



US006625350B2

(12) **United States Patent**
Kikuchi et al.

(10) **Patent No.:** **US 6,625,350 B2**
(45) **Date of Patent:** **Sep. 23, 2003**

(54) **FIBER COLLIMATOR ARRAY**

(75) Inventors: **Juro Kikuchi**, Kakegawa (JP);
Yasuyuki Mizushima, Kakegawa (JP);
Hiroki Takahashi, Fukuroi (JP);
Yoshiaki Takeuchi, Shizuoka (JP)

(73) Assignee: **Osaki Electric Co., Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 40 days.

(21) Appl. No.: **09/767,255**

(22) Filed: **Jan. 22, 2001**

(65) **Prior Publication Data**

US 2002/0097956 A1 Jul. 25, 2002

(51) **Int. Cl.**⁷ **G02B 6/32**

(52) **U.S. Cl.** **385/33; 385/31; 385/34; 385/35**

(58) **Field of Search** **385/31, 33-35, 385/39, 51, 78, 80, 85, 89, 93**

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,815,807 A	3/1989	Kaneko et al.	385/33
4,995,709 A	2/1991	Iwata et al.	359/641
5,394,493 A	2/1995	Ames	385/35
5,400,429 A	3/1995	Ames et al.	385/147
5,446,815 A	* 8/1995	Ota et al.	385/33
5,815,624 A	* 9/1998	Rosenberg	385/115
6,010,251 A	* 1/2000	Koyanagi et al.	385/93
6,012,852 A	* 1/2000	Kadar-Kallen et al.	385/74
6,019,522 A	2/2000	Kim	385/80
6,142,678 A	* 11/2000	Cheng	385/79
6,168,319 B1	* 1/2001	Francis	385/79
6,263,133 B1	* 7/2001	Hamm	385/33
6,304,694 B1	* 10/2001	Ford	385/33
6,328,482 B1	* 12/2001	Jian	385/88
6,393,179 B1	* 5/2002	Cheng et al.	385/34
6,404,955 B1	* 6/2002	Kikuchi et al.	385/35
2002/0057873 A1	* 5/2002	Wu et al.	385/33

OTHER PUBLICATIONS

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Collimator Arrays," 2 pgs., Sep. 7, 2000, www.advant.com/collarray.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Microlens AR Coatings," 2 pgs., Sep. 7, 2000, www.advant.com/microlens.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Fiber AR, Reflective Coatings," 2 pgs., Sep. 7, 2000, www.advant.com/arcoating.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Angle Polished Fibers," 1 pg., Sep. 7, 2000, www.advant.com/angpolish.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Fiber Arrays," 3 pgs., Sep. 7, 2000, www.advant.com/array.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, 2-D Fiber Arrays," 2 pgs., Sep. 7, 2000, www.advant.com/2darray.htm.

ACT MicroDevices, Inc., "Fiber Optic SubComponents, Fiber Collimators," 2 pgs., Sep. 7, 2000, www.advant.com/collimator.htm.

Rochester Photonics Corporation, "Collimating lenses & Arrays," 2 pgs., Oct. 25, 2000, www.rphotonic.com/collimator.htm.

(List continued on next page.)

Primary Examiner—Brian Healy

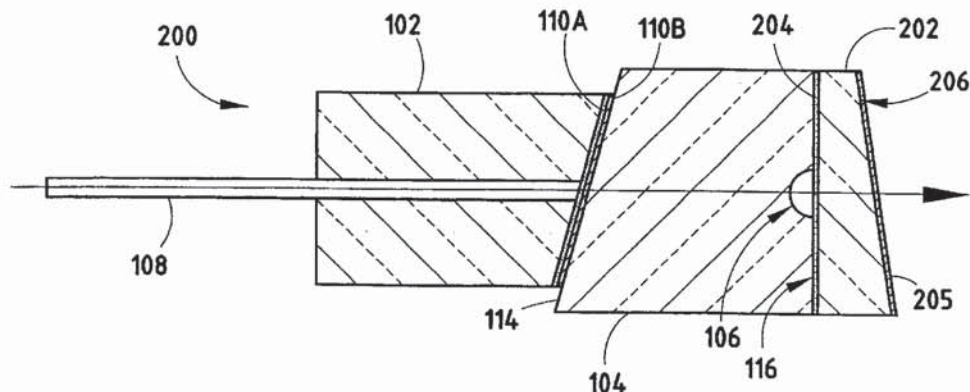
Assistant Examiner—Sarah U Song

(74) *Attorney, Agent, or Firm*—Collard & Roe, P.C.

(57) **ABSTRACT**

An optical fiber collimator array includes an optical fiber array block and a microlens array substrate. The optical fiber array block includes an angled surface and is configured to receive and retain a plurality of individual optical fibers, which carry optical signals. The microlens array substrate includes a plurality of microlenses integrated along a microlens surface and a sloped surface opposite the microlens surface. The microlens surface is coupled to the angled surface such that the optical signals from the individual optical fibers are each collimated by a different one of the integrated microlenses.

24 Claims, 5 Drawing Sheets



OTHER PUBLICATIONS

Rochester Photonics Corporation, "Microlens Array," 2 pgs., Oct. 25, 2000, www.rphotonics.com/array.htm.

Rochester Photonics Corporation, "About RPC," 2 pgs., Oct. 25, 2000, www.rphotonics.com/about.htm.

NSG America, Inc., "Planar Microlens Array (PML)," 2 pgs., Sep. 8, 2000, www.nsgamerica.com/pml.shtml.

NSG America, Inc., "Our Products," 3 pgs., Sep. 8, 2000., www.nsgamerica.com/products.shtml.

NSG America, Inc., "Physics of the SELFOC Lens," 2 pgs., Sep. 8, 2000, www.nsgamerica.com/physics.shtml.

NSG America, Inc. "Grin & SELFOC," 2 pgs., Sep. 8, 2000, www.nsgamerica.com/grin_selfoc.shtml.

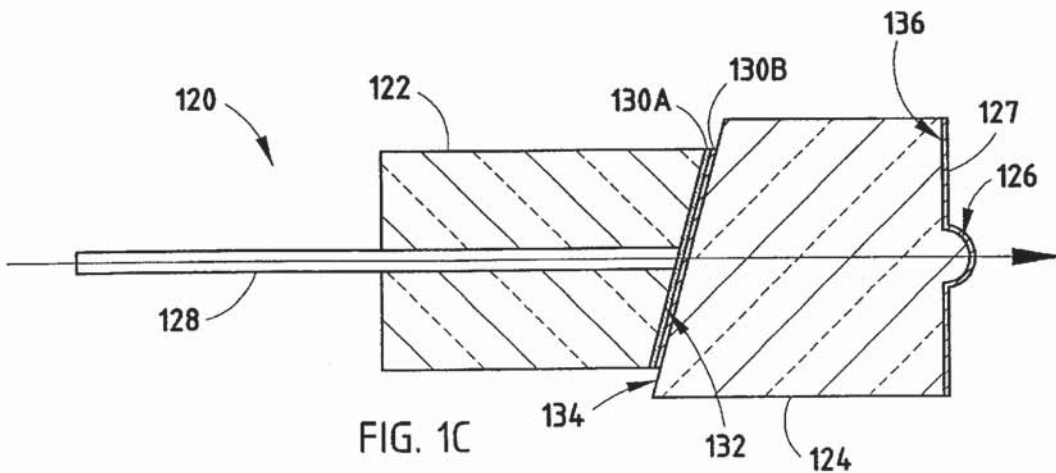
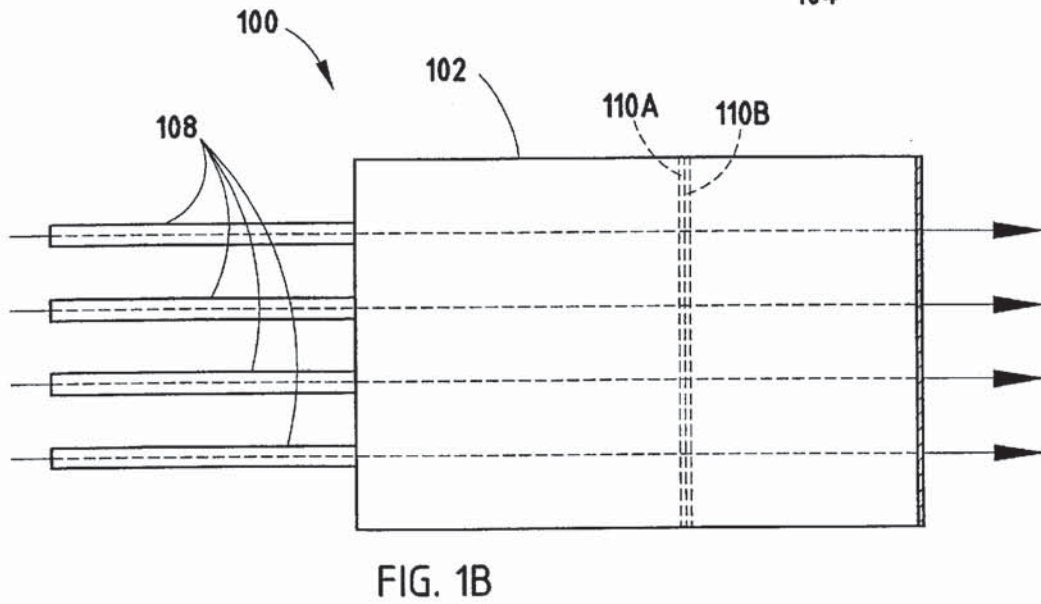
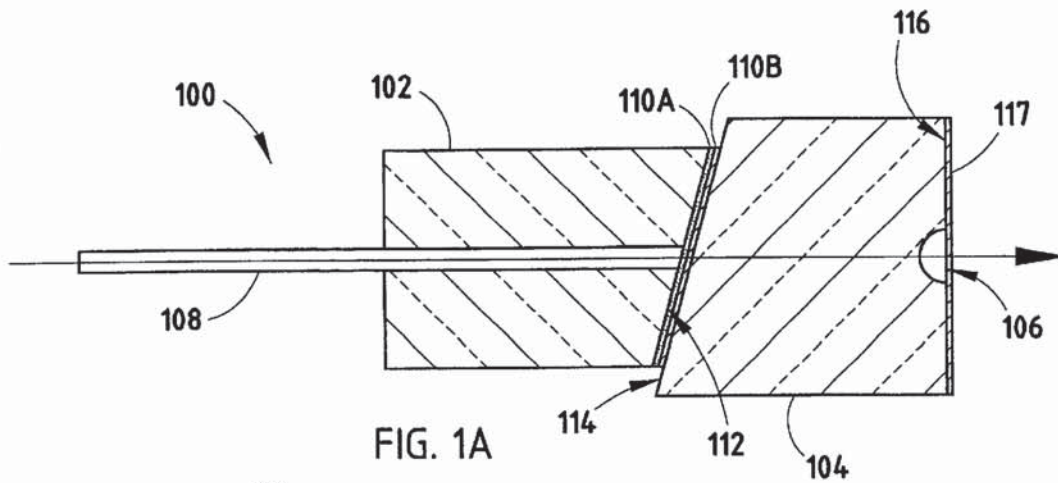
NSG, "Micro-optics," 2 pgs., Sep. 7, 2000, www.nsg.co.jp/english/moc.

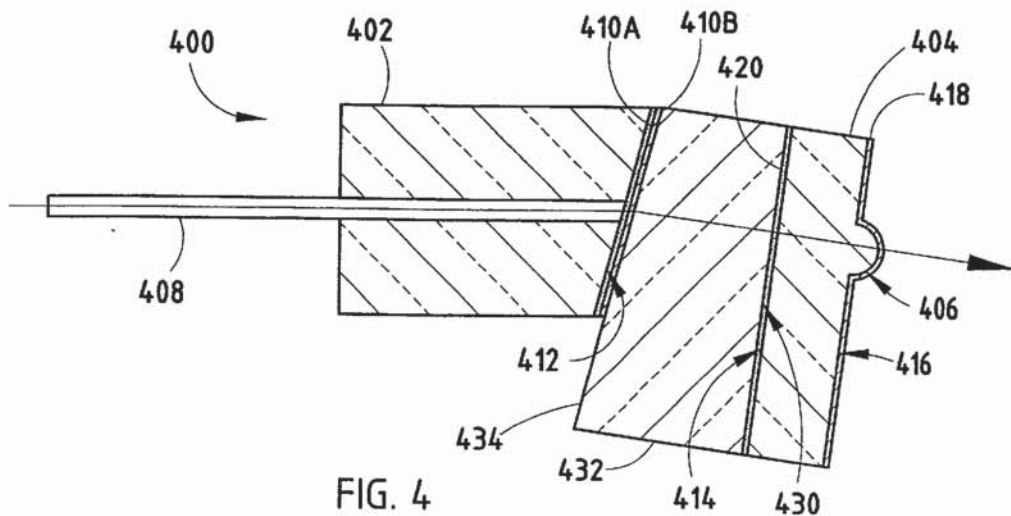
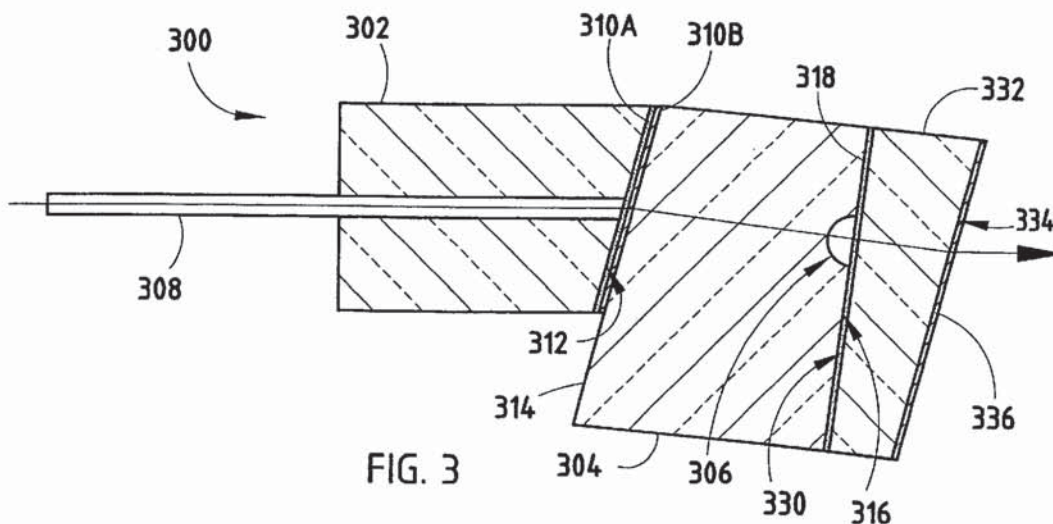
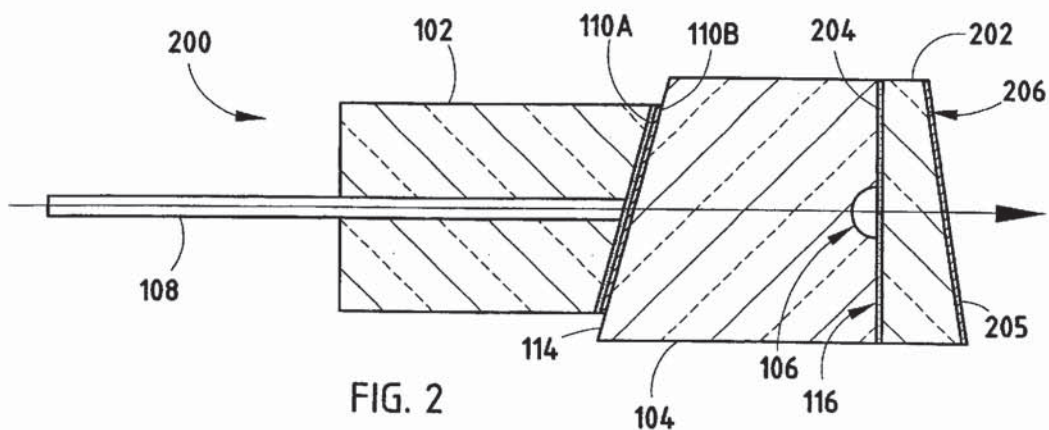
NSG America, Inc., "SELFOC® Lens Array (SLA)," 5 pgs., Sep. 8, 2000, www.nsgamerica.com/sla.shtml.

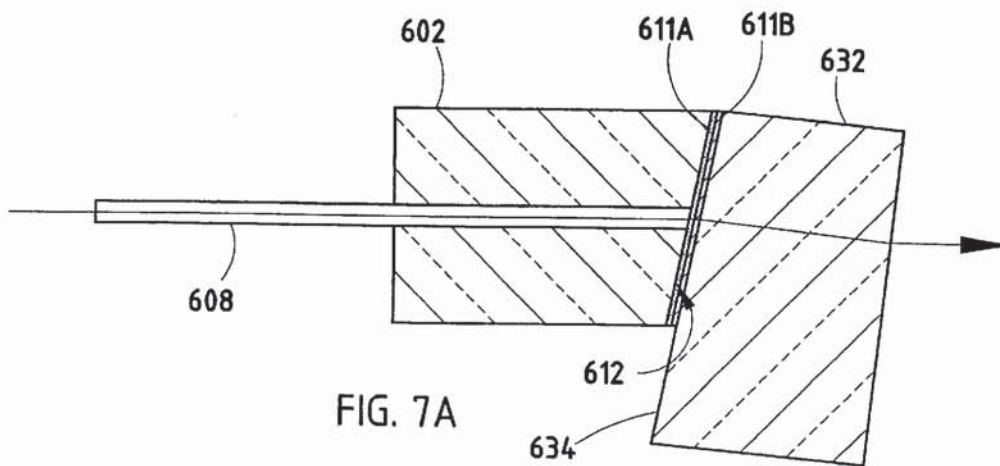
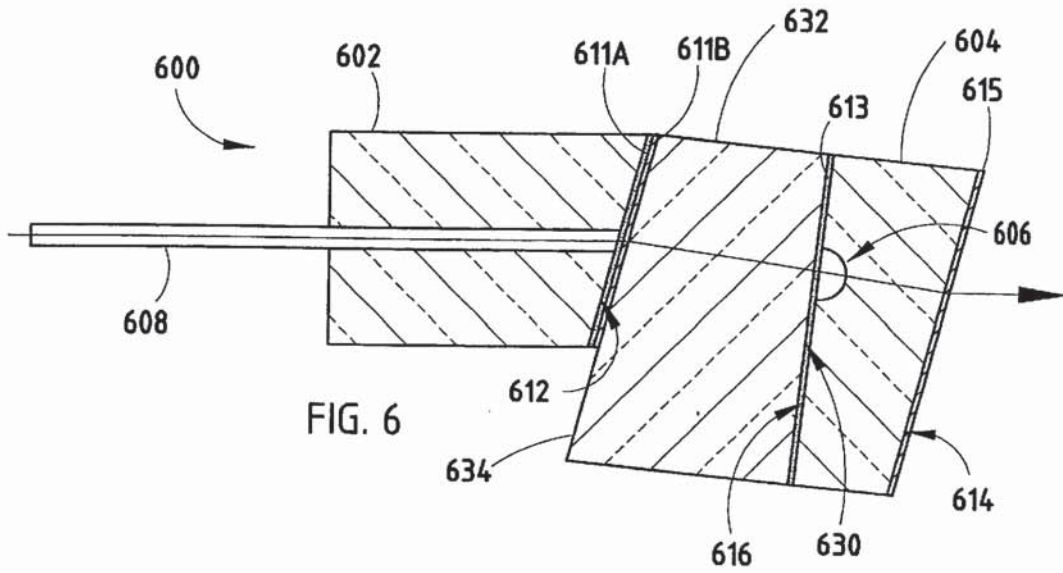
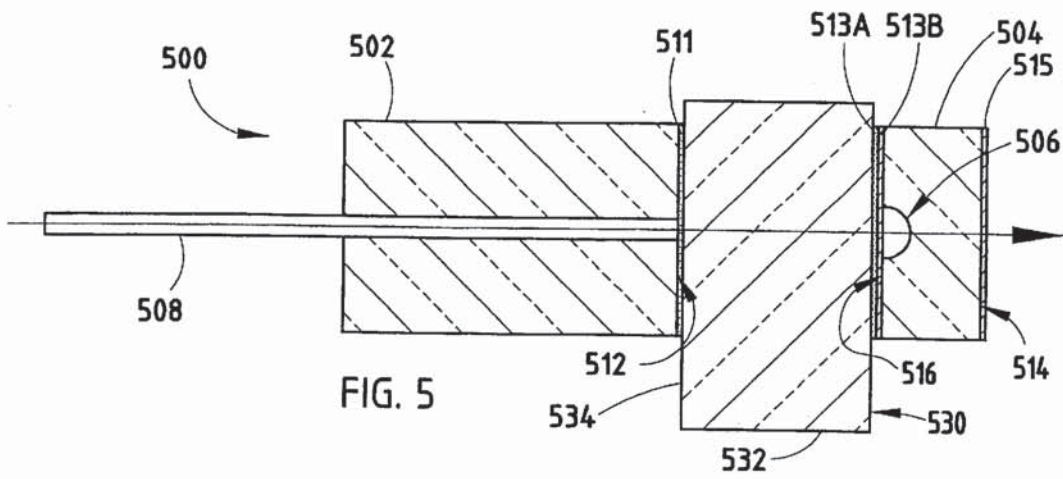
ACT MicroDevices, Inc., "Data Sheet S4100XX Series, Fiber Array Assemblies," 1 pg., Feb. 25, 2000.

ACT MicroDevices, Inc., "Data Sheet S4101XX Series, Fiber Collimators," 1 pg., Feb. 14, 1999.

* cited by examiner







Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.