In reply to the chairman, the appellant agreed that the independent claim of the auxiliary requests nevertheless contained the feature referring to perpendicular.

X. The case of the respondent can be summarised as follows.

(i) Disclosure of the documents as filed

The refracted rays shown in Figure 2B of the patent in dispute can be differentiated from perpendicular. Incident rays are not disclosed at all, and, even if the rays leaving the front face are perceived by the naked eye as perpendicular, they need not result from perpendicular incidence. The deviation actually shown is indicative of a greater deviation of the incident light. Drawings have only an explanatory character and can by no means be used for deriving any measurements therefrom. The shape of the bottom wall does not imply a perpendicular incidence because some perpendicularly incident rays would first be incident thereon. Submissions advanced by the respondent before the opposition division concerning document D3 related to novelty and inventive step and were thus only applicable, had the opposition division decided no

impermissible broadening existed. The argument was thus only precautionary. The relevance of document A1 is disputed because the ray path is described in detail, the drawings only having an illustrative function. Document A2 refers expressly to a perpendicular ray entrance and exit, thus showing the drawing alone to be inadequate. It can thus be concluded that the refracted beams leaving the front face are understood by the skilled person as an example of possible path. Off perpendicular incident rays are not therefore excluded. The skilled person would therefore simply ensure the angle of the ray impinging on the top wall is smaller or the same as the critical angle and the inclination range of incident angle on the front face takes account of refraction.

(ii) The Condition

The condition relating to perpendicular incidence mentioned by the appellant is not comprehensible if it is to be understood as anything other than a restricting feature not present in the documents as filed. Moreover, the material of the prism is not a feature of the granted claim. The feature involving "incident on the front face perpendicular thereto" is a device feature because the inclination angle is restricted to being greater than the critical angle as explained by the appellant. No such condition was given in the documents as filed, in particular not in Figure 2B, because no direct relationship between the not perpendicular refracted beams leaving the front face and the inclination angle is disclosed.

(iii) Oral Proceedings

During the oral proceedings, the respondent explained that the disclosure simply does not go far enough to provide the reference to perpendicular. The inclination angle of the front face plays no role in the teaching of the patent as attention is centred on total internal reflection. Additionally, if the appellant argues that the exit angle from the device is variable, then the incidence angle is also variable.

XI. The independent claim according to the requests of the appellant is worded, respectively, as follows.

Main Request

Claim 1 as granted as set out in section IV above.

Auxiliary Request 1

This request differs from the main request in that the following text is added at the end of the claim, i.e. between "(97)" and ".".

", and wherein said probing member is made of glass,"

Auxiliary Request 2

This request differs from auxiliary request 1 in that the following text is added at the end of the claim, i.e. between "glass" and ".".

", and is composed of an anterior segment (91) and a posterior segment (92)."



XII. At the end of the oral proceedings, the board gave its decision.

### **Reasons for the Decision**

1. The appeal is admissible.

2. Amendments (Article 100(c), 123 EPC 1973)

2.1 The parties did not disagree with the opposition division that there was no explicit disclosure in the description and claims as filed of the feature "so as to ensure that light beams incident on the front face perpendicular thereto impinge said top wall at an angle providing their total internal reflection". The board will refer to this feature as the "perpendicularity feature" in the following.

2.2 Turning to the disclosure of the drawings, in particular Figures 2A and 2B of these Figures, particularly Figure 2B, light rays inside the probing member and exiting therefrom are, to use the wording of the description, "represented schematically", but "light beams" incident on the front face are not represented at all, which is consistent with the description of Figure 2B given in section III(a) of the Facts above and reciting "depicting also some exemplary rays passing therethrough". In other words, the drawings too provide no explicit disclosure of the "perpendicularity feature". Of course, there must be some incident rays, the board concluded that the opposition division was correct in considering there is

a disclosure thus of incidence of the rays but not of angle of incidence.

2.3 In the board's view, a significant disclosure is contained in the original documents as set out section III(c) of the facts above, namely

"Three light rays are 99 are represented schematically. As can be seen, they bounce at the walls of the probing member at an angle in which the walls are totally reflective and finally bounce on mirror 94 and reflected from there out through the sensing face 97."

2.4 As the incident rays onto the probe are not mentioned, this explicit disclosure is just what the draughtsman represented in Figure 2B (see section III(d) of the facts above) and is also consistent with the description of the drawings "light rays passing therethrough". An element of draughtsman's artistic freedom or licence is, in the view of the board, involved in portraying the ray paths shown in Figure 2B. The draughtsman had only to illustrate the bouncing on the walls then mirror and exit from the probe, choosing to show the latter as a straight line. The incident ray path was left open. The board therefore considers the refracted ray path actually shown in the probe as not to be a reliable indication of the angle of incidence. In a way, the appellant confirms this assessment of draughtsman's artistic freedom or licence of the draughtsman by referring to the Goldmeier effect that small angles cannot be differentiated by the human eye, i.e. implying the path shown is unreliable, and to "assuming perpendicular incidence", i.e. the draughtsman left it out.

- 2.5 Significantly, there is no teaching at all in the description, of how the paths shown give an indication that the relationship between the wedge angle and perpendicular incidence is pertinent to meeting the bouncing and exiting constellation as set out in point 2.3 above. The situation concerning this relationship is not therefore unlike that set out, for instance, in point 3.4 of decision T0666/07 - "... relationship introduced...has been singled out from amongst equally feasible other features, which selection is an arbitrary one as there is no basis for it in the originally filed application...".
- 2.6 The board cannot therefore agree with the appellant that the skilled person would draw any conclusion about the relationship between wedge angle and perpendicular incidence as applied to the path through and exiting the probe. In fact, the approach of the respondent appears persuasive in arguing that the skilled person would simply ensure the angle of the ray impinging on the top wall is smaller or the same as the critical angle and the inclination range of incident angle on the front face takes account of refraction. Thus, even if the board accepts the interpretation of decisions T 0261/90 and T 0748/99 advanced by the appellant, i.e. the drawings are constructional like drawings in relation to wedge angle which can be seen to be more than  $45^\circ$ ; this does not imply any disclosure beyond that argued by the respondent.
- 2.7 Supposing, arguendo, that the Figures are taken to give a specific teaching of ray path, then since Figure 2B does show a slightly off-perpendicular refracted ray

path in the probe, this is what the skilled person is taught. While, as the appellant argued, there are many possible angles of incidence, there is no reason in the documents as filed with the wedge angle drawn then to consider any refracted ray path other than that disclosed as necessary to provide the path through and exiting in a straight line from the probe exactly as shown. In particular, the wedge angle does not define perpendicular incidence in the drawings. Where is then the direct and unambiguous disclosure that the angle of incidence is modifiable with the knock-on effect of changing the path through the probe and exit angle? Thus, while the board would not dispute that the skilled person could, as a kick-off criterion, choose perpendicular incidence and dimension the probe accordingly, this choice is simply not disclosed in the documents as filed. Similarly, even if the skilled person can deduce that the wedge angle shown is greater than  $45^\circ$ ; this still offers no reason to modify the ray path. Whether the probe would be larger for off perpendicular incidence may play a role for instance in respect of fitting and space criteria, but it does not compel the skilled person to assume perpendicular incidence nor to add the missing disclosure to the documents as filed.

3. The Condition

3.1 As the respondent explained, if the exit angle from the probe is variable, so is the incidence angle. The approach of the appellant in relation to its "condition" argument accepts incident angles other than perpendicular being permissible contending that the wedge angle ensuring the "perpendicularity feature"

merely represents a condition. This argument is not very convincing in relation to added subject matter, because even if its lengthy explanation of total internal reflection is plausible up to the rays being totally internally reflected at the top wall, it stops there, as the appellant said - "That is all."

- 3.2 In reality the ray path does not stop at the top wall but goes through the exit of the probe. If a particular off-perpendicular incidence taken, and such is disclosed in Figure 2B, to achieve the ray path shown, then a perpendicular or different off-perpendicular incidence requires a selection of a different wedge angle to achieve the ray path actually shown, any such selecting being specific to match the light path in the probe and exit angle therefrom. Otherwise a deliberate and undisclosed change from the light path is made. If, on the other hand, the ray path in the Figure is ignored, for whatever reason, then the angle of incidence is completely open and has to be selected by the skilled person. Where is the direct and unambiguous disclosure of the steps of selecting a different wedge angle or effecting a deliberate change of light path or angle of incidence? Why should a probe with a working light path for some non-perpendicular incidence angle work for perpendicular incidence without selection of a different wedge angle to achieve the same light path? Thus by implicitly calling for these steps, the board sees the "condition" argument as implying an addition to the disclosure because any corresponding selection of wedge angle to ensure transmission through the probe as claimed is not directly and unambiguously disclosed in the documents as filed. The board can only concur with the remark of the respondent at the oral

proceedings that the disclosure simply does not go far enough to provide the reference to perpendicular.

#### 4. Other Documents

First of all, the board observes that the application document itself is the source of its disclosure, other documents are not so relevant, especially if, as in the present case, they are not illustrating common technical knowledge, such as is done by textbooks, dictionaries and the like.

##### 4.1 Document D3

The appellant has not argued that a perpendicular incidence is disclosed in this document, but has relied on an earlier remark of the respondent in this sense. However, the respondent/opponent is free to present its case as it wishes; there could be a number of reasons unknown to the board for the remark, one has been offered, namely the remark is in another context (patentability) and only conditional on a position of the opposition division at that time unknown to the respondent in relation to added subject matter. In this hypothetical situation, the board does not see this helping the appeal case of the appellant in relation to added subject matter.

##### 4.2 Document A1

This document recites in column 8, lines 10 to 12, that "entry and exit surfaces are perpendicular to rays along the optical axis for control of aberration. In other words the skilled person is, differing from the

disclosure in the present case, explicitly taught about the perpendicularity and does not have to rely on the drawings, so its applicability to the present case is dubious. Moreover, the skilled person is not obliged to assume disclosure of a default condition or to apply the teaching to other disclosures so that the document cannot be considered relevant to added subject matter in the present case.

#### 4.3 Document A2

This document recites in column 6, lines 35 to 47, that "the transmission of light along the optical path through the prisms can be considered with reference to the chief ray. The ray enters the prism at the entrance window along its perpendicular. While some deviation from the perpendicular is permissible, in general increases in the angle of incidence (measured from the perpendicular or normal) tend to reduce the transmission of light energy into the prisms and to introduce image distortions which become increasingly difficult to correct. Within the prism, the ray is reflected from the reflective surface... where it reflects to the exit face portion substantially along its perpendicular." Here again, there is an explicit teaching of a perpendicular chief ray, although some deviation is permissible. The board sees no compelling reason to select any teaching here about perpendicular or off perpendicular incidence and apply it to cure any added subject matter defect in the documents as originally filed in the present case.

5. Auxiliary Requests

Both auxiliary requests contain the "perpendicularity feature" and therefore contain added subject matter for the same reasons as for the main request.

6. Since the all the requests of the appellant fail for added subject matter, the case of the respondent succeeds.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar

The Chairman

M Kiehl

A G Klein