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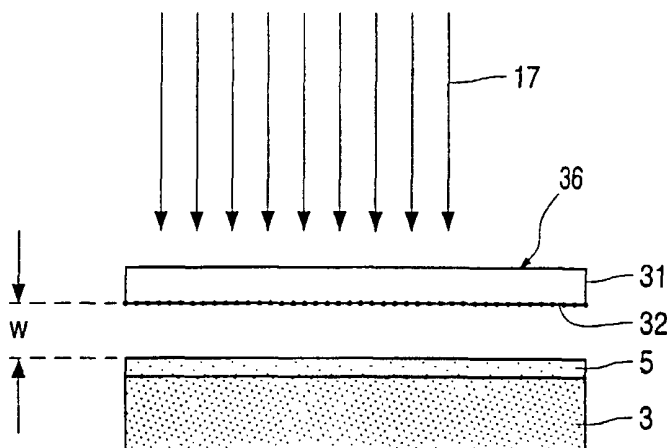
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- (74) Agent: **COBBEN, Louis, M., H.**: Internationaal Octrooibureau B.V., Prof Holstlaan 6, NL-5656 AA Eindhoven (NL).
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- (71) Applicant: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
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- (72) Inventor: **NELLISSEN, Antonius, J., M.**: Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

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(54) Title: METHOD OF FORMING OPTICAL IMAGES, MASK FOR USE IN THIS METHOD, METHOD OF MANUFACTURING A DEVICE USING THIS METHOD, AND APPARATUS FOR CARRYING OUT THIS METHOD



(57) Abstract: The resolution achieved with a proximity printing method and apparatus can be increased considerably by using, instead of a photo mask, a diffraction mask (30) wherein the image information is encoded in a two-dimensional array (32) of image cells (37) having dimensions which are smaller than the minimum feature size to be printed, each image cell having one out of at least two amplitude levels and one out of at least three phase levels. The mask may be a multiple focus mask which has multiple focal planes within one image field.



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INTERNATIONAL SEARCH REPORT

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PCT/EP 01/06765

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G03F1/00 G03F7/20 G03F1/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 612 986 A (HOWELLS MALCOLM S ET AL) 18 March 1997 (1997-03-18) ---	
A	JACOBSEN C ET AL: "PROJECTION X-RAY LITHOGRAPHY USING COMPUTER-GENERATED HOLOGRAMS: A STUDY OF COMPATIBILITY WITH PROXIMITY LITHOGRAPHY" JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY: PART B, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 10, no. 6, 1 November 1992 (1992-11-01), pages 3177-3181, XP000332529 ISSN: 0734-211X ---	
A	US 5 229 255 A (WHITE DONALD L) 20 July 1993 (1993-07-20) ---	
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Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Haenisch, U

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 785 471 A (LUCENT TECHNOLOGIES INC) 23 July 1997 (1997-07-23) -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 5612986	A	18-03-1997	US 5455850 A WO 9309546 A1	03-10-1995 13-05-1993
US 5229255	A	20-07-1993	CA 2061624 A1 DE 69219929 D1 DE 69219929 T2 EP 0505102 A1 HK 1000542 A1 JP 5080493 A KR 273072 B1	23-09-1992 03-07-1997 11-09-1997 23-09-1992 03-04-1998 02-04-1993 01-12-2000
EP 0785471	A	23-07-1997	US 5834160 A EP 0785471 A2 JP 9197678 A	10-11-1998 23-07-1997 31-07-1997