Internal distribution code:
(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 6 March 2014

Case Number: T 1157/10 - 3.4.03

Application Number: 02079739.5

Publication Number: 1293833

IPC: G03F7/20

Language of the proceedings: EN

Title of invention:
High resolution printing technique by using a mask pattern adapted to the technique

Applicant:
NIKON CORPORATION

Headword:

Relevant legal provisions:
EPC Art. 123(2)
EPC 1973 Art. 56, 84

Keyword:
Clarity (no)
Inventive step (no)

Decisions cited:

Catchword:

This datasheet is not part of the Decision.
It can be changed at any time and without notice.

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1157/10 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 6 March 2014

Appellant: (Applicant)	NIKON CORPORATION 12-1, Yurakucho 1-chome Chiyoda-ku Tokyo 100-8331 (JP)
Representative:	Whitlock, Holly Elizabeth Ann R.G.C. Jenkins & Co 26 Caxton Street London SW1H 0RJ (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 5 November 2009 refusing European patent application No. 02079739.5 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman:	G. Eliasson
Members:	R. Bekkering
	P. Mühlens

Summary of Facts and Submissions

I. The appeal is against the refusal of application no. 02 079 739 for added subject-matter, Article 123(2) EPC (main, first and second auxiliary request), for lack of novelty, Article 54(1) EPC (third auxiliary request) and for lack of an inventive step, Article 56 EPC (fourth auxiliary request), over documents:

D2: Ito T. et al.: "*Photo-Projection Image Distortion Correction for a 1-µm Pattern Process*", Electronics and Communications in Japan, Part 2 - Electronics, Scripta Technica, New York, US, vol. 69, no. 3, 1986, pages 30 to 38, and

D4: US 4 895 780 A.

II. With the statement setting out the grounds of appeal dated 15 March 2010, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the following:

Main request:

Claims 1 to 11 filed with the statement setting out the grounds of appeal,

First auxiliary request:

Claims 1 to 10 filed with the statement setting out the grounds of appeal.

Second auxiliary request:

Claims 1 to 9 filed with the statement setting out the grounds of appeal,

Third auxiliary request:

Claims 1 to 7 filed with the statement setting out the grounds of appeal,

Fourth auxiliary request:

Claims 1 to 9 filed with the statement setting out the grounds of appeal.

III. A summons to oral proceedings was issued by the board, provided with an annex in which a provisional opinion of the board on the matter was given.

In particular, the appellant was informed that claim 1 of the main request lacked clarity and was not concise, contrary to the requirements of Article 84 EPC 1973. Moreover, the amendments had no basis in the application as originally filed, Article 123(2) EPC, and in the parent application, Article 76 EPC. Furthermore, the subject-matter of claim 1 lacked an inventive step in the sense of Article 56 EPC 1973 over documents D4 and D2.

Claim 1 of the first auxiliary request, in addition to having the deficiencies of that of the main request, further lacked clarity. Moreover, the subject-matter of claim 1 of the first auxiliary request lacked an inventive step in the sense of Article 56 EPC 1973 over documents D4 and D2.

The objections above, in particular that of lack of inventive step, applied in substance also to claim 1 according to the second to fourth auxiliary request.

IV. No arguments were provided by the appellant in response to the board's observations. The board was informed that the appellant would not attend the oral proceedings.

Oral proceedings were held in the absence of the appellant.

V. Claim 1 of the main request reads as follows:

"*A lithographic mask (R) manufactured by forming a plurality of pattern elements (PC; PA; PB; PM; PN) on an original plate serving as a mask on the basis of design data defining shapes and layout of the pattern elements,*
in which design data for a target pattern element among the plurality of pattern elements is modified to modify a target outer edge portion that is a portion of an outer edge portion of said target pattern element relatively outward or inward with respect to an outer edge portion continuous with said target outer edge portion, and
said design data for the target pattern element is modified to modify said outer edge portion defining a width of said target pattern element in an end portion to be expanded outwardly with respect to the remaining portion of said outer edge portion in addition to the modification of said outer edge portion."

VI. Claim 1 of the first auxiliary request corresponds to claim 1 of the main request with the following addition at the end of the claim:

"*wherein said design data for said target pattern element is modified so that a length of said target pattern element is expanded in a longitudinal direction, or the length of said pattern element is not expanded in a longitudinal direction.*"

VII. Claim 1 of the second auxiliary request reads as follows:

"*A lithographic mask manufactured by forming a plurality of pattern elements on an original plate serving as a mask on the basis of design data defining shapes and layout of the pattern elements, wherein forming the plurality of pattern elements includes:*
(a) setting a line width of one of the plurality of pattern elements to be larger than or smaller than a design value included in the design data, and
(b) setting a line width of an end portion of the one of the plurality of pattern elements to be larger than a design value included in the design data."

VIII. Claim 1 of the third auxiliary request reads as follows:

"*A manufacturing method of a lithographic mask (R) by forming a plurality of pattern elements (PC; PA; PB; PM; PN) on an original plate serving as a mask on the basis of design data defining shapes and layout of the pattern elements, comprising:*
specifying part of an outer edge portion of a target pattern element of said plurality of pattern elements as a target outer edge portion;
modifying said target outer edge portion relatively outward or inward with respect to an outer edge portion continuous with said target outer edge portion on the

basis of a first condition that there is no adjacent pattern element within a predetermined spacing from said target outer edge portion; and
modifying on the basis of a second condition that said target outer edge portion is an end portion of said target pattern element said outer edge portion defining a width of said target pattern element in said end portion to be expanded outwardly with respect to the remaining portion of said outer edge portion in addition to the modification of said outer edge portion on the basis of the first condition."

IX. Claim 1 of the fourth auxiliary request reads as follows:

"A method of manufacturing a lithographic mask by generating, on a predetermined original plate, a plurality of pattern elements for shielding or transmitting a predetermined energy beam on the basis of design data which defines the shapes and layout of the respective pattern elements, the method further comprising the steps:
a) from amongst the plurality of pattern elements, an outer edge of a specific pattern having a predetermined line width or less is determined whether to be spaced apart from other patterns adjacent thereto by a predetermined distance or more, and if the specific pattern is spaced apart from other patterns by the predetermined distance or more, the design data is corrected such that the outer edge of the specific pattern element is expanded outward or decreased relative to other outer edges by a small amount;
b) determining whether a target edge portion of the specific pattern element is an edge for defining a widthwise direction of a portion near a pattern end portion of a predetermined width or less, and if so

correcting the design data such that the target edge portion is expanded outward relative to other edge portions by a second small amount; and
c) forming the plurality of pattern elements on the original plate on the basis of the corrected design data."

X. The appellant submitted with the statement setting out the grounds of appeal in substance the following arguments:

A basis for new claim 1 according to the main request could be found in the originally filed claims and parts of the description. Moreover, the subject-matter of claim 1 was novel in particular over document D4, which did not disclose the second step of claim 1. Document D2 discussed the problems of distortion caused by the increasing integration of mask pattern elements, and the provision of subspaces at the corners of the pattern elements. However, D4 did not disclose the problem of distortion of resist images at end portions of a pattern element. D2 did not disclose the problem to be solved, or a solution thereto. Accordingly, the subject-matter of claim 1 of the main request involved an inventive step.

Claim 1 of the first auxiliary request was further inventive over a combination of D2 and D4. Even if the skilled person followed the teaching of D4 and expanded the side edges of a pattern element before adding the subspaces of D2, the skilled person would not be motivated to further adapt D2 to expand the longitudinal direction of the pattern element.

Claim 1 of the second auxiliary request differed from that of the main request in that claim 1 was based more

closely on the wording used in the description. Both claimed features were broadly equivalent to the features included in the main request. The claims of this request were novel and inventive for at least the same reasons as identified in the main request.

The claims of the third auxiliary request differed from those of the main request in that claim 1 was directed to a manufacturing method. Claim 1 otherwise corresponded to the subject-matter of claim 1 of the main request. Claims 1 to 7 of this request were considered to meet the requirements of Articles 54(1) and 56 EPC for at least the same reasons as claims 1 to 9 of the main request.

Claim 1 of the fourth auxiliary request differed from that of the main request, in that it was based more closely on the wording used in the description. Both claimed features were broadly equivalent to the features included in the main request. Claim 1 of this request was novel and inventive over D1 to D6 for at least the same reasons as identified for claim 1 of the main request.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Clarity, conciseness

Claim 1 lacks clarity and is not concise in particular regarding the following expressions:

"*a target outer edge portion that is a portion of an outer edge portion of said target pattern element*", and

"*relatively outward or inward with respect to an outer edge portion continuous with said target outer edge portion*".

Moreover, in respect of the feature "*in addition to the modification of said outer edge portion*" it remains unclear whether the modification according to the preceding, first claimed step is meant.

Furthermore, claim 1 fails to specify any criterion for the modification according to the first step, when an inward or outward modification is to be made.

Accordingly, the requirements of Article 84 EPC 1973 are not met.

2.2 *Amendments*

The above unclear definitions also have no basis in the application as originally filed or in the parent application.

Accordingly, the requirements of Articles 76 and 123(2) EPC are not met.

2.3 *Novelty, inventive step*

Moreover, as far as claim 1 is comprehensible, the following is found on the issues of novelty and inventive step.

2.3.1 Novelty

Document D4 is, like the application, concerned with a lithographic mask taking account of the proximity effect.

According to D4, and as is generally known, the result of the proximity effect is (for positive photoresist) that if features in dense structures are resolved to their exact size, isolated features tend to be over exposed (cf D4, column 1, lines 45 to 49; application, page 93, line 22 to page 94, line 3).

The solution of D4 is to expand the outer edge of the pattern where necessary (cf column 2, lines 23 to 28; column 7, lines 19 to 37; figures 4 and 5).

Accordingly, a mask with a pattern based on design data modified according to the first step of claim 1, as far as clear, is known from document D4.

However, as argued by the appellant, the second step of claim 1, as far as clear, is not known from D4.

Accordingly, the subject-matter of claim 1 according to the main request is new over document D4, Article 54(1) EPC 1973.

2.3.2 Inventive step

The effect of the above distinguishing feature over D4 is that mask patterns are modified, yielding lines which would otherwise be too short and too narrow at the end portions (cf application, page 96, lines 3 to 18). The problem arises in particular where the line

width has a value close to the resolving limit of the exposure apparatus (cf page 95, lines 23 to 25).

The objective problem to be solved relative to D4, thus, is to correct these distortions.

Document D2 addresses this problem (cf page 30, left-hand column, last paragraph to right-hand column, first paragraph).

The solution offered in D2 is to modify the pattern by adding "*subspaces*" to the corners (cf page 31, left-hand column, second paragraph; page 33, point 4.1 and figure 4; page 37, point 6 and figure 7).

This falls under the claimed definition of "*to modify said outer edge portion defining a width of said target pattern element in an end portion to be expanded outwardly with respect to the remaining portion of said outer edge portion*".

Accordingly, the subject matter of claim 1 of the main request is obvious to a person skilled in the art and thus lacks an inventive step (Article 56 EPC 1973).

2.4 No arguments were submitted by the appellant in response to the board's observations provided in the annex to the summons to oral proceedings, which essentially correspond to the above.

2.5 For these reasons, the appellant's main request is not allowable.

3. First auxiliary request

3.1 Claim 1 according to the first auxiliary request, with respect to the main request, includes the following additional feature:

"*wherein said design data for said target pattern element is modified so that a length of said target pattern element is expanded in a longitudinal direction, or the length of said pattern element is not expanded in a longitudinal direction*".

3.2 Clarity

In addition to the deficiencies noted above for the main request, claim 1 according to the first auxiliary request fails to specify any criterion for when the length is expanded or not.

Accordingly, the requirements of Article 84 EPC 1973 are also not met in this respect.

3.3 Inventive step

The above additional feature includes as one alternative that the length is not expanded and, thus, no further limitation is provided.

Moreover, for the reasons given above for the main request, it is obvious to the skilled person to modify the mask pattern when the dimensions of developed photoresist structures turn out shorter than the design data.

The appellant argued in the statement setting out the grounds of appeal that the skilled person would not be motivated to further adapt D2 to expand the longitudinal direction of the pattern element.

In the board's opinion, however, it would be readily apparent to the skilled person that the same considerations for pattern correction apply in the longitudinal direction of the pattern.

Accordingly, the subject matter of claim 1 of the first auxiliary request is obvious to a person skilled in the art and, thus, lacks an inventive step (Article 56 EPC 1973).

3.4 Also with respect to the first auxiliary request, the appellant did not submit any arguments in response to the board's observations provided in the annex to the summons to oral proceedings, which essentially correspond to the above.

3.5 For these reasons, the appellant's first auxiliary request is also not allowable.

4. Second auxiliary request

Claim 1 according to the second auxiliary request, as acknowledged by the appellant, essentially is a reworded version of claim 1 according to the main request.

The objections above for the main request, in particular that of lack of inventive step, apply *mutatis mutandis* also to claim 1 according to the second auxiliary request.

Accordingly, the subject matter of claim 1 of the second auxiliary request is also obvious to a person skilled in the art and, thus, lacks an inventive step (Article 56 EPC 1973).

Hence, the appellant's second auxiliary request is also not allowable.

5. *Third auxiliary request*

Claim 1 according to the third auxiliary request essentially is, as acknowledged by the appellant, again a reworded version of claim 1 according to the main request, though in this case the claim 1 is directed to a manufacturing method.

The objections above for the main request, in particular that of lack of inventive step, apply *mutatis mutandis* also to claim 1 according to the third auxiliary request.

Accordingly, the subject matter of claim 1 of the third auxiliary request is also obvious to a person skilled in the art and, thus, lacks an inventive step (Article 56 EPC 1973).

Accordingly, the appellant's third auxiliary request is also not allowable.

6. *Fourth auxiliary request*

Claim 1 according to the fourth auxiliary request essentially also is a reworded version of claim 1 according to the main request, again as a method claim.

The objections above for the main request, in particular that of lack of inventive step, apply *mutatis mutandis* also to claim 1 according to the fourth auxiliary request.

Accordingly, the subject matter of claim 1 of the fourth auxiliary request is also obvious to a person skilled in the art and, thus, lacks an inventive step (Article 56 EPC 1973).

Hence, the appellant's fourth auxiliary request is not allowable either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated