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D E C I S I O N
of 21 June 2004

Case Number: T 0153/01 - 3.4.2

Application Number: 93110388.1

Publication Number: 0577088

IPC: G01D 5/38, G01D 5/34

Language of the proceedings: EN

Title of invention:
Displacement information detection apparatus

Patentee:
CANON KABUSHIKI KAISHA

Opponent:
DR. JOHANNES HEIDENHAIN GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56, 114, 111(2)

Keyword:
"Document filed at appeal"
"Relevance; fresh case"
"Remittal to first instance"

Decisions cited:
-

Catchword:
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Case Number: T 0153/01 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 21 June 2004

Appellant: (Opponent)
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Representative:
-

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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 5 December 2000 concerning maintenance of European patent No. 0577088 in amended form.

Composition of the Board:

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

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal, received on 30 January 2001, against the interlocutory decision of the opposition division, dispatched on 5 December 2000, whereby European patent No. 0 577 088 (based on application No. 93 110 388.1) could be maintained in an amended form. The fee for the appeal was paid on 30 January 2001. The statement setting out the grounds of appeal was received on the same day.

II. Opposition had been filed against the patent as a whole on the basis of Article 100(a) EPC in combination with Articles 52(1), 54 and 56 EPC. To support its objections the opponent referred inter alia to the following documents:

(E1) DE-A-25 11 350

(E2) "Dreigitterschrittgeber - photoelektrische Aufnehmer zur Messung von Lageänderungen", J. Willhelm, thesis, Hannover, 1978, pages IX and 47 to 50.

(E3) DE-A-40 06 789.

III. In its decision the opposition division expressed the view that the subject-matter of Claim 1 of the granted patent did not involve an inventive step over the combination of documents E2 and E3. As to Claim 1 according to the first auxiliary request the opposition division followed the argumentation of the patent proprietor that the subject-matter of this Claim was not obtainable from this combination of documents

because E2, considered to be the closest prior art document, did not disclose an arrangement with three gratings wherein the grating of the grating scale was a reflective type diffraction grating. The only document showing a reflective type diffraction grating was E1, but only in an arrangement of two gratings so that this document was not combinable with E2.

IV. In the grounds of appeal the appellant argued that the reasoning of the opposition division that Claim 1 of the patent as granted was obvious over the teaching in documents E2 and E3 would equally be valid for Claim 1 of the auxiliary request allowed by the division, because displacement detecting apparatuses with three gratings and with a reflecting grating were also disclosed in E2. As a further document showing such an arrangement the appellant made reference to the document:

(E6) JP-A-3 279 812

According to the appellant, this document was of prima facie importance, because in Figures 2A and 2B of document E6 a displacement detecting apparatus including a three-grating arrangement with a reflective grating was shown. The appellant requested that the decision under appeal be set aside and that the patent be revoked. Subsidiarily oral proceedings were requested.

V. In a letter dated 22 June 2001 the respondent objected against the introduction of document E6 into the proceedings because it could have been introduced already earlier in the opposition proceedings and

because its relevance was not clear, the document being in Japanese and a translation not having been provided. Remittal of the case to the opposition division was requested in the event that the Board would be of the opinion that because of the possible relevance of document E6 the patent could not be maintained. Furthermore oral proceedings were requested as an auxiliary measure.

VI. In a Communication by the Board of Appeal of 11 March 2004 the Board expressed its preliminary opinion that the subject-matter of Claim 1 was not derivable in an obvious way from the documents (E1 to E4) available at the oral proceedings before the opposition division. As to document E6 it was explained that because this document was in Japanese it was not a priori clear from the Figures alone whether these related to the same embodiment and that therefore a translation of this document to be filed by the appellant would be compulsory. Should the observations by the appellant be confirmed by a translation of this document it would follow that the evidence forming the basis of the appeal proceedings had substantially changed and the Board in this respect would be presented with a completely fresh case, whence the Board would consider remitting the case to the first instance. Therefore the parties were requested to communicate to the Board whether they would maintain their requests for oral proceedings in the event of remittal of the case.

VII. With the letter dated 23 March 2004 the appellant filed a translation of document E6 and withdrew its auxiliary request for oral proceedings if the Board would remit

the case for further prosecution by the opposition division.

VIII. With the letter dated 30 April 2004 the respondent stated that its auxiliary request for oral proceedings should be interpreted as an auxiliary request for oral proceedings before the opposition division in case of remittal by the Board.

IX. Claim 1 as maintained by the opposition division reads as follows:

"An apparatus for detecting information relating to displacement of an object (20; 209; 110) on which a grating scale (20a; 209; 110A) is affixed, comprising:

a beam-emitting system for irradiating the grating scale (20a; 209; 110A) with a beam and having a light source (41; 1; 101; 111); and

at least one light-detecting element (45, 46; 50; 32B, 32C; 102B, l02C; 102) having a photoelectric conversion surface (53) and a grating unit (56; 57; 55, 54; 53, 57) being integrally formed on at least a part of the surface of said photoelectric conversion surface for detecting a beam from said grating scale which is irradiated by the beam from said beam—emitting system;

characterized in that

said beam—emitting system further has a first diffraction grating (44; 32A; 109A) for splitting beams from said light source, at least two beams of diffracted light from the first diffraction grating are incident on said grating scale as a second diffraction grating; and

wherein said grating unit synthesizes at least two beams of diffracted light from said grating scale and

has a light transmission portion in the shape of a grating whose pitch is the same as the pitch of the interference fringe formed by at least two beams of diffracted light from said grating scale and an information relating to displacement of the object is detected on the basis of detection by said light-detecting element, and wherein

said light split by said first diffraction grating travels via a first light path towards said grating scale as a second diffraction grating, said second diffraction grating being a reflecting type diffraction grating, and

said light diffracted by said second diffraction grating travels via a second light path towards said grating unit, said first and second light paths being different from each other."

X. The arguments of the appellant may be summarised as follows:

In points 2.1 to 2.5 of the Grounds for the Decision the opposition division had given the reasons why the subject-matter of Claim 1 of the granted patent was obviously derivable from documents E2 and E3. In Claim 1 maintained by the opposition division the patent proprietor had added the two further features:-

(i) the second diffraction grating is a reflecting type diffraction grating; and

(ii) the light diffracted to the second diffraction grating travels via a light path different from that of the light diffracted by the second grating towards the third grating.

Document E2 discloses not only three-grating interference displacement detection devices working in transmission but in addition such devices working in reflection, as shown in the Figure on page 47. In the arrangement in this Figure, the incident light bundle (upper right) is separated by the first grating into two diffracted beams which then impinge on the obviously reflective second grating. Therefore the first feature (i) is known from E2. From the second grating these beams are again diffracted and are reflected in the direction of the third grating. As can readily be seen from the Figure, the ray paths of the beams travelling towards the second, reflecting, grating are different from those travelling away from this grating, therefore feature (ii) is equally known from document E2.

The inclusion in such a system of the third grating unit of the type disclosed in document E3, i.e. a grating unit integrally being formed with the required detector, would be just as obvious as the inclusion of this unit in the transmissive three-grating arrangement when the technical problem addressed is to obtain a very compact arrangement, which problem and solution is known from document E3, see column 2, lines 18 to 21. Therefore the subject-matter of Claim 1 is obvious in the light of the combined disclosures in E2 and E3.

Furthermore, an interferential three-grating displacement detecting apparatus working in reflection is also disclosed in document E6, Figures 2A and 2B. Figure 2A shows an arrangement in which a light bundle emitted by light source 1 is diffracted by grating 30

in different diffraction orders. These bundles impinge on the reflection grating 4, therefore the above feature (i) is also known from E6. The light bundles are diffracted from grating 4 towards gratings 31a and 31b. Figure 2A clearly shows that the ray paths of the light beams towards the second grating 40 are different from the ray paths of the bundles diffracted from this grating. Therefore also feature (ii) is known from E6.

Finally Figure 2B showing transmission scale 3 clearly illustrates that the first grating 30 and both third gratings 31a and 31b are separate grating structures. Therefore in order to obtain a more compact detection system it would be obvious to implement the adopt the construction proposed in document E3 and to combine the gratings 31a and 31b integrally with the respective detectors.

Therefore the subject-matter of Claim 1 is obvious in view of the combination of documents E6 and E3.

XI. The arguments of the respondent may be summarised as follows:

The disclosures of documents E2 and E3 do not render the subject-matter of Claim 1 obvious. Document E2 discloses on page 48 a grating interference system utilizing 0^{th} order and 1^{st} order diffracted light bundles and on page 49 a different grating interference system utilizing $+1^{st}$ order and -1^{st} order diffraction bundles. This document, however, does not teach or suggest an integration of the light detecting element into the third grating, since in the arrangements shown in E2 such an integration would not be possible.

In the system shown on page 48, 1st order diffracted light and 0th order diffracted light are combined by the third grating to obtain one interference beam. The diagram on page 48 shows a blazed grating structure. The purpose of employing a blazed grating is to generate only the 0th order and 1st order diffraction beams, but other orders are inevitably generated, thereby causing undesired interference signals which can only be suppressed by disposing the third grating at a distance apart from the detector.

In the structure shown on page 49, the cross-section of the grating is a lamellar grating which generates 1st order and 0th order diffracted light. The diagram shows that three interference beams emerge from the third grating towards different directions, which different interference beams are spatially separated by the lens to respectively be incident on different light receiving elements.

The idea behind the arrangements in E2 is to spatially separate at a distant position the interference light obtained by the third grating from unnecessary interference light. In contrast, in the invention the third grating and the light-detecting element are integrated or the array-shaped light-detecting element is used, so that the interference fringes combined by the two diffraction gratings are detected while spatially scanning the interference fringe. In order to achieve this, the grating pitch on the light detecting element disposed at the position of the third grating must conform to the pitch of the interference fringe as an optimum configuration. In the embodiment of the

patent, since two light beams projected onto the position corresponding to the third grating are zero order and first order diffracted light, the pitch of the interference fringe coincides with the pitch of the third grating. In contrast, in the arrangement on page 49 of document E2, since two light beams projected onto the third grating are -1st order diffracted light and +1st order diffracted light, interference fringes with half pitch are projected. From this it follows that the optical arrangement of document E2 is completely different from the one in the patent.

As to document E3, this discloses a structure wherein a so-called talbot interference fringe directly projected to a space from slit rows is spatially scanned with the array shaped light-detecting element. This is a conventional detecting element in a typical encoder in which only light is directly projected from slit rows.

Since the concept in document E2 relies on separating the interference light beam obtained by the third grating from unnecessary light by detecting it at a spatially distant position it cannot be seen how this should be combined with the array-shaped light detecting element of reference E3 wherein the pitch of the sensor array must be optimised in correspondence to the structure of the employed optical system. Therefore a combination of documents E2 and E3 is not obvious.

Document E6 has been late submitted. According to the case law of the Boards of Appeal, new facts and evidence in appeal procedures are only admissible in very exceptional cases and if they are prima facie highly relevant. The appellant has not presented any

reason for the presence of such an exceptional case and it appears that this document could have been presented in the notice of opposition or during the opposition procedure. Finally the relevance of document E6 is not clear. Therefore it should not be admitted.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The support for the newly introduced features in Claim 1 with respect to the granted Claim 1 is indicated in point 3.1 of the Decision under Appeal. The appellant has not raised any objection against the introduction of these features and the Board does not have a reason to come to a different assessment.

3. *Patentability*

Since novelty of Claim 1 as maintained by the opposition division was not in question nor has been raised by the appellant, the only issue to be dealt with is inventive step.

3.1 Documents considered in the decision under appeal

3.1.1 In the decision under appeal the opposition division considered document E2 as the closest prior art. In the Grounds of Appeal the appellant made explicit reference to the reasoning in points 2.1 to 2.5 of the Grounds for the Decision.

The opposition division in this passage (implicitly, by making reference to its prior communication dated 28 July 2000, point 4.1.2) and the appellant (referring to this passage in the decision) based their analysis on inventive step on the embodiment in the Figure on page 49. Since -having regard to the documents available to the opposition division (documents E1 to E4)- the Board agrees that this embodiment forms the most promising starting point for the problem and solution approach, this embodiment forms the closest prior art.

3.1.2 The three-grating device on page 49 of document E2 comprises a light source (*Lichtquelle*); a first diffraction grating (*Aufspaltgitter*) for splitting beams from the light source, at least two diffracted beams being incident on the grating scale as the second diffraction grating (*Ablenkgitter*); and a third grating (*Vereinigungsgitter*), synthesising at least two beams of diffracted light from the grating scale. The device further comprises at least one light-detecting element (*Empfänger*).

3.1.3 The subject-matter of Claim 1 differs from the displacement detecting apparatus shown in the Figure on page 49 of document E2 in the following features:

(i) The light-detecting element comprises a grating unit being integrally formed on at least a part of the photoelectric conversion surface for detecting a beam from the grating scale, whereas in the embodiment on page 49 the third grating is

spatially separated from the detector with an interposed collimating lens; and

(ii) The grating scale is a reflecting type diffraction grating whereas the grating scale in the prior art arrangement is a transmission type grating, Claim 1 furthermore defining a requirement of the beam paths of the incident and diffracted beams of this reflecting grating.

3.1.4 According to the opposition division (point 3.3 of the Grounds) and the appellant in the Statement of the Grounds of Appeal, the technical problem underlying the above differences can be seen in providing a very compact displacement information detection apparatus. The appellant made reference to the Figure on page 47 of document E2, showing a grating arrangement with a reflecting grating wherein the incident and diffracted beam paths are different and to document E3, which, according to column 2, lines 18 to 21, addresses the problem to provide a compact arrangement and provides as a solution a detection apparatus with a grating integrated in the detector surface.

3.1.5 In reference E2 it is documented that in the field of interferometric displacement detection apparatuses both arrangements including transmission gratings (*page 49*) as well as those on the basis of reflecting gratings (*page 47*) were known. It is, however, not *a priori* clear in which way the skilled person would modify the transmission grating type apparatus on page 49 if he wished to replace the transmission grating scale by a reflecting one, since in the arrangement with the transmission grating the elements (light source,

collimator lenses, gratings and detectors) are positioned symmetrically with respect to the optical axis whereas the arrangement with reflecting grating (*only roughly sketched on page 47*) has not a symmetrical structure because the incident (*angle* α) and diffracted (*angle* q) beams are at different angles.

Furthermore, as pointed out by the respondent, the beams diffracted by the grating scale in the arrangement on page 49 are diffracted differently than in the device in the patent in suit. According to page 49, Section 4.2.1.1, at the grating scale the beams are diffracted at the double refraction angle, which leads to the requirement that this grating has half the grating period from the first (and third) grating, see page 50, equation 4.2.1.1.1. As a further consequence, the rays divergently diffracted by the scale grating are strongly sheared (*page 49, 2nd paragraph*). According to this passage, in the detection unit a collimator lens is employed, which has the function that at its rear focal plane the undesired rays form a fringe pattern with very high spatial frequency and same tilt, whereby their contribution to the signal is only an average signal which can be filtered out. Since in this arrangement the collimator lens has this important function it is not obvious why the skilled person would consider to eliminate it from the device.

3.1.6 With respect to document E3 which discloses an optical displacement detection apparatus including a scale grating and a further grating structure integrated with the detector the respondent has argued that this apparatus relies on the talbot effect. Indeed,

according to column 4, lines 50 to 55, the distance between the scale grating and the detector surface is critical and must be chosen in order that the 1st and 0th diffraction orders are displaced by one grating period. Therefore the underlying principle being the talbot effect (*i.e. self-interference of the beam transmitted by the scale grating*) the device in E3 does not involve a first grating as the device in document E2, page 49.

Hence, since the underlying optical principles of the arrangements in document E2, page 49, and document E3 are rather different, it is not clear how these teachings are combinable and it is not plausible that the skilled person *would* consider to combine them.

3.1.7 Therefore it is concluded that the subject-matter of Claim 1 as maintained by the opposition division is not derivable in an obvious way from documents E1 to E4 available at the oral proceedings before the opposition division.

3.2 Document E6 and its translation

3.2.1 This document has been late filed (Article 114 EPC) and the respondent has objected against its introduction into the proceedings, because, in its opinion, this document could have been cited already earlier in the opposition proceedings, no reason for its late filing being given, and its relevance was not clear.

3.2.2 The appellant reasons that the filing of document E6 is motivated by the argumentation of the patent proprietor during the oral proceedings before the opposition division that document E2 did not disclose an

arrangement with three individual gratings, which should apparently contribute to inventive step. A displacement detecting apparatus including such a three grating arrangement and working in reflection was disclosed in Figures 2A and 2B of document E6.

3.2.3 With respect to the question of whether document E6 should be admitted into the procedure the Board notes that it is the sole document on the file to disclose, in connection with a three-grating arrangement, the feature relating to the grating of the grating scale being a reflective type diffraction grating, which the opposition division in the decision under appeal relied upon to justify its conclusion that the claimed subject-matter involved an inventive step. Document E6 is therefore highly relevant.

It is not apparent from the file that the appellant had been made aware of the relevance of this feature in advance of the oral proceedings held before the opposition division, which in its summons of 28 July 2000 had still expressed the opposite view that the same subject-matter did not involve an inventive step.

The late-filing of document E6 therefore appears to be exceptionally excusable in the circumstances and the document can be admitted in the procedure, accordingly.

4. *Further prosecution*

4.1 Since, on the one hand, the documents available to the opposition division do not prejudice the maintenance of the patent but, on the other hand, it appears that, without going more into the merits of document E6, this

document appears to be highly relevant, it is concluded that the evidence forming the basis of the appeal proceedings has substantially changed.

4.2 The respondent requested that the case be remitted to the first instance if document E6 was admitted into the procedure, and the appellant did not object to this cause of action as envisaged by the Board in its Communication of 11 March 2004.

4.3 Therefore the Board in following the accepted practice of the Boards of Appeal remits the case to the first instance in accordance with Article 111(2) EPC for the assessment of patentability of the claimed subject-matter making due account of document E6 (including translation).

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 for assessment of patentability of the claimed subject-matter making due account of document E6.

The Registrar: The Chairman:

P. Martorana A. Klein