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**D E C I S I O N**  
of 11 July 2000

**Case Number:** T 0441/99 - 3.4.2

**Application Number:** 92110556.5

**Publication Number:** 0520369

**IPC:** G02F 1/13, G02B 27/18, H04N 9/31

**Language of the proceedings:** EN

**Title of invention:**  
Projector

**Patentee:**  
CANON KABUSHIKI KAISHA

**Opponent:**  
Koninklijke Philips Electronics N.V.

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 54, 56

**Keyword:**  
"Main request - novelty (yes)"  
"Main request - inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0441/99 - 3.4.2

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.2**  
**of 11 July 2000**

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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 24 February 1999  
maintaining European patent No. 0 520 369 in  
amended form.

**Composition of the Board:**

**Chairman:** E. Turrini  
**Members:** M. A. Rayner  
V. Di Cerbo

## Summary of Facts and Submissions

- I. The present appeal is made by the patent proprietor (=appellant) against the decision of the opposition division in the matter of European patent No. 520 369 (application No. 92 110 556.5) that the at that time seventh auxiliary request met the requirements of the EPC, whereas the main request and first sixth auxiliary requests did not do so.
- II. The following documents were referred to in the decision under appeal.

D1: "A polarization transforming optics for high luminance LCD projection", Shikama et al., Proc. Eurodisplay 1990, pp. 64-67;

D2: JP-A-63 216 026 (English language Abstract).

The opposition division reasoned inter alia that with respect to document D1, the independent claims of the allowable request provided definition of the problem of wavelength variation of the polarisation of the light from the polarising means and that the polarisation converting means compensate for this variation. The division saw this difference as involving an inventive step even taking account of document D2, where polarising plates act by absorbing light rather than rotating its polarisation.

- III. In the statement of appeal, the appellant requested the maintenance of the patent according to a main or first and second auxiliary requests and on an auxiliary basis oral proceedings. According to the appellant the teaching of document D1 is that a half wavelength plate

(converting means) is present only in the blue light path. The whole optical system according to document D1 only functions appropriately with a 45° input polarisation and the converting means compensates for a rotation of polarisation direction generated by colour separation (see the first paragraph of the statement of appeal). Moreover, the teaching of document D2 is that light of undefined polarisation penetrates through polarising plates to be polarised so that no suggestion of a polarisation converting means arranged in every coloured light beam is provided.

IV The respondent (=opponent) requested the board to dismiss the appeal of the appellant and on an auxiliary basis oral proceedings. According to the respondent, if the skilled person is confronted with the problem of incorrect hue of the combined light beams and has corrected the blue channel with polarisation conversion means according to document D1, but finds out the hue is still not correct, then the same measure will be applied again to the red and green beams without any inventive step. Furthermore, taken with document D1, document D2 also gives a solution for incorrect hue in that polarising plates are arranged in each of the light beams for adjustment of hue by rotation thereof.

V. Oral proceedings were appointed, consequent to the auxiliary requests of the parties. In a communication accompanying the summons, the board expressed doubts about whether the half wave plate inserted consequent to the mirror arrangement according to document D1 really would have suggested to the skilled person that polarisation conversion means were also necessary in the red and green channels. It also seems questionable whether the polarisation plates known from document D2

can be considered to convert polarised light into the first predetermined direction.

- VI. A further letter was filed by the appellant following the summons and concerning modifications of the first and second requests and submissions relating thereto.
  
- VII. During the oral proceedings, the appellant argued that a half wavelength plate as disclosed in the blue channel according to document D1 is neither in all channels nor does it correspond to converting as claimed. The objective problem addressed by the invention is an improvement in light intensity, for which the skilled person would not consider document D2, where the polarisers reduced light intensity.

The respondent submitted that the problem to be solved is removal of the wavelength dependence caused by 1003a shown in Figure 2 of the patent which is only satisfactory for one colour. The solution to this problem is to transfer the compensation to the split parts of the light path and adapt to the polarity of the liquid crystal display. It is obvious to the skilled person that where a number of beams are used with elements having specific functions he should use his skilled knowledge about the wavelength dependence of the elements in each beam for this purpose.

With respect to document D1, firstly the input polarisers correspond to the converting means, it being taught that the retarder in the polarisation beam splitter is wavelength dependent. Secondly, document D1 starts from a conventional projector and discloses that loss of light in the blue channel is compensated by a half wave plate. The teaching drawn by the skilled

person is that intensity is compensated where necessary by a half wave plate. It must be remembered that the patent in dispute is not concerned with different angles but with illumination. Thus there can be no inventive step in using a retarder in each beam, the polarisation being made to coincide with the liquid crystal display. The general wording of the independent claims of the patent does not provide subject matter patentable over either the first or second of the teachings of document D1.

With respect to document D2, the respondent filed an English language translation and explained that the device 3 (Figure 3) is a polarisation beam splitter. A further half wave plate is not provided as this function is performed by the input polarisers built into the LCDs as can be seen from the second paragraph of page 4 explaining that the incident beams have the same polarisation direction. Thus as well as the subject matter of the claims in dispute not being patentable over a combination of the teachings of documents D1 and D2, it is also not patentable even over the teaching of document D2 alone.

VIII. The appellant requested that the decision under appeal be set aside and as main request that the patent be maintained on the basis of independent claims 1 and 8 filed with the statement of appeal, or on the basis of auxiliary requests 1 and 2, filed following the summons. The independent claims of the requests before the board are worded as follows:

*Main Request*

"1. A projector comprising:

a light source (1) emitting light of undefined polarization;  
polarizing means (31) for converting said light into linearly or circularly polarized light;  
at least one color separating means (32,33; 62,63) for separating light incident on said color separating means into first and second colored light beams having different colors from each other;  
at least two modulation means, one disposed in each of said colored light beams, for converting light of a first predetermined linear polarization into light of a second predetermined linear polarization modulated with an image, each modulation means comprising, disposed in succession along the optical path of the corresponding colored light beam, selective polarization rotating means (57R,57G,57B; 67R,67G,67B;77R) for selectively, in accordance with a desired image, rotating portions of a light beam having said first predetermined linear polarization direction, and polarization analyser means (58R,58G,58B; 68, 78R) for transmitting one of said first and second linear polarisation;  
combining means (36,37; 62,63) for combining the colored light beams, after they have at least passed through said selective polarization rotating means, with their polarization directions parallel to each other; and  
projection means (10; 105) for projecting said combined beams;  
characterized in that  
said polarization means (31) is positioned between said light source (1) and said color separating means (32,33;62,63); and in that  
a polarization converting means (51R,51G,51B; 61R,61G,61B; 71R) is disposed in all of said colored light beams between said color separating means (32,33;

62,63) and said modulation means for converting said linearly or circularly polarized light into light polarized in said first predetermined linear polarization direction.

8. A projection method comprising the steps of emitting light of undefined polarization from a light source (1); converting said light into linearly or circularly polarized light by using a polarizing means (31); separating light incident on said color separating means into first and second colored light beams having different colors from one other by using at least one color separating means (32,33; 62,63); converting light of a first predetermined linear polarization into light of a second predetermined linear polarization modulated with an image by using at least two modulation means, one disposed in each of said colored light beams and each modulation means being adapted for, in succession along the optical path of the corresponding colored light beam, selectively, in accordance with a desired image, rotating the polarization of portions of a light beam having said first predetermined linear polarization direction by using a selective polarization rotating means (57R,57G,57B; 67R,67G,67B;77R), and transmitting only said second predetermined linear polarisation by using a polarization analyser means (58R,58G,58B; 68, 78R); combining the colored light beams, after having at least selectively rotated the polarization of portions of the light beams, with their polarization directions parallel to each other by using combining means (36,37; 62,63); and projecting said combined beams by using a projection means (10; 105);



characterized in that said converting by using said polarizing means (31) is effected after emitting of light of undefined polarization and before separating said light into at least first and second colored light beams having different colors from one another; and in that in all of said colored light beams, between the step of separating and the step of modulating, said linearly or circularly polarized light is converted into light linearly polarized in said first predetermined linear polarization direction by using a polarization converting means (51R,51G,51B, 61R,61G,61B, 71R)."

*First auxiliary request*

This request differs in claim 1 from the main request by virtue of the omission of "or circularly" in the second ("polarising means") and last ("polarisation converting means") features of the claim. In addition, there follows after "(32,33;62,63)" in the penultimate feature of the claim "wherein the linearly polarized light from said polarizing means (31) is P-polarized light or S-polarized light with respect to said color separating means (32,33;62,63)". Corresponding amendments are made in the independent method claim 7.

*Second auxiliary request*

This request differs from the first auxiliary request by virtue of addition at the end of independent method claim 6 of ", the direction of said first predetermined polarization being 45° with respect to the polarization direction of said linearly polarized light."

The respondent requested the dismissal of the appeal.

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

## **Reasons for the Decision**

1. The appeal complies with the provisions mentioned in Rule 65(1) EPC and is therefore admissible.

### *Main Request*

2. *Amendments*

The amendments to the independent claims as granted are the references to "all" of said coloured light beams and said first predetermined "linear polarization" direction in the last feature of the claim. The latter amendment is merely an explicit recitation of the antecedent in the claim. The former amendment derives from the figures and the explicit statements in lines 40 to 54 of column 5, lines 29 to 31 and column 8, lines 3 to 13 of the patent ("A"-publication, column 5, lines 5 to 20; column 5, lines 54 to 56; and column 7, lines 38 to 44). Moreover, the amendment to "all" from "at least one" is a restriction. Method claim 8 has, in accordance with the drawings, also been restricted to transmitting only said second predetermined linear polarization by using a polarization analyzer means. Accordingly, the amendments made comply with Article 123 EPC.

3. *Novelty*

- 3.1 Document D1 can be taken as representing the closest prior art. In Figure 1 of this document, there is

disclosed a light source comprising a lamp and a parabolic mirror followed by polarising beam splitter, the P polarised light directly illuminating the input polariser of a TN-LCD with its polarisation axis coincident with the P axis and the S polarised light being reflected by a mirror and passing through a half wave plate for synthesis with the P polarised light illuminating the input polariser. Wavelength dependence of the half wave plate retarder is considered in section 2.2 resulting in the conclusion that loss of blue spectrum is rather large. In Figure 3, an optical layout of LCD projector is disclosed, wherein the light source beam is decomposed into red, green and blue beams by two dichroic mirrors and illuminates respective LCDs. As the illumination beam of the blue LCD is reflected once after being released from the light source, the plane of vibration has to be rotated 90° compared to the other illumination beams. For this purpose, a half wave plate is placed just before the blue LCD, this retarder being inserted so that its fast and slow axes are opposite those of the retarder in the polarisation transforming optics so as not to increase the chromaticity change.

- 3.2 Present claim 1 differs from this disclosure by requiring that a polarisation converting means is disposed in all of the coloured light beams for converting polarised light into first linearly polarised light. This first linearly polarised light is that converted by modulation means into light of a second predetermined polarisation, the modulation means comprising polarisation rotating means and an analyser for transmitting only one of said first and second linear polarisations.

3.3 The respondent has found in document D1 two possible candidates for the polarisation converting means, namely the input polariser of the LCDs or the half wave plate in the blue channel. Since, in the polarising beam splitter, there is according to document D1 only one half wave plate, it cannot be effective for all of the different wavelength (=colour) channels causing, where it is not, light to be lost when incident on the input polarisers, as is apparent from the first paragraph of the right hand column on page 64. Thus, the theory advanced by the respondent that each input polariser of the LCDs in the channels is also a polarisation converter is not in accordance with the teaching of document D1. Furthermore, the teaching of document D1 explicitly recognises that blue spectrum is lost, but there are no half wave plates corresponding to the additional blue channel half wave plate in the other channels. Thus the first candidate found by the respondent is no more than a polariser and thus not a polarisation converting means and the second candidate is not present in all channels.

Therefore the subject matter of claim 1 is novel over the disclosure of document D1.

3.4 Document D2 discloses a projection type liquid crystal display device, where white light is split into red green and blue channels for passing through respective sandwich structure liquid crystal displays and then resynthesised, colour balance and brightness adjustment being provided in the embodiment according to Figures 1 and 2 by using rotatable polarisers. Thus, when the direction of polarisation of a rotatable polariser coincides with that of the polariser of the liquid crystal the maximum light intensity is obtained, on the

other hand when the directions are perpendicular, almost no light intensity is achieved. A device constituting the prior art starting point for the document D2 device is described in connection with Figure 3, this device involving adjustment of light intensity by use of detection elements connected to a balance adjustment circuit leading to a controlling circuit for providing an electrical control signal to the liquid crystals.

- 3.5 The fundamental mechanisms involved according to the teaching of document D2 are therefore different from that of the patent in dispute because in the case of the Figures 1 and 2 embodiment, the rotatable polarisers control the quantity of light, in other words the intensity is reduced by absorption depending on the polarisation selected. The rotatable polarisers are therefore not polarisation converting means within the meaning of the claims. The electrical controlling means is a quite different principle to the polarization converting means claimed in the patent. Moreover, following a similar analysis to that made with respect to document D1, input polarisers for the LCDs are not polarisation converting means.

Therefore the subject matter of claim 1 is novel over the disclosure of document D1.

4. *Inventive step*

- 4.1 While the skilled person may now appreciate the invention described in the patent in the knowledge of its teaching, it does not follow therefrom that it was obvious to provide the subject matter of the independent claims at the priority date of the patent

without knowledge of the teaching thereof. On the contrary, an objective assessment of inventive step requires assessment of whether the invention was obvious to the skilled person having regard to the state of the art. The board is not therefore persuaded of lack of inventive step by the simple allegation of the respondent that the subject matter claimed is obvious in view of wavelength dependence caused by 1003a in Figure 2 of the patent.

- 4.2 The problem solved by the novel feature relating to the polarisation converting means can be seen in the avoidance of light loss, in other words providing better projector illumination. Since the projector channels are of a different colour, the converting to the first polarisation direction in all of these channels is wavelength (=colour) dependent. In the case of document D1 on the other hand, there is no hint at all that better illumination should be provided by inserting a polarisation converting means in the red and green as well as the blue channel. The reason why the half wave converter is present in the blue channel has in fact to do with reflection taking place in this channel as unlike the red and green channels an extra reflection takes place, which reflection is compensated by the half wave plate. Since such reflection does not occur in the other channels, insertion of a half wave into these channels is unnecessary. Contrary to the submission of the respondent, when considering the teaching of document D1, it is its own teaching relating to reflections which is important, application of knowledge about improving illumination gained from the patent in dispute is not permissible. The lines of reasoning offered by the respondent and based on replicating the half wavelength plate in the blue

channel in the other channels is thus without foundation in relation to document D1 and cannot therefore provide a convincing argument of lack of inventive step.

4.3 The light striking the input polarisers according to document D1 (or D2, Figure 3 embodiment) is according to the function of these devices only polarised, no polarisation conversion within the meaning of the present independent claims takes place. Thus, only a hindsight induced wish to read the term onto the prior art might twist the meaning of polarisation converting means to polariser. From the point of view of inventive step, no reason can be seen by the skilled person in the prior art documents for replacing the input polarisers by polarisation converting means. Therefore, submissions of the respondent on this basis do not amount to a successful attack on inventive step of the subject matter of the independent claims.

4.4 The rotatable polarisers known from the Figures 1 and 2 embodiment of document D2 are, in view of their absorbing function, also not polarisation converting means within the meaning of the independent claims (see section 3.5 above relating to novelty). There is no reason to dispense with the rotatable polarisers in the teaching of document D2, indeed to do so would run counter to the basic idea disclosed. Accordingly, even if the teachings of documents D1 and D2 were combined, the resultant combined teaching would not lead to the subject matter of the independent claims in dispute because even this combined teaching would lack polarisation conversion means in all beams. Therefore, submissions of the respondent on this basis that the subject matter of the independent claims lacks an

inventive step do not convince the board.

4.5 The other prior art documents mentioned in the proceedings do not come closer to the subject matter of the independent claims than documents D1 or D2 and thus offer no reason to question the inventive step of this subject matter.

4.6 Accordingly, the subject matter of the independent claims is considered to involve an inventive step within the meaning of Article 56 EPC.

5. *Auxiliary requests*

Since the subject matter of the independent claims of the main request is allowable, consideration of that of the auxiliary requests is not necessary.

**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 on the basis of the main request as filed on 6 July 1999.

The Registrar:

The Chairman:



P. Martorana

E. Turrini