Patent Abstracts

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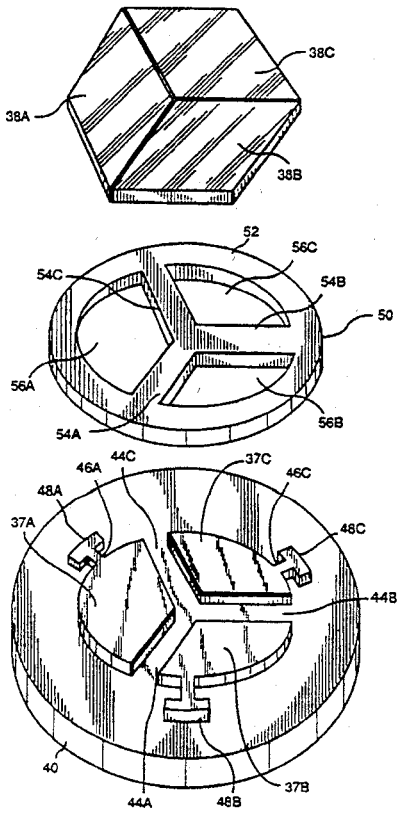
5,448,058 Sept. 5, 1995

Optical Signal Detection Apparatus and Method for Preventing Polarization Signal Fading in Optical Fiber Interferometric Sensor Systems

Inventors: Akbar Arab-Sadeghabadi and Karlheinz vonBieren.
Assignee: Litton Systems, Inc.
Filed: Sept. 27, 1993.

***Abstract*—A photodetector includes a polarizer array and an array of photodetector elements. The polarizer array includes a plurality of polarizers having axes of polarization spaced apart by selected angles such that each optical signal incident on the polarizer array has a polarization component along at least one of the axes of polarization. The array of photodetector elements is arranged such that each of the photodetector elements receives light from a selected one of the polarizers. At least one of the photodetector elements receives parallel polarization components from the optical signals to form an electrical signal indicative of interference between the optical signals.**

1 Claim, 3 Drawing Sheets



Publisher Item Identifier S 1051-8207(96)07966-4.

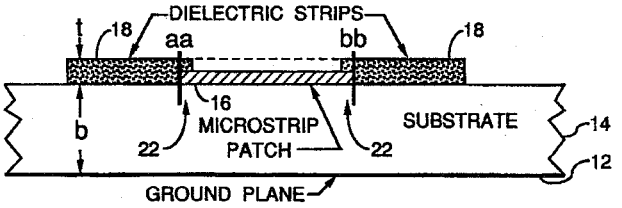
5,448,252 Sept. 5, 1995

Wide-Bandwidth Microstrip Patch Antenna

Inventors: Azar S. Ali and Kuldip C. Gupta.
Assignee: The United States of America as Represented by the Secretary of the Air Force.
Filed: Mar. 15, 1994.

***Abstract*—An improved microstrip patch antenna has a pair, for example, of dielectric overlay strips attached along the radiating edges of the patch where the patch is rectangular. By optimizing dimensions parameters and materials, the bandwidth of the patch is increased substantially as well as the amount of radiated energy.**

10 Claims, 4 Drawing Sheets



5,448,390 Sept. 5, 1995

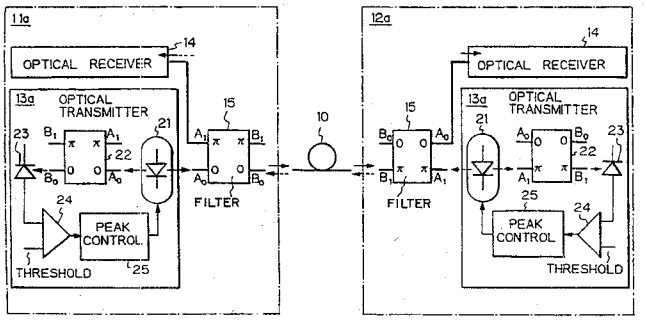
Wavelength Division Multiplex Bothway Optical Communication System

Inventors: Toshiyuki Tsuchiya, Ikutaro Kobayashi, and Nobuyuki Tokura.
Assignee: Nippon Telegraph and Telephone Corporation.
Filed: Jan. 13, 1994.

***Abstract*—Bothway optical communication is carried out through a wavelength division multiplex system between two terminal stations (11*a*, 12*a*), each having a two-beam interference-type filter (**15**) coupled with an optical cable (**10**) for multiplexing and/or de-multiplexing transmitted light and received light. The Filter (**15**) has passbands and attenuation bands having periodic characteristics for the wavelength in the communication wavelength band. The wavelength of the transmitted light is essentially the same as the wavelength of the received light in each terminal station, with a small offset of the two wavelengths less than 5 nm. The oscillation wavelength of the laser (**21**) for transmission is adjusted so that it coincides with the passband of the filter, which doubles as a reference wavelength of the oscillation wavelength of the laser. Preferably, the two-beam interference-type filter (**15**) is a Mach–Zehnder-type asymmetrical interferometer having a pair of directional couplers (**F1**, **F2**) connected to each other through a pair of optical**

fibers (f1, f2) so that the period of the passbands and/or the attenuation bands of the filter (**15**) is adjustable.

10 Claims, 12 Drawing Sheets



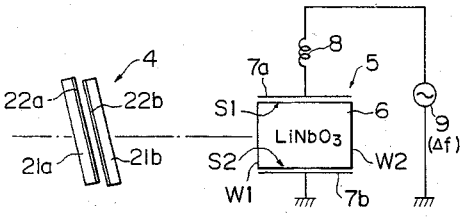
5,448,396 Sept. 5, 1995

Photo Isolator

Inventor: Takehiro Fukushima.
Assignee: Fujitsu Limited.
Filed: Aug. 31, 1993.

Abstract—A photo isolator transmits light of a frequency in the normal direction and substantially intercepts the light in the reverse direction. A phase modulator comprising an optical crystal having a refractive index, counter faces, and counter electrodes formed on the counter faces. The phase modulator receives an electrical signal having a frequency of Δf or higher and changes the refractive index of the optical crystal by the Pockels effect. A narrow band pass filter with a half bandwidth of Δf is mounted on an optical axis and substantially transmits light having frequency of from $(fo - \Delta f)$ to $(fo + \Delta f)$. The phase modulator is juxtaposed with the narrow bandpass filter on the optical axis.

6 Claims, 5 Drawing Sheets



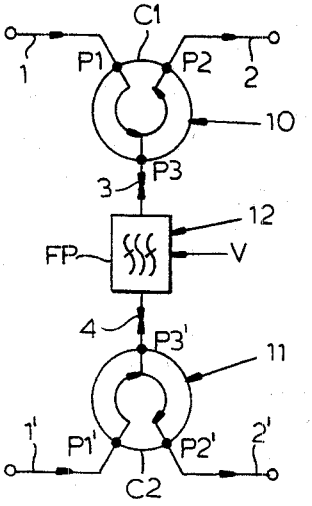
5,448,660 Sept. 5, 1995

Wavelength-Selective Optical Switch

Inventors: Riccardo Calvani and Emilio Vezzoni.
Assignee: CSELT–Centro Studi e Laboratori Telecomunicazioni S.p.A.
Filed: July 6, 1994.

Abstract—The devices includes a first and a second optical circulator (C1, C2) having an input port and an output port that are the inputs and the outputs of the switch, as well as an optical bandpass filter (FP) placed between the two circulators (C1, C2) and connected with means for switching its state so that the filter either reflects or transmits a given wavelength, thus allowing a carrier with this wavelength at the input port of one of the circulators (C1, C2) to reach the output port of the same circulator or the output port of the other circulator.

5 Claims, 2 Drawing Sheets



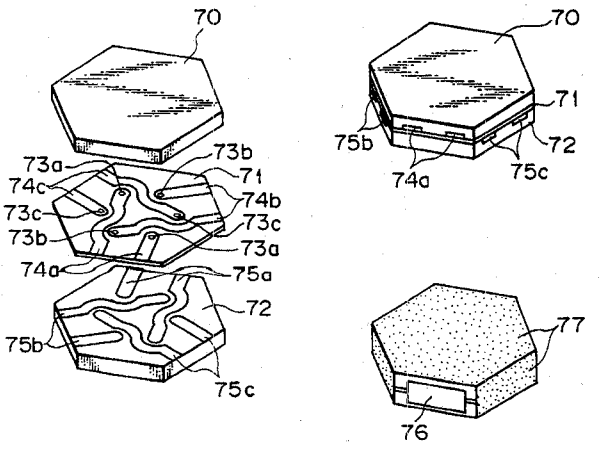
5,450,045 Sept. 12, 1995

Multilayer Microwave Circulator

Inventors: Taro Miura, Makoto Kobayashi, Kazuaki Suzuki, and Tadao Fujii.
Assignee: TDK Corporation.
Filed: Mar. 30, 1994.

Abstract—A circular includes a circulator element (**50**) with inner conductors (**41**) having a predetermined pattern and an insulating ferromagnetic material body (**40**) closely surrounding the inner conductors. The insulating ferromagnetic material body is constituted by a fired single continuous body. The circulator also includes a plurality of terminal electrodes (**76**) formed on side surfaces of the circulator element and electrically connected to one end of the inner conductors, a plurality of circuit elements (**51***a*, **51***b*, **51***c*) electrically connected to the terminal electrodes, and excitation permanent magnets (**52**, **53**) for applying a dc magnetic field to the circulator element.

40 Claims, 25 Drawing Sheets



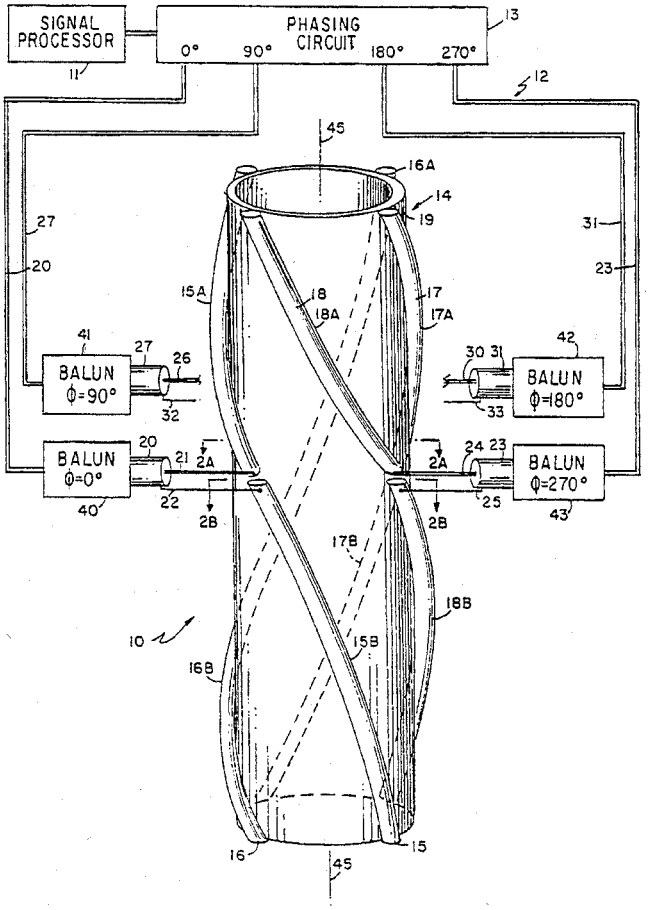
5,450,093 Sept. 12, 1995

Center-Fed Multifilar Helix Antenna

Inventor: Chang S. Kim.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: Apr. 20, 1994.

***Abstract*—An antenna system including a phasing circuit for producing balanced, phase-displaced signals for connection to an antenna. The antenna comprises, for each set of balanced phase signals, a pair of antenna elements disposed serially along a helical path. A transmission line, connected to each of the phasing circuit terminals, drives each antenna element pair at a center location by being connected to the proximate ends of each pair. The antenna has a omnidirectional radiation pattern, a wide bandwidth, a good front-to-back ratio, and can be constructed in a compact form.**

12 Claims, 3 Drawing Sheets



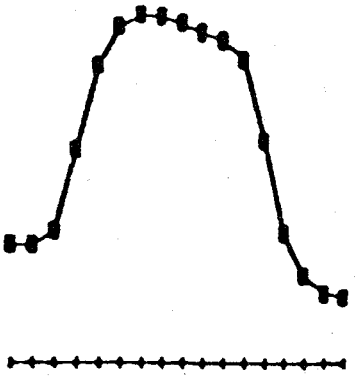
5,450,191 Sept. 12, 1995

Method for Testing Optical Waveguide Fibers to Detect Reflection-Type Discontinuities

Inventors: Thomas W. Parks and Annette L. Vandervort.
Assignee: Corning Incorporated.
Filed: May 6, 1993.

***Abstract*—A method for detecting reflection-type discontinuities in an optical waveguide fiber, such as those produced by a fiber break, a contaminant in the glass making up the fiber, a microbend, or a mechanical splice or connector is provided. The method employs an optical time domain reflectometer (OTDR) and involves cross-correlating an OTDR trace or a modified OTDR trace, e.g., one from which fiber attenuation has been subtracted, with a predetermined waveform that is characteristic of a reflection-type discontinuity. The predetermined waveform can compensate for differences between the noise spectrum of the OTDR trace and white noise. In particular, a predetermined waveform obtained by backward differencing and then forwarding differencing an average of waveforms known to correspond to reflection-type discontinuities is able to provide such white noise compensation.**

18 Claims, 6 Drawing Sheets



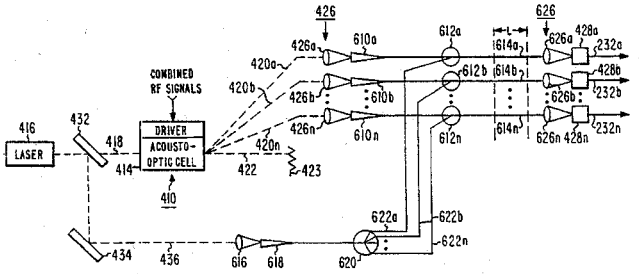
5,450,223 Sept. 12, 1995

Optical Demultiplexer for Optical/RF Signals

Inventors: Harvey L. Wagner, Michael S. Margulis, and Thomas W. Karras.
Assignee: Martin Marietta Corp.
Filed: Sept. 7, 1993.

***Abstract*—An optical demultiplexer includes an electrooptic modulator (**410**) that modulates a beam of light (**418**) in response to frequency-multiplexed radio-frequency (RF) information signals, to produce diverging beamlets of light (**420**). The diverging beamlets are separated by a spatial separator arrangement (**426**), and each beamlet (**420**), including the information of its RF carrier, is coupled to a separate optical detector (**428**). The detector (**428**) can extract amplitude modulation from the signal. In order to reconstruct the RF signal as well as the amplitude modulator, an optical "local oscillator" signal (OLO) is coupled to each detector together with its information signal. Signal loss due to vibration or misalignment is avoided, and heterodyne mixing efficiency is maximized in an embodiment of the invention by propagating the OLO and information signals through a single-mode optical fiber to the detector. In a particular embodiment of the invention, the OLO signal is applied to a first fiber (**622**), the information signal is applied to a second fiber (**610**), and the first and second fibers are coupled together by a fiber-optic coupler (**612**). In another embodiment of the invention, the OLO signal results from generating an RF L.O. signal and combining the RF L.O. local signal with the information signals before application to the electrooptic modulator to generate an OLO beamlet (**720**), which is subject to the same vibration and misalignment as the signal beamlets.**

20 Claims, 5 Drawing Sheets



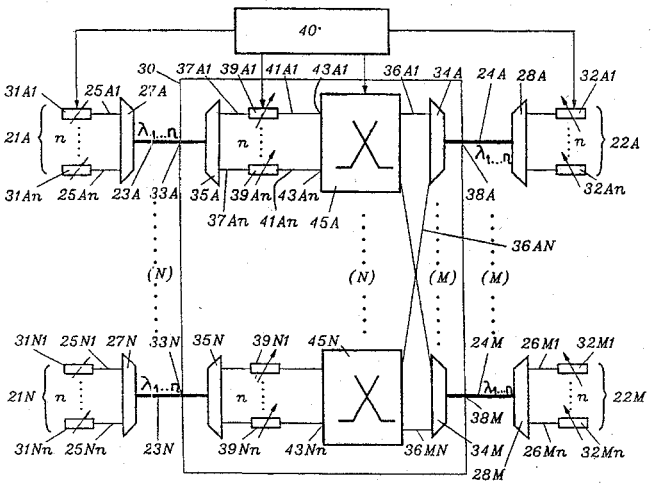
5,450,224 Sept. 12, 1995

Method and Arrangment for Optical Switching

Inventor: Sonny Johansson.
Assignee: Telefonaktiebolaget LM Ericsson.
Filed: Dec. 3, 1991.

Abstract—An optical switch for switching wavelength multiplexed optical signals between N input links and M output links is disclosed. The optical switch contains a first plurality of input terminals, optical splitters, tunable optical wavelength filters, optical switching elements, transmitters, and optical couplers. In addition, the optical switch also contains a second plurality of output terminals, optical couplers, receivers, and optical splitters. Controllers control the first tunable wavelength optical filters, transmitters, and the receivers, selecting wavelengths for each from among $2n - 1$ different wavelengths so as to prevent two identical wavelengths from occurring simultaneously in any one of the input links and output links.

9 Claims, 3 Drawing Sheets



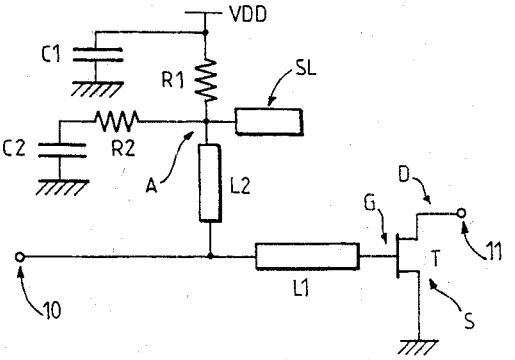
5,451,905 Sept. 19, 1995

Microwave Semiconductor Device Comprising Stabilizing Means

Inventors: Patrice Gamand and Christophe Cordier.
Assignee: U.S. Philips Corporation.
Filed: May 5, 1994.

Abstract—A semiconductor device microwave integrated circuit includes at least a transistor stage, which stage includes a microwave matching circuit and a dc bias circuit interconnected at a link node (A). The transistor stage further includes a stabilizing circuit that includes an open stub line connected to the link node. The open stub line connected to the link node is a $\lambda/4$ line that, at the operating frequency, imposes a short circuit on the link node. A matching circuit made up of a low-value resistor connected to ground in the microwave mode through a dc isolating capacitor is connected to the link node. A $\lambda/4$ line of the radial type ($\lambda/4$ radial stub) provides broadband operation.

13 Claims, 2 Drawing Sheets



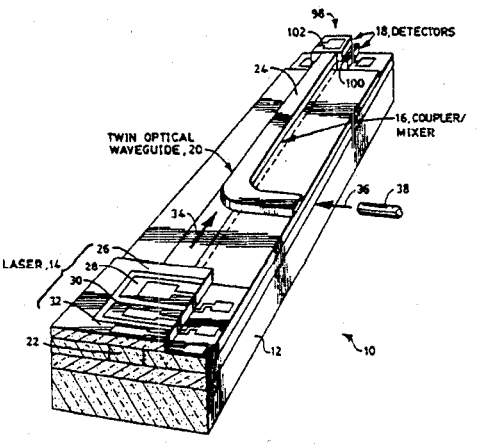
5,452,118 Sept. 19, 1995

Optical Heterodyne Receiver for Fiber-Optic Communications System

Inventor: H. Paul Maruska.
Assignee: Spire Corporation.
Filed: Apr. 20, 1993.

Abstract—A monolithic integrated optical heterodyne receiver circuit formed on a single chip and a process of its manufacture are disclosed. The heterodyne receiver circuit essentially includes a tunable local oscillator formed on a substrate for generating a first light beam, a first waveguide coplanarly formed on the substrate adjacent to the local oscillator for transmitting the first light beam, a second waveguide formed on top of the first waveguide for receiving and transmitting an information-encoded second light beam, a coupler region sandwiched between the first and second waveguides for mixing the two light beams, and a pair of detectors mounted in electrical series with one another for converting the mixed light beams to a radio frequency signal operating at an intermediate frequency.

12 Claims, 4 Drawing Sheets



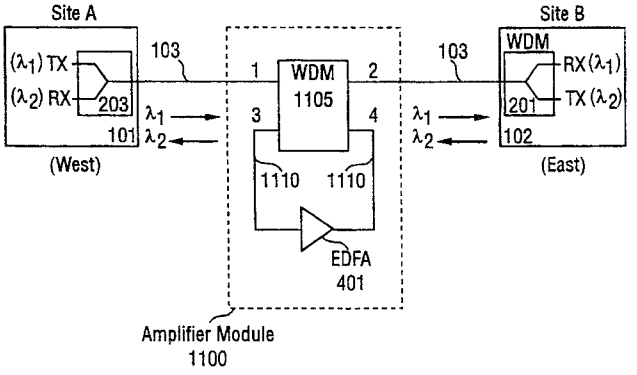
5,452,124 Sept. 19, 1995

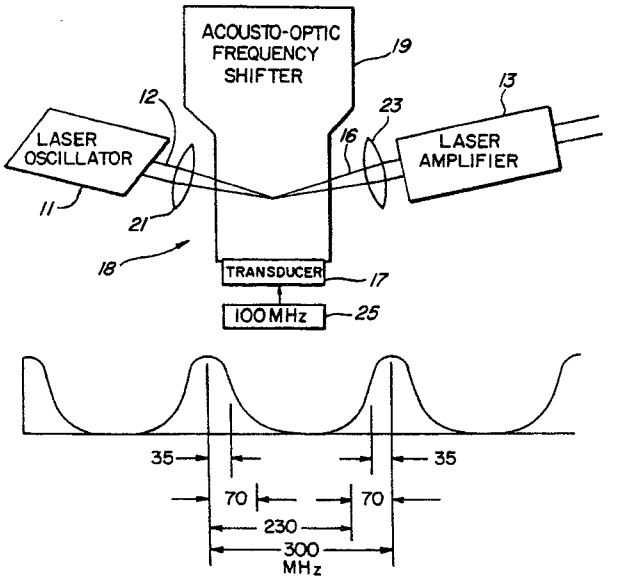
Unidirectional Amplification for Bi-Directional Transmission Using Wavelength-Division Multiplexing

Inventor: Phillip E. Baker.
Assignee: Williams Telecommunications Group, Inc.
Filed: Mar. 4, 1994.

Abstract—A device in accordance with the invention uses a novel four-port wavelength-division multiplexing (WDM) filter and a single erbium-doped optical amplifier (EDFA) to implement a dual wavelength bi-directional (single fiber) optical amplifier module. A system using an amplifier module in accordance with the invention, advantageously allows communication network managers to simultaneously reduce the cost of signal amplification hardware across a fiber optic network, increase fiber utilization, simplify field installation and maintenance operations, and maintain adherence to conventional protection philosophies such as "one system per fiber."

7 Claims, 7 Drawing Sheets





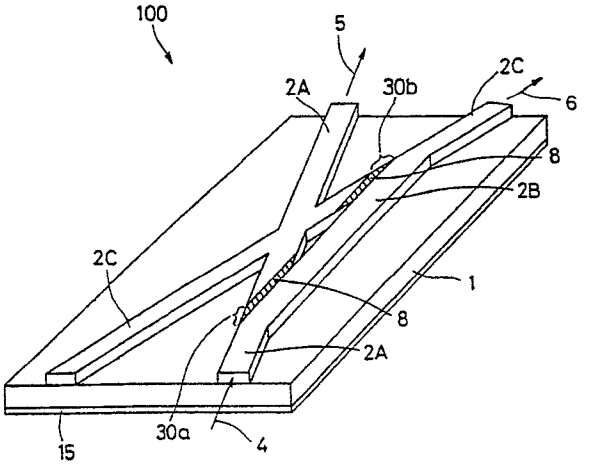
5,452,383 Sept. 19, 1995

Optical Switch and Method for Producing the Optical Switch

Inventor: Tohru Takiguchi.
Assignee: Mitsubishi Denki Kabushiki Kaisha.
Filed: Jan. 28, 1994.

Abstract—An optical switch includes a semiconductor substrate having a surface, a ridge waveguide disposed on the surface of the semiconductor substrate and including an optical waveguide layer having an MQW structure, first and second cladding layers sandwiching the optical waveguide layer, and a switch disposed in a part of the ridge waveguide. A part of the MQW optical waveguide layer included in the switch is thicker than the other part of the optical waveguide layer, whereby the energy band gap of the optical waveguide layer of the switch is smaller than the energy band gap of the other part of the optical waveguide layer and larger than the energy of the signal light. Therefore, the absorption loss of the signal light traveling through the optical waveguide layer is reduced. Furthermore, since the variation in the refractive index of the switch when current is applied to the switch is increased, the ON/OFF ratio of the switch is increased.

9 Claims, 19 Drawing Sheets



5,452,313 Sept. 19, 1995

Optical Feedback Eliminator

Inventor: David Fink.
Assignee: Hughes Aircraft Company.
Filed: Mar. 21, 1994.

Abstract—Deleterious feedback reflections from a power amplifier into a laser master oscillator are eliminated by interposing a nonreciprocal frequency shifter between the oscillator and amplifier, which shifts the laser frequency by more than twice the bandwidth of the laser oscillator resonant cavity.

15 Claims, 1 Drawing Sheet

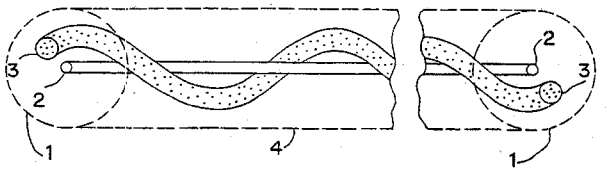
5,452,394 Sept. 19, 1995

Practical Circular-Polarization-Maintaining Optical Fiber

Inventor: Hung-Chia Huang.
Filed: Feb. 24, 1994.

Abstract—The present invention is directed to a circular-polarization-maintaining fiber structure, containing a stress-applying filament whirling around a central core. The fiber is fabricable by any of the existing fiber-making methods. The fiber is capable of maintaining circular polarizations of light, segments of such fiber can be easily spliced by lining up the cores only, and the fiber tolerates well bending and random perturbations likely to occur in practice. The invention is immediately applicable to fiber gyroscope and other interferometric architectures, to a variety of sensors, and to coherent optical transmission.

10 Claims, 6 Drawing Sheets



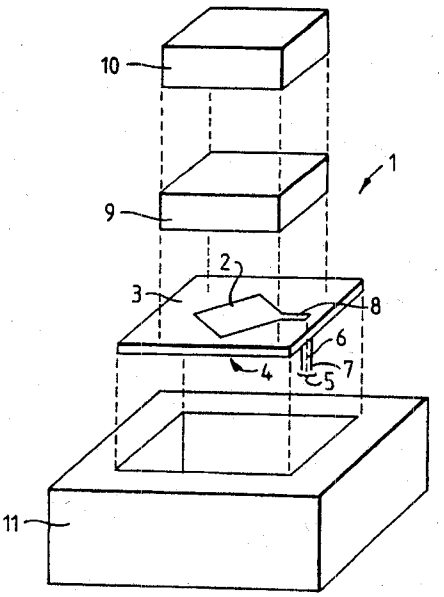
5,453,754 Sept. 26, 1995

Dielectric Resonator Antenna with Wide Bandwidth

Inventor: Adrian F. Fray.
Assignee: The Secretary of State for Defence in Her Brittanic Majesty's Government of the United Kingdom of Great Britain and Northern Ireland.
Filed: Sept. 8 1993.

Abstract—The invention relates to a dielectric resonator antenna system that exhibits an unusually wide bandwidth. This is achieved by chosing a patch antenna/dielectric resonator combination with shape and dimensions such that resonance modes over a continuous range wavelengths can be established therein. The bandwidth and transmission properties of the device are further improved by including a dielectric coupling element (between the dielectric resonator and air) whose antireflection characteristics are optimized for a wavelength that is slightly different from the maximum wavelength of the patch antenna.

9 Claims, 5 Drawing Sheets



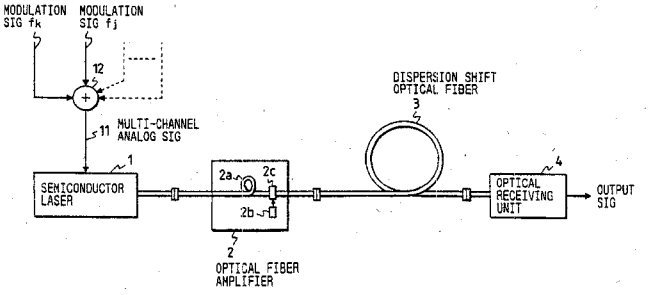
5,453,867 Sept. 26, 1995

Analog Optical Transmission System

Inventors: Jun Ohya, Toshihiro Fujita, and Hisanao Sato.
Assignee: Matsushita Electric Industrial Co., Ltd.
Filed: Aug. 18, 1993.

Abstract—An analog transmission system for transmitting a multichannel analog signal including plural carrier signals having different frequencies comprises: 1) a laser unit responsive to the multichannel analog signal for emitting laser light signal intensity-modulated by the multichannel analog signal, the laser unit having an oscillation wavelength **W1**; 2) an optical fiber amplifier for amplifying the laser light signal with a peak gain at a wavelength **W2**; 3) an optical fiber for transmitting the amplified laser light; and 4) an optical receiver for receiving the transmitted laser light and for converting the received laser light into an electric signal as an output. In this system, a total distortion characteristic of the laser unit is compensated by distortions developed in the optical fiber amplifier.

20 Claims, 11 Drawing Sheets



5,453,868 Sept. 26, 1995

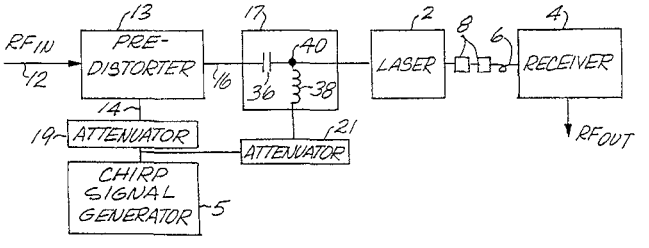
Suppression of Noise and Distortion in Fiber-Optic Systems

Inventors: Henry A. Blauvelt, John S. Frame, Amnon Yariv, and David B. Huff.

Assignee: Ortel Corporation.
Filed: Aug. 2, 1994.

***Abstract*—Noise and distortion due to scattering and reflection in a fiber-optic communications system are suppressed by modulating the optical frequency of (chirping) a laser light source to broaden the spectrum of the laser light output. The broader spectrum spreads the noise produced by an unchirped source over a broader band. A noise and distortion suppression system includes a chirp signal generator coupled to the signal path of an RF input signal carrying information to modulate the laser optical output. In some cases, the frequency of the chirp generating signal may result in second-order intermodulation products falling within the information band. In such cases, the RF input signal is predistorted to offset the expected distortion products.**

38 Claims, 6 Drawing Sheets



5,453,874 Sept. 26, 1995

Semiconductor Optical Component and Manufacturing Method Therefor

Inventors: Takahiro Ono and Hisaharu Yanagawa.
Assignee: The Furukawa Electric Co., Ltd.
Filed: Nov. 20, 1992.

***Abstract*—A manufacturing method for a semiconductor optical component in which ridge-shaped semiconductor light amplifier sections and ridge-shaped semiconductor waveguides connected thereto are integrated on the same substrate includes the steps of forming the ridge-shaped semiconductor light amplifier sections having a path width narrower than that of the ridge-shaped semiconductor waveguide at the appropriate positions on the substrate on which the ridge-shaped semiconductor light amplifier sections are to be formed, and forming the ridge-shaped semiconductor waveguide at the remaining positions other than the appropriate positions so as to connect to the ridge-shaped semiconductor light amplifier sections. The semiconductor optical component manufactured by this method provides high current density because the confining of the current injected to the light amplifier is strengthened. Therefore, it is useful as an optical component that can perform light amplification efficiently even if a small current is injected.**

7 Claims, 7 Drawing Sheets