Patent Abstracts

These Patent Abstracts of recently issued patents are intended to provide the minimum information necessary for readers to determine if they are interested in examining the patent in more detail. Complete copies of patents are available for a small fee by writing: U.S. Patent and Trademark Office, Box 9, Washington, DC 20231.

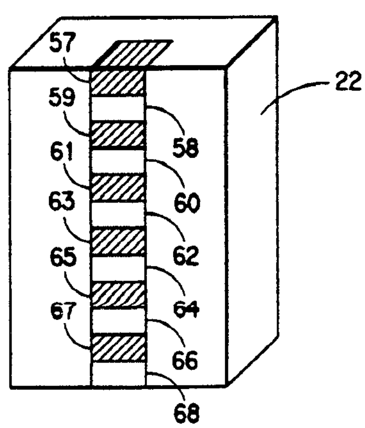
5,028,107 July 2, 1991

Optical Articles for Wavelength Conversion and Their Manufacture and Use

Inventors: John D. Bierlein and Daniel B. Laubacher.
Assignee: E. I. DuPont de Nemours and Company.
Filed: Apr. 25, 1990.

Abstract—Articles and process for wavelength conversion are disclosed which use a series of aligned sections of optical materials that are suitably balanced over the series with regard to the section length and the section Δk (i.e., the difference between the sum of the propagation constants for the incident waves and the sum of the propagation constants for the waves generated). The sections are selected such that the sum for the series of the product of the length of each section with the Δk is equal to about zero, and the length of each section is less than its coherence length. Embodiments are disclosed wherein at least one of the optical materials is optically nonlinear and/or wherein a layer of nonlinear optical material is provided adjacent to the series of sections. Also disclosed is a process for preparing a channel waveguide for wavelength conversion systems wherein areas along a portion of a crystal substrate surface used for forming the desired channel are alternately masked and unmasked during cation replacement by immersion in a molten salt.

26 Claims, 3 Drawing Sheets



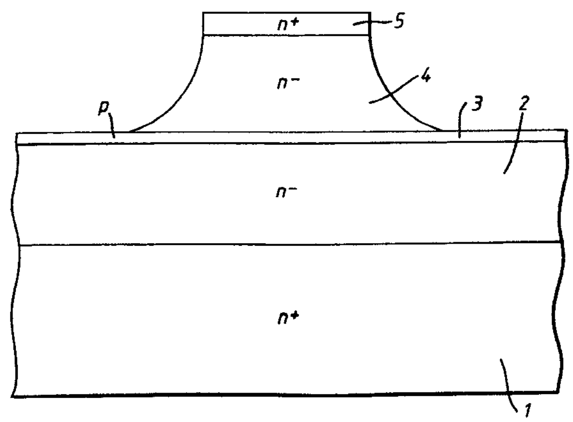
5,028,108 July 2, 1991

Bipolar Transistor Including Optical Waveguide

Inventor: Terence P. Young.
Assignee: GEC-Marconi Limited.
Filed: June 15, 1989.

Abstract—An optical device comprises a heterojunction bipolar transistor that includes a light guiding layer to which the base contact is made. A ridge is included adjacent to the light guiding layer and acts as the emitter or collector of the transistor, the ridge also defining the lateral extent of the light guiding region. Current injected via the base contact controls the electric field in the region of the ridge and hence the refractive index of the layer controlling the passage of light transmitted along it.

20 Claims, 1 Drawing Sheet



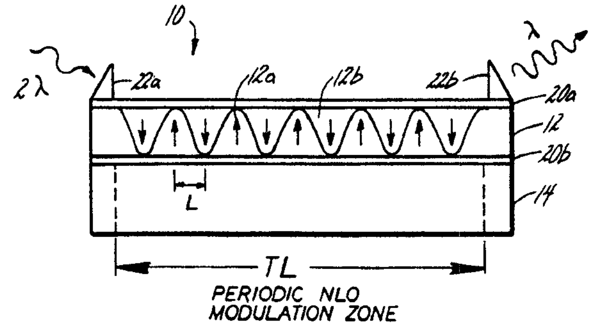
5,028,109 July 2, 1991

Methods for Fabricating Frequency Doubling Polymeric Waveguides Having Optimally Efficient Periodic Modulation Zone and Polymeric Waveguides Fabricated Thereby

Inventor: Nabil M. Lawandy.
Filed: Jan. 26, 1990.

Abstract—A method of fabricating a periodic nonlinear optic radiation modulation zone within a polymeric waveguide structure. The method includes the steps of a) providing a layer of a polymeric material having an optically active material that is orientable by an electrical field; b) applying an electrical field to the layer for orienting at least a portion of the optically active material; and c) photopolymerizing at least a portion of the polymeric layer for fixing the oriented optically active material into the oriented position. In accordance with one embodiment the step of photopolymerizing includes the steps of d) generating a diffraction pattern within the polymeric layer, the diffraction pattern being characterized by bright and dark fringes; and e) photopolymerizing a volume of the polymeric layer within substantially only portions thereof that correspond to the bright fringes. In accordance with another embodiment the step of applying includes a step of generating a periodic dc field potential within the polymeric layer by a third-order effect induced by passing radiation having a wavelength of lambda and a wavelength of 2 (lambda) through the polymeric layer.

30 Claims, 2 Drawing Sheets



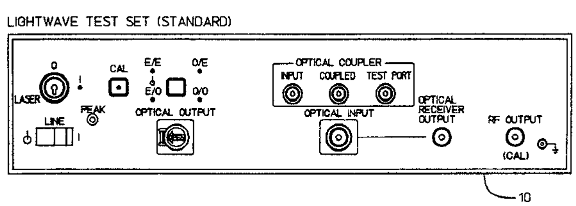
5,028,131 July 2, 1991

Lightwave Test Set for an RF Network Analyzer System

Inventor: Joel P. Dunsmore.
Assignee: Hewlett-Packard.
Filed: Aug. 8, 1989.

Abstract—A lightwave test set interconnected to an existing RF vector or scalar network analyzer system for performing calibrated electrooptical, optoelectrical, optical, and/or electrical measurements on optical systems, subsystems, and associated components.

3 Claims, 2 Drawing Sheets



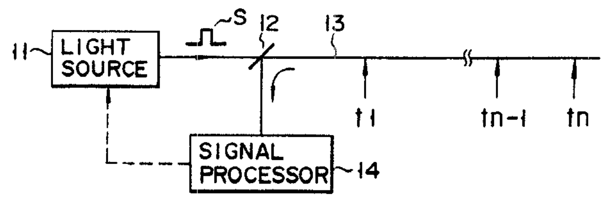
5,028,146 July 2, 1991

Apparatus and Method for Measuring Temperatures by Using Optical Fiber

Inventor: Ichiro Wada.
Assignee: Kabushiki Kaisha Toshiba.
Filed: May 21, 1990.

Abstract—An optical fiber is installed to pass through a plurality of measurement places. Predetermined positions in the optical fiber are set at a predetermined temperature. When an optical signal is radiated on the optical fiber, Raman scattering occurs at various portions of the optical fiber. The intensities of the Raman scattered light components depend on temperatures. Backscattered light components of the Raman scattered light are sampled and stored in a memory. A temperature distribution on the optical fiber is obtained on the basis of the stored data. The temperatures of the measurement places can be specified on the basis of the predetermined temperature on the obtained temperature distribution as a reference. The temperatures of the measurement places can be corrected on the basis of the predetermined temperature.

16 Claims, 7 Drawing Sheets



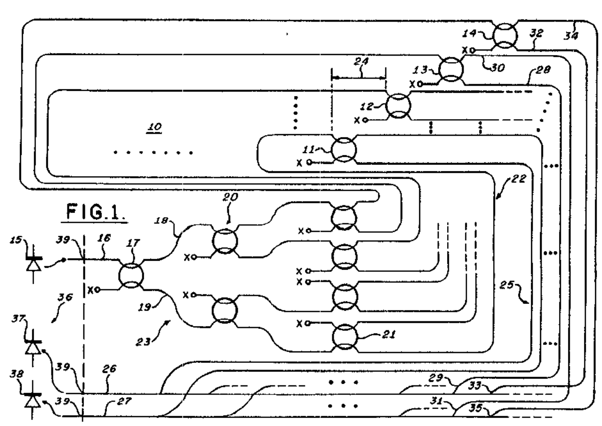
5,028,801 July 2, 1991

Apparatus and Method for Multiplexing Fiber-Optic Sensors

Inventor: David W. Gerdt.
Assignee: Sperry Marine Inc.
Filed: Jan. 16, 1990.

Abstract—The pulsed input light source of the fiber-optic sensor array is divided into a plurality of input light sources for the respective sensors of the array by a network of low-loss single mode fixed ratio fiber-optic couplers. The input light is applied to the input fiber of a first fixed ratio coupler, the output fibers thereof providing the input fibers of further fixed ratio couplers and so forth until the light is divided into the appropriate number of sources. The divided light sources are applied to the input fibers of the variable ratio fiber-optic coupler sensors of the array through differing lengths of optical fiber so that the input light pulses impinge upon the sensors of the array at different times. The output fibers of the sensors are coupled to multimode busses through low-loss taps. In an alternative embodiment for highly imbalanced ratio fiber-optic coupler sensors, the pulsed input light is applied to the input fiber of a first sensor. The high percentage output leg of the first sensor provides the input to a second sensor of the array, the high percentage output fiber thereof providing the input to the next array sensor. The low percentage legs of the sensors, which carry the information, are tapped into a multimode fiber-optic bus.

8 Claims, 2 Drawing Sheets



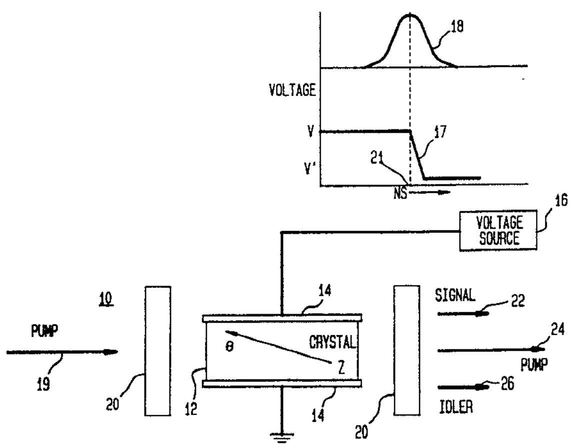
5,028,816 July 2, 1991

Electrooptic Line Narrowing of Optical Parametric Oscillators

Inventor: Bruce P. Boczar.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: May 21, 1990.

Abstract—In the present invention, a nonlinear crystal of an optical parametric oscillator is provided with a pump pulse and electrodes for applying a high voltage to the crystal during the pump pulse. The high voltage is switched from one level to another during the pump pulse duration. The initial value of the high voltage determines the position of the frequency center of the optical parametric oscillator gain profile because the indices of refraction are a function of the applied voltage due to the electrooptic effect. During the pump pulse, when the high voltage is switched to some other value, a new set of momentum and energy conservation conditions results. This causes a frequency shift in the gain profile. Thus, the oscillator is provided with two differing gain profiles during the pump pulse. The output frequency of the oscillator is only those frequencies in both gain profiles.

18 Claims, 2 Drawing Sheets



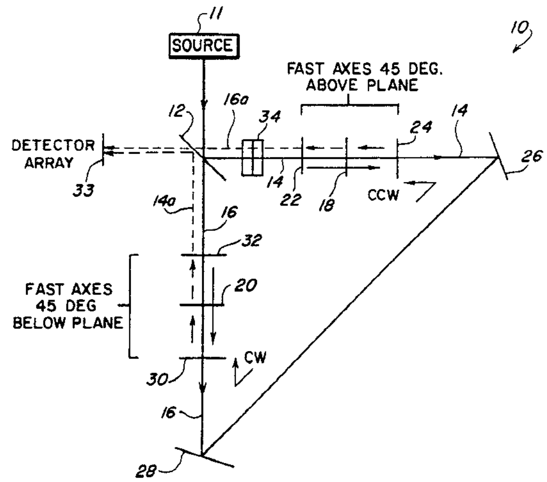
5,028,864 July 2, 1991

Optically Stable, Large Time Bandwidth Acoustooptic Heterodyne Spectrum Analyzer with Fixed Nonzero Heterodyne Output

Inventors: John N. Lee and Ray B. Brown, Jr.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: Sept. 14, 1990.

Abstract—A common-path interferometric acoustic–optic heterodyne spectrum analyzer having high immunity to ambient vibration uses two, counter-propagating beams, two Bragg cells for beam diffraction, a series of waveplates and a birefringent quartz wedge. Proper light polarization with the waveplates and Bragg cell geometry allows one Bragg cell to diffract primarily the clockwise beam and the other Bragg cell to diffract the counter-clockwise beam. The birefringent quartz wedge shifts the diffracted beams to provide a heterodyne signal with a nonzero IF carrier frequency. The analyzer is highly angle compensated and alignment stable when components are disturbed in position or orientation.

26 Claims, 1 Drawing Sheet



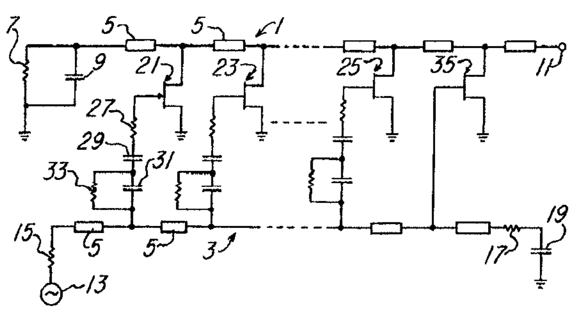
5,028,879 July 2, 1991

Compensation of the Gate Loading Loss for Travelling Wave Power Amplifiers

Inventor: Bumman Kim.
Assignee: Texas Instruments Incorporated.
Filed: Sept. 10, 1990.

Abstract—The disclosure relates to a circuit to reduce the gate loss in a semiconductor travelling wave power amplifier using series capacitors on the gate feeding lines for a distributed amplifier design. The circuit arrangement significantly increases the gate width of the amplifier with a resultant increases of the broadband output power and efficiency.

28 Claims, 1 Drawing Sheet



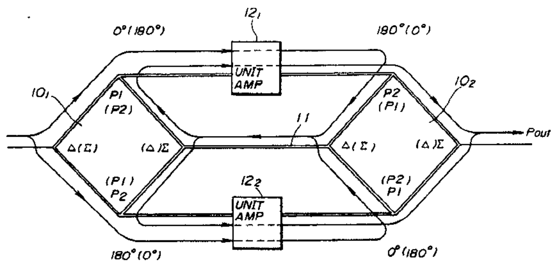
5,028,880 July 2, 1991

Microwave Power Amplifier Using Phase Inverters

Inventor: Fuminori Sakai.
Assignee: Fujitsu Limited.
Filed: Feb. 14, 1990.

Abstract—A microwave power amplifier includes first and second circuits, each having first, second, third, and fourth terminals. Each of the first and second circuits has functions of distributing an input signal to the second and third terminals and generating first and second output signals 180° out of phase with each other through the second and third terminals, respectively, adding a first pair of 180° out-of-phase input signals to the second and third terminals and outputting a first resultant signal through the first terminal, and adding a second pair of in-phase input signals to the second and third terminals and outputting a second resultant signal through the fourth terminal. The microwave power amplifier further includes a first amplifier circuit connected between the second terminal of the first circuit and the third terminal of the second circuit, a second amplifier circuit connected between the third terminal of the first circuit and the second terminal of the second circuit, and a feedback circuit connected between the fourth terminal of the first circuit and the first terminal of the second circuit. The first terminal of the first circuit serves as an input terminal of the microwave power amplifier, and the fourth terminal of the second circuit serves as an output terminal of the microwave power amplifier.

18 Claims, 8 Drawing Sheets



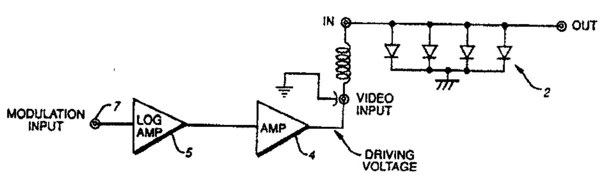
5,028,890 July 2, 1991

Voltage Driven Microwave Amplitude Modulation System

Inventor: Ronald K. Larson.
Assignee: Hewlett-Packard Company.
Filed: May 2, 1990.

Abstract—A microwave amplitude modulation system maintains constant amplitude attenuation at very high modulation rates over a broad range of microwave frequencies in response to voltage driving signals derived from modulation signals. In the system, the video input of a shunt-type PIN diode microwave amplitude modulation system is driven by a logarithmic voltage amplifier circuit which receives the modulation signals as an input.

15 Claims, 4 Drawing Sheets



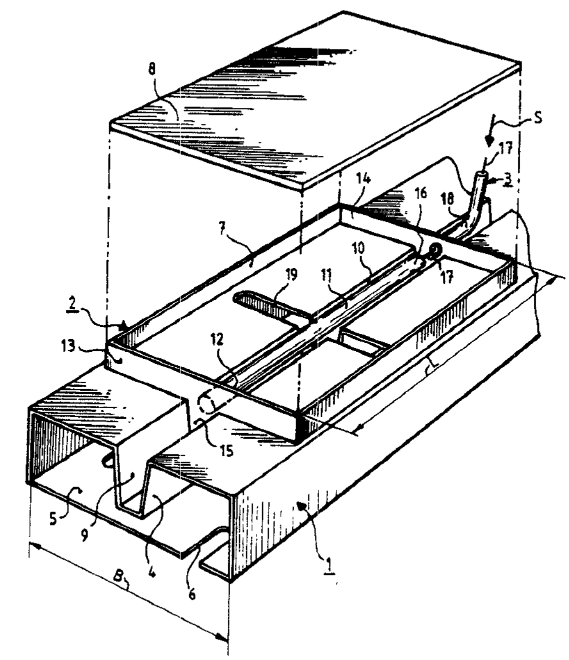
5,028,891 July 2, 1991

Arrangement for Supplying Power to a Hollow Waveguide Intended for Electromagnetic Microwaves

Inventor: Rolf O. E. Lagerlöf.
Assignee: Telefonaktiebolaget L M Ericsson.
Filed: Jan. 31, 1990.

Abstract—A hollow waveguide (1) for electromagnetic microwaves supports an adaptation chamber (2) on one side thereof. The chamber includes a frame structure (7) and a cover member (8) and is provided with an adapter line (11). The hollow waveguide is a ridge waveguide having a longitudinally extending ridge (4). The chamber (2) is connected electrically to an outer conductor (18) of a coaxial line (3), through which the arrangement is supplied with power with an electromagnetic microwave (S). One end (12) of the adapter line (11) is connected electrically to the adaptation chamber (2), whereas the other end (16) is connected electrically to a centre conductor (17) of the coaxial line (3). The ridge waveguide (1) is supplied with power from the adaptation chamber (2) through a transverse slot (19) and emits microwaves to the surroundings through longitudinally extending slots (6). The chamber (2) is of simple construction and requires only little space, and can be readily adapted to a desired wavelength of the microwave (S).

9 Claims, 3 Drawing Sheets



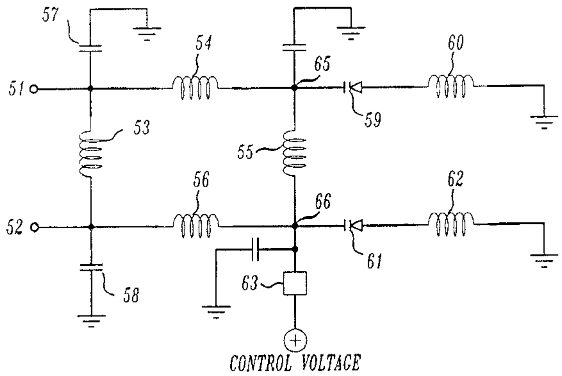
5,028,892 July 2, 1991

Analog Phase Shifter

Inventor: Timothy E. Daughters.
Assignee: AT&T Bell Laboratories.
Filed: Apr. 30, 1990.

Abstract—An analog voltage-controlled phase shifter is disclosed that is smaller in size and provides a larger phase shift for a smaller change of capacitance of presently available voltage controlled phase shifters These unexpected advantages are obtained by using lumped elements to simulate the normally used λ/4 transmission lines of the hybrid portion of the phase shifter and by eliminating or reducing the value of the capacitors normally present at the varactor nodes of the hybrid. The capacitance fully or partially removed from the varactor nodes of the hybrid can be selectively fully or partially added to the varactors.

8 Claims, 3 Drawing Sheets



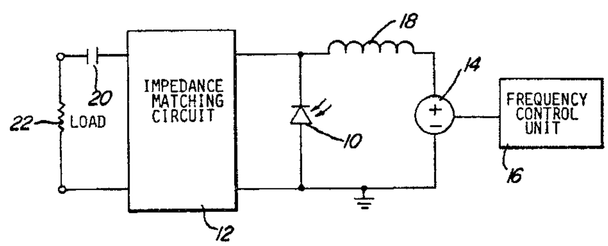
5,029,240 July 2, 1991

Electronically Tunable Fiber-Optic Receiver for Narrow-Band Microwave Signal Reception

Inventors: Michael de La Chapelle and Hui-Pin Hsu.
Assignee: Hughes Aircraft Company.
Filed: June 26, 1989.

Abstract—The optical receiver has a photodiode (10) which is reverse biased by a voltage supply (14). The voltage supply provides a variable bias voltage determined by a control unit (16) and the photodiode is matched to the load (22) by an impedance matching circuit (12). The photodiode exhibits large capacitance changes over a range of bias voltages and may be implemented using a Schottky barrier or P+N photodiode. By changing the bias voltage, the photodiode capacitance changes to vary the tuned frequency of the receiver. The matching circuit cancels the reactive component of the photodiode impedance and matches the resistive component to the load. The photodiode may have a doping profile in which an intrinsic or lightly doped region of width greater than the average photon penetration depth is located next to the junction. After the intrinsic region, the doping profile may be selected to achieve linear tuning. This doping profile gives linear tuning without sacrificing photodiode conversion efficiency.

11 Claims, 4 Drawing Sheets



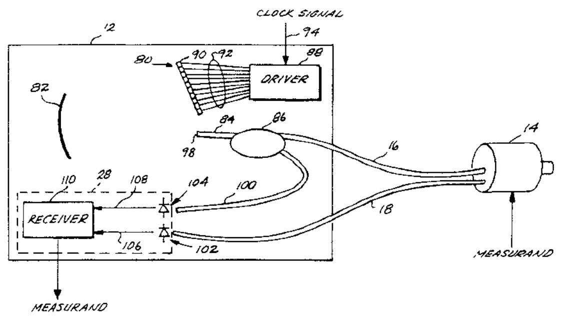
5,029,967 July 9, 1991

Optical Source for Optical Sensing System

Inventors: Darrell L. Livezey, David M. Griffith, and Raymond W. Huggins.
Assignee: The Boeing Company.
Filed: Apr. 9, 1990.

Abstract—An optical source for use in an optical sensing system such as a wavelength division multiplexing system. The source produces an optical interrogation signal comprising a plurality of component signals, each component signal comprising light in a wavelength band different from the wavelength bands of the other component signals. The source comprises a concave diffraction grating, means for forming an aperture at which the interrogation signal will be formed, and a plurality of optical emitters. Each emitter is positioned such that the emitter output signal strikes the concave diffraction grating, and is focused onto the aperture, such that a portion of the emitter signal enters the aperture and forms one of the component signals. As a result, the component signal wavelengths are not sensitive to temperature-induced fluctuations in the emitter output signal.

10 Claims, 5 Drawing Sheets



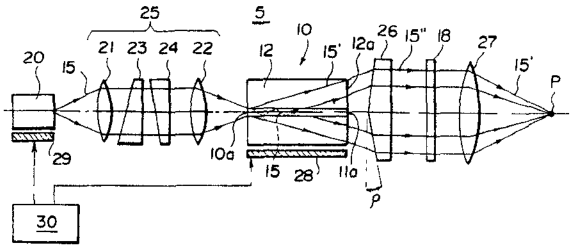
5,029,976 July 9, 1991

Optical Wavelength Converter Device and Optical Wavelength Converter Module

Inventor: Chiaki Goto.
Assignee: Fuji Photo Film Co., Ltd.
Filed: Oct. 18, 1989.

Abstract—A fiber Cerenkov-type optical wavelength converter module includes an optical wavelength converter device comprising an optical fiber including a cladding having a first refractive index and a core of a nonlinear optical material disposed in the cladding, said core having a second refractive index higher than the first refractive index, whereby the optical fiber converts the wavelength of a fundamental wave introduced into the core and radiates a wavelength-converted wave into the cladding. A laser beam is emitted from a semiconductor laser and applied as the fundamental wave to the optical wavelength converter device. The temperature of the optical wavelength converter device, or the temperatures of the optical wavelength converter device and the semiconductor laser, are regulated such that the tolerances specified for the length of the optical fiber, the diameter of the core, and other dimensions can be increased. Therefore, the optical wavelength converter device and the optical wavelength converter module can be fabricated with greater ease.

15 Claims, 3 Drawing Sheets



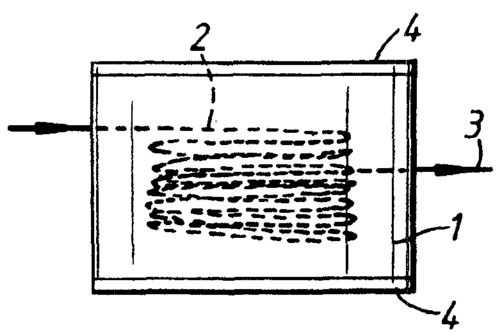
5,029,978 July 9, 1991

Optical Phase Modulator

Inventors: Alan C. Curtis and Michael L. Henning.
Assignee: GEC-Marconi Limited.
Filed: Aug. 14, 1989.

Abstract—An optical phase modulator comprises a body 1 of a matrix material that supports a length of optical fiber 2, the said body including a polymer material having piezoelectric properties and being provided with spaced electrode areas 4 such that the application of an electrical potential between said areas will produce a mechanical strain in the body 1, the said strain affecting the said fiber 2 so as to control phase modulation of light when this is present in the fiber. This can give a device of inexpensive construction that is robust and has high sensitivity.

8 Claims, 2 Drawing Sheets



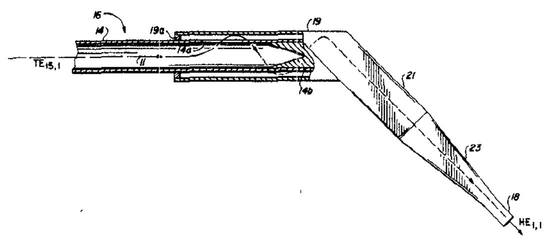
5,030,929 July 9, 1991

Compact Waveguide Converter Apparatus

Inventor: Charles P. Moeller.
Assignee: General Atomics.
Filed: Jan. 9, 1990.

Abstract—Conversion from a whispering gallery or volume mode to a more usable mode, such as the $HE_{1,1}$ mode is achieved in a waveguide mode converter that includes input and output sections. The input section includes overlapping circular and coaxial waveguides. Microwave energy in a whispering gallery or volume mode within the circular waveguide is coupled through an array of N equally spaced axial slots placed in the common wall separating the circular waveguide and the coaxial waveguide to coaxial TE and TM modes. Helical grooves placed in one of walls of the coaxial waveguide convert the coaxial mode to a quasi-parallel plate mode wherein the common wall separating the inner circular waveguide from the outer coaxial waveguide functions as one plate, and the outer wall of the coaxial waveguide functions as the other plate. The quasi- parallel plate mode propagates microwave energy spirally through the coaxial waveguide in a direction k, where k makes an angle θ to the waveguide axis. The helical grooves are placed transverse to k. Such grooves cause the normal modes to no longer be the coaxial TE and TM modes, but modified linear combinations thereof One such linear combination is a desired $TE_{0,1}$ mode, which normal mode is only slightly affected by the grooves. The other normal mode is analogous to the parallel plate $TM_{0,1}$ mode, which mode is strongly affected by the grooves. The output section extracts the $TE_{0,1}$ energy by helically unwinding the walls of the coaxial waveguide. Additional conversion to the $HE_{1,1}$ mode is accomplished by using a compact configuration that makes the wavefront cylindrical using a lens or mirror coupled to a sectorial horn.

30 Claims, 4 Drawing Sheets



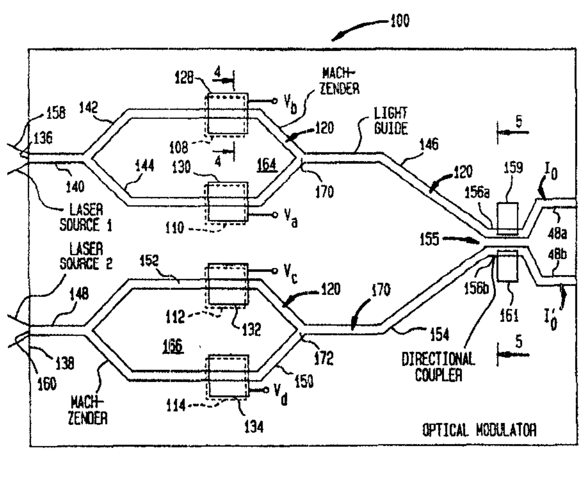
5,031,235 July 9, 1991

Cable System Incorporating Highly Linear Optical Modulator

Inventors: Donald Raskin, Kophu Chiang, and James B. Stamatoff.
Assignee: Hoechst Celanese Corp.
Filed: Oct. 27, 1989.

Abstract—A system incorporating a pair of Mach–Zehnder modulators (164,166) for performing amplitude modulation of an optical carrier is disclosed. Each of the modulators is designed to suppress even-order distortion products and develop third-order distortion products of opposite sign and equal magnitude. The outputs of the two modulators are combined in a directional coupler (155) resulting in substantially suppressing second through fourth-order distortion products.

13 Claims, 3 Drawing Sheets



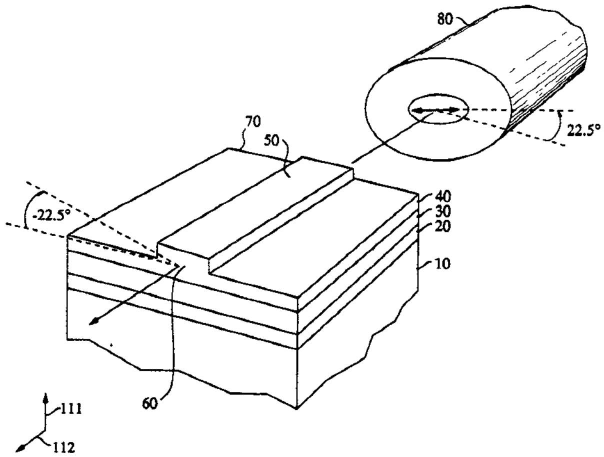
5,031,983 July 16, 1991

Apparatus Comprising a Waveguide Magneto-Optic Isolator

Inventors: Joseph F. Dillon, Jr. and Raymond Wolfe.
Assignee: AT&T Bell Laboratories.
Filed: Apr. 4, 1990.

Abstract—The invention relates to optical systems comprising thin-film optical waveguide isolators that are characterized by linear birefringence at least some wavelengths and temperatures. Disclosed is a method for using such a system at more than one wavelength and temperature.

9 Claims, 5 Drawing Sheets



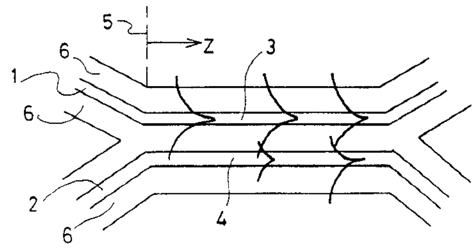
5,031,989 July 16, 1991

Optical Filter Coupler

Inventors: Katsumi Morishita and Toshiharu Takesue.
Assignees: Osaka Electric and Communication University and Seiko Instruments Inc.
Filed: Sept. 16, 1988.

Abstract—An optical filter-coupler comprises at least two optical waveguides such as optical fibers closely spaced apart to each other for allowing light propagating in one waveguide to couple into the other. Materials for the waveguides are selected to have different wavelength-dispersive refractive indexes so that the waveguides have a common refractive index at a selected wavelength, whereby a complete power transfer is obtained at such selected wavelength.

19 Claims, 3 Drawing Sheets



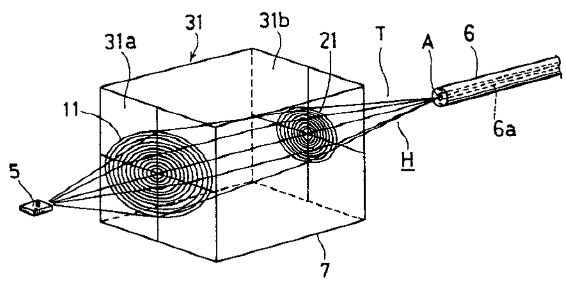
5,031,991 July 16, 1991

Optical Coupling Circuit Element

Inventors: Hiroshi Nakatsu, Toshiyuki Okumura, Kazuhiko Inoguchi, and Haruhisa Takiguchi.
Assignee: Sharp Kabushiki Kaisha.
Filed: Dec. 1, 1989.

Abstract—An optical coupling circuit element providing one transparent substrate, a first micro Fresnel lens formed on one side surface of said substrate, and a second micro Fresnel lens formed on the other side surface of said substrate, so that coherent light incident into said first micro Fresnel lens is projected, through said transparent substrate, on said second micro Fresnel lens to be left therefrom as a collimating beams, which is useful for directing light emitted from coherent source such as semiconductor laser to optical communication means such as optical fiber for condensation.

22 Claims, 6 Drawing Sheets



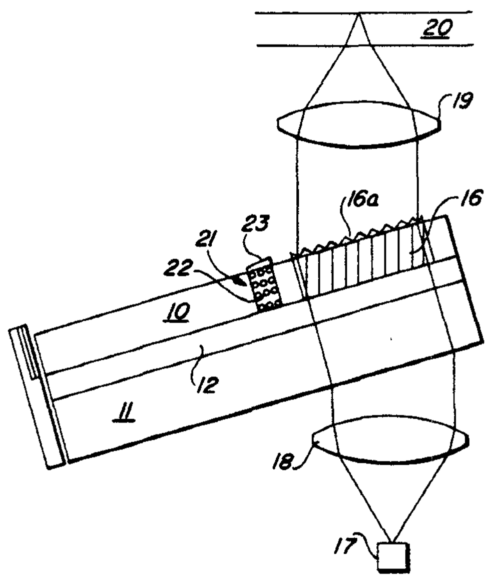
5,031,993 July 16, 1991

Detecting Polarization State of an Optical Wavefront

Inventors: Rahul Asthana, Robert D. Miller, Franklin M. Schellenberg, Glenn T. Sincerbox, and James M. Zavisian.
Assignee: International Business Machines Corporation.
Filed: Nov. 16, 1989.

Abstract—An improved apparatus and method for detecting the polarization state of an optical wavefront is disclosed, which is especially suitable for use in an integrated magneto-optic recording head. An optically transparent waveguide structure transmits TE and TM modes of the wavefront propagated as a beam coupled into the waveguide by a TE/TM grating coupler. In the waveguide structure is a periodic structure comprising a birefringent mode separator that splits the propagating beam into TE and TM modes. The mode separator comprises an array of uniformly spaced volumes of identical configuration. Photosensitive devices detect the intensity of the light contained within each of the separated beams. The signals from these photosensitive devices are used to determine the state of polarization of the optical wavefront. The periodic structure may, if desired, comprise regions of alternating birefringence, such as a Bragg grating, either in a waveguide layer or a cladding layer. Focal power is introduced 1) by providing focal power in the input grating coupler to the waveguide with a curved grating structure, 2) by varying the pitch of the birefringent mode separator extending in a direction transverse to the optical axis of the propagating beam, or 3) by introducing a surface grating with a varying pitch in a direction transverse of the optical axis.

19 Claims, 2 Drawing Sheets



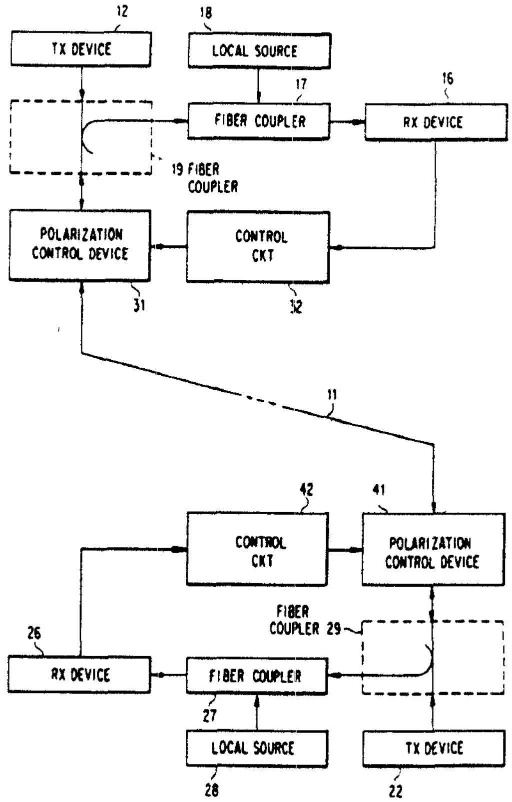
5,031,998 July 16, 1991

Polarization Control on Signal Beams for Principal-State Bidirectional Transmission Through an Optical Fiber

Inventors: Takashi Ono and Shuntaro Yamazaki.
Assignee: NEC Corporation.
Filed: Aug. 9, 1990.

Abstract—In a polarization control system for use in an optical communication system comprising an optical fiber (11), first and second polarization control devices (31, 41) are controlled to make the optical fiber bidirectionally transmit first and second signal beams with their respective incident polarization states rendered coincident with a common one or with respective ones of two principal states of the optical fiber. When the first signal beam is supplied to the first polarization control device with a first original polarization state and passes through the second polarization control device with a first variable polarization state and when the second signal beam is supplied to the second polarization control device with a second original polarization state and passes through the first polarization control device with a second variable polarization state, the first polarization control device keeps the second variable polarization state parallel or orthogonal to the first original polarization state. The second polarization control device keeps the first variable polarization state parallel or orthogonal to the second original polarization state. Each of the signal beams may be either a single signal beam or an FDM'ed signal beam.

19 Claims, 3 Drawing Sheets



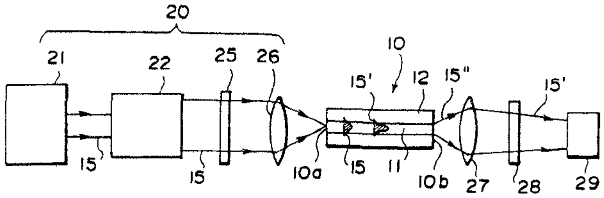
5,031,999 July 16, 1991

Optical Wavelength Converter Device

Inventors: Akinori Harada and Chiaki Goto.
Assignee: Fuji Photo Film Co., Ltd.
Filed: May 15, 1990.

Abstract—An optical wavelength converter device comprises a cladding and waveguide disposed in the cladding. The waveguide is made of an organic nonlinear optical material such as PRA that has a first refractive index with respect to the wavelength of the wavelength-converted wave and a second refractive index with respect to the wavelength of the fundamental wave, the first refractive index being lower than the second refractive index. Alternatively, the first and second refractive indexes are substantially the same as each other, and the cladding is made of a material that has a third refractive index with respect to the wavelength of the wavelength-converted wave and a fourth refractive index with respect to the wavelength of the fundamental wave, the third refractive index being substantially the same as the fourth refractive index. The effective refractive index with respect to the fundamental wave which is guided in a zero-order mode and the effective refractive index with respect to the wavelength-converted wave that is guided in the zero-order mode are equal to each other.

5 Claims, 9 Drawing Sheets



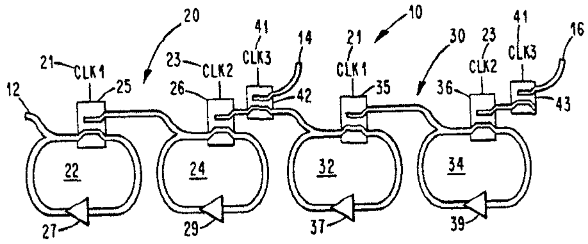
5,032,010 July 16, 1991

Optical Serial-to-Parallel Converter

Inventor: Shing-Fong Su.
Assignee: GTE Laboratories Incorporated.
Filed: Dec. 19, 1988.

Abstract—An optical serial-to-parallel converter constructed from at least two optical shift registers connected in cascade, each optical shift register having a 1 × 2 optical switch connected to its output. Each optical shift register in the sequence is optically coupled to the next sequential optical shift register through one output of said 1 × 2 optical switch to the input port of the next sequential optical shift register. The input port of the first optical shift register serves as the input to the optical serial-to-parallel converter, receiving a series of optical pulses. The output ports of each of said third optical switches serve as the output ports of the optical serial-to-parallel converter. The optical shift registers are controlled by two clocks, operating at the same rate, but each out of phase with the other. Control signals are provided by a third clock to output said optical pulses simultaneously from said optical shift registers through said optical output switches to effect an optical serial-to-parallel conversion.

2 Claims, 1 Drawing Sheet



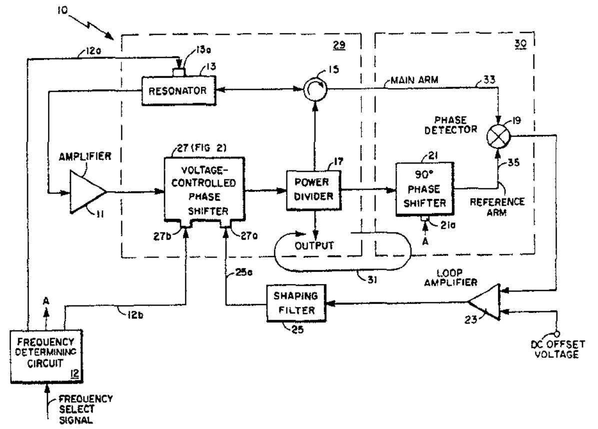
5,032,800 July 16, 1991

Tunable Oscillation with Noise Degeneration

Inventors: Zvi Galani, Michael J. Bianchini, Raymond C. Waterman, Jr.
Assignee: Raytheon Company.
Filed: June 15, 1990.

Abstract—An oscillator providing predictable oscillator modulation sensitivity includes an amplifier and a feedback circuit disposed about the amplifier. The feedback circuit includes a resonator having a first port and a second port and a voltage-controlled phase shifter having an input port, an output port and a control port, the input port of the voltage-controlled phase shifter connected to the output port of the amplifier and the output port of the voltage-controlled phase shifter coupled to a port of the resonator. The oscillator further includes a circuit, responsive to signals from the output of the voltage-controlled phase shifter and the first port of the resonator, to provide a control signal to the control port of the voltage-controlled phase shifter for degenerating low-frequency FM noise rising within the amplifier.

5 Claims, 2 Drawing Sheets



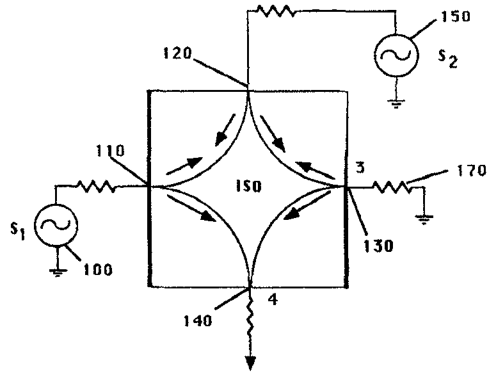
5,032,802 July 16, 1991

Hybrid Bidirectional Coupler Circuit

Inventor: Teny L. Fry.
Assignee: Rowe Communications, Inc.
Filed: Feb. 9, 1990.

Abstract—A hybrid network including a four-port directional coupler with the terminating impedance of one port being intentionally mismatched with the characteristic impedance of the coupler. Such an intentionally mismatched port will cause the transfer signal of an input signal from an adjacent port to be reflected to another adjacent port and to be combined with the transfer signal of a second input signal, which is from an input port not isolated from the first input port. Placing the two input ports adjacent to one another also allows one input to radiate out of another adjacent input port. Alternately, a hybrid network is provided including a four-port directional coupler with all ports properly terminated at the characteristic impedance of the coupler. An external combiner for signals from one port and its adjacent port allows the combining of two input transfer signals generated from the other two nonisolated input ports.

5 Claims, 3 Drawing Sheets



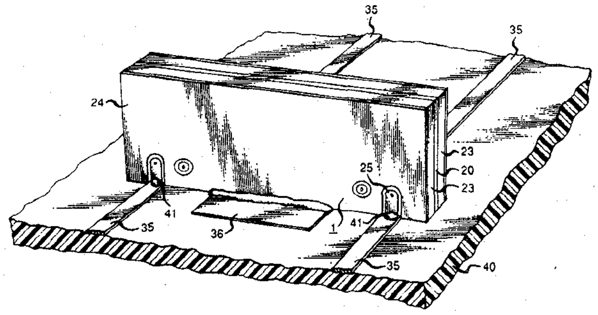
5,032,803 July 16, 1991

Directional Stripline Structure and Manufacture

Inventor: Michael J. Koch.
Assignee: American Telephone & Telegraph Company.
Filed: Feb. 2, 1990.

Abstract—This disclosure describes a double-sided transmission substrate formed with striplines and end-ports in juxtaposition on either side. The transmission substrate is sandwiched between two exterior dielectric substrates, each coated on one side with a metallic layer. The three substrates are laminated together. Through-holes are drilled into the lamination and its interior substrate, at known locations to intersect the said ports. The copper exteriors of each board are etched to identify two contact pad lands on each side. Plated-thru holes are created to connect to each of the ports.

10 Claims, 4 Drawing Sheets



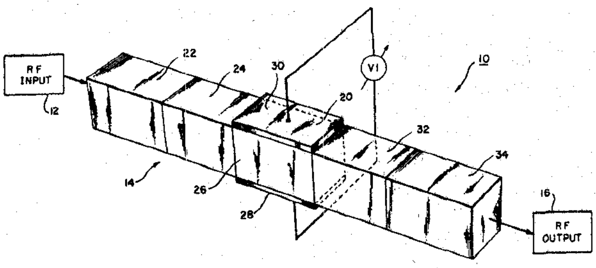
5,032,805 July 16, 1991

RF-Phase Shifter

Inventors: Frank J. Elmer, Kaiser S. Kunz, and Sei Joo Jang.
Assignee: The United States of America as represented by the Secretary of the Army.
Filed: Oct. 23, 1989.

Abstract—An electrically controlled RF-phase shifter having an active medium formed from a ceramic material the permittivity of which may be varied by varying the strength of an electric field in which it is immersed. The phase shifter includes the ceramic material having electrodes mounted thereon that are connected to an adjustable dc voltage source. The phase shifter may be placed in an RF-transmission line that includes appropriate input and output impedance matching devices such as quarter-wave transformers. The phase of the RF power exiting the phase shifter will depend on the effective electrical length of the material in the active medium. Because changes in the permittivity of the material will produce corresponding changes in the electrical length of the material, changes in the phase of the RF power transmitted therein will be produced. The quarter-wave transformers may also be made of a similar adjustable permittivity material. Control voltages applied to the transformers are used to adjust the amount of output power. An interdigitated electrode is used to reduce the amount of voltage needed to operate the phase shifter. The phase shifter may be embedded as part of a microwave integrated circuit.

8 Claims, 3 Drawing Sheets



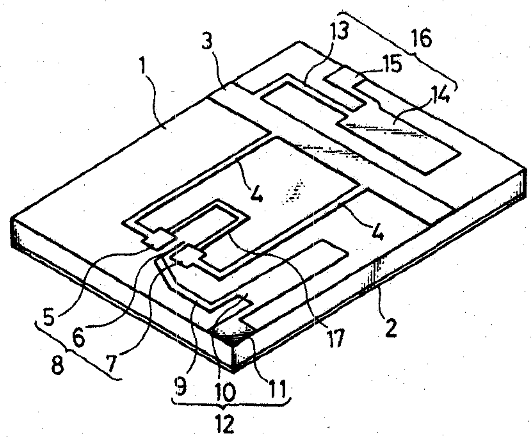
5,032,806 July 16, 1991

Loaded-Line Phase Shifter

Inventor: Kazuhiko Nakahara.
Assignee: Mitsubishi Denki Kabushiki Kaisha.
Filed: Mar. 21, 1990.

Abstract—A loaded-line phase shifter using striplines disposed on a semiconductor substrate includes a main stripline having an electrical length of one-half wavelength, loaded striplines connected to respective ends of the main stripline, a field-effect transistor having its source electrode and its drain electrode connected to the respective load lines, a bias circuit connected to the gate electrode of the field- effect transistor for controlling the bias voltage applied to the gate electrode, and a resonant stripline connected between the source electrode and the drain electrode.

2 Claims, 6 Drawing Sheets



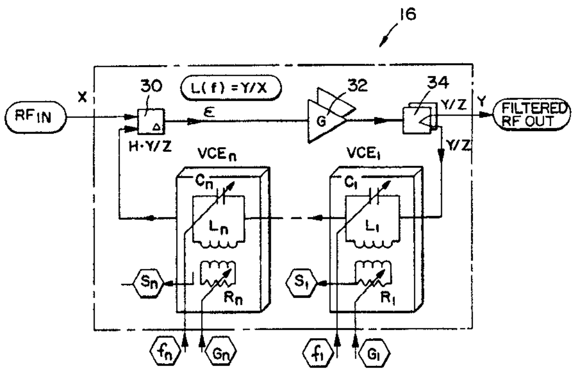
5,032,839 July 16, 1991

Self-Equalizing Coherent Optical RF Memory

Inventor: Baruch Even-Or.
Assignee: American Electronic Laboratories.
Filed: Apr. 9, 1990.

Abstract—A coherent optical RF memory has an input circuit for receiving RF input signals having wide-band frequency content. An electronically tuned frequency selector selects from the RF input at least one desired RF signal having a desired frequency content for storing in memory. A first transducer responsive to the frequency selector converts the at least one desired RF signal into an optical signal representative of the RF signal. The optical signal is stored in an optical storage device. A second transducer responsive to the optical storage device converts the stored optical signal back to an RF signal, forming a recirculating loop. The desired signal is automatically self-equalized as it recirculates in the loop in order to avoid oscillation while maintaining signal coherency. The desired signal may be used for jamming or deception in electronic warfare (EW) or electronic intelligence (ELINT) systems.

6 Claims, 2 Drawing Sheets



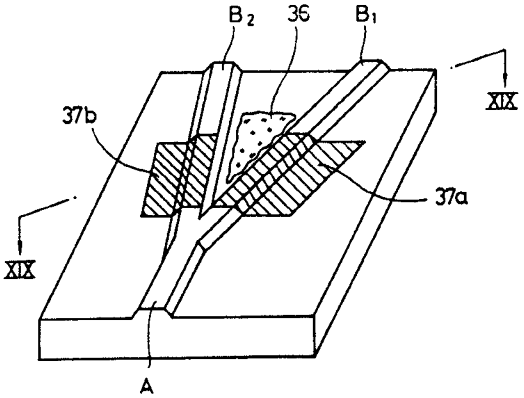
5,033,811 July 23, 1991

Optical Switch

Inventors: Hisaharu Yanagawa, Yoshiyuki Kamata, Ken Ueki, and Hidehisa Miyazawa.
Assignee: The Furukawa Electric, Co., Ltd.
Filed: Oct. 30, 1989.

Abstract—An optical switch includes at least one input optical semiconductor waveguide. Two output optical semiconductor waveguides are connected at a branch point to the input optical waveguide, and diverge from the branch point with a preset angle θ (degree) between them. A refractive index controlling portion is located on at least one of the output optical waveguides and away from the branch point. The refractive index controlling portion effects a light mode cut-off by electromagnetically causing a reduction of the refractive index of the associated output optical waveguide.

6 Claims, 17 Drawing Sheets



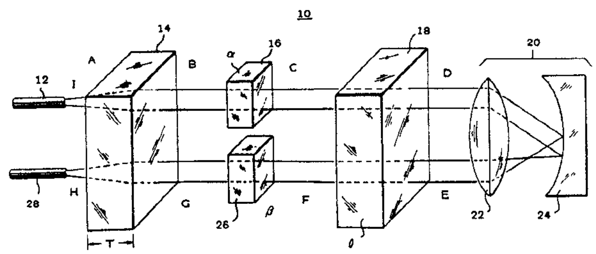
5,033,830 July 23, 1991

Polarization Independent Optical Isolator

Inventor: Ralph S. Jameson.
Assignee: AT&T Bell Laboratories.
Filed: Oct. 4, 1989.

Abstract—A polarization independent optical isolator is disclosed that uses a single birefringent plate. A pair of stacked reciprocal rotators, a Faraday rotator, and reflector are positioned in tandem adjacent to the birefringent plate. In the forward (transmitting) direction, a lightwave signal exiting an optical fiber is split into a pair of orthogonal rays by the birefringent plate. The orthogonal rays then pass through a first reciprocal rotator and the Faraday rotator. The rotated rays are then redirected by the reflector back through the Faraday rotator. After passing through the second reciprocal rotator, the orthogonal rays re-enter the same birefringent plate where they are recombined and launched in an output fiber. Since a faraway rotator is a nonreciprocal device, any signal traveling through the isolator in the reverse (isolation) direction will be split on both passes through the birefringent plate such that neither will intercept the input fiber.

10 Claims, 7 Drawing Sheets



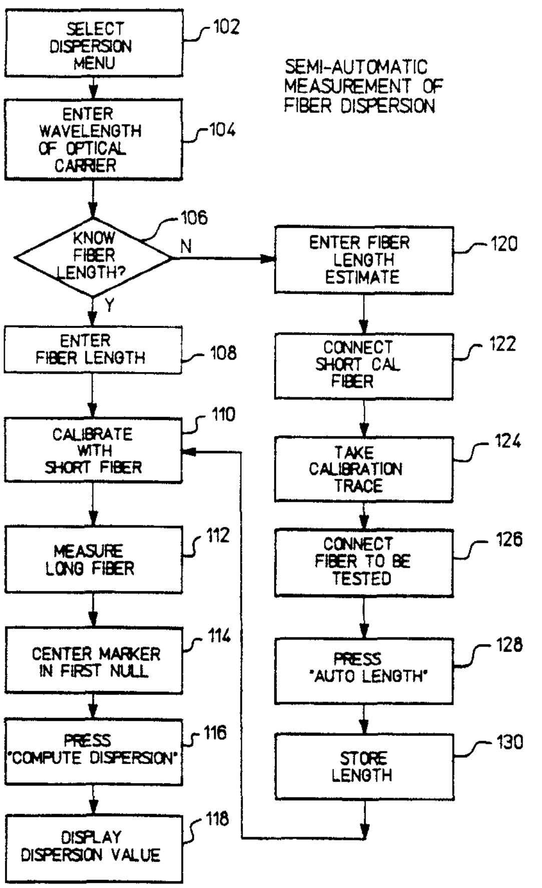
5,033,846 July 23, 1991

Lightwave Component Analyzer for Determination of Chromatic Dispersion in Single-Mode Optical Fiber

Inventors: Paul R. Hernday, Roger W. Wong, and Harry Chou.
Assignee: Hewlett-Packard Company.
Filed: Jan. 22, 1990.

Abstract—A lightwave component analyzer and method for determining chromatic dispersion in single-mode optical fiber. The lightwave component analyzer initially performs various measurements that are used in the determination of chromatic dispersion in single-mode optical fiber. The lightwave component analyzer then computes a chromatic dispersion factor using the measured parameters, as well as additional parameters that are stored in the analyzer or entered by a user. Various expressions are described for computation of chromatic dispersion in single-mode optical fiber.

20 Claims, 6 Drawing Sheets



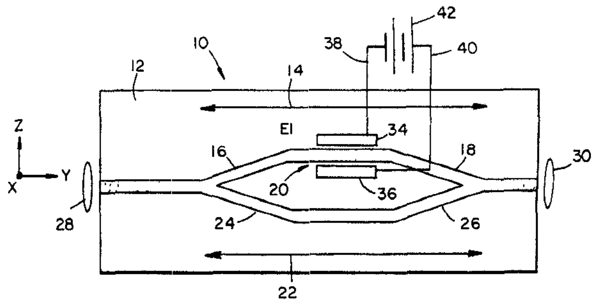
5,034,603 July 23, 1991

Integrated Optics Wavelength Stabilization Unit

Inventor: Keith E. Wilson.
Filed: Nov. 6, 1989.

Abstract—An integrated-optics wavelength stabilization device for broad-bandwidth optical sources requires small-optical-path-difference interferometers to detect wavelength shifts. The phase retardation between the arms of the interferometer is modulated using small applied ac voltages.

30 Claims, 3 Drawing Sheets



5,034,711 July 23, 1991

Dielectric Resonator Support System for a Waveguide

Inventors: Louis W. Hendrick and David S. Levinson.
Assignee: Hughes Aircraft Company.
Filed: Jan. 23, 1990.

Abstract—A system for supporting a dielectric resonator in a circular waveguide. A dielectric resonator is held in its optimum position using support posts or rods. The support rods are made from a suitable dielectric material, and slip fitted in holes provided at 90° intervals around the periphery of the dielectric resonator. The support rods are affixed to the waveguide, by gluing or being screwed in place. The support rods are slip fitted such that they are allowed to expand, due to temperature, without causing stress on the dielectric resonator, thus the dielectric resonator is held in position without being affixed to its supporting structure. This is an inexpensive and simple solution to a complex problem. The support system is self-centering and free from all stress. The support system utilizes a minimum amount of supporting material that permits realization of the best unloaded Q.

6 Claims, 1 Drawing Sheet