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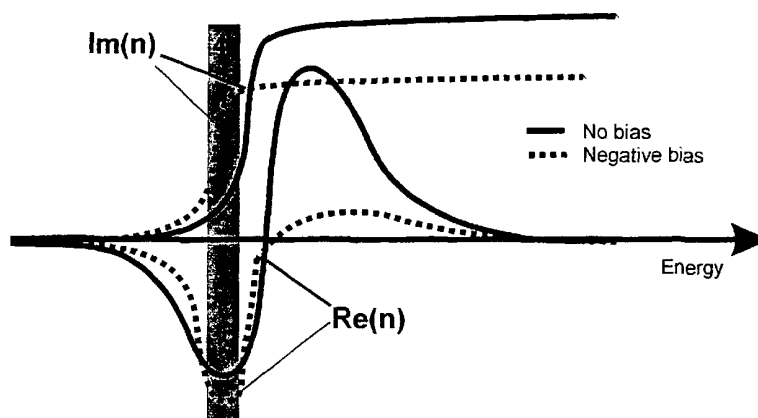
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(54) Title: BENT ELECTRO-ABSORPTION MODULATOR



(57) Abstract: The present invention relates to a method and a device for modulating optical signals based on modulating bending losses in bend, quantum well semiconductor waveguide sections. The complex refractive index of the optical active semiconducting components of the waveguide section is modulated by applying a variable electric or electromagnetic field. The modulation of the complex refractive index results in a modulation of the refractive index contrast and the absorption coefficient for the waveguide at the frequency of the light. By carefully adjusting the composition of the semiconducting components and the applied electric field in relation to the frequency of the modulated radiation, the bending losses (and possibly coupling losses) will provide extinction of light guided by the bent waveguide section. The refractive index contrast may be modulated while keeping the absorption coefficient substantially constant and small, whereby the guided light can be modulated only by bending losses. Alternatively, the invention may be applied to enhance the extinction ratio of existing absorption modulators such as Electro-Absorption Modulators (EAMs) in which case extinction by absorption and extinction by bending losses co-operates to provide more compact modulators with improved performance (extinction) and speed.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

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PCT/DK 01/00544

A. CLASSIFICATION OF SUBJECT MATTER

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02F

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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 088 500 A (NICHOLS DOYLE T ET AL) 11 July 2000 (2000-07-11) abstract	1-16
P,A	US 6 243 525 B1 (LUIZINK MIRIAM ET AL) 5 June 2001 (2001-06-05) abstract	1-16
A	G J VELDHUIS ET AL: "Integrated optic intensity modulator based on a bent channel waveguide" OPTICS COMMUNICATIONS, vol. 168, 1999, pages 481-491, XP002902300 abstract	1-16

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☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6088500	A	11-07-2000	EP 0871057 A2	14-10-1998
			JP 10293279 A	04-11-1998
			TW 404044 B	01-09-2000

US 6243525	B1	05-06-2001	JP 11271550 A	08-10-1999
			NL 1011252 C2	16-08-1999
