

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

OPTICIS CO., LTD

Petitioner,

v.

INNEOS LLC,

Patent Owner.

Case No. IPR2023-01256
U.S. Patent No. 7,198,416

**DECLARATION OF MICHAEL LIANG IN SUPPORT OF PATENT
OWNER'S PRELIMINARY RESPONSE TO PETITION**

I, Michael Liang, hereby declare and state the following:

1. I am over the age of 18 years, I am a citizen of the United States, and I have personal knowledge of the facts recited herein and could testify competently thereto.

2. I currently work at IT Pro Source, as a Network Engineer. In this role, I provide IT support to Inneos. I provided support for Inneos and its predecessor for the last 15 years. In particular, I am familiar with metadata associated with Word files.

3. Eric Grann has provided me access to his “passport drive,” which I understand is a backup external hard drive where he saves his old files.

4. Below is a screenshot of Windows Explorer from Eric Grann’s passport drive, showing files saved in the folder named PassportDrive:\Eric\Aduro Company\Company Info\Legal\Patents.

Name	Date last saved	Type	Size	Folder
 Aduro mux disclosure rev 0.doc	10/16/2003 2:39 PM	Microsoft Word 97 - 2003 Document	840 KB	Patents (F:\Eric\Aduro\Company\Company info\Legal)
 Aduro mux disclosure rev 1.doc	11/10/2003 10:06 AM	Microsoft Word 97 - 2003 Document	846 KB	Patents (F:\Eric\Aduro\Company\Company info\Legal)
 Aduro mux disclosure rev 2.doc	1/27/2004 3:40 PM	Microsoft Word 97 - 2003 Document	842 KB	Patents (F:\Eric\Aduro\Company\Company info\Legal)

5. As shown above, several files begin with the file name “Aduro mux disclosure.” “Aduro” is the former name of Inneos LLC. I understand that mux refers to multiplexing technology.

6. When I click on the Word file “Aduro mux disclosure rev 0,” I can open and view the document. On the File-Info tab, I can view metadata associated with this particular file. The metadata shows the file was created on October 7, 2003 at 2:47 PM and was last modified on October 16, 2003, at 2:39 PM. The author metadata for this file is Eric B. Grann and the metadata states that the document was last modified by “cray.” I understand “cray” to refer to Curtis Ray. A screenshot of the metadata for the file named “Aduro mux disclosure rev 0” is below:

Aduro mux disclosure rev 0

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Some new features are disabled to prevent problems when working with previous versions of Office. Converting this file will enable these features, but may result in layout changes.

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Properties

Size	840KB
Pages	11
Words	1276
Total Editing Time	12906 Minutes
Title	Add a title
Tags	Add a tag
Comments	Add comments

Related Dates

Last Modified	10/16/2003 2:39 PM
Created	10/7/2003 2:47 PM
Last Printed	10/16/2003 2:19 PM

Related People

Author: Eric B. Grann
Add an author

Last Modified By: cray

Related Documents

Open File Location

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7. I have reviewed the file “Aduro mux disclosure rev 0” and compared it to pages from a PDF that are labeled **Opticis Co., Ltd. IPR Exhibit 1002 - Page 84** through **Opticis Co., Ltd. IPR Exhibit 1002 - Page 94**, also marked as Ray Ex C. Based on my comparison, the contents of the documents are the same. I printed to PDF the file named “Aduro mux disclosure rev 0” and it is attached here as EXHIBIT 1.

8. When I click on the Word file “Aduro mux disclosure rev 1,” I can open and view the document. On the File-Info tab, I can view metadata associated with this particular file. The metadata shows the file was created on October 24, 2003 at

9:52 AM and was last modified on November 10, 2003, at 10:06 PM. The author metadata for this file is Eric B. Grann and the metadata states that the document was last modified by “grann.” I understand “grann” to refer to Eric Grann. A screenshot

Aduro mux disclosure rev 1
 F: » Eric » Aduro » Company » Company info » Legal » Patents

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Version History
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Manage Document
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Properties

Size	845KB
Pages	11
Words	1332
Total Editing Time	10114 Minutes
Title	Add a title
Tags	Add a tag
Comments	Add comments

Related Dates

Last Modified	11/10/2003 10:06 AM
Created	10/24/2003 9:52 AM
Last Printed	10/16/2003 2:19 PM

Related People

Author	Eric B. Grann Add an author
Last Modified By	grann

Related Documents

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of the metadata for the file named “Aduro mux disclosure rev 1” is below:

9. I have reviewed the file “Aduro mux disclosure rev 1” and compared it to pages from a PDF that are labeled **Opticis Co., Ltd. IPR Exhibit 1002 - Page 95** through **Opticis Co., Ltd. IPR Exhibit 1002 - Page 105**, also marked as Ray Ex D. Based on my comparison, the contents of the documents are the same. I printed to

PDF the file named “Aduro mux disclosure rev 1” and it is attached here as EXHIBIT 2.

10. When I click on the Word file “Aduro mux disclosure rev 2,” I can open and view the document. On the File-Info tab, I can view metadata associated with this particular file. The metadata shows the file was created on January 27, 2004 at 2:51 PM and was last modified on January 27, 2004 at 3:40 PM. The author metadata lists Eric B. Grann and states that the document was last modified by “grann.” I understand “grann” to refer to Eric Grann. A screenshot of the metadata for the file named “Aduro mux disclosure rev 2” is below:

Aduro mux disclosure rev 2

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Compatibility Mode

Some new features are disabled to prevent problems when working with previous versions of Office. Converting this file will enable these features, but may result in layout changes.

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Check for Issues

Inspect Document

Before publishing this file, be aware that it contains:

- Revisions
- Document properties, author's name, editor names and related dates
- Footers
- Content that cannot be checked for accessibility issues because of the current file type

Version History

Version History

View and restore previous versions.

Manage Document

Manage Document

There are no unsaved changes.

Properties

Size	842KB
Pages	11
Words	1449
Total Editing Time	50 Minutes
Title	Add a title
Tags	Add a tag
Comments	Add comments

Related Dates

Last Modified	1/27/2004 3:40 PM
Created	1/27/2004 2:51 PM
Last Printed	1/27/2004 3:10 PM

Related People

Author	Eric B. Grann
	Add an author
Last Modified By	grann

Related Documents

Open File Location

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11. I have reviewed the file “Aduro mux disclosure rev 2” and compared it to pages from a PDF that are labeled **Opticis Co., Ltd. IPR Exhibit 1002 - Page 106** through **Opticis Co., Ltd. IPR Exhibit 1002 - Page 116**, also marked as Ray Ex E. Based on my comparison, the contents of the documents are the same. I printed to PDF the file named “Aduro mux disclosure rev 2” and it is attached here as EXHIBIT 3.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on this 12th day of November, 2023.

By:


Michael Liang

EXHIBIT 1



2134A Rheem Drive
Pleasanton, CA 94588

REPORT OF POSSIBLE SUBJECT INVENTION

1. SUBMITTER(s):

Curtis A. Ray, Eric B. Grann, Brian C. Peters

2. TITLE:

Micro-Optical Wavelength Division Multiplexer Device with Integrated Fiber Optic Connector

3. ABSTRACT:

A micro-optical device for wavelength division multiplexing or optical combining is described wherein, an array of light sources are collimated, directed to propagate along a similar path, and coupled into an optical fiber. Multiple pairs of lenses for each light source spatially combine multiple-wavelengths. One lens of each pair is for each light source and one lens is for the fiber. The passively or actively aligned monolithic optical coupling module is constructed by plastic-mold injection, and contains all of the mechanical alignment features, an array of collimating lenses, and a fiber coupling lens housed within a fiber optic connector ferule.

4. PROBLEM THE INVENTION OVERCOMES:

Current wavelength division multiplexed (WDM) devices are designed using dielectric filters or expensive waveguides. The WDM device described herein utilizes plastic-mold injection to create a compact device capable of multiplexing multiple optical wavelengths.

5. DETAILED DESCRIPTION OF THE INVENTION:

Background of the Invention

1. Field of the Invention

The present invention pertains to optical communications. More particularly, this invention relates to an optical multiplexing device which spatially combines multi-wavelength light from a plurality of lasers into an optical fiber. In certain preferred embodiments, the improved multiplexing device of the present invention is particularly suited for wavelength division multiplexing systems for the fiber-optic data-communications and telecommunications systems.

2. Description of the Related Art

In wavelength division multiplexed optical communication systems, many different optical wavelength carriers provide independent communication channels in a single optical fiber. Future computation and communication systems place ever-increasing demands upon communication link bandwidth. It is generally known that optical fibers offer much higher bandwidth than conventional coaxial communications; furthermore a single optical channel in a fiber waveguide uses a small fraction of the available bandwidth of the fiber (typically a few GHz out of several tens of THz). By transmitting several channels at different optical wavelengths into a fiber (i.e., wavelength division multiplexing, or WDM), this bandwidth may be more efficiently utilized.

An optical multiplexing device combines or separates multiple light signals with varying optical wavelengths. The optical multiplexing device has applications for both dense and course wavelength division multiplexing (DWDM & CWDM) for both multi-mode and signal-mode fiber optic data communications and telecommunications. Multiple wavelength light sources are combined into a single optical path for transmission.

Summary of the Invention

One of the key features of the present invention is to provide a compact and cost effective optical multiplexer for both single-mode or multimode fiber optic communication systems.

Another feature of the present invention is to minimize optical loss due to divergence of light between the source coupling optics and the fiber optic connector coupling optics.

Another feature of the present invention to integrate a fiber optic connector within the optical module, to passively align an optical fiber to the coupling optic.

The present invention is comprised of a plastic molded coupling module consisting of a plurality of lenses, one lens for focusing several geometrically placed collimated beams onto the fiber and one or more lenses for collimating light from lasers or fibers and a means for geometrically arranging the plurality of collimated beams for maximum coupling efficiency into the fiber.

The plastic molded coupling module is formed by integrating an aspherical on-axis, offset collimating lens array, a redirectional mirror, a coupling lens, a fiber optic connector, and mechanical features for alignment of the optical part to either an array of light sources or an optical fiber array, all within a single part.

Brief Description of the Drawings

FIG. 1 shows a cross-section side view of the WDM optical multiplexer;

FIG. 2 shows an isometric top view of the WDM device;

FIG. 3 shows an isometric bottom view of the WDM device;

FIG. 4 shows a cross-sectional isometric side view of the WDM device;

FIG. 5 shows an isometric view of an alternative embodiment of the WDM device;

FIG. 6 shows an isometric cross-sectional view of an alternative embodiment of the WDM device;

Detailed Description of the Invention

Fig. 1 shows a wavelength division multiplexer 1 that illustrates an embodiment of the present invention. The multiplexer 1 in this embodiment shows four input collimating lenses 2a, 2b, 2c, 2d and output focusing lens 3. Light sources are located at the focal points of the four input lenses and the light is collimated, reflected off a prism 4 and focused by the focusing lens 3 onto a spot at which a fiber is stopped 5. Pins 6 are located to aid in affixing the WDM device 1 to the light sources.

This multiplexing device has the ability to combine individual light signals into a single optical path that can be directed towards an optical fiber. Matching the NA of the larger lens 3 and the NA of the fiber inserted at the fiber stop 5, as well as the spot size of the focused beam being made smaller than the fiber core couples a maximum amount of the collimated light into the fiber. Similarly, by arranging four (in this embodiment) collimating lenses 2a, 2b, 2c, 2d of a size small enough to fit inside the diameter of the focusing beam, and matching their NA to the light sources, the maximum amount of light will couple into the collimated beam. Figure five and six show an alternative embodiment which does not include a prism and is shown able to mate to a standard "TO" style can for chip packaging.

6. RELATED ART: List all prior art references known to you to be relevant to the novelty (newness) of the invention, and include a copy of each one

U. S. Patent 4,244,045 (Jan. 6, 1981)	Kiyoshi Nosu
U. S. Patent 5,583,683 (Dec. 10, 1996)	Michael A. Scobey
U. S. Patent 5,786,915 (Jul. 28, 1998)	Michael A. Scobey
U. S. Patent 5,835,517 (Nov. 10, 1998)	Vijaysekhar Jayaraman
U. S. Patent 5,859,717 (Jan. 12, 1999)	Michael A. Scobey
U. S. Patent 5,894,535 (Apr. 13, 1999)	Brian E. Lemoff
U. S. Patent x,xxx,xxx (XXX. XX, 19xx)	Eric Grann

7. UNIQUE FEATURES: Itemize the features or advantages you consider unique and compare those with

the references listed in Item number 6

Key Features:

- | | |
|--------------------------------------|--|
| 1) <u>Manufacturing throughput.</u> | Replication procedures are extremely fast, thus reducing the overall cost of the manufactured device. |
| 2) <u>Passive Alignment.</u> | All of the optical components within the multiplexer could utilize passive alignment mechanisms. |
| 3) <u>Monolithic Coupling Optics</u> | Each optical coupling and redirection component is integrated within a single monolithic plastic-molded device. |
| 4) <u>Cost Reduction</u> | Fewer parts are required such as filters and reflector blocks |
| 5) <u>Offset Launch</u> | Spots may be focused on a section of the fiber which is offset from the center of the fiber, thus creating an offset launch condition, which is known by those skilled in the art to produce a better condition for resisting modal partition noise. |

8. POSSIBLE ALTERNATIVE VERSIONS:

Potential applications:

- 1) Wavelength division multiplexing / demultiplexing (WDM)
- 2) Optical signal routing
- 3) Spectroscopy
- 4) Biological and chemical integrated optical sensors
- 5) Optical computing

9. PROBABLE VALUE:

10. SUBMITTERS AND CONTRIBUTIONS: Provide the following for each contributor to the invention:

(If any submitter is not an employee of Blaze Network Products, Inc., indicate affiliation and supply a copy of the controlling contract)

Name: Curtis Ray
Home Address: 108 Warwick Court
Alamo, CA 94507
Citizenship: U.S.
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

Name:
Home Address:

Citizenship:
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

Name:
Home Address:

Citizenship:
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

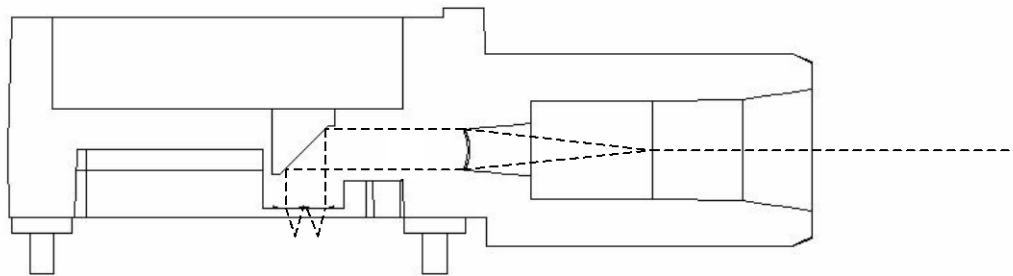


Figure 1

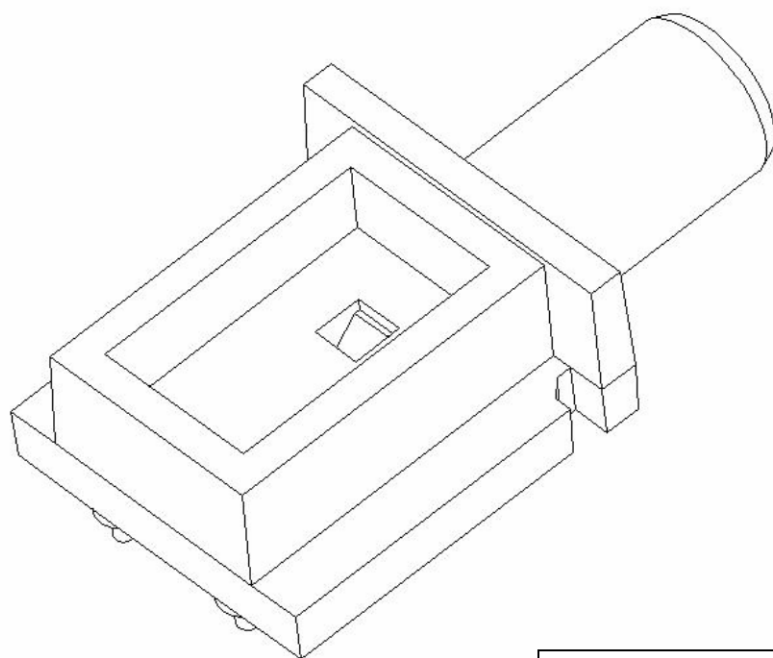


Figure 2

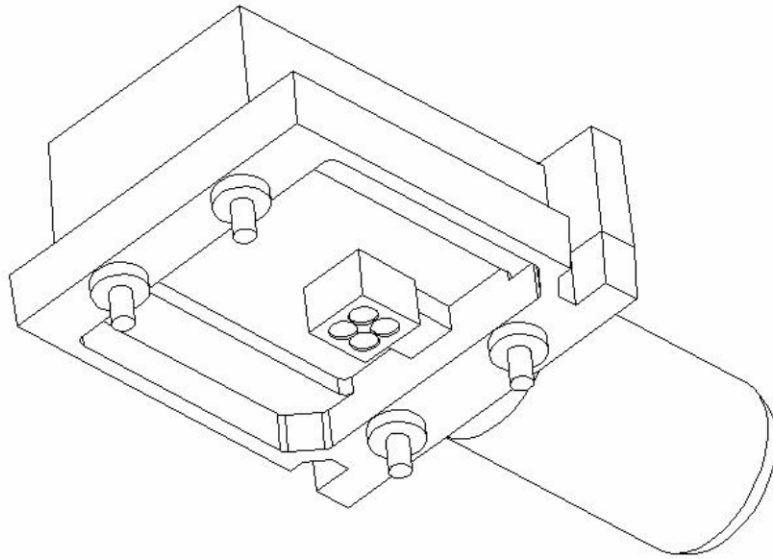


Figure 3

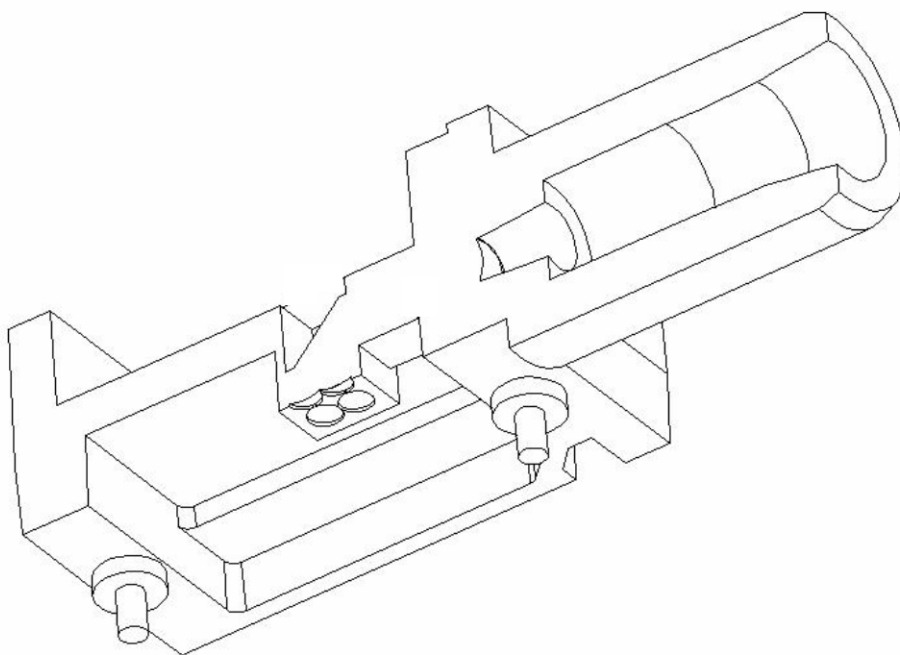


Figure 4

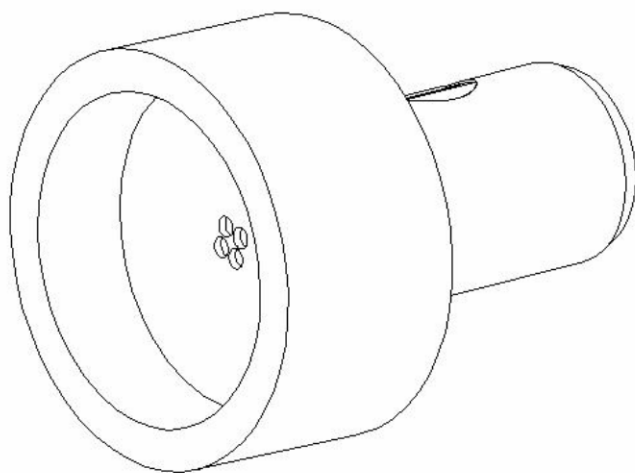


Figure 5

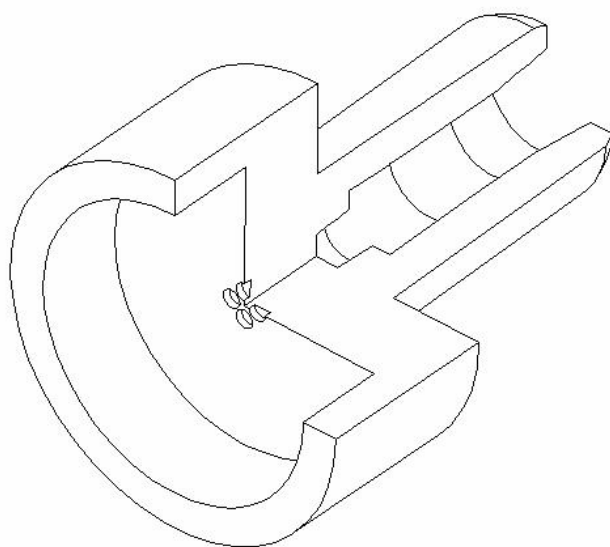


EXHIBIT 2



2134A Rheem Drive
Pleasanton, CA 94588

REPORT OF POSSIBLE SUBJECT INVENTION

1. SUBMITTER(s):

Curtis A. Ray, Eric B. Grann, Brian C. Peters

2. TITLE:

Micro-Optical ~~Wavelength-Division-Multiplexer~~Combiner Device ~~with Integrated Fiber-Optic Connector~~

3. ABSTRACT:

A micro-optical device for ~~wavelength-division-multiplexing-or-optical-combining~~ optical signals of similar or different wavelengths is described wherein, an array of light sources are collimated, directed to propagate along a similar path, and coupled into an optical fiber through a single lens. ~~Multiple pairs of lenses for each light source spatially combine multiple wavelengths. One lens of each pair is for each light source and one lens is for the fiber. The passively or actively aligned monolithic~~The optical coupling module ~~is~~ can be constructed in various ways to achieve the desired configuration. ~~by~~ One example is a single plastic-mold injection molded part, ~~and~~ contain~~ing~~s all of the mechanical alignment features, an array of collimating lenses, and a fiber coupling lens housed within a fiber optic connector ferule.

4. PROBLEM THE INVENTION OVERCOMES:

Most combiner devices are used as wavelength division multiplexers. Current wavelength division multiplexed (WDM) devices are designed using dielectric filters or expensive waveguides. The combiner / WDM device described herein utilizes plastic-mold injection to create a compact device capable of ~~multiplexing—~~combining multiple optical ~~wavelengths~~signals into a single optical fiber. While a single molded device can be constructed to create the present invention, two or more parts can be combined to accomplish the same function, and may be necessary to achieve certain environmental conditions.

5. DETAILED DESCRIPTION OF THE INVENTION:

Background of the Invention

1. Field of the Invention

The present invention pertains to optical communications. More particularly, this invention relates to an optical multiplexing device which spatially combines multi-wavelength light from a plurality of lasers into an optical fiber. In certain preferred embodiments, the improved multiplexing device of the present invention is particularly suited for wavelength division multiplexing systems for the fiber-optic data-communications and telecommunications systems.

2. Description of the Related Art

In wavelength division multiplexed optical communication systems, many different optical wavelength carriers provide independent communication channels in a single optical fiber. Future computation and communication systems place ever-increasing demands upon communication link bandwidth. It is generally known that optical fibers offer much higher bandwidth than conventional coaxial communications; furthermore a single optical channel in a fiber waveguide uses a small fraction of the available bandwidth of the fiber (typically a few GHz out of several tens of THz). By transmitting several channels at different optical wavelengths into a fiber (i.e., wavelength division multiplexing, or WDM), this bandwidth may be more efficiently utilized.

An optical multiplexing device combines or separates multiple light signals with varying optical wavelengths. The optical multiplexing device has applications for both dense and course wavelength division multiplexing (DWDM & CWDM) for both multi-mode and signal-mode fiber optic data communications and telecommunications. Multiple wavelength light sources are combined into a single optical path for transmission.

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Another feature of the present invention is to minimize optical loss due to divergence of light between the source coupling optics and the fiber optic connector coupling optics.

[Another feature of the present invention is to minimize reflections directly back to the same focal position they were emitted from.](#)

Another feature of the present invention to integrate a fiber optic connector within the optical module, to passively align an optical fiber to the coupling optic.

The present invention is comprised of a plastic molded coupling module consisting of a plurality of lenses, one lens for focusing several geometrically placed collimated beams onto the fiber and one or more lenses for collimating light from lasers or fibers and a means for

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[Search for Patents on optical combiners](#)

U. S. Patent 4,244,045 (Jan. 6, 1981)	Kiyoshi Nosu
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U. S. Patent 5,786,915 (Jul. 28, 1998)	Michael A. Scobey
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(If any submitter is not an employee of Blaze Network Products, Inc., indicate affiliation and supply a copy of the controlling contract)

Name: Curtis Ray
Home Address: 108 Warwick Court
Alamo, CA 94507
Citizenship: U.S.
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

Name:
Home Address:
Citizenship:
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

Name:
Home Address:
Citizenship:
Specific Contributions:

Notebook #: Page #: Date:
Signature: Date:

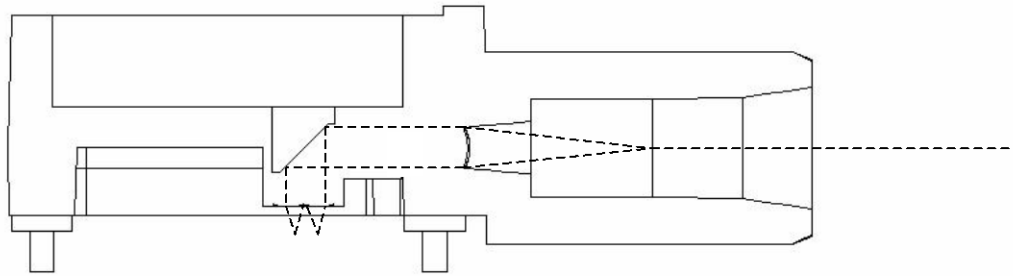


Figure 1

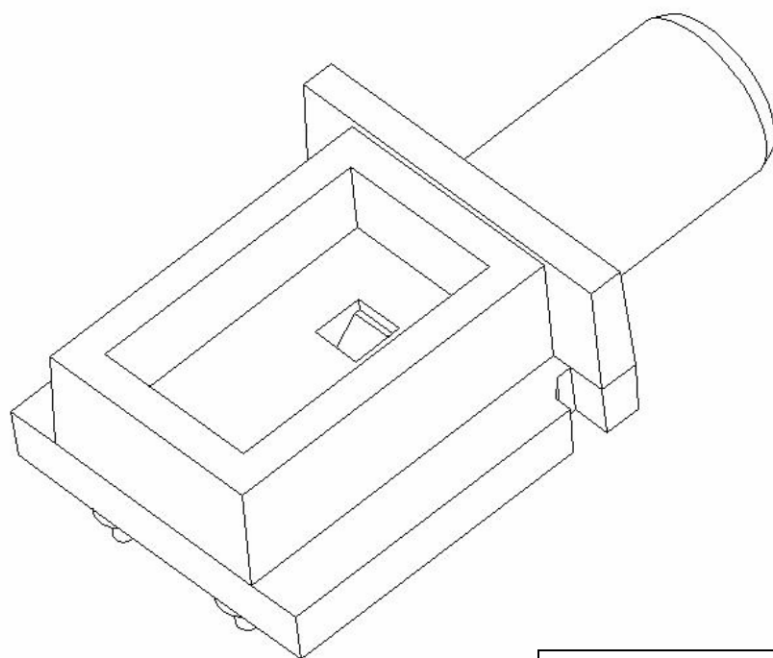


Figure 2

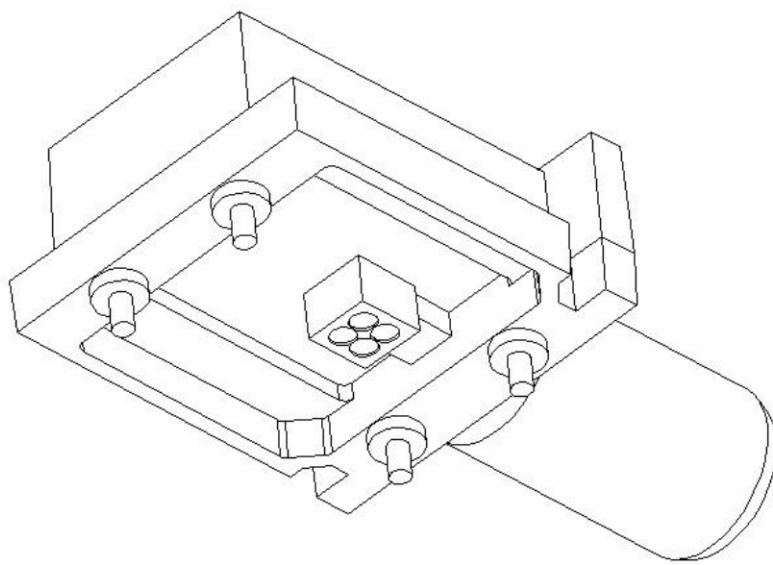


Figure 3

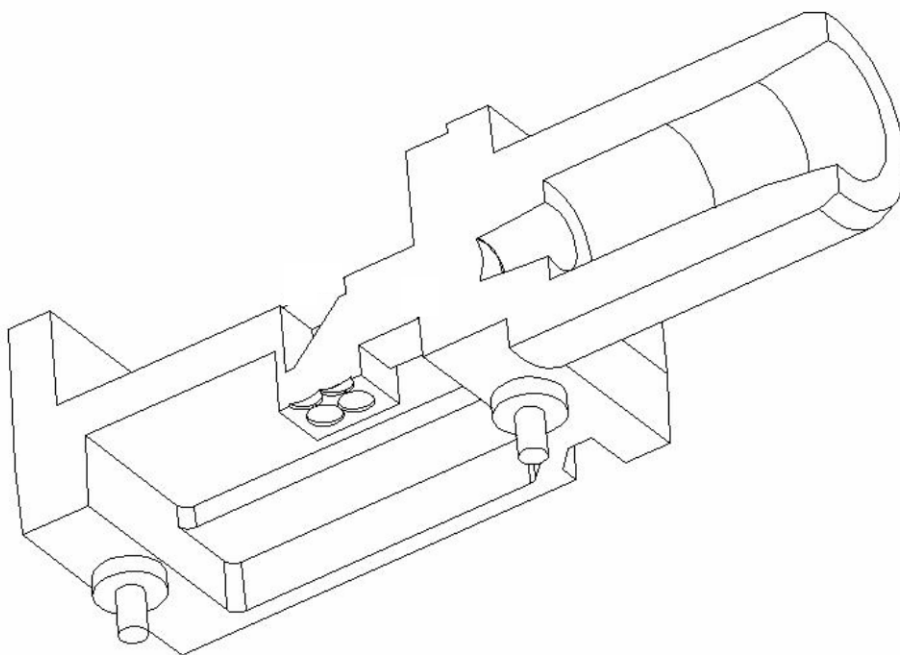


Figure 4

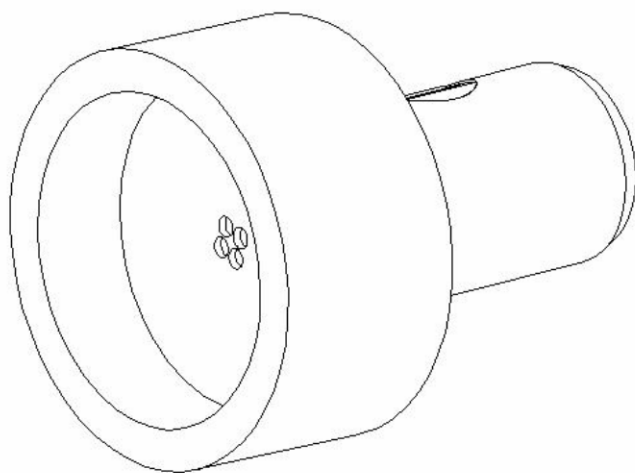


Figure 5

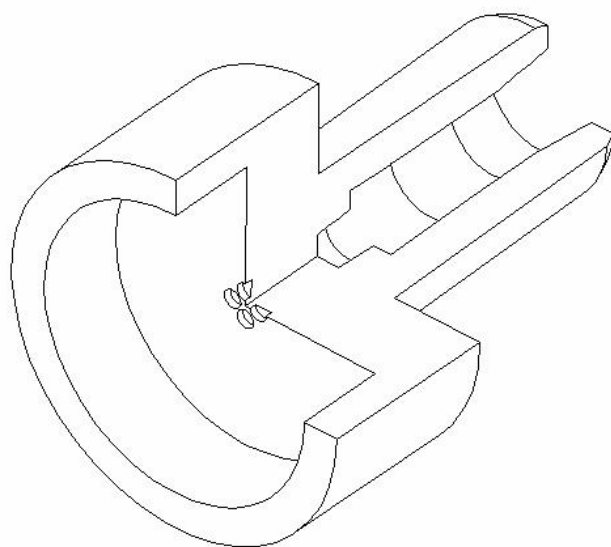


EXHIBIT 3



2134A Rheem Drive
Pleasanton, CA 94588

REPORT OF POSSIBLE SUBJECT INVENTION

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Curtis A. Ray, Eric B. Grann, Brian C. Peters

2. TITLE:

Micro-Optical Combiner Device

3. ABSTRACT:

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2. Description of the Related Art

In wavelength division multiplexed optical communication systems, many different optical wavelength carriers provide independent communication channels in a single optical fiber. Future computation and communication systems place ever-increasing demands upon communication link bandwidth. It is generally known that optical fibers offer much higher bandwidth than conventional coaxial communications; furthermore a single optical channel in a fiber waveguide uses a small fraction of the available bandwidth of the fiber (typically a few GHz out of several tens of THz). By transmitting several channels at different optical wavelengths into a fiber (i.e., wavelength division multiplexing, or WDM), this bandwidth may be more efficiently utilized.

An optical multiplexing device combines or separates multiple light signals with varying optical wavelengths. The optical multiplexing device has applications for both dense and course wavelength division multiplexing (DWDM & CWDM) for both multi-mode and signal-mode fiber optic data communications and telecommunications. Multiple wavelength light sources are combined into a single optical path for transmission.

Summary of the Invention

One of the key features of the present invention is to provide a compact and cost effective optical multiplexer for both single-mode or multimode fiber optic communication systems.

Another feature of the present invention is to minimize optical loss due to divergence of light between the source coupling optics and the fiber optic connector coupling optics.

Another feature of the present invention is to minimize reflections directly back to the same focal position they were emitted from.

Another feature of the present invention to integrate a fiber optic connector within the optical module, to passively align an optical fiber to the coupling optic.

The present invention is comprised of a plastic molded coupling module consisting of a plurality of lenses, one lens for focusing several geometrically placed collimated beams onto the fiber and one or more lenses for collimating light from lasers or fibers and a means for

geometrically arranging the plurality of collimated beams for maximum coupling efficiency into the fiber.

The plastic molded coupling module is formed by integrating an aspherical on-axis, offset collimating lens array, a redirectional mirror, a coupling lens, a fiber optic connector, and mechanical features for alignment of the optical part to either an array of light sources or an optical fiber array, all within a single part.

Brief Description of the Drawings

FIG. 1 shows a cross-section side view of the WDM optical multiplexer;

FIG. 2 shows an isometric top view of the WDM device;

FIG. 3 shows an isometric bottom view of the WDM device;

FIG. 4 shows a cross-sectional isometric side view of the WDM device;

FIG. 5 shows an isometric view of an alternative embodiment of the WDM device;

FIG. 6 shows an isometric cross-sectional view of an alternative embodiment of the WDM device;

Detailed Description of the Invention

Figures 1 - 4 show an optical combiner **1** that illustrates an embodiment of the present invention. The combiner **1** in this embodiment shows four input collimating lenses **2a, 2b, 2c, 2d** and output focusing lens **3**. Light sources are located at the focal points of the four input lenses and the light is collimated, reflected off a prism **4** and focused by the focusing lens **3** onto a spot at which a fiber is stopped **5**. Pins **6** are located to aid in affixing the combiner device **1** to the light sources. The integrated ferrule **7** enables one to place a fiber optic cable into the pre-aligned connector.

This combiner device has the ability to combine individual light signals into a single optical path that can be directed towards an optical fiber. Matching the NA of the larger lens **3** and the NA of the fiber inserted at the fiber stop **5**, as well as the spot size of the focused beam being made smaller than the fiber core couples a maximum amount of the collimated light into the fiber. Similarly, by arranging four (in this embodiment) collimating lenses **2a, 2b, 2c, 2d** of a size small enough to fit inside the diameter of the focusing beam, and matching their NA to the light sources, the maximum amount of light will couple into the collimated beam.

Figure 5 and 6 show an alternative embodiment for combining multiple optical signals **8**, which does not include a prism for translating the optical beams from one axis to another. This particular embodiment is beneficial for mating to a standard "TO" style laser chip package. Similar to the embodiment described in figure 1-4, the embodiment shown here utilizes a two-dimensional array of lenses **9a, 9b, 9c, 9d** for collimating the input light signals, a single focusing lens **10**, and a fiber connector **11** that allows one to place a fiber optic cable into the pre-aligned connector.

6. **RELATED ART:** List all prior art references known to you to be relevant to the novelty (newness) of the invention, and include a copy of each one

Search for Patents on optical combiners

U. S. Patent 6,369,925	(Apr. 9, 2002)	Il'ya Agurok
U. S. Patent 6,362,919	(Mar. 26, 2002)	Dale Flanders
U. S. Patent 6,219,480	(Apr. 17, 2001)	William Cassarly
U. S. Patent 6,201,908	(Mar. 13, 2001)	Eric Grann
U. S. Patent 5,852,699	(Dec. 22, 1998)	Vitaly Lissatschenko
U. S. Patent 5,751,869	(May 12, 1998)	Kenneth Li
U. S. Patent 5,377,287	(Dec. 27, 1994)	Jar Lee
U. S. Patent 4,516,832	(May 14, 1985)	Kantilal Jain
U. S. Patent 4,230,941	(Oct. 28, 1980)	Norman Stauffer

7. **UNIQUE FEATURES:** Itemize the features or advantages you consider unique and compare those with the references listed in Item number 6

Key Features:

- | | |
|--------------------------------------|--|
| 1) <u>Manufacturing throughput.</u> | Replication procedures are extremely fast, thus reducing the overall cost of the manufactured device. |
| 2) <u>Passive Alignment.</u> | All of the optical components within the multiplexer could utilize passive alignment mechanisms. |
| 3) <u>Monolithic Coupling Optics</u> | Each optical coupling and redirection component is integrated within a single monolithic plastic-molded device. |
| 4) <u>Cost Reduction</u> | Fewer parts are required such as filters and reflector blocks |
| 5) <u>Offset Launch</u> | Spots may be focused on a section of the fiber which is offset from the center of the fiber, thus creating an offset launch condition, which is known by those skilled in the art to produce a better condition for resisting modal partition noise. |

8. **POSSIBLE ALTERNATIVE VERSIONS:**

Potential applications:

- 1) Wavelength division multiplexing / demultiplexing (WDM)
- 2) Optical signal routing
- 3) Spectroscopy
- 4) Biological and chemical integrated optical sensors
- 5) Optical computing

9. **PROBABLE VALUE:**

10. SUBMITTERS AND CONTRIBUTIONS: Provide the following for each contributor to the invention:

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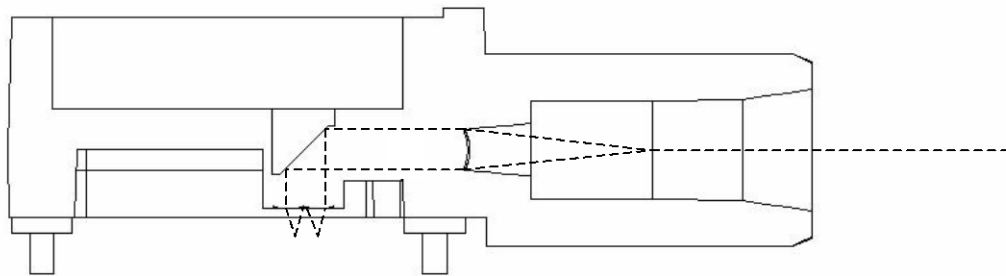


Figure 1

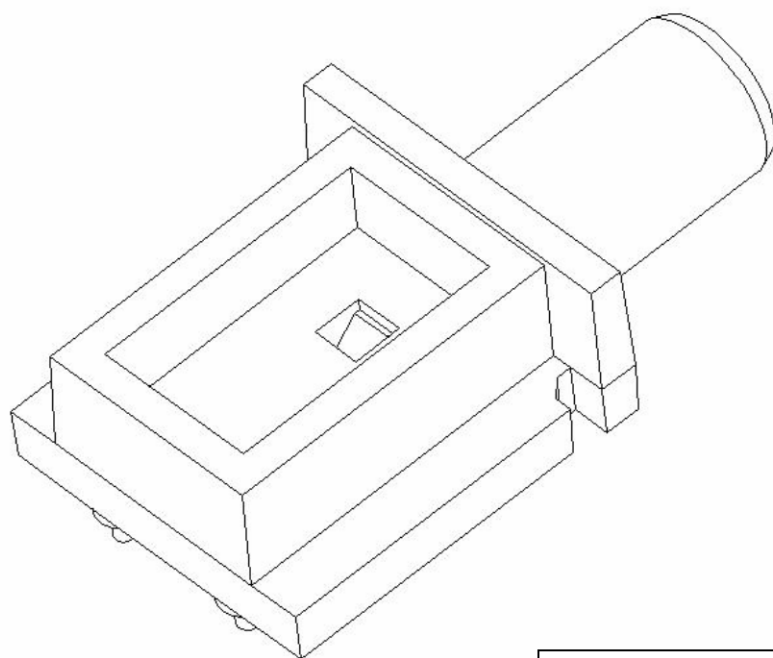


Figure 2

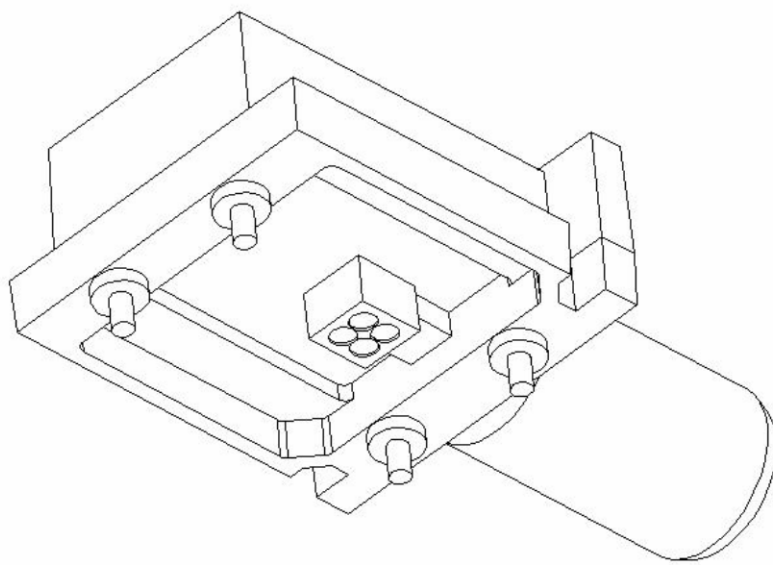


Figure 3

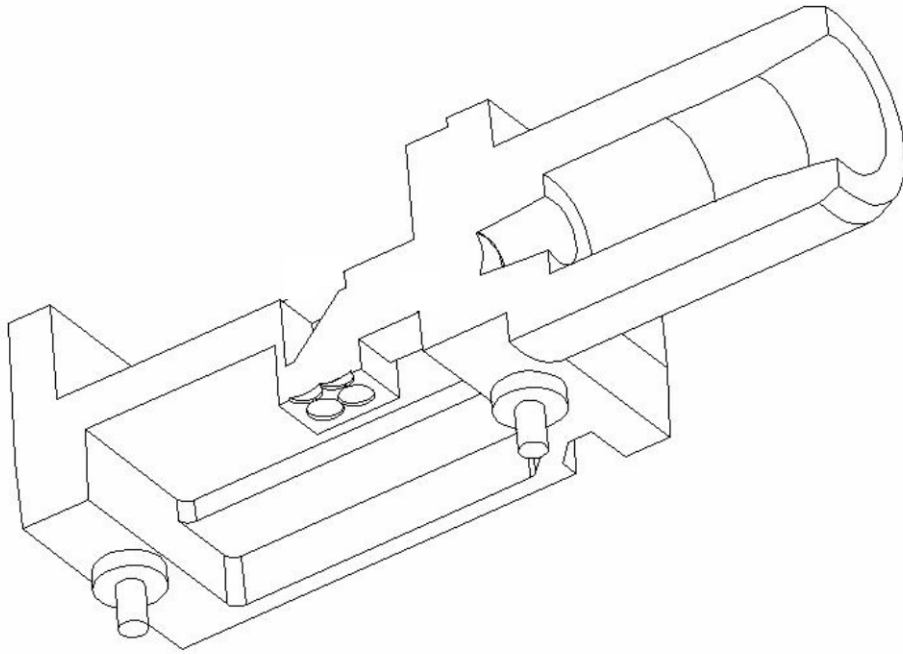


Figure 4

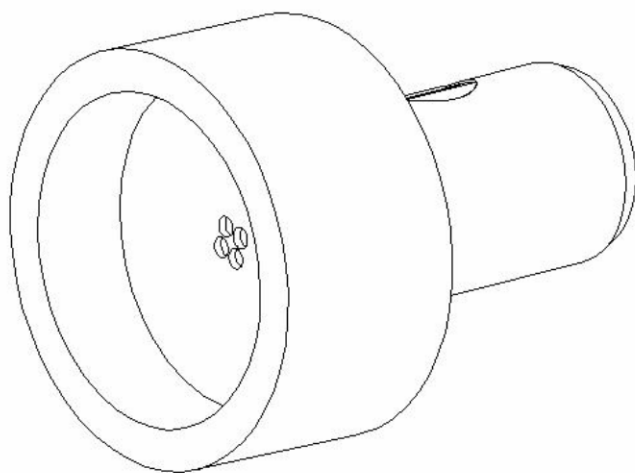


Figure 5

