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Datasheet for the decision of 16 November 2017

Case Number: T 1728/12 - 3.4.01

Application Number: 07075901.4

Publication Number: 1912276

IPC: H01P1/17, H01P1/18

Language of the proceedings: EN

Title of invention:
Quarter wave plate

Applicant:
MBDA UK LIMITED

Headword:

Relevant legal provisions:
EPC 1973 Art. 76(1), 123(2), 84, 83, 54(1), 54(2), 56

Keyword:
Divisional application - added subject-matter (no)
Inventive step - (yes)
Sufficiency of disclosure - (yes)

Decisions cited:
T 0667/08, T 0542/94, T 0088/95

Catchword:

Europäisches Patentamt
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Office européen des brevets

Beschwerdekammern

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Case Number: T 1728/12 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 16 November 2017

Appellant: (Applicant)	MBDA UK LIMITED Six Hills Way Stevenage, Hertfordshire SG1 2DA (GB)
Representative:	Lewis, Debra Louise BAE Systems plc Group Intellectual Property Department P.O. Box 87 Warwick House Farnborough Aerospace Centre Farnborough Hampshire GU14 6YU (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 March 2012 refusing European patent application No. 07075901.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Assi
Members:	P. Fontenay
	J. Geschwind

Summary of Facts and Submissions

I. The examining division refused European patent application No. 07 075 901 that had been filed as a divisional application of the earlier parent application No. 99 310 081.

II. In the "*Reasons*" for the decision, the examining division held that amendments to independent claims 1 and 8 according to the single request then pending introduced subject-matter extending beyond the content of the earlier application as filed, thus contravening the requirements of "*Art. 123(2) EPC*" (cf. point 2 below).

The examining division further held that claims 1, 4, 5 and 8 were not clear contrary to Art. 84 EPC.

Moreover, the subject-matter of independent claims 1 and 8 was not inventive in the sense of Art. 56 EPC. Particular reference was made in this respect to documents:

D1: L. L. Goldstone, IBM Technical Disclosure Bulletin, "*Circular Polarizer For Microwave Transmission*", Vol. 22, N° 9, February 1980,

and

D2: US-A-4 551 692.

Document D1 was considered to illustrate the closest prior art to the claimed invention.

III. The appellant (applicant) filed an appeal against the decision to refuse the application.

The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of a set of claims according to a main request or auxiliary requests 1 to 3, as filed with the statement of grounds.

IV. According to a further auxiliary request, a summons to attend oral proceedings on 21 November 2017 was issued.

V. In a communication pursuant to Art. 15(1) RPBA, the appellant was informed of the provisional opinion of the Board with regard to the requests then pending.

The amendments introduced by the applicant with a letter dated 27 July 2010, which had been considered by the examining division in the decision under appeal to extend beyond the content of the earlier parent application No. 99 310 081, had been deleted, so that there was no need to rule on this aspect of the impugned decision. The reference to Art. 123(2) EPC instead of Art. 76(1) EPC as legal basis for the raised objection was incorrect but, as such, without any adverse consequence for the appellant (cf. decision T 542/94, unpublished).

The reference in claim 1 of the main request to a first number and a second number of grooves was considered to generate ambiguities as to the actual configuration of the claimed quarter wave plate contrary to Art. 84 EPC.

Moreover, novelty of the claimed subject-matter was acknowledged over D1 considered as the closest prior art.

VI. In reply, with letter dated 19 October 2017, the appellant filed a new main request for grant of a patent, addressing the issues raised in the Board's communication.

The former main request was maintained as new auxiliary request. Previous auxiliary requests 1 to 3 were withdrawn.

VII. On 16 November 2017 the scheduled oral proceedings were cancelled.

VIII. Claim 1 of the appellant's main request reads:

"*1. A quarter wave plate (100; 400) comprising at least one body of dielectric material, the or each said body having first and second end faces on opposite sides thereof; the or each body comprising*

a first portion (a; a', a") comprising a first number of parallel grooves (2; 42) extending inwardly of said first end face;

a second portion (b; b', b") comprising a second number of parallel grooves (12; 42') extending inwardly of said second end face; the second number being identical to the first number and each groove (2, 42) of the first portion (a; a', a") being aligned with a corresponding groove (12, 42') of the second portion (b; b', b"); and

a third portion (c; c', c") defined between the first and second portions;

the respective depths of the first (2; 42) and second grooves (12; 42') being such that a phase difference of an odd integer multiple of quarter wavelengths is produced between first and second orthogonal components of an electromagnetic wave traversing the plate (100; 400), the first component

having its E-vector parallel to the grooves (2, 12; 42, 42'), the second component having its E-vector perpendicular to the grooves (2, 12; 42,42');

characterised in that

the dielectric material has a relative dielectric constant of less than 5; and the length of the third portion (c; c', c") is not exactly an integer number of half wavelengths but varies from an integer number of half wavelengths by an amount selected to minimise the reflection coefficient at the first and second end faces."

Claims 2 to 8 of the main request depend on claim 1.

The content of the auxiliary request is not relevant for the present decision. It is thus not reproduced herewith.

Reasons for the Decision

1. The appeal is admissible.

2. Main request - Art. 123(2) and 76(1) EPC

2.1 Claim 1 of the main request includes the amendment "*the second number* [of grooves] *being identical to the first number* [of grooves] *and each groove of the first portion being aligned with a corresponding groove of the second portion*".

Although deprived of any literal support, the amendment derives directly and unambiguously from the present application as originally filed. Concretely, the added features would be the direct consequence of the

intended purpose of the claimed invention, i.e. to generate a differential phase shift of 90 degrees between the two orthogonal components of an electrical field of a wave propagating longitudinally along the axis of the quarter wave plate. Literal support for amendments in a patent application are not required under Article 123(2) EPC, insofar as the amended or added features reflect the technical information that the skilled person reading the original disclosure would have derived from its content (description, claims and drawings) considered in its entirety (cf. decision T 667/08, not published).

Support for the introduced wording also results from the geometry of the quarter wave plate according to the embodiment of the invention as disclosed with regard to Figure 3 of the present application as originally filed:

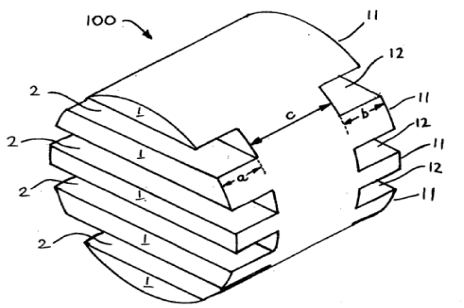

Figure 3 of the application

Claim 1 of the main request further differs from claim 1 of the present application as originally filed in that the feature according to which each body comprises a continuous region which defines the perimeter of each end face has been deleted. Paragraph [0025] of the present application as originally filed explicitly specifies that this feature is optional, thus providing

a clear support for its deletion from the claim, as further confirmed by the embodiment of Figure 3 for which no such continuous perimeter is present.

Dependent claims 2 to 8 of the main request derive, respectively, from claims 2 to 7 and claim 1 of the present divisional application, as filed.

Claims 1 to 8 of the main request thus meet the requirements of Article 123(2) EPC.

2.2 With regard to the original parent application, the following is noted.

The preamble of claim 1 of the main request results, primarily, from a combination of claims 1 and 2 of the original parent application (cf. EP-A-1 022 800, as published). In particular, the additional features according to which the second number of grooves is identical to the first number and each groove of the first portion is aligned with a corresponding groove of the second portion derive from the intended purpose of the claimed invention as disclosed in said original parent application and also from the embodiment disclosed therein with regard to Figure 3.

The characterising feature of claim 1 regarding the dielectric constant results directly from the indication in claim 6 regarding the use of a "*soft*" dielectric material in combination with paragraph [0008] of the published parent application regarding the definition of the term "*soft*". The additional characterising feature of claim 1 regarding the length of the third portion is based on paragraph [0018] of the published parent application.

Claims 2 to 5 of the main request derive respectively from original claims 7 to 10 of the original parent application as published. A support for claim 6 may be found in paragraph [0021] of the original parent application. Paragraph [0009] of said parent application constitutes a valid basis for claim 7 whereas paragraph [0025] provides support for the wording of claim 8.

The requirements of Art. 76(1) EPC are therefore met by the main request.

3. Main request - Art. 84 and 83 EPC

3.1 The feature according to which the respective depths of the first and second grooves is such that a phase difference of an odd integer multiple of quarter wavelengths is produced between first and second orthogonal components of an electromagnetic wave traversing the plate, the first component having its E-vector parallel to the grooves, the second component having its E-vector perpendicular to the grooves, was considered unclear by the examining division (Art. 84 EPC). Concretely, it was held that the claim defined the invention in terms of the result to be achieved.

This view is not convincing. Indeed, the claimed invention is not merely defined in terms of the result to be achieved since it is specified which parameter should be adapted so that the intended phase difference be obtained. It is namely by appropriate selection of the depths of the first and second grooves that the required effect is achieved. Moreover, the skilled person knows how the value of the constant dielectric affects the velocity of a wave in a given medium. Depending on the medium filling the grooves, the

skilled person is thus able to determine, for a given geometry of the quarter wave plate and a given operating frequency, which phase shift results at its end face for the two orthogonal components of the electromagnetic wave traversing the plate. The skilled person would *a contrario* be able to determine, for a given dielectric constant, the geometrical characteristics of the plate which are necessary in order to obtain the desired phase shift. It would be unreasonable, under the circumstances, to require from the appellant that the specific dimensions of the plate be recited in claim 1. This appears all the more true since such dimensions depend not only on the frequency of the electromagnetic wave for which the quarter wave plate is conceived but also on the constants of the selected dielectric material.

For the same reasons, it is considered that the skilled person would have no difficulties in reproducing the claimed effect. Relying on general knowledge in the field of electromagnetism, the skilled person would namely have no difficulties, once the selection of the dielectric material has been made, to define the total depth of the first and second grooves.

3.2 Similarly, the feature according to which the length of the third portion is not exactly an integer number of half wavelengths but varies from an integer number of half wavelengths by an amount selected to minimise the reflection coefficient at the first and second end faces, is considered to meet the requirements of Art. 84 EPC. It is stressed, in this respect, that the effect relied upon is technically understandable and may be verified for the frequency for which the plate is conceived.

A limitation to a specific length appears unjustified under the circumstances since it would unduly restrict the scope of protection conferred by the patent (cf. decision T 68/85, unpublished).

As mentioned in paragraph [0017] of the published application, an estimation of the exact dimension of the third portion can be made by computer modelling or, alternatively, be empirically determined. There is no doubt that both alternatives would indeed permit the skilled person to reduce the invention to practice without undue burden (Art. 83 EPC).

3.3 Consequently, the invention is considered to meet the requirements of both Art. 84 EPC as to clarity and Art. 83 EPC regarding sufficiency of disclosure.

4. *Main request - Art. 54(1),(2) EPC*

Notwithstanding various objections raised under Art. 84 EPC, the examining division acknowledged that the subject-matter of claim 1 of the request then pending was new (cf. point 2.3 of the impugned decision).

The appellant convincingly stated that none of the available items of prior art disclosed a quarter wave plate as recited in claim 1.

4.1 In particular, document D1, which discloses a circular polarizer for microwave transmission, fails to disclose the claimed feature according to which "*the dielectric material has a relative dielectric constant of less than 5*".

Moreover, the third portion of the polarizer of D1 has a length of one half-wave contrary to the claimed

subject-matter which requires that "*the length of the third portion is not exactly an integer number of half wavelengths but varies from an integer number of half wavelengths by an amount selected to minimise the reflection coefficient at the first and second end faces*".

In this respect, the argument according to which normal manufacturing processes would de facto generate deviations from the nominal half-wave length is rejected. Even if such deviations exist, it cannot be argued that they will indeed lead to the effect of minimising reflections as recited in claim 1.

4.2 Document D2 discloses a dielectric substrate effective for transforming linearly to circularly polarized microwaves. A first portion is formed of ridges separated by parallel troughs (cf. Figures 1a, 1b, 2a; column 3, lines 19-30). A second portion of the waveplate of D2 comprises at its opposite end a pattern of crossed troughs thus defining a plurality of "hills" at the second end of the wave plate (cf. column 3, lines 31-45). A plurality of materials is proposed in D2, some of which having a relative dielectric constant less than 5 (cf. column 4, Table 1).

The third portion of the polarizer disclosed in D2 has a thickness of one half-wavelength contrary to the claimed invention.

4.3 None of the other available items of prior art discloses the claimed configuration of features.

The subject-matter of claim 1 is thus new in the sense of Art. 54(1),(2) EPC.

5. *Main request - Art. 56 EPC*

5.1 The appellant and the examining division concur in that document D1 discloses the closest prior art.

Document D1 discloses a quarter wave plate as defined in the preamble of claim 1. It is further observed that its configuration is quite similar to the quarter wave plate disclosed according to a preferred embodiment of the present invention as illustrated in Figure 3 of the published application.

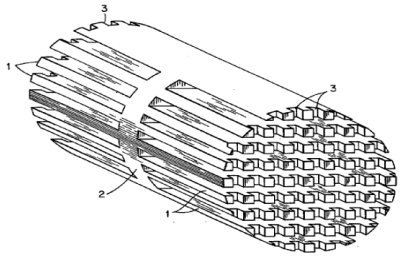

Figure of D1

Document D1 constitutes a valid item of prior art in order to decide on the inventive merits of the claimed invention.

As underlined above (cf. section 4.1), the claimed invention differs from this known configuration in that:

(i) the dielectric material has a relative dielectric constant of less than 5, and

(ii) the length of the third portion is not exactly an integer number of half wavelengths but varies from an integer of half wavelengths by an amount selected to minimise the reflection coefficient at the first and second end faces.

The feature (i) regarding the relative dielectric constant of the claimed quater wave plate permits to reduce the drawbacks in terms of impedance matching resulting from the use of "*hard*" materials, that is, materials with a high dielectric constant. The problem of impedance matching is, however, explicitly addressed in D1. It is solved therein by incorporating impedance transformers in the form of slots positioned orthogonally to the planes of the dielectric plates at both polarizer ends. There is therefore no incentive for the skilled person, starting from D1, to select a material with the claimed relative dielectric constant.

The second distinguishing feature (ii) concerns the length of the central portion (third portion) which is not exactly an integer number of half wavelengths.

The length of the third portion is namely selected so as to minimise the reflection coefficient at the first and second end faces of the quarter-wave plate.

There is however no indication to be found in the available prior art that such optimisation may be obtained by varying the length of the center portion with regard to its nominal value. Document D1 stresses that a half-wave length thickness for the center section makes it "*transparent to the impinging waves since it produces no phase shift*". A similar statement may be found in D2 which insists on the necessity of a thickness corresponding to one-half wavelength which is considered to provide optimum matching conditions for both linear polarizations (cf. D2, column 4, lines 54-62). This view did not appear to have been questioned until the present "*Applicants found that the making dimension c exactly equal to one half wavelength did not produce the minimum reflection in*

practice" (cf. paragraph [0018] of the published application).

There was accordingly no reason for the skilled person to depart from a configuration which was considered to be fully satisfactory until the inventors found that this was not the case.

5.2 Also document D2 appears to constitute a valid item of prior art in order to decide on the existence of an inventive step. It discloses a quarter wave plate according to the preamble of claim 1 and further suggests to use soft dielectric materials, i.e. materials with a relative dielectric constant less than 5, as recited in the characterising portion of the claim (cf. D2, Table 1). Consequently, D2 is considered to represent the closest prior art to the claimed invention.

The analysis made above with regard to D1 and the distinguishing feature regarding the length of the third portion, however, still applies. In the absence of any clear teaching for the skilled person to deviate from said nominal length of one half wavelength for the center portion, the skilled person had no reason to expect any improvement by varying said parameter.

5.3 Consequently, the subject-matter of claim 1 does not result in an obvious manner from the prior art. It is thus inventive in the sense of article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent with claims 1 to 8 according to the main request, as filed with the letter of 19 October 2017, and a description to be adapted thereto.

The Registrar: The Chairman:

R. Schumacher G. Assi

Decision electronically authenticated