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(12) **United States Patent**
Holmes

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(54) **OPTICAL PROCESSING**
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4,952,010 A 8/1990 Healey et al.
5,107,359 A 4/1992 Ohuchida
5,315,423 A * 5/1994 Hong 398/79
5,428,466 A 6/1995 Rejman-Greene et al.
5,526,171 A 6/1996 Warren
5,539,543 A 7/1996 Liu et al.
5,589,955 A 12/1996 Amako et al.
5,629,802 A 5/1997 Clark
5,938,309 A 8/1999 Taylor

(Continued)

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FOREIGN PATENT DOCUMENTS

EP 1 050 775 A1 11/2000

(Continued)

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OTHER PUBLICATIONS

Mears, R. J., et al., "Telecommunications Applications of Ferroelectric Liquid-Crystal Smart Pixels," IEEE Journal of Selected Topics in Quantum Electronics, vol. 2, No. 1, Apr. 1996, pp. 35-46.

(Continued)

Related U.S. Application Data

(62) Division of application No. 10/487,810, filed as application No. PCT/GB02/04011 on Sep. 2, 2002, now Pat. No. 7,145,710.

Primary Examiner—Alessandro Amari
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(30) **Foreign Application Priority Data**
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(57) **ABSTRACT**

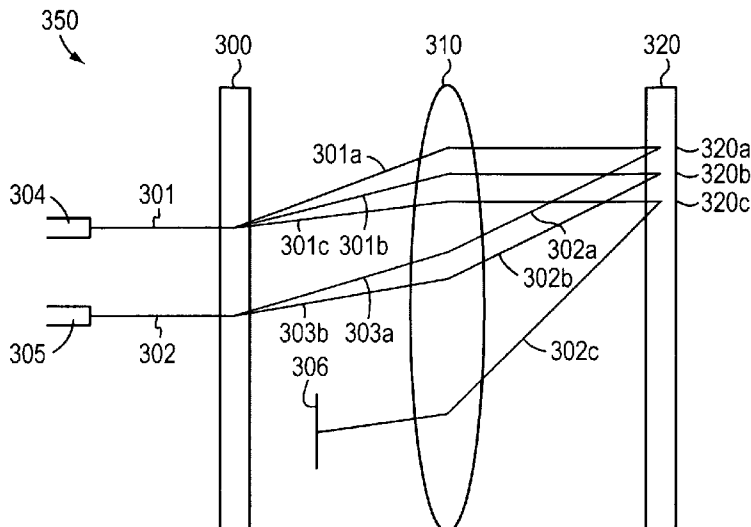
(51) **Int. Cl.**
H04J 14/00 (2006.01)
(52) **U.S. Cl.** **398/49**
(58) **Field of Classification Search** 359/15, 359/19, 9, 569, 566, 572, 571, 244; 349/201, 349/202; 398/48, 49, 79, 81, 82, 84, 87
See application file for complete search history.

To operate an optical device comprising an SLM with a two-dimensional array of controllable phase-modulating elements groups of individual phase-modulating elements are delineated, and control data selected from a store for each delineated group of phase-modulating elements. The selected control data are used to generate holograms at each group and one or both of the delineation of the groups and the selection of control data is/are varied. In this way upon illumination of the groups by light beams, light beams emergent from the groups are controllable independently of each other.

(56) **References Cited**
U.S. PATENT DOCUMENTS

3,773,401 A 11/1973 Douklias et al.

27 Claims, 36 Drawing Sheets



U.S. PATENT DOCUMENTS

5,959,747	A	9/1999	Psaltis et al.	
5,960,133	A	9/1999	Tomlinson	
5,995,251	A	11/1999	Hesselink et al.	
6,072,608	A	6/2000	Psaltis et al.	
6,115,123	A	9/2000	Stappaerts et al.	
6,243,176	B1	6/2001	Ishikawa et al.	
6,529,307	B1	3/2003	Peng et al.	
6,594,082	B1	7/2003	Li et al.	
6,710,292	B2	3/2004	Fukuchi et al.	
6,714,309	B2	3/2004	May	
6,747,774	B2	6/2004	Kelly et al.	
6,760,511	B2	7/2004	Garrett et al.	
6,954,252	B1 *	10/2005	Crossland et al.	349/196
6,975,786	B1	12/2005	Warr et al.	
2001/0050787	A1 *	12/2001	Crossland et al.	359/15
2002/0060760	A1 *	5/2002	Weiner	349/96
2004/0126120	A1	7/2004	Cohen et al.	
2005/0270616	A1	12/2005	Weiner	
2007/0268537	A1	11/2007	Holmes	
2008/0145053	A1	6/2008	Holmes	

FOREIGN PATENT DOCUMENTS

EP	1 207 418	A1	5/2002
----	-----------	----	--------

EP	1 053 501	B1	7/2003
WO	WO 01 25840	A1	4/2001
WO	WO 01 25848	A2	4/2001
WO	WO 01 90823	A1	11/2001
WO	WO 02 079870	A2	10/2002
WO	WO 02 101451	A1	12/2002

OTHER PUBLICATIONS

Mears, R. J., et al., "WDM Channel Management Using Programmable Holographic Elements," IEE Colloquium on Multiwavelength Optical Networks: Devices, Systems and Network Implementations, IEE, London, GB, Jun. 18, 1998, pp. 11-1-11-6.

Pan, Ci-Ling, et al., "Tunable Semiconductor Laser with Liquid Crystal Pixel Mirror in Grating-Loaded External Cavity," Electronics Letters, IEE Stevenage, GB, vol. 35, No. 17, Aug. 19, 1999, pp. 1472-1473.

Marom, D.M., et al., "Wavelength-Selective 1x4 Switch for 128 WDM Channels at 50 Ghz Spacing," *OFC Postdeadline Paper*, pp. FB7-1-FB7-3 (2002).

Yamazaki, H., et al., "4x4 Free Space Optical Switching Using Real-Time Binary Phase-Only Holograms Generated by a Liquid-Crystal Display," *Optical Society of America*, 16(18):1415-1417(1991).

* cited by examiner

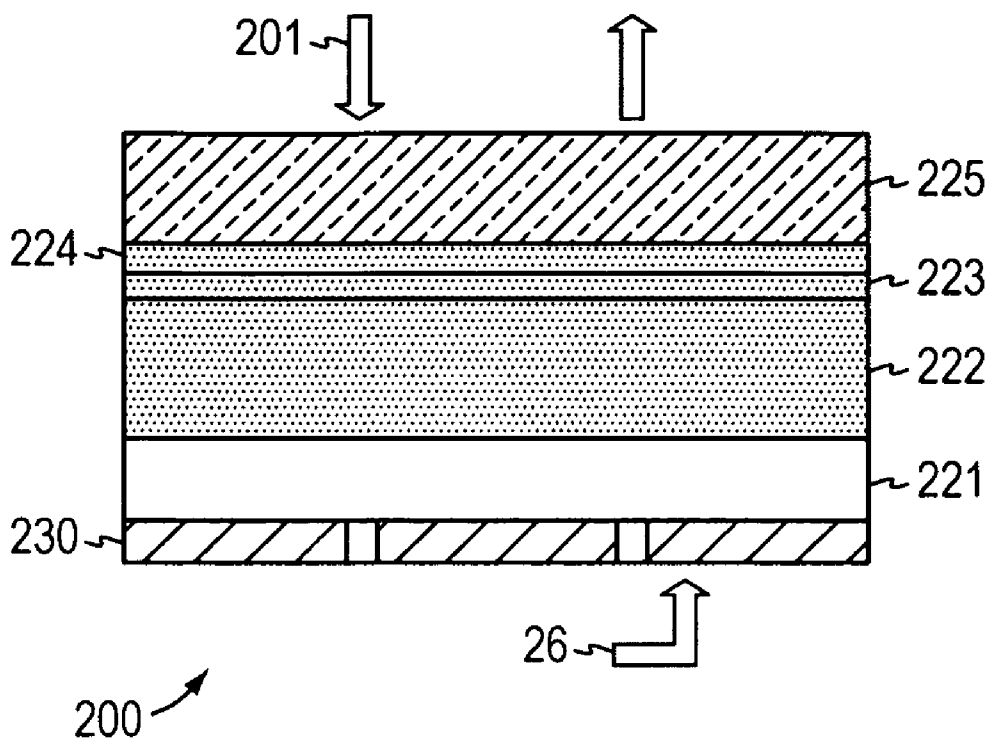


FIG. 1

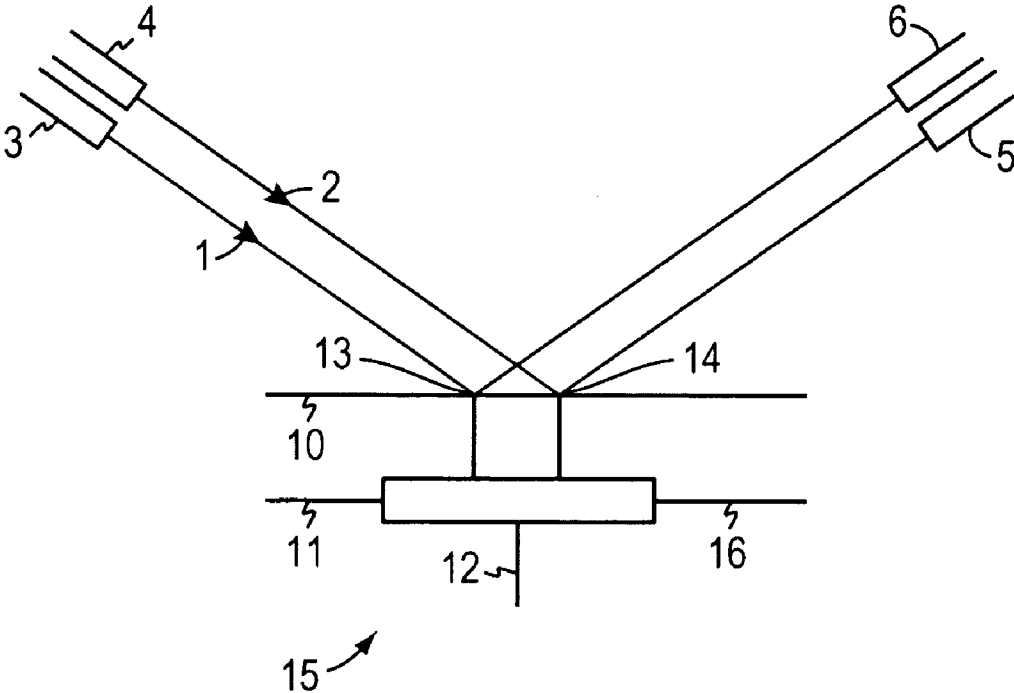


FIG. 2

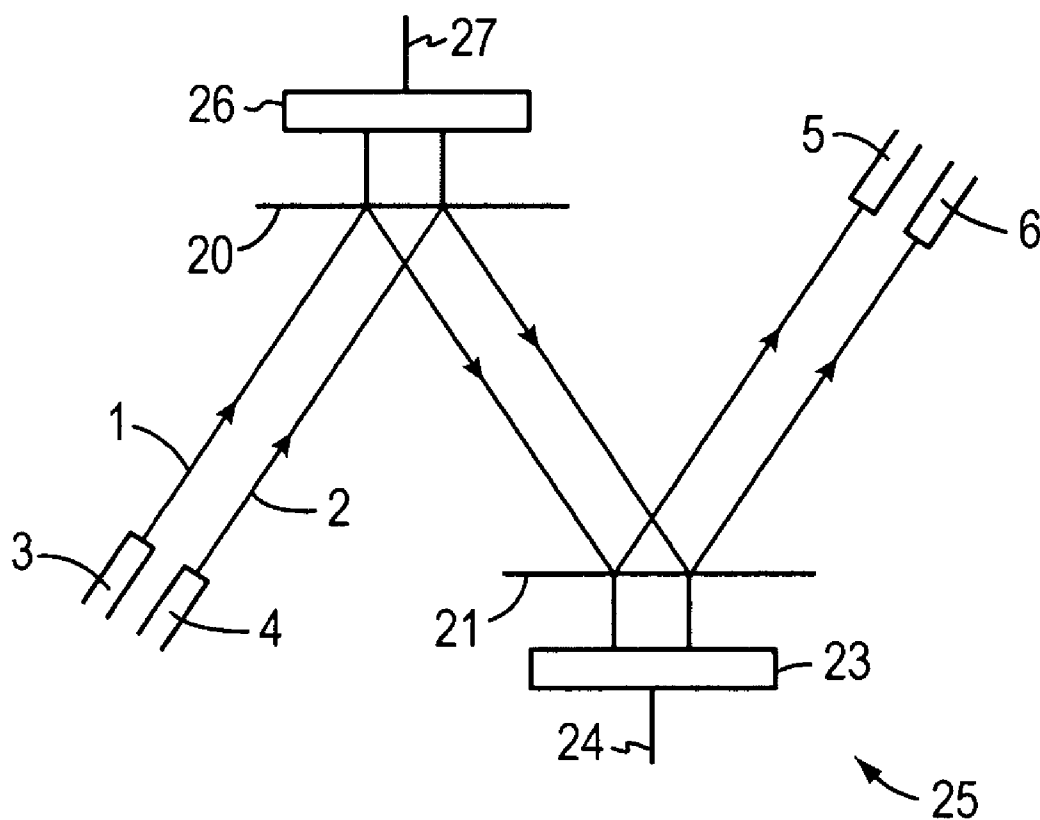


FIG. 3

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