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**Boueitch et al.**

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(54) **OPTICAL CONFIGURATION FOR A DYNAMIC GAIN EQUALIZER AND A CONFIGURABLE ADD/DROP MULTIPLEXER**

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(51) **Int. Cl.**<sup>7</sup> ..... **G02B 6/28**; H04J 14/02

(52) **U.S. Cl.** ..... **385/24**; 385/37; 359/130; 359/246; 359/247; 359/301; 359/302; 359/128

(58) **Field of Search** ..... 349/193, 196; 359/115, 122, 128, 124, 130, 131, 245-247, 301-302; 385/16, 18, 24, 31, 37, 39, 47

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,367,040 A	1/1983	Goto	356/44
4,707,056 A	11/1987	Bittner	350/96.12
4,839,884 A	6/1989	Schloss	370/3
5,233,405 A	8/1993	Wildnauer et al.	356/333
5,311,606 A	* 5/1994	Asakura et al.	359/337.21
5,414,540 A	* 5/1995	Patel et al.	349/196
5,477,350 A	12/1995	Riza et al.	359/39
5,526,155 A	6/1996	Knox et al.	359/130

5,740,288 A	4/1998	Pan	385/11
5,745,271 A	4/1998	Ford et al.	359/130
5,847,831 A	12/1998	Tomlinson, III et al.	356/364
5,867,264 A	2/1999	Hinrichs	356/310
5,881,199 A	3/1999	Li	385/140
5,936,752 A	8/1999	Bishop et al.	359/124
5,943,158 A	8/1999	Ford et al.	359/295
5,960,133 A	9/1999	Tomlinson	385/18
6,018,603 A	1/2000	Lundgren et al.	385/33
6,081,331 A	6/2000	Teichmann	356/328
6,134,359 A	10/2000	Keyworth et al.	385/33
6,415,080 B1	* 7/2002	Sappey et al.	359/127

\* cited by examiner

*Primary Examiner*—Hemang Sanghavi

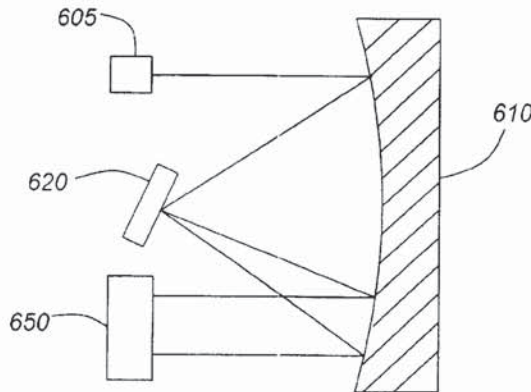
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(57) **ABSTRACT**

An optical device for rerouting and modifying an optical signal that is capable of operating as a dynamic gain equalizer (DGE) and/or a configurable optical add/drop multiplexer (COADM) is disclosed. The optical design includes a front-end unit for providing a collimated beam of light, an element having optical power for providing collimating/focusing effects, a diffraction element for providing spatial dispersion, and modifying means which in a preferred embodiment includes one of a MEMS array and a liquid crystal array for reflecting and modifying at least a portion of a beam of light. The modifying means functions as an attenuator when the optical device operates as a DGE and as a switching array when the optical device operates as a COADM. Advantageously, this invention provides a 4-f system wherein a preferred embodiment the element having optical power is a concave reflector for providing a single means for receiving light from the front-end unit, reflecting the received light to the dispersive element, receiving light from the dispersive element, and providing dispersed light to the modifying means. Conveniently and advantageously, this same concave reflector is utilized on a return path, obviating the requirement of matching elements. In one embodiment a single focussing/collimating lens is provided substantially at a focal plane of the element having optical power.

**41 Claims, 12 Drawing Sheets**



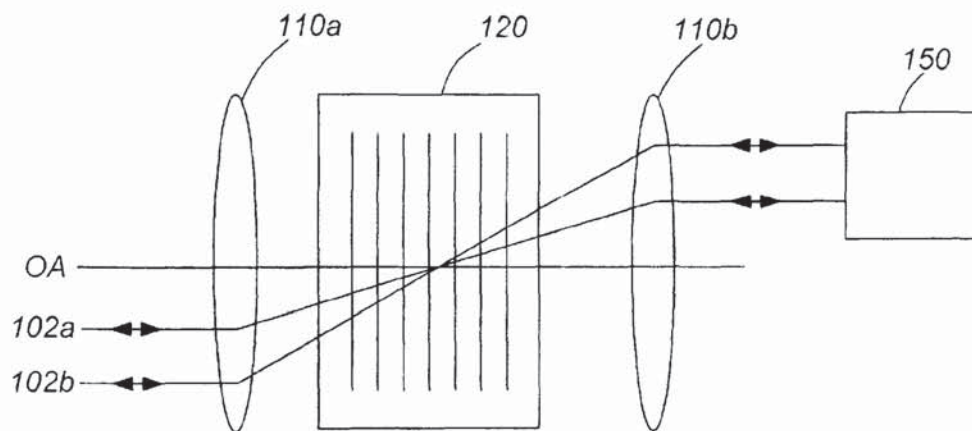


FIG. 1

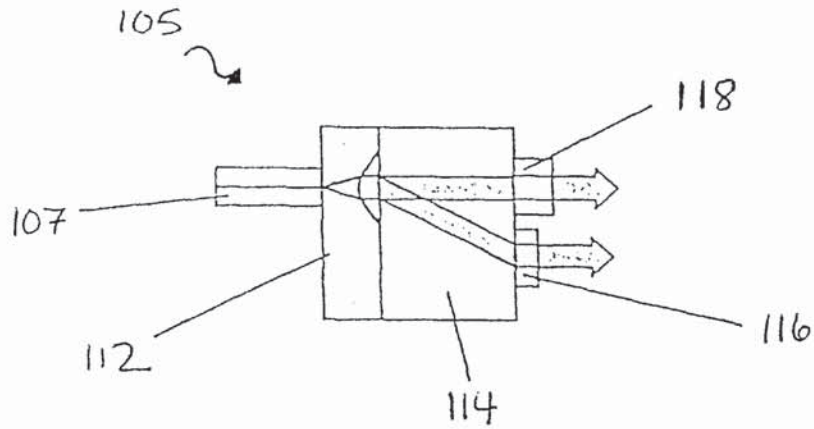


Figure 2a.

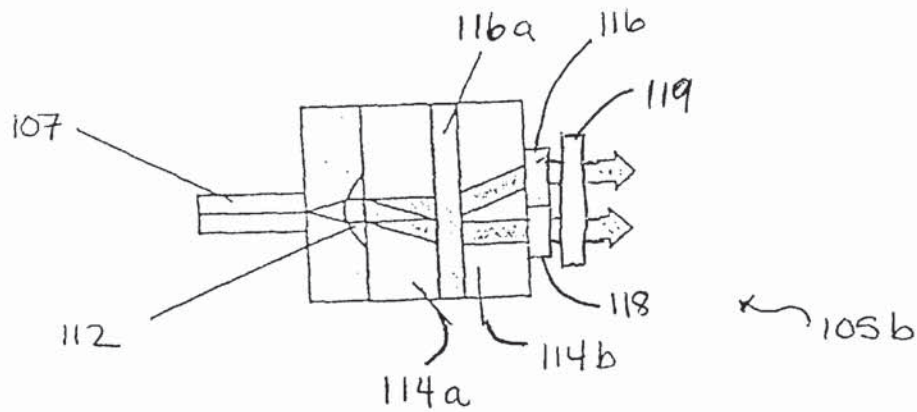


Figure 2b.

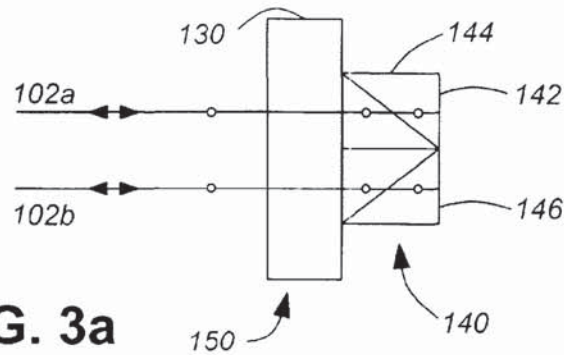


FIG. 3a

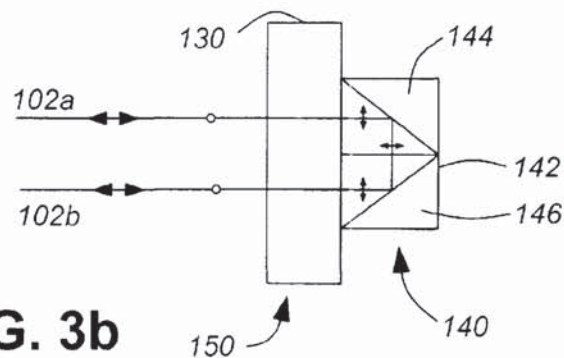


FIG. 3b

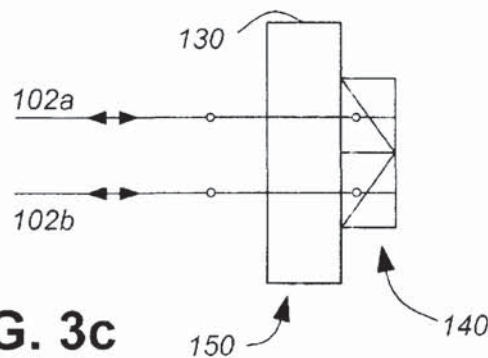


FIG. 3c

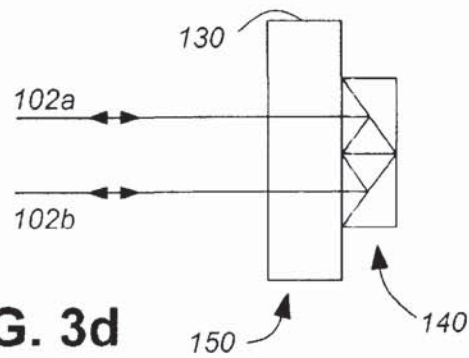


FIG. 3d

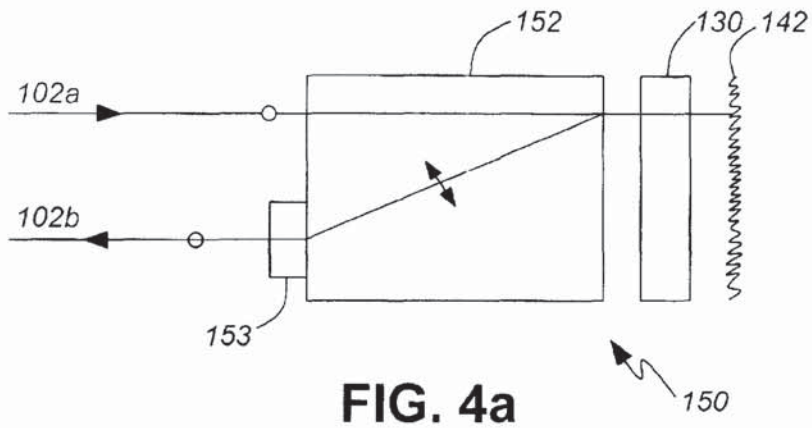


FIG. 4a

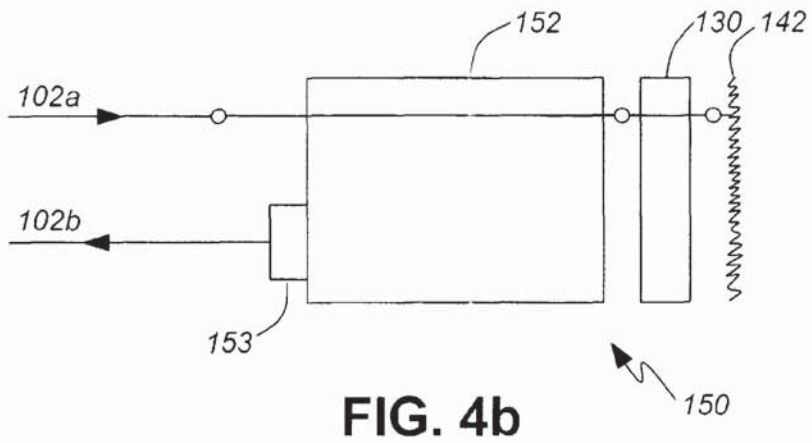


FIG. 4b

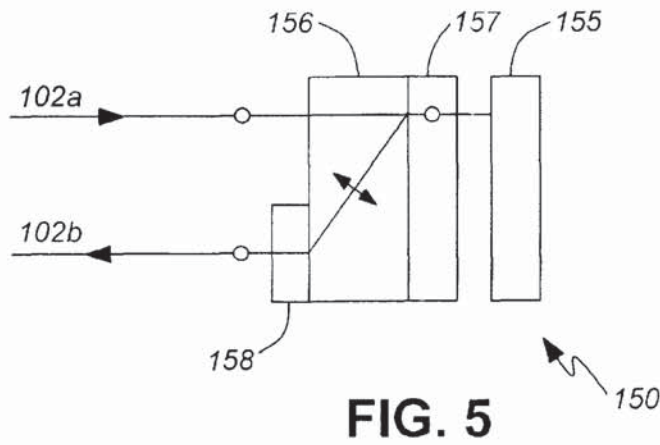


FIG. 5

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