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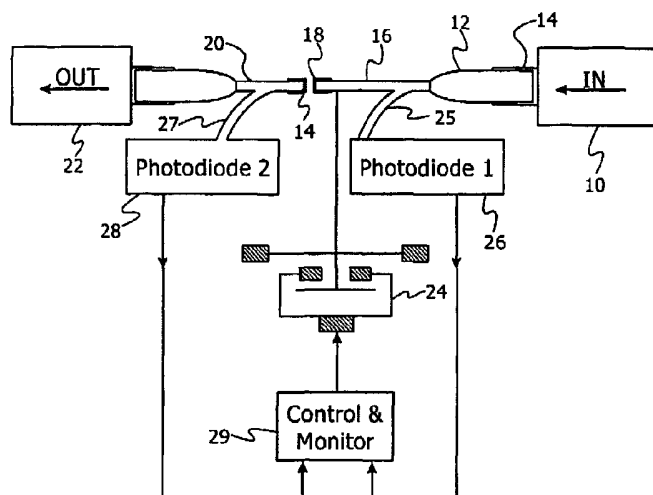
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MONOLITHIC OPTICAL CONTROL COMPONENTS



(57) Abstract: Novel optical waveguide components, operated by means of micro-actuators which move suspended section of waveguides, and especially variable optical attenuators, and optical couplers. Methods are also described for aligning and latching the micro-actuators in two or three dimensions, such that settings of variable attenuators can be maintained. Such micro-actuators are also used for ensuring good alignment between the various waveguide and fiber ports in integrated optical circuits. Additional components based on micro-actuators include multi-pole switches, digital variable optical attenuators, receiver input protectors, and multifunctional line protection chips. The components and systems described can be executed in monolithic form, thus engendering significant cost and space savings. Furthermore, methods of substrate etching to obtain accurately vertical faces are also described.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL03/00031

A. CLASSIFICATION OF SUBJECT MATTER		
IPC(7) : G02B 6/35, 26		
US CL : 385/140, 16, 25, 30		
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)		
U.S. : 385/140, 16, 22, 23, 25, 30, 48; 359/222		
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 practicable, search terms used)		
USPAT text search		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5612815 A (LABEYE et al.) 18 March 1997 (18.03.1997), figs. 3a, 3b, and 4, col. 5 line 54 - col. 6 line 49.	1-14, 37-44
X	US 6122084 A (BRITZ et al.) 19 September 2000 (19.09.2000), figs. 5A and 5B, col. 5 line 50 - col. 6 line 52.	21-25
X	US 4013000 A (KOGELNIK) 22 March 1977 (22.03.1977), fig. 2, col. 2 line 60 - col. 3 line 13 and col. 3 lines 49-58.	28-36
X	US 6212314 B1 (FORD), 03 April 2001 (03.04.2001), fig. 1, col. 2 line 56 - col. 3 line 8, claim 1.	28-36
X	US 3931518 A (MILLER) 06 January 1976 (06.01.1976), fig. 2, col. 5 lines 15-40.	15-20
X	US 4150870 A (D'AURIA) 24 April 1979 (24.04.1979), figs. 1 and 5, col. 2 lines 1-53 and col. 3 lines 18-30.	62-67
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search		Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL03/00031

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-25, 28-44, 62-67

Remark on Protest

☐
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-25, 28-44, and 62-67, drawn to an optical switch, a variable attenuator, or a receiver protection device, each using a deflectable suspended waveguide.

Group II: Claims 26-27 and 58-61, drawn to a monolithic optical power monitoring device, which does not use a deflectable suspended waveguide.

Group III: Claims 45-49, drawn to an apparatus for locking an operating arm of a microactuator.

Group IV: Claims 50-51, drawn to a thermal actuator.

Group V: Claims 52-57, drawn to an etching process.

The inventions listed as Groups I-V do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The invention of each group does not require features of any of the other groups for successful operation. Group I relies on a deflectable suspended waveguide to achieve its attenuation or switching functions. It can be made and used without the components of Groups II- IV or the method of Group V. Group II does not require the suspended waveguide structure of Group I, or the locking apparatus of Group III, or the thermal actuator of Group IV, nor is its manufacture limited to the method of Group V. The locking apparatus of Group III is applicable to microactuators other than the ones mentioned in Groups I and IV, and is independent of the elements of Group II and the method of Group V. The thermal actuator of Group IV is applicable beyond the devices of Groups I and II, does not require any specific locking device such as the device of Group III, and can be made by a method other than that of Group V. The method of Group V is not limited to use in manufacturing only the devices of Groups I-IV.