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**Datasheet for the decision
of 21 January 2010**

Case Number: T 1526/07 - 3.4.02

Application Number: 93110388.1

Publication Number: 0577088

IPC: G01D 5/38

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. 104

Relevant legal provisions (EPC 1973):

-

Keyword:

"Apportionment of costs (no)"

Decisions cited:

T 0847/93

Catchword:

-



Case Number: T 1526/07 - 3.4.02

DECISION
of the Technical Board of Appeal 3.4.02
of 21 January 2010

Appellant: DR. JOHANNES HEIDENHAIN GmbH
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Representative: -

Respondent: CANON KABUSHIKI KAISHA
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
3 July 2007 concerning maintenance of European
patent No. 0577088 in amended form.

Composition of the Board:

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

Summary of Facts and Submissions

I. The present appeal lies from the interlocutory decision of the opposition division dated 3 July 2007 on the maintenance in amended form of European patent 0 577 088.

II. During the first opposition proceedings the following documents had been considered:

(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

(E4) US-A-4 840 488.

III. In a first decision the opposition division had expressed the view that 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 in an obvious way from this combination of documents E2 and E3, 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 its appeal against this first decision (*appeal case T 0153/02*) the opponent had for the first time in the proceedings referred to the document:

(E6) JP-A-3 279 812.

According to the opponent, 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. Subsequently a translation of this document was filed which in the following shall also be referred to as "E6".

V. In this appeal case (T 0153/02), the board considered that because of these features disclosed in document E6 which the opposition division in the decision under appeal had relied upon to justify its conclusion that the claimed subject-matter involved an inventive step (*viz. a three-grating arrangement with a reflective grating*), document E6 appeared highly relevant. It was not apparent that the opponent had been made aware of 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. Therefore the late-filing of document E6 appeared to be exceptionally excusable in the circumstances and the document could be admitted in the procedure, accordingly. The patent proprietor requested that the case be remitted to the first instance if document E6 was admitted into the procedure. The board in following the accepted practice of the

Boards of Appeal remitted 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.

- VI. In its second decision dated 3 July 2007 - now under appeal - the opposition division found that claim 1 of the second auxiliary request then on file met the requirements of the European Patent Convention and that on this basis the patent could be maintained. Furthermore, on a request by the patent proprietor for apportionment of costs according to Art. 104 EPC the opposition division decided that the opponent had to pay the patent proprietor 50% of the costs incurred.
- VII. With a letter of 10 September 2007 the opponent filed an appeal against this decision and requested to revoke the patent in its entirety and to annul the decision of the apportionment of costs and, as an auxiliary request, oral proceedings. The grounds of appeal were filed on 25 October 2007.
- VIII. With a letter of 12 September 2007 the proprietor also appealed the decision and filed a new set of claims 1 - 15 which, together with the description and figures as granted, should form the main request. The auxiliary request included the documents of the interlocutory decision and a further request for oral proceedings. The grounds of appeal were filed on 9 November 2007.
- IX. The appellant/opponent (*in the following: opponent*) submitted further arguments in its subsequent letters dated 19 December 2007 and 9 June 2008.

- X. The appellant/proprietor (*in the following: proprietor*) filed further arguments in its letter dated 14 May 2008 and filed a new main request including claims 1 to 10 replacing its former main request. These claims were received by the board in a letter of 17 June 2008.
- XI. At the request of both parties the board issued on 24 September 2009 summons to oral proceedings on 21 January 2010.
- XII. In a letter dated 17 December 2009, the opponent submitted further arguments.
- XIII. During the oral proceedings, the proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of claims 1 - 10, dated 14 May 2008 (*main request*); on the basis of the documents as maintained by the opposition division (*first auxiliary request*); or on the basis of claims 1 - 7, description col. 1 - 22, all filed during the oral proceedings, drawings as granted (*second auxiliary request*). Furthermore it requested maintenance of the decision of apportionment of costs of the opposition division.

The opponent requested that the decision under appeal be set aside and that the patent be revoked; furthermore that the second auxiliary request be rejected as inadmissible because of its late filing and that the decision of apportionment of costs be set aside.

The wording of claim 1 of the proprietor's main request reads as follows:

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

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

at least one light-detecting element (45, 46; 50; 32B, 32C) 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) 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 and a light blocking portion in 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 ".

Claim 1 of the first auxiliary request 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, 102C; 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;

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 grating portions of said grating unit are formed, immediately or laminatedly, on the surface of a light-translucent resin (106) which air-hermetically seals said light-detecting element, 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 ".

Claim 1 of the first auxiliary request 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, 102C; 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;

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 grating portions of said grating unit are formed, immediately, on the surface of a light-translucent resin (106) which air-hermetically seals said light-detecting element, 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".

Claims 2 to 7 of this request are dependent claims.

XIV. The arguments of the opponent may be summarised as follows.

Claim 1 of the main request is objectionable under Art. 123(2) EPC because of the amendment "...and a light blocking portion in the pitch" which should apparently define that the third grating is an amplitude grating having light transmissive and light blocking portions and should, according to the proprietor, exhibit a "shutter effect". Such a shutter effect is, however, only disclosed for the examples in Figures 3 - 5, which relate to examples not falling within the scope of the present claim because these do not show a three-grating configuration. The basis of a three-grating configuration in the description is rather found in Figure 14 including the examples in Figures 7A - 13C and in Figures 16 to 26. In the context of these examples the description invariably uses the term "diffraction gratings", see in particular col. 18, l. 12 - 17. Also the examples in Figures 11a and 11b explicitly disclose phase diffraction gratings which do not have any "shutter effect". Furthermore, claim 1 and also the description, see col. 16, l. 21, define that a synthesis of the diffracting beams to obtain an interference beam is the underlying process and consequently the claimed apparatus does not involve a shutter effect. Therefore the original patent specification does not include an embodiment in which the third structure only comprises light transmissive and blocking portions without being a diffraction grating, contrary to Art. 123(2) EPC. Furthermore, this claim also contravenes Art. 123(3) EPC because of the passage "in the shape of a grating whose" which has

been removed from claim 1 as granted. According to the granted claim 1 the light transmissive portions were arranged in the shape of a grating whereas the present claim only requires light transmissive and blocking portions arranged at certain distances. Therefore the present claim is broader than claim 1 as granted, contrary to Art. 123(3) EPC.

With respect to the issue of patentability document E6 shows in Fig. 2b a top view of the grating unit 3 of Fig. 2a with respective gratings 31a and 31b. This Figure clearly reveals light and dark portions of this grating, i.e. an arrangement of light transmissive and blocking portions. In this respect document E6 explicitly discloses on page 18, penultimate paragraph, that the gratings may be phase or amplitude gratings. Also a comparison of Figure 2A of E6 with Figure 16 of the patent in suit immediately shows that these three-grating displacement detecting devices have identical structures. Therefore the newly introduced feature does not render the subject-matter of claim 1 novel (Art. 52(1) and 54 EPC).

Claim 1 according to the first auxiliary request is identical to claim 1 maintained in the decision under appeal. In point 3.2 of its decision the opposition division considered that the subject-matter of this claim differed from the closest prior art in document E6 in that the grating unit is formed, immediately or laminatedly, on the surface of a light-translucent resin which air-hermetically seals the light detecting element. It was also recognised that document E4 described such grating portions laminatedly formed on the surface of a light-translucent resin sealing a

detector element. According to the opposition division the skilled person would not have had an incentive to implement this structure known from document E4 in the detector unit shown in document E6, because the grating structures of the displacement apparatus in E4 (two-grating arrangement) was different from the one in E6 (three-grating arrangement) and because E6 disclosed that the detector should be arranged at a distance of the rating unit to avoid cross-talk.

However, starting from the apparatus of E6, the technical problem addressed by the features of this claim 1 resides in obtaining a compact sensor head, see col. 17, l. 31 - 43 of the patent specification. This technical problem is not related to the particular grating arrangement. Rather, document E4 discloses in Figure 10 and the corresponding description in col. 13, l. 66 to col. 14, l. 13 explicitly that such an integral bonding of the grating member to the receiver unit renders the device more compact and improves its stability. Such a compact structure would not be in conflict with the aim of suppressing undesired interference orders which the skilled person could solve by additional spatial measures such as the additional grooves 161 shown in Fig. 23 of the patent.

Therefore the subject-matter of this claim results in an obvious way from the combination of the teachings of documents E6 and E4, or, alternatively, of E6 and E1, which document similarly discloses a photodetector 23 enclosed in a resin block and a grating 20 fixed onto the resin block.

In the opinion of the opponent the second auxiliary request is late filed, see the last Communication by the board according to which any amended requests should be filed at least one month before the date of the oral proceedings. Therefore this request should not be admitted into the proceedings.

Finally the decision of the opposition division relating to the apportionment of costs is not justified: the introduction of document E6 in the first appeal by the opponent had been in reaction of the completely unexpected and surprising change in the position of the opposition division during the first oral proceedings which, in its Summons of 18.07.2000, had expressed its opinion that the claims of all requests then on file did not present patentable subject-matter having regard to the cited documents, in particular E2 and E3. Therefore the present situation resembles the one in the appeal case T 0955/99, in which the board in point 8 considered that the introduction in the grounds of appeal of a new document in reaction of the reasoning of the opposition division and a remittal of the Case to the first instance should not lead to a deviation of the provision of Article 104(1) EPC according to which each party to the opposition proceedings should bear the costs it has incurred.

XV. The arguments of the patent proprietor may be summarised as follows.

The opponent has objected under Art. 123(2) EPC that the amended feature of claim 1 of the main request "...and a light blocking portion in the pitch" would only

be based on Figures 3 to 5, because only these Figures would disclose a shutter effect and that Figures 7 to 14 and 16 to 26 disclose a beam combining effect which would exclude a shutter effect. This opinion is based on a misconception, in particular, the slit rows 45a and 45b in Fig. 6 have a light blocking portion in addition to the light transmission portion and have the same pitch as the interference fringes. Furthermore, the examples in Figures 7 - 10 show that the grating unit may also be comprised of a remaining resist or aluminium, see col. 9, l. 33 to 36. Finally col. 10, l. 21 - 25, l. 37 - 42 and l. 49 - 51 in conjunction with Figs. 8B, 9B and 10B define that the diffraction gratings may also be formed as aluminium wiring patterns, which is a non-transparent, i.e. light-blocking material.

The further objection under Art. 123(3) EPC is contested since the expression that the grating unit "has a light transmission portion and a light-blocking portion in the pitch of the interference fringe..." unambiguously defines that these portions are arranged in the shape of a grating, therefore the protection conferred by the objected expression in claim 1 is exactly the same as that by the former expression.

With respect to the issue of novelty of claim 1 of the main request the opponent has referred to the displacement detecting device in Figure 2A of document E6, arguing with reference to Figure 2B that the grating structures 31A and 31B would be amplitude gratings. However, this conclusion cannot be drawn from E6: rather p. 8, last paragraph, and p. 8, first two paragraphs of the translation clearly disclose that the

grating structure 31A and 31B comprises a phase or transmission grating. The further passage on p. 18, penultimate paragraph, is merely a general declaration of possible alternatives, which, however, are not included in the embodiment of Fig. 2A. Therefore already by virtue of the feature "light transmission" and "light blocking" portions and the corresponding shutter effect the subject-matter of this claim is novel. Moreover, the proprietor disputes that document E6 discloses the feature that a grating unit is integrally formed on at least a part of the photoelectric conversion surface: in its decision the opposition division had given this expression a very broad interpretation in order for it to comply with all the examples given in the patent specification, however the skilled person would use the description of the patent specification for interpreting this term and conclude that the grating unit in the device of document E6 is not integrally formed with the detector.

As regards inventive step, the problem addressed in the invention is related to the miniaturization and precise adjustment of the components in assembling the apparatus, see col. 2, l. 8 - 14. The solution to this problem is defined by the technical features of claim 1 of the main request, in particular by the grating unit being integrally formed on the surface of the detector and by this unit having the light transmission and light blocking portions. This enables a compact structure. In the structure shown in document E6, the optical paths of the two diffracted lights are combined by the action of the diffraction grating 31a of the transmission scale 3, but diffracted lights of other, undesired, orders are caused at the same time. In order

to prevent these from entering the detector it is necessary to ensure some distance between the transmission scale 3 and the detector 5a, see p. 13, first three paragraphs of E6. In contrast to the structure shown in document E6, according to the present invention, the grating unit merely functions as a shutter. For this reason, a distance between the grating unit and the light-detecting unit can be greatly reduced so as to even enable the grating unit and the light-detecting unit to be disposed in contact with each other. Thus, the optical path length can be reduced so as to realize a compact apparatus. In contrast, the teaching of document E6 rather leads away from the solution as claimed. Therefore, the subject-matter of claim 1 also involves an inventive step with respect document E6. Further, there are no other documents which could serve to resolve the above-mentioned differences between the present invention and document E6 in an obvious way.

Claim 1 of the 1st auxiliary request corresponds to the claim maintained in the decision under appeal. This claim defines the further features that grating portions of the grating unit are formed, immediately or laminatedly, on the surface of a light-translucent resin which air-hermetically seals the light-detecting element. Document E6 relates to an encoder having a reflective type diffractive grating in a three-gratings optical arrangement and teaches that the detector should be distanced from the grating unit in order to avoid detection of undesired interference orders. On the other hand, document E4 discloses a quite different encoder having a transmissive type diffraction grating in a two-grating arrangement. According to the

opposition division, since the types of apparatuses are rather different and since the problem of detecting undesired interference orders is not addressed in E4 the skilled person would not have an incentive to combine the teachings of E6 and E4. The opponent's argument that when combining the teachings of E6 and E4 the skilled person could solve the undesired interference orders at the detector by additional spatial measures such as the additional grooves 161 shown in Fig. 23 of the patent is rebutted, since the only such "elements" in document E6 are either stops or cylindrical screening elements (see p. 13, l. 30 to p. 14, l. 3) which are introduced into the optical path between the third grating and the light detecting element. Thus, these "elements" could only be construed to a pointer in a direction opposite to the teaching of document E4, since the skilled person would refrain from reducing the distance between third grating in that document and light detecting element. The same holds for documents E1 or E3 since these documents do also not teach a solution of overcoming the problem in document E6 that the grating unit and the detector must be arranged at a distance for avoiding the detection of unwanted interference orders.

Claim 1 according to the 2nd auxiliary request defines the further restriction that the grating units are formed immediately on the surface of a light-translucent resin. As explained in col. 17, l. 31 - 43 of the patent specification, this arrangement renders the device still more compact and with a positional relation between the elements which is hard to change after the formation and therefore very stable. None of the cited documents teaches or suggests such a measure.

For the question of apportionment of costs it is decisive whether document E6 is prima facie (i.e. without any further examination) highly relevant and whether the late filing of this document opened a so-called "fresh case", i.e. the appeal is based on a new case entirely different from that of the decision under appeal (cf. also T 847/93, item 3, cited by the opposition division). In the present case, late-filed document E6 became the new closest prior art in the appeal proceedings. Hence, a fresh case was opened and therefore, document E6 is insofar prima facie highly relevant. It is to be noted that the decision of the board of appeal dated June 21, 2004, reasons for the decision, item 4.1, confirms that late-filed document E6 leads to a fresh case. Thus, the decision on apportionment of costs is fully justified. Contrary thereto, in the decision T 955/99 cited by the opponent, a late-filed document was deemed relevant, but not prima facie highly relevant (cf. T 955/99, item 7). That is, since a timely filed closest prior art document remained the closest prior art, no fresh case was opened in the appeal proceedings. The arguments of the opponent can only be construed to constitute mitigating circumstances. However, the opponent was only apportioned 50%, not 100%, of the costs incurred by the remittance to the opposition division and was therefore already admitted to have such mitigating circumstances.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 *Amendments*

2.1.1 Claim 1 of this request differs from claim 1 of the patent as granted in that the final part of granted claim 1

"(...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"

now reads:

"(...and) has a light transmission portion ~~in the shape of a grating whose pitch is the same as~~ and a light blocking portion in 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 " .

The passage "in the shape of a grating whose pitch is the same as" shown in ~~strikethrough~~ is no longer included in the claim. The passages shown underlined are added to the claim. Of these the final part of the claim ("...and wherein ...each other") had not been objected to.

2.1.2 With respect to the added feature "*light transmission portion and a light blocking portion*" the opponent has argued that the purported "shutter effect" had only been disclosed in the context of Figures 3 - 5, showing light receiving means of the encoder apparatus of Figure 2, which, however, does not falls within the scope of the claims. Therefore the definition of these features for the three-grating encoder device in claim 1 constituted subject-matter extending beyond the application originally filed (Art. 123(2) EPC).

2.1.3 It is correct that the originally filed patent application includes the example in Figure 2 as "the first embodiment" (*col. 4, l. 25 - 29 of the published A2-application*) and that the detection principle in this example was shadow-casting of the rays passing the slit-row 4a, which, together with the slit-row 5a on the light receiving means 5, produced a "shutter effect" (*col. 5, l. 1 - 6 of the A2-publication*) in a proximity-configuration of these respective slit-rows. Therefore the only disclosure of this "shutter effect" is for the case of a combined slit-row in the scale and slit-row on the light receiving detector surface: indeed the remainder of the original description does

not disclose a detection principle based on a "shutter effect" produced by a proximity shadow-casting, rather the further Figures 6, 14, 16, 18, 19, 21, 23 and 25, all based on three-grating arrangements, clearly show that the light pattern incident onto the detector unit is an interference pattern produced by "synthesizing two beams of diffracted light from the grating scale" and by "diffraction by the second diffraction gratings traveling via a second light path towards the grating unit", as defined in the independent claim.

2.1.4 Therefore the board does not concur with the opponent that the definition of the grating unit in terms of a light transmission portion and a light blocking portion would constitute new subject-matter involving a "shutter", rather the new definition is simply a limitation of the grating to an amplitude grating, whereas the former definition also included a phase or transmission grating (*disclosed in the context of Figures 11A and 11B, see col. 11, l. 1 - 8 of the patent specification*). Since the disclosure reveals numerous examples for such amplitude gratings used in the three-grating device the amendment does not involve subject-matter which had not been originally disclosed. Therefore the amendment is not objectionable under Article 123(2) EPC.

2.1.5 With respect to the deleted feature that the grating unit "has a light transmission portion in the shape of a grating..." the opponent has objected that the present wording is broader than that in the granted patent, contrary to the provisions of Article 123(3) EPC. However, claim 1 requires that the grating unit comprises light transmission and light blocking

portions arranged in a particular pitch. As explained before, these features in context exactly define an amplitude grating which indeed has "light transmission portions in the shape of a grating". Therefore the amendment does not result in an extension of protection and is not objectionable under Article 123(3) EPC.

2.2 *Patentability - Novelty*

2.2.1 From comparing the respective devices in Figure 16 of the patent and Figure 2A of document E6 the opponent has argued that the subject-matter of claim 1 was known from this document. According to the opponent this conclusion was corroborated by the grating structure of grating 30 in Figure 2B of E6, which showed light and dark portions, and by the penultimate paragraph on p. 18 of the translation, which disclosed that alternatively phase gratings or amplitude gratings could be employed. This view was disputed by the proprietor, who furthermore held that the feature "a grating unit being integrally formed on a part of the detector surface" was not known from the apparatus in Fig. 2A of document E6.

2.2.2 In point 1.1 of the Grounds for its decision the opposition division had identified the following features of claim 1 of the then-main request in document E6 (*references in parenthesis applying to E6*):

- An apparatus for detecting information relating to displacement of an object (cf. p. 1, l. 5 - 7 and p. 5, l. 19 - 22 of the description) on which a grating scale (4) is affixed, comprising:
 - a beam-emitting system (1, 2) for irradiating the grating scale (4) with a beam (L) and having a light

source (1); and

- at least one light-detecting element (5a, 5b) having a photoelectric conversion surface (cf. p. 12, l. 1) and a grating unit (31a, 31b) which, according to the opposition division, was integrally formed on at least a part of the surface of said photoelectric conversion surface (cf. p. 13, l. 30 to p. 14, l. 3) for detecting a beam from the grating scale (4) which is irradiated by the beam (L) from the beam-emitting system (1, 2); wherein

- the beam-emitting system (1, 2) further has a first diffraction grating (3) for splitting beams from the light source (1), at least two beams of diffracted light (L(-1), L(1)) from the first diffraction grating (3) are incident on the grating scale (4) as a second diffraction grating (40); and wherein

- the grating unit (31a, 31b) synthesizes at least two beams of diffracted light (L(-1, 1), L(0, -1)) from the grating scale (4) and has a light transmission portion in the shape of a grating (cf. p. 8, l. 34 - 36) whose pitch (P) is the same as the pitch (P) of the interference fringe formed by at least two beams of diffracted light from the grating scale (4) and an information relating to displacement of the object is detected on the basis of detection by the light-detecting element (5a, 5b, cf. p. 12, l. 1 - 4), and wherein

- the light split by the first diffraction grating (3) travels via a first light path (L(-1), L(1)) towards the grating scale (4) as a second diffraction grating (40), the second diffraction grating (40) being a reflection type diffraction grating (p. 8, l. 20 - 21), and

- the light diffracted by the second diffraction

grating (40) travels via a second light path (L(-1,1), L(1,-1)) towards the grating unit (31a, 31b), the first and second light paths being different from each other (Fig. 2a).

2.2.3 Present claim 1 of the main request differs from the former claim in that the feature "said grating unit ...has a light transmission portion in the shape of a grating whose pitch is the same as the pitch of the interference fringe..." has been replaced by the expression "said grating unit ...has a light transmission portion and a light blocking portion in the pitch of the interference fringe...". As discussed in the context of Article 123 EPC *supra*, by virtue of the new expression the grating unit now comprises an amplitude grating. The opponent has argued that the device shown in Fig. 2A of E6 includes an amplitude grating, referring to Fig. 2B and p. 18, penultimate paragraph. The board does not concur with this position because of the following passages in E6: on p. 8, penultimate paragraph, the German translation of E6 refers to the "transmitting" or "transparent" arrangement 3 ("durchlässige Einteilung") and discloses in the subsequent paragraph bridging pages 8 and 9 that the diffraction gratings 30, 31a, 31b and 40 on the arrangements comprise pitches of "concave" and "convex" portions with equal widths. The terms "concave" and "convex" are probably an attempt to describe the corrugated grating structure shown in Fig. 2A, wherein the height of the corrugations or "steps" indicates the provided phase differences. This corrugated structure should be compared with the gratings 40, 30, 31a and 31b in the embodiment of Fig. 5 which are amplitude gratings having transmitting and blocking portions (see

p. 17, first paragraph). As is readily visible, the gratings shown in Fig. 5 do not have the corrugated structure as the ones in the embodiment in Fig. 2A but rather a striped pattern indicating the blocking portions. Also the board does not follow the interpretation of the opponent that the top view of the grating shown in Fig. 2B would imply an amplitude grating structure, rather the light/dark passages designate the different phase portions of the "durchlässige Einteilung 3" (see the paragraph bridging pages 10 and 11). It is recognised that E6 discloses on p. 18, penultimate paragraph that the gratings in the embodiments of E6 may comprise an arbitrary combination of phase gratings or amplitude gratings, however, the explicit embodiment of Fig. 2A discloses the use of transmission gratings.

2.2.4 The proprietor furthermore disagreed with the assessment by the opposition division of the feature "...a grating unit being integrally formed on at least a part of the surface of the photoelectric conversion surface". According to the division in point 1.2 of the Grounds of the decision the example shown in Fig. 16 of the patent shows gratings being formed on a translucent resin containing the light-receiving elements, therefore the gratings are not directly formed on the surface of the photoelectric elements but can be located away from this surface. The opposition division concluded that the wording "integrally formed" would not have any particular limiting meaning (point 1.3).

2.2.5 The board does not share the position that the expression "integrally formed" does not have any particular limiting meaning: indeed the embodiment in

Fig. 16 does not literally support an "integral" arrangement of the grating on the detector surface, nor does the embodiment in Fig. 18 in which the gratings are deposited onto a glass substrate which, in a subsequent step, is bonded onto the resin encasing the detector elements. However, having regard to the respective arrangements in all the Figures of the patent specification this expression can at least be construed as implying that the grating unit and the detector are arranged somehow in a fixed, permanent position with respect to each other. When construing this expression in this sense and comparing it with the arrangement in Fig. 2A of E6 it appears that the respective elements 30 (grating), 5a and 5b (detectors) as well as the further components 1 (light source) and 2 (collimator lens) are only schematically indicated, without any fixed spatial relationship. In the description on p. 13 document E6 discloses that the diffraction gratings 31a and 31b are arranged at a distance from the detectors 5a, 5b, which distance may be reduced if spatial filtering components ("Blenden mit bestimmter Öffnungsform oder zylinderförmige Abschirmungselemente") are included. It is concluded that document E6 does not provide any information on the mounting or fixation of the components in the apparatus and that this document does not disclose that the grating unit is "integrally formed" on the detector surface, even when using the expression in a broader interpretation.

- 2.2.6 Since document E6 is the only prior art document disclosing a three-grating arrangement it follows that the subject-matter of claim 1 of the main request is novel.

2.3 *Inventive step*

2.3.1 It is undisputed amongst the parties that document E6 discloses the closest prior art. The subject-matter of claim 1 of the main request differs from the three-grating arrangement in Fig. 2A of this document in the following features:

i) the (third) grating has a light transmission portion and a light blocking portion in the pitch of the interference fringe formed by the diffracted beams, i.e. this grating is an amplitude grating with a predetermined pitch; and

ii) the grating unit is integrally formed, i.e. grating unit and the detector are arranged somehow in a fixed, permanent position with respect to each other.

2.3.2 According to the proprietor, the underlying technical problem may be seen in a miniaturization of the device and the precise adjustment of the components. In its opinion, the skilled person would not consider to modify the arrangement in Fig. 2A of document E6, because this document teaches on page 13 of the translation that the detector must be arranged at a distance of the gratings 31a and 31b, which recombine the incident diffracted beams from scale 40 and in which process further undesired interference beams are generated (beams labelled I_{N1} , I_{N2} , I_{N3} , I_{N4} in Fig. 2A) which should be prevented from reaching the detector surface. The proprietor has argued that this problem would not arise in the claimed device because the amplitude gratings would function as a shutter.

2.3.3 The board does not concur with this argument: in the three-grating arrangement of the apparatus disclosed in the patent in suit the pitches of the first, second and third gratings are equal (see, for instance, col. 7, l. 22 - 47; and col. 12, l. 28 - 31 of the patent specification). The device in Fig. 2A of E6 has the same property, since the Figure shows that the scale 40 and the gratings 30, 31a, 31b have equal pitches labelled as "P". Furthermore the optical lay-outs of both devices between the light source and the third gratings are the same. Therefore the interference pattern of the beams, after being diffracted by the second grating (*moving scale*) and incident to the third grating is also the same. It is correct that claim 1 now requires that the third grating is an amplitude grating, whereas in the embodiment shown in Fig. 2A of E6 the third grating is a transmission grating. However, contrary to the line of argument of the patent proprietor, this third amplitude grating in the claimed device does not function as a shutter: rather, this third amplitude grating has the same periodicity in its structure (pitch) as the first and the second gratings, which also applies to the gratings of the device in Fig. 2A of E6. Therefore in both devices the incident diffracted beams are again diffracted by the periodic structure of the third gratings and generate further, undesired, interference beams. In fact, this phenomenon is acknowledged in the patent specification, see col. 18, l. 17 ("*and other beams, of which the (-) first order diffracted light R_0^{+1} is taken out vertically from the diffraction grating surface...*"). Since the patent does not disclose any technical measures for preventing the detection of these spurious diffraction orders (*the grooves in the arrangement of*

Fig. 23 and the absorbing bumps in Fig. 25 serving the different purpose of reducing scattered light) it is concluded that the claimed arrangement has been optimised to render it more compact but at the cost of detecting spurious interference signals.

2.3.4 With respect to feature i), it follows from the above discussion that the skilled person could select the third grating either as a phase or as an amplitude grating because both types of gratings enable the recombination of the diffracted beams from the second grating. This conclusion is corroborated by the disclosure in the patent specification according to which the phase gratings shown in Figures 11A and 11B were considered as a viable alternative of the other (amplitude) gratings shown in Figures 7A to 13C (see *col. 14, l. 58; and col. 15, l. 9*). Similarly, document E6 explicitly discloses that both types of gratings may be employed (*p. 18, penultimate paragraph*). Therefore the selection of an amplitude grating as the third grating is an obvious alternative.

2.3.5 With respect to the second feature that the grating unit is integrally formed, i.e. grating unit and the detector are arranged somehow in a fixed, permanent position with respect to each other, it is observed that whereas Fig. 2A of E6 does not disclose any constructional details, the paragraph in the translation of E6 bridging pages 13 and 14 teaches that the device can be easily made more compact by reducing the distance between the gratings 31a, 31b and the detector. It is also observed that it is generally known in the technical field of displacement detection devices working on the principle of interference

gratings to render the grating/detector unit in a compact form, see document E1, Fig. 5; document E3, Figure 1; and in particular document E4, Figure 10. In the latter document, col. 14, l. 9 - 13, it is disclosed that "...the light receiver 20 is integrally bonded to the second member (=grating) so that further rendering the device compact in size an improved stability can be achieved". Therefore, in its aim to render the arrangement of Fig. 2A of document E6 more compact, as already suggested on p. 14, first line of this document, the skilled person would consult other prior art documents in the same technical field disclosing solutions for compact arrangements and consider to integrally bond the third grating to the detector in the same way as disclosed in document E4.

2.3.6 The proprietor has objected that the skilled person would not consider deviating from the teaching of E6 to maintain a distance between the third grating and the detector in order to prevent the detection of spurious signals. However, to the understanding of the board this document E6 offers different solutions for suppressing spurious interference signals: firstly by selecting a distance between the components; alternatively by providing diaphragms or other stops. In any case the desirability of having a compact device is emphasised. On the other hand, it follows immediately to the skilled person that if he is satisfied with the quality of the detection signal including the spurious signals or accepts the disadvantage of having the undesired signals in the detector at the cost of a lower signal-to-noise ratio he may consider reducing the distance between the third grating and the detector even further. Therefore, to

the conviction of the board, the choice made in the apparatus defined in claim 1 of the main request, namely constructing a device which is compact but suffers from the disadvantages inherent in such a compact structure, does not involve an inventive step.

2.3.7 The proprietor has also argued that the skilled person would not consider a combination of documents E1 or E4 with E6, because these documents would concern quite different types of encoder devices. The board does not find this argument persuasive, since the technical problem, starting from the closest prior art in document E6, is not related to a particular grating arrangement, rather the question concerns how to integrate the individual components of the detector module (gratings 31a, 31b; collimator lens, light source and detectors) in one compact unit. Since, irrespective of the particular optical lay-out of the displacement device, a detector module is common to these devices, the skilled person would generally consider all suitable detector modules in this technical field.

2.3.8 It is concluded that the main request is not allowable.

3. *First auxiliary request*

3.1 *Amendments*

Claim 1 of this request is identical to the one maintained in the decision under appeal. Neither the opposition division, nor the parties had any objections to its formal admissibility. The board does not see any reason for a different assessment.

3.2 Patentability

3.2.1 Claim 1 of this request differs from that of the main request in that the type of grating (*phase-transmission or amplitude*) is not defined, and that the claim includes the additional feature: "wherein grating portions of said grating unit are formed, immediately or laminatedly, on the surface of a light-translucent resin which air-hermetically seals said light-detecting element" "

3.2.2 The arguments of the proprietor in favour of the independent claim according to this request (*the skilled person being discouraged by the disclosure in E6 to reduce the distance between the third grating and the detector; and a non-combinability of documents E6 and E4*) have been addressed in the context of the main request *supra* and are not persuasive. Rather, in order to obtain a compact light-receiver module having a simplified construction the skilled person would follow the teaching of document E4, which in col. 13, l. 66 - col. 14, l. 12 refers to such an embodiment. In particular, as shown in Figure 10 and disclosed in col. 11, l. 1 - col. 12, l. 23, a grating unit 16 is formed on a glass body, called "second member 14" and this second member is fixed onto a resin mould 39 in which the light-detecting elements 34A - 34E are integrally bonded, viz. air-hermetically sealed (see *Fig. 10 and col. 12, l. 20 - 23*). Thus, by realising the light receiver module comprising the third grating and the light detector in the arrangement of Fig. 2A of document E6 according to the teaching of document E4 the skilled person would arrive at the subject-matter

of claim 1 of the auxiliary request without an inventive step being involved.

4. *Second auxiliary request*

4.1 *Amendments*

Claim 1 of this request differs from claim 1 according to the first auxiliary request in that grating portions of the grating units are formed immediately on the surface of a light-translucent resin which air-hermetically seals the light-detecting element.

4.1.1 This request had been filed at the oral proceedings before the board. The opponent had objected that this request had been late filed and was therefore not admissible.

4.1.2 However, this amendment merely involves the deletion of one of the alternatives "immediately" or "laminatedly" in the former claim and therefore a further limitation of the claimed subject-matter. Such an attempt of overcoming an objection to lack of patentability by further limitation is not uncommon during oral proceedings and the question of admissibility of such a request is often assessed by considering, whether the actual amendment would cause particular understanding problems. In the present case the board does not see that the amendment would be problematic, nor did the opponent present any such arguments. Therefore the request is formally admissible.

4.2 Patentability

4.2.1 In support of claim 1 of this request the proprietor has referred to col. 17, l. 31 - 43 of the patent specification. Here it is disclosed in the context of the embodiment in Fig. 16 that if the diffraction gratings are formed on the surface of the package (*i.e. the resin 106*) they are formed with high precision and that the positional relation between the gratings and the light-receiving portions is hard to change after formation. Therefore the further technical problem addressed by this claim may be seen in rendering the light-detecting module of the displacement detecting device more compact and stable against mutual misalignment or mutual shifts.

4.2.2 At the oral proceedings the opponent has not provided further arguments against the patentability of the subject-matter of this claim. With respect to the embodiment in Fig. 10 of document E4 it has already been discussed in point 3.2.2 *supra* that the optical gratings are formed on the second member 14, which is made of glass. Subsequently this structure is bonded (*i.e. laminated*) to the resin mould 39 containing the photoelectric elements. Therefore in this embodiment the portions of the grating unit are formed laminatedly on the resin, because the gratings are formed on a laminate comprising the glass carrier. This document does not disclose or suggest an alternative formation of the gratings immediately on the resin surface.

4.2.3 Hence the subject-matter of this claim is not suggested by a combination of documents E6 and E4, nor was any other combination of prior art documents proposed which

would lead to the claimed subject-matter in an obvious way. The board therefore concludes that the subject-matter of claim 1 of this request involves an inventive step. Claims 2 - 7 of this request as appended to claim 1 also meet the requirements of Articles 52(1) and 56 EPC.

5. *Apportionment of costs*

5.1 In point 4.3 of its decision relating to apportionment of costs the opposition division had made reference to the board's decision in the first appeal and stated "It is noted that the Board of Appeal stated in its decision that the late filing of E6 was considered "exceptionally excusable. This is not a clear indication that apportionment of costs could not be justifiable in this case" (*emphasis by the board*). In the subsequent point 4.4 the division, noting that the case law on apportionment of costs in case of (un)justifiable late-filing of relevant documents was not unitary, referred to decision T 847/93 for motivating its decision that the opponent was charged with 50% of the costs incurred by the proprietor.

5.2 The board concurs with the opposition division that since the question of late submissions in each and every opposition or appeal case is unique it may be difficult to compare a particular case with earlier case law decisions. However, the standard principle in the Convention cast in Article 104 EPC is that each party to the proceedings shall meet the costs he has incurred *unless* a decision of an opposition division or board of appeal, for reasons of equity, a different apportionment. The board in its present composition

considers that the tenor of this Article implies that an apportionment of costs different from that foreseen in this Article should only be contemplated if there are strong reasons.

5.3 The decision T 847/93 cited by the opposition division and the proprietor may, at first glance, concern a situation similar to the present case. Yet, in that decision the board in point 3 of the Reasons explained "However, the present case is similar to the case reported in decision T 101/87 of 25 January 1990, unpublished (see point 6 of the reasons), cited by the Respondent, in that the present Statement of Grounds of Appeal makes no substantiated criticism of the reasons for the decision of the Opposition Division but relies only on new prior art documented in said statement...".

5.4 The circumstances of the present case differ from the situation in T 847/93 that the appellant in the first appeal case (T 0153/01) in its letter of 30 January 2001 in fact had dealt with the reasoning of the opposition division in the first decision; in its opinion, the reasoning that claim 1 of the patent as granted (main request) was obvious over the teachings of documents E2 and E3 would equally be valid for claim 1 of the auxiliary request, allowed by the division. Indeed the new document E6 had been newly cited by the opponent in the grounds of appeal to refute the division's position that three-grating arrangements including a reflective grating were not known in the art.

5.5 Furthermore, the board's decision to remit the case to the first instance had also been motivated by the

proprietor's auxiliary request for remittal in case the new document was admitted into the procedure.

5.6 Therefore in the present situation the board does not see a compelling ground to deviate from the provisions of Art. 104(1) EPC that, as a rule, each party shall meet the costs it has incurred and also this part of the decision is set aside.

6. Accordingly, taking into consideration the amendments made to the patent, the patent and the invention to which it relates meet the requirements of the Convention. The patent as so amended can therefore be maintained (Article 102(3) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:
 - claims 1 - 7 and description col. 1 - 22, all filed as amended second auxiliary request during the oral proceedings;
 - drawings, as granted.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein