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, D.C. 20231.

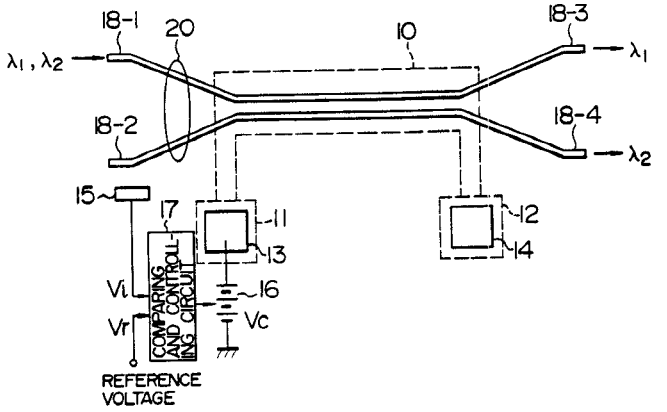
4,953,934 Sept. 4, 1990

Waveguide Type Light Merging and Branching Device

Inventors: Katsuyuki Imoto, Hirohisa Sano, Masaru Miyazaki, Naoyuki Matsuoka, and Hisato Uetsuka.
Assignees: Hitach, Ltd. and Hitachi Cable, Ltd.
Filed: Dec. 7, 1988.

Abstract—A waveguide type light merging and branching device, in which a resistance layer is disposed on a surface of a substrate or at least on one side therein and a low refractive index layer (refractive index n_b), a core waveguide layer (refractive index n_c, $n_c > n_b$), and a cladding layer (refractive index n_n, $n_n > n_c$) superposed thereon on each other, the resistance layer having electrode terminals at the two extremities thereof, to which a voltage is applied.

2 Claims, 4 Drawing Sheets



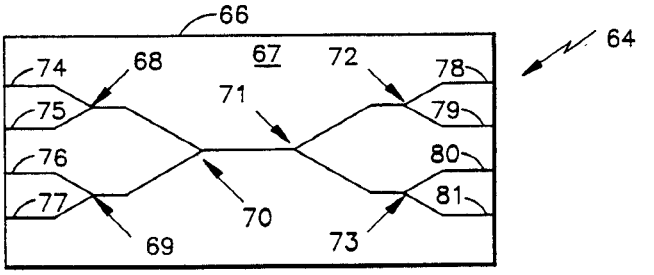
4,953,935 Sept. 4, 1990

Integrated Optic Star Coupler

Inventors: Paul G. Suchoski, Jr., Talal K. Findakly, and Frederick J. Leonberger.
Assignee: United Technologies Corporation.
Filed: Mar. 27, 1989.

Abstract—An optical power star coupler includes a $LiNbO_3$ or $LiTaO_3$ substrate having a major surface for receiving a circuit array of one or more surface for splitters disposed thereon by a two step proton exchange (TSPE) process, in a geometric pattern to provide an $N \times M$ star coupler having high polarization extinction, uniform splitting ratio, and low loss.

12 Claims, 1 Drawing Sheet



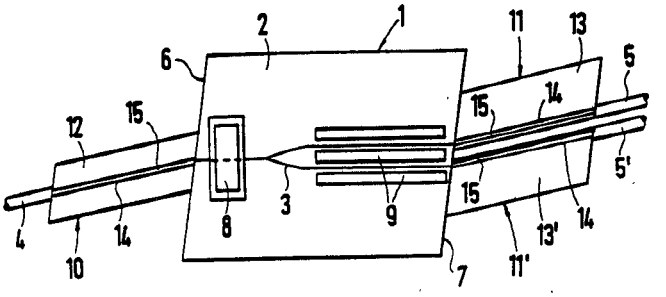
4,953,936 Sept. 4, 1990

Optical Waveguide Module with Fiber Coupling

Inventors: Rolf Regener and Joachim Scholz.
Assignee: Standard Elektrik Lorenz Aktiengesellschaft.
Filed: Sept. 1, 1989.

Abstract—To improve the stability and optical transmission properties of an optical waveguide module (1), a fillet shaped supporting body (12, 13, 13') is used to hold the end (15) of a fiber, particularly of a polarization-maintaining fiber. The top side of the supporting body contains a groove (14) which extends in the direction of the body's longitudinal axis and in which the fiber end (15) is completely sunk and embedded in adhesive. After proper alignment, polished end faces of the fiber and the supporting body (12, 13, 13') are attached to the substrate (2) with adhesive.

4 Claims, 1 Drawing Sheet



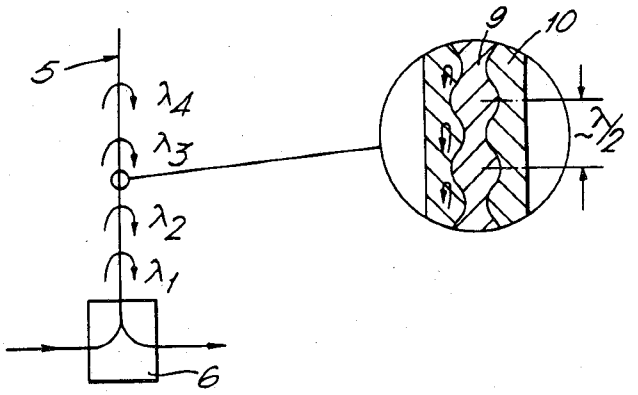
4,953,939 Sept. 4, 1990

Optical Fiber Transmission Systems

Inventor: Richard E. Epworth.
Assignee: STC PLC.
Filed: Dec. 16, 1987.

Abstract—A device for producing an optical delay in an optical signal having variable optical frequency, the optical delay varying with the optical frequency, comprises a chirped Bragg reflector formed in an optical fiber and a directional coupler for separating the reflected signal from the input signal. One application of the device is for chromatic dispersion equalization. Various methods of manufacturing the chirped Bragg reflector are described.

17 Claims, 3 Drawing Sheets



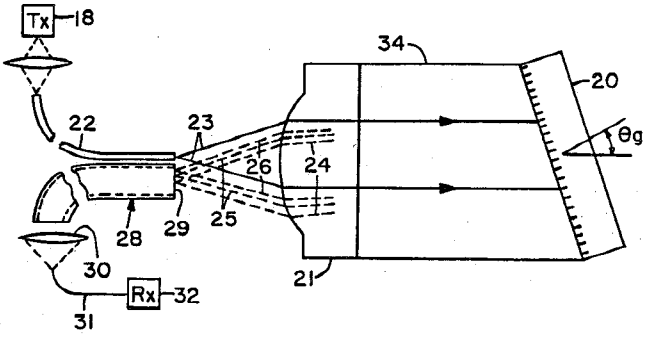
4,953,947 Sept. 4, 1990

Dispersion Transformer Having Multichannel Fiber

Inventor: Venkata A. Bhagavatula.
Assignee: Corning Incorporated.
Filed: Aug. 8, 1986.

Abstract—An optical transmission system wherein light is transmitted from a transmitter to a receiver by at least one transmission optical fiber. The system includes a dispersion transformer that receives light from one of the components, compensates for or transforms the delay distortion of the various wavelengths transmitted through the system, and provides the next component in the system with a compensated or transformed light beam. The dispersion transformer comprises means for receiving light from one of the components and dispersing/separating the light into the plurality of spatially separated beams which are directed onto the endface of a multimode optical fiber. The position of each beam on that end-face is a function of the velocity with which the light that forms the beam propagates through the transmission optical fiber. The multimode fiber is characterized in that it comprises a plurality of light-conducting channels, adjacent ones of which are separated by cladding regions having refractive indices lower than those of the adjacent light-conducting channels.

8 Claims, 3 Drawing Sheets



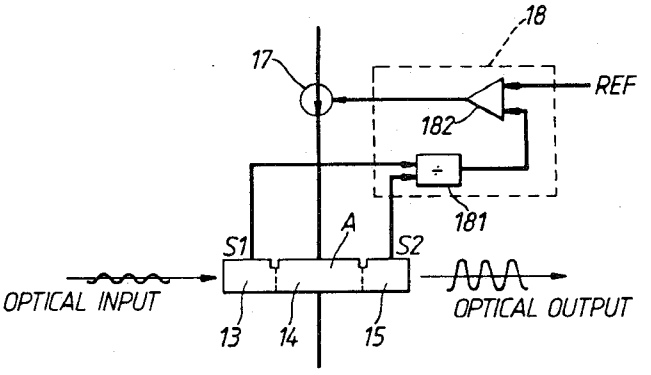
4,954,786 Sept. 4, 1990

Optical Amplifying Device

Inventors: Hideaki Yamakawa, Nobuo Suzuki, and Takeshi Ozeki.
Assignee: Kabushiki Kaisha Toshiba.
Filed: Dec. 5, 1989.

Abstract—A device for amplifying an input optical signal includes an optical amplifier having a gain control region in which the input optical signal is amplified, a first detecting region for detecting the input optical signal, and a second detecting region for detecting an amplified optical signal. The gain of the optical amplifier is controlled by a gain control signal from a signal source. A controller, responsive to detecting signals from the first and second detecting regions, produces a source control signal which is supplied to control the signal source.

23 Claims, 6 Drawing Sheets



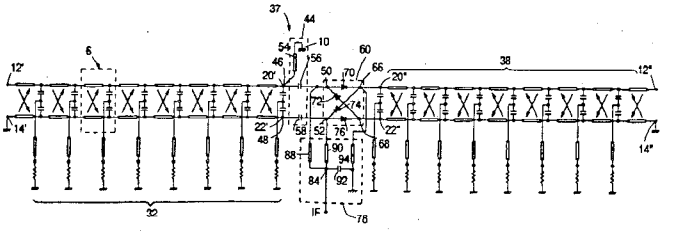
4,954,790 Sept. 4, 1990

Enhanced Coupled, Even Mode Terminated Baluns, and Mixers and Modulators Constructed Therefrom

Inventor: Richard G. Barber.
Assignee: Avantek, Inc.
Filed: Nov. 15, 1989.

Abstract—A balun section formed of a pair of transmission lines connected between separate pairs of corresponding input and output terminals with a pair of capacitors connected in series between the output terminals and another transmission line connected in series with a resistor between the circuit ground and the interconnection between the pair of capacitors. A multisection balun is constructed from a plurality of such balun sections connected in cascade. In one embodiment, the output of a pair of multisection baluns are supplied to a circuit such as a mixer or the like.

25 Claims, 4 Drawing Sheets



4,955,683 Sept. 11, 1990

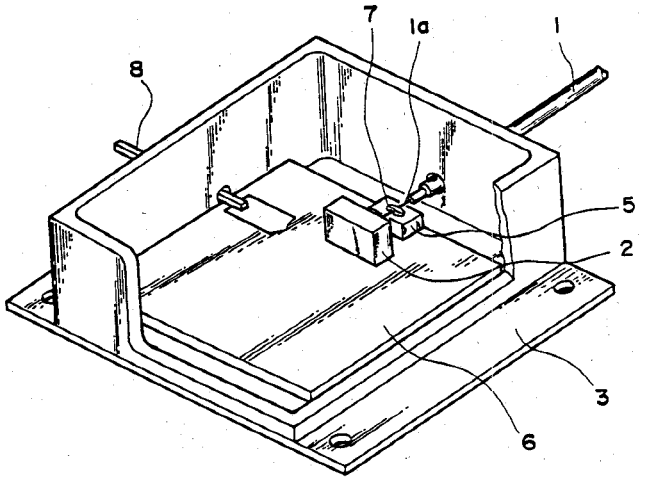
Apparatus and a Method for Coupling an Optically Operative Device with an Optical Fiber

Inventors: Nobuo Shiga, Takeshi Sekiguchi, and Keigo Aga.
Assignee: Sumitomo Electric Industries, Ltd.
Filed: Apr. 18, 1989.

Abstract—This invention relates to an optical module for coupling an optically operative device with an optical fiber. Near the optically operative

device, the module includes a fiber saddle on which the optical fiber is affixed by soldering to optically connect the operative device and the fiber. The fiber saddle is provided on a heat insulative substrate, which also mounts the optically operative device, so that heat for melting the solder will not be conducted through the fiber saddle when the optical fiber is soldered to the saddle. Thus, the temperature necessary for soldering can be attained rapidly. A mounting surface of the fiber saddle is plated with solder. A preformed solder structure is bridged over the optical fiber after it is positioned on the fixation surface. The preformed structure is melted and then allowed to solidify whereby the optical fiber is affixed to the fiber saddle to prevent dislocation of the fiber. The optically operative device is kept free of contamination by flux during soldering of the optical fiber.

19 Claims, 3 Drawing Sheets



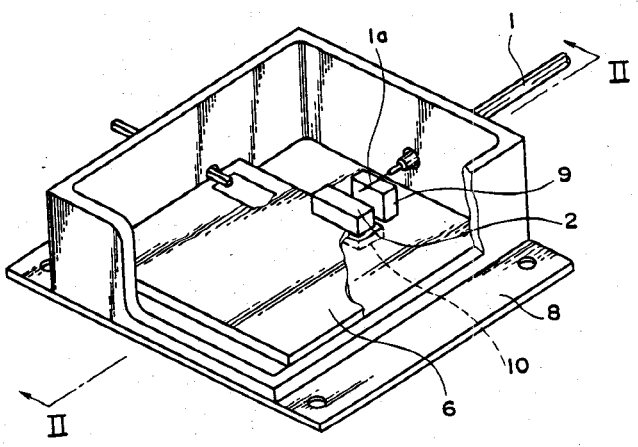
4,955,684 Sept. 11, 1990

Optical Module Coupling Device

Inventor: Nobuo Shiga.
Assignee: Sumitomo Electric Industries, Ltd.
Filed: Aug. 9, 1989.

Abstract—In an optical module with a substrate having an optical unit mounted thereon which substrate is provided on the bottom of a package so that the optical unit is optically coupled with an end of an optical fiber extending into the package, a chip carrier, including the optical unit, is die-bonded to a conductive land formed on the substrate. A recess is formed in the bottom of the package which faces the land. Thus, a capacitance of a parallel-plate capacitor formed by the land and the bottom of the package is made negligibly small.

10 Claims, 4 Drawing Sheets



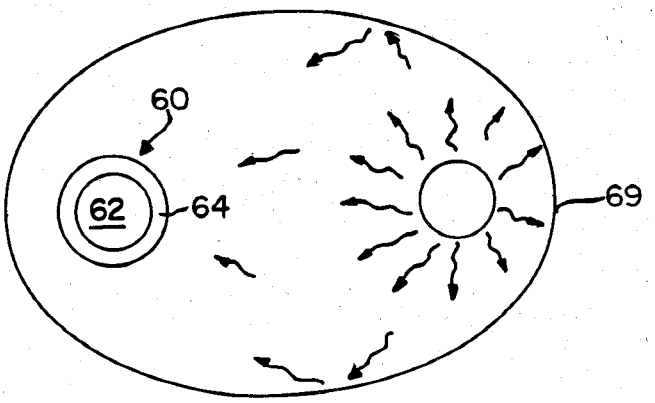
4,955,685 Sept. 11, 1990

Active Fiber for Optical Signal Transmission

Inventor: Jonathan D. Garman.
Assignee: Sun Microsystems, Inc.
Filed: Feb. 21, 1989.

Abstract—An improved optical fiber is disclosed having particular application for use in a fiber optic communication system. The optical fiber includes an optically transparent core which is doped with a lasing material of the same type used in the diode laser transmitter of the particular communication system. The lasing dopant has the greatest density in the center of the core, and is diffused outward into an optically transparent cladding surrounding the core that has an index of refraction lower than an index of refraction of the core. The optical fiber is "pumped" such that the lasing dopant within the fiber lases at a desired wavelength and provides gain for the original optical signal provided by the diode laser. The lasing of the dopant material within the fiber results in continuous optical gain along the length of the fiber and avoids the need for repeaters in the fiber optic communication system. Various pumping embodiments are disclosed including coating the outside of the cladding with a light emitting material, such as radium fluorescent paint, and providing a reflector on the outer surface of the fiber to reflect light generated by the radium through the cladding and into the core to achieve lasing. An alternate embodiment is disclosed in which an electroluminescent material coats the outer surface of the cladding, such that upon the application of voltage along the length of the fiber, the electroluminescent material generates photon energy and pumps the dopant within the core to achieve lasing.

21 Claims, 4 Drawing Sheets



4,955,686 Sept. 11, 1990

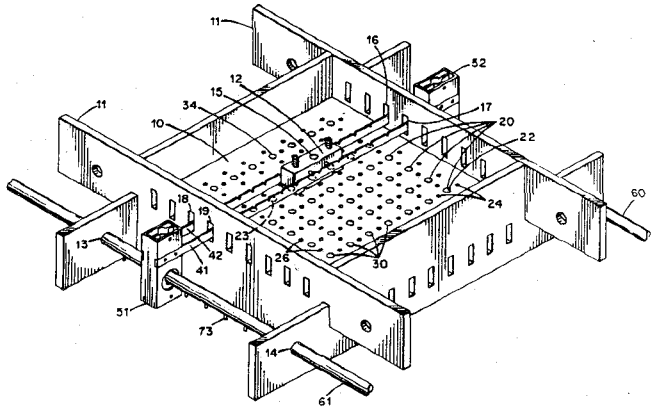
Optical Fiber Crossconnect Switch

Inventors: Carl F. Buhrer, W. John Carlsen, Sarah S. Cousins, and Alfred H. Bellows.
Assignee: GTE Laboratories Incorporated.
Filed: June 16, 1989.

Abstract—A true *n*-by-*n* optical crosspoint matrix switch has *n* optical fiber outputs each carrying the same light that entered the switch at one of *n* fiber inputs, maintaining the full optical spectral characteristics although the polarization states may be modified. A mounting plate on a patch panel has an *n*-by-*n* array of connection adapters in *n* rows and no columns. An electromechanical positioning mechanism is utilized to position *n* input fibers along one row to any of *n* adapter positions each in a different column on a first side of said plate, and *n* output fibers along one column to any one of *n* adapter positions, each in a different row on a second side of said plate.

Any input fiber can be connected to any output fiber and none of the adapters are shared by more than one input or one output connector. The electromechanical positioning mechanism includes a pair of cam driven walking legs supporting a fiber carrier one for each column on the first side of said plate and one for each row on the second side of said patch plate. The fiber carriers step linearly from one adapter position to the next, raising and lowering the fiber to break or make connections.

16 Claims, 4 Drawing Sheets



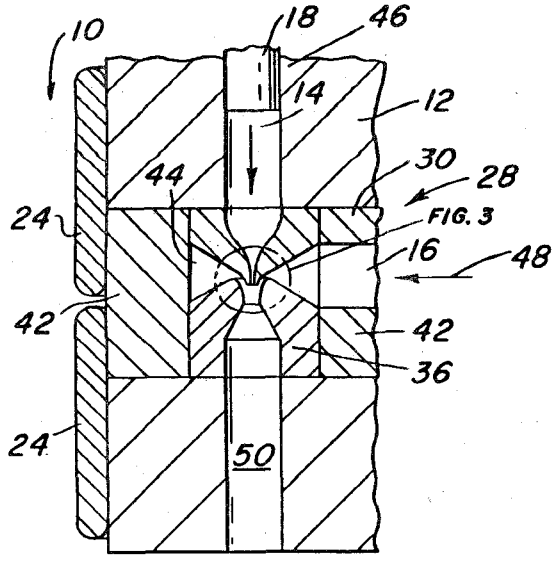
4,955,689 Sept. 11, 1990

IR Transmitting Optical Fiber

Inventors: Terry A. Fuller, Vijay J. Nadkarni, and John R. Peschke.
Assignee: Fuller Research Corporation.
Filed: Oct. 24, 1988.

Abstract—The present invention is directed to a cladded optical fiber and a process for manufacturing the same. The cladding and core are halide materials. An interface for inhibiting radiation scatter is provided at the boundary between the halide cladding and the halide core. The process steps include extruding a first halide or halide core from a first chamber, and extruding a second halide or halide cladding from a second chamber into contact with the halide core. The halide cladding is joined to the halide core at the boundary.

12 Claims, 4 Drawing Sheets



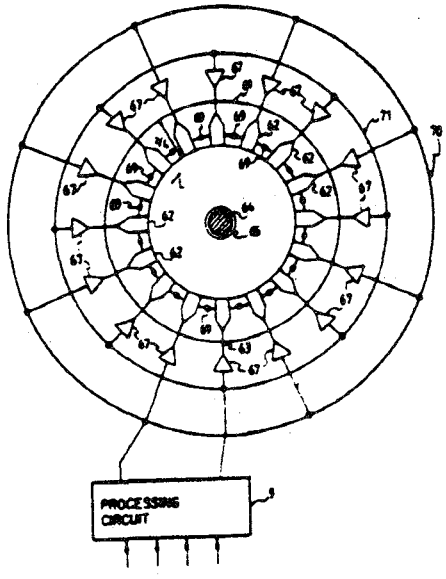
4,956,614 Sept. 11, 1990

Device Including a Radial Combiner for Electromagnetic Waves

Inventor: Michel Baril.
Assignee: Thomson-CSF.
Filed: Mar. 30, 1988.

Abstract—The invention provides a device including a radial combiner for electromagnetic waves and a method using a radial combiner. The invention provides a radial combiner with resistors disposed between the impedance matchers capable of combining these signals from a plurality of radially disposed amplifiers or transmitters. By applying desired phase shifts to the signals transmitted by certain amplifiers or transmitters, amplitude-phase modulation of the total signal transmitted can be provided. It is more particularly possible to provide radar pulse modulation for reducing the frequency spectra of the transmitted signal.

10 Claims, 15 Drawing Sheets



4,956,620 Sept. 11, 1990

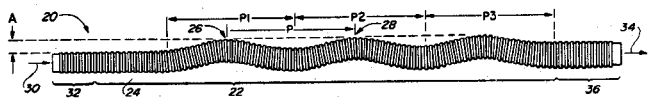
Waveguide Mode Converter and Method Using Same

Inventor: Charles P. Moeller.
Assignee: The United States of America as represented by the United States Department of Energy.
Filed: July 17, 1989.

Abstract—A waveguide mode converter converts electromagnetic power being transmitted in a TE_{0n} or a TM_{0n} mode, where n is an integer, to an HE_{11} mode. The conversion process occurs in a single stage without requiring the power to pass through any intermediate modes. The converter comprises a length of circular corrugated waveguide formed in a multiperiod periodic curve. The period of the curve is selected to couple the desired modes and decouple undesired modes. The corrugation depth is selected to control the phase propagation constant, or wavenumbers, of the input and output modes, thereby preventing coherent coupling to competing modes. In

one embodiment, both the period and amplitude of the curve may be selectively adjusted, thereby allowing the converter to be tuned to maximize the conversion efficiency.

21 Claims, 4 Drawing Sheets



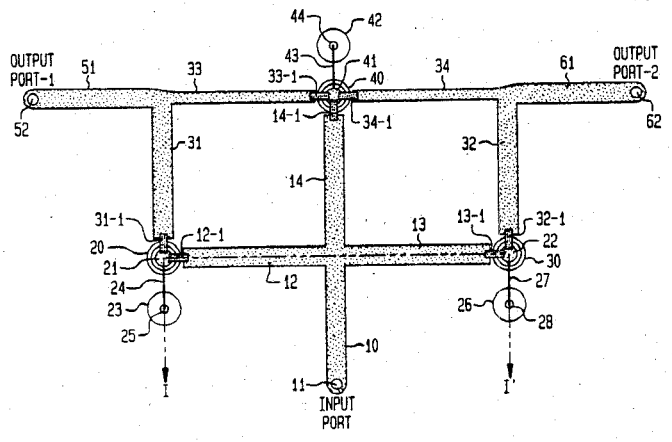
4,956,621 Sept. 11, 1990

Three-State, Two-Output Variable RF Power Divider

Inventors: Douglas E. Heckaman, John E. Baker, and Walter M. Whybrew.
Assignee: Harris Corporation.
Filed: Dec. 8, 1987.

Abstract—A three-state, two-output R.F. power divider is configured as a microstrip device having an input port and first and second output ports. Between these three ports there is disposed a substantially *T*-shaped microstrip transmission line structure such that the input port is coupled to a base portion of the *T*-shaped structure and the first and second output ports are coupled to opposite ends of a top portion of the *T*-shaped structure. A substantially *U*-shaped microstrip transmission line structure is intercoupled with the *T*-shaped structure such that end portions of the *U*-shaped structure are coupled to the top portion of the *T*-shaped structure and a bottom portion of the *U*-shaped structure is coupled to the base portion of the *T*-shaped structure. A first PIN diode is coupled between a first location of the *T*-shaped structure and a ground plane brassboard underlying the dielectric layer on which the microstrip metalization is formed. Second and third PIN diodes are coupled between second and third respective locations of the *U*-shaped structure and the ground plane. Power is selectively coupled from the input port and the two output ports by controllably biasing the shunting action of the three PIN diodes, such that two diodes operate as shunts, while the other diode remains open.

14 Claims, 2 Drawing Sheets



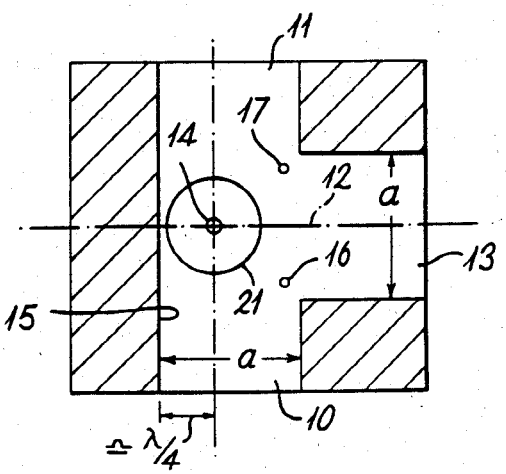
4,956,622 Sept. 11, 1990

Waveguide *H*-Plane Junctions

Inventors: Frans C. de Ronde.
Assignee: National Research Development Corporation.
Filed: Nov. 28, 1988.

Abstract—An *H*-plane waveguide "*T*" junction is described in which matching is achieved over a full waveguide band at the waveguide which forms the stem of the "*T*." Reflection from the wall facing the stem is reduced by using a probe as a monopole located about a quarter of a wavelength from the said wall. Variations with frequency in the reflection coefficient at the stem are reduced by a disc, at the foot of the probe, which acts as a radial reduced quarter wave transformer.

11 Claims, 2 Drawing Sheets



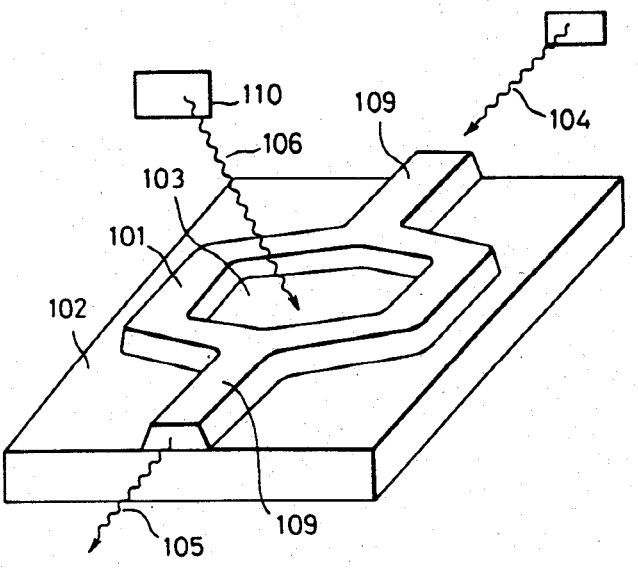
4,957,337 Sept. 18, 1990

Optical Quantum Interference Device and Method of Modulating Light Using Same

Inventors: Kensuke Ogawa, Toshio Katsuyama, and Tadashi Fukuzawa.
Assignee: Hitachi, Ltd.
Filed: May 5, 1989.

Abstract—A device structure is provided for optical modulation using a quantum interference effect in an excited state of electron-systems. The optical modulation is performed by causing the effect of modulation on the excited state of electron-systems represented by excitons to be executed on light via the state in which the light and the excited state of electron-systems represented by the excitonic polaritons are coupled.

31 Claims, 16 Drawing Sheets



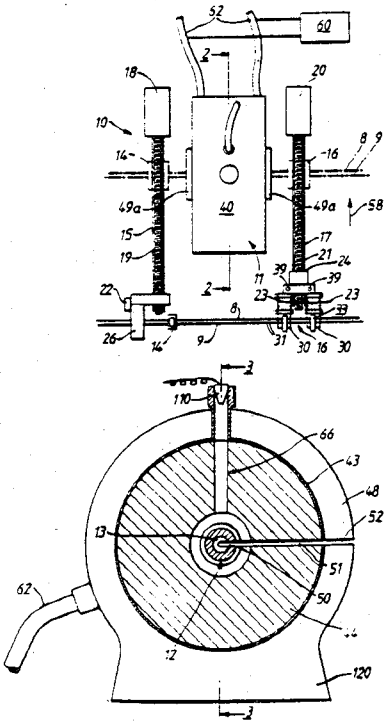
4,957,338 Sept. 18, 1990

Fabrication of Fiber-Optic Components

Inventors: David A. Thorncraft, David R. Kennedy, Scott C. Rashleigh, and Timothy P. Dabbs.
Assignee: The Commonwealth of Australia.
Filed: Nov. 9, 1987.

Abstract—A method of fabricating a fused fiber optic coupler includes disposing two or more segments of optical fiber under longitudinal tension. The tensioned fiber segments are preheated to a temperature sufficient to soften the segments and thereby substantially relieve their tension by inelastic stretching of the segments. After the segments have cooled, the fiber segments are retensioned and then heated while in intimate side-by-side contact to a temperature sufficient to cause the fiber segments to fuse together.

17 Claims, 4 Drawing Sheets



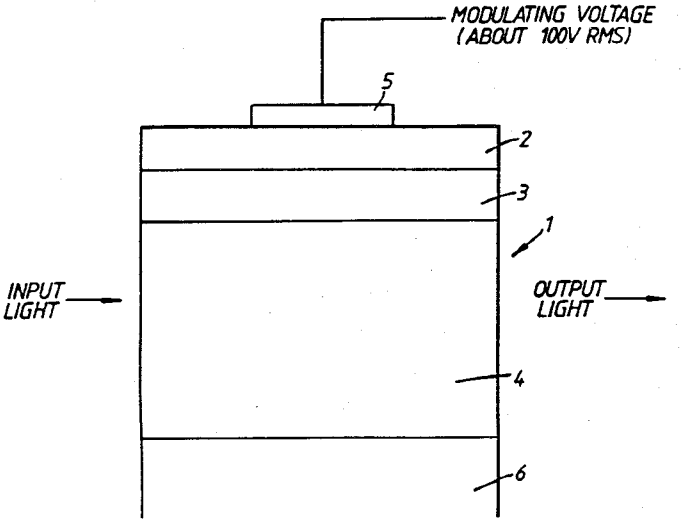
4,958,895 Sept. 25, 1990

Optical Waveguides

Inventors: Paul J. Wells and David Bloor.
Assignee: GEC-Marconi Limited.
Filed: June 23, 1989.

Abstract—A thin film optical waveguide made of a polymeric waveguiding film supported on a substrate, the film being made of a homopolymer of vinylpyridine or of a derivative or vinylpyridine in which the pyridine heterocyclic nucleus is substituted. Alternatively, a copolymer containing a major proportion of vinylpyridine, or of said derivative thereof, may be used in the film. A layer of a material having a lower refractive index may cover the film. The polymer may be modified to increase its capacity for refractive index variation in response to an electric field, by inclusion in the structure of the polymer of at least one optically nonlinear moiety. The polymer may also include cross-linking. The thin film optical wave guide may incorporate a laser dye in the film, for use with laser devices.

16 Claims, 10 Drawing Sheets



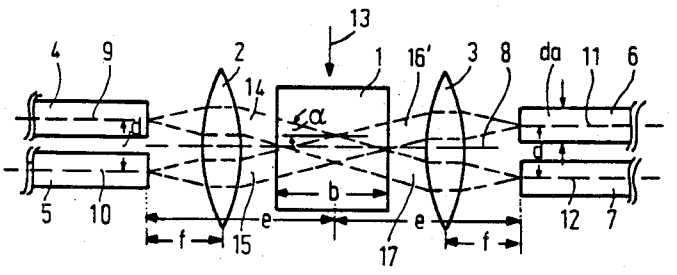
4,958,896 Sept. 25, 1990

Optical Multigate Element with an Acoustooptical Modulator

Inventors: Ernst Brinkmeyer, Manfred Fuchs, Wolfgang Brennecke, and Wilhelm Dargatz.
Assignee: U. S. Phillips Corp.
Filed: Nov. 4, 1988.

Abstract—An optical multiport element with an acoustooptical modulator (AOM) has at least two monomode optical waveguide connections, at one side thereof. The end surfaces of the waveguides disposed in the focal plane of a lens situated between the optical waveguides and the acoustooptical modulator. In order to obtain a construction which can be adjusted in a simple manner and which has low attenuation, with a small overall length, it is provided that at least one side of the AOM (1) a single lens (2,3,31) is disposed with its optical axis aligned to the transmission axis of the AOM (1),a nd that the optical wave-guides (4 to 6, 18 to 20 or 27, 28) are disposed with their axes parallel to one another and spaced from the optical axis of the lens (2, 3, 31) in such a manner that parallel beams (14 to 17), leading from the lens (2, 3, 31) to the AOM (1), are directed to the active region of the AOM (1) at the Bragg angle to the optical axis.

26 Claims, 1 Drawing Sheet



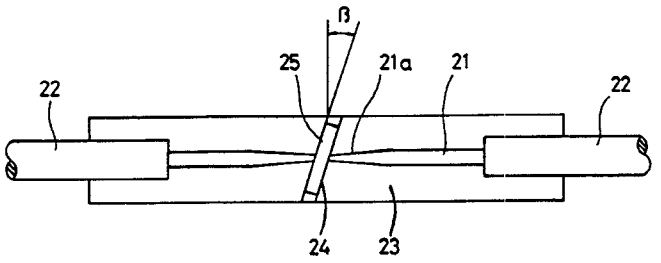
4,958,897 Sept. 25, 1990

Thin Film Optical Component for Use in Optical Transmission Lines and Method of Manufacturing the Same

Inventors: Hisaharu Yanagawa, Toshihiro Ochiai, Hirokazu Hayakawa, and Hidehisa Miyazawa.
Assignee: The Furukawa Electric Co., Ltd.
Filed: June 16, 1989.

Abstract—An optical component and a manufacturing method therefore are provided, in which an optical member is arranged across a spot-size enlarged portion of an optical fiber. The spot-size enlarged portion is formed either by heating and drawing an optical fiber to reduce its diameter or by diffusing core dopant of an optical fiber outwardly while heating the same. The optical component functions as an optical filter, an optical attenuator, a polarizer, a wavelength division multiplexer/demultiplexer of the like, depending on selection of the optical member.

10 Claims, 6 Drawing Sheets



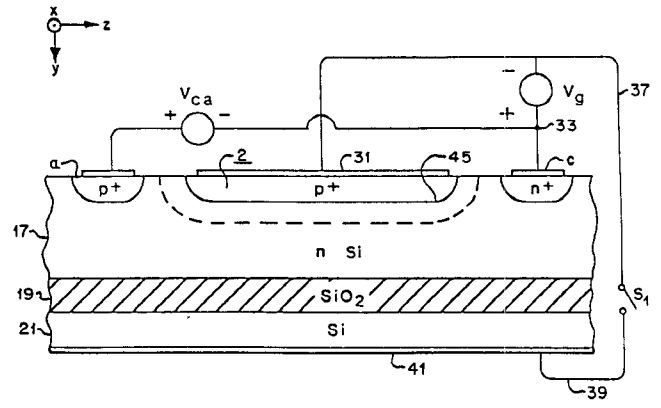
4,958,898 Sept. 25, 1990

Silicon Double-Injection Electrooptic Modulator with Insulated-Gate and Method of Using Same

Inventors: Lionel Friedman and Richard A. Soref.
Assignee: The United States of America as Represented by the Secretary of the Air Force.
Filed: Mar. 15, 1989.

Abstract—A double-injection transistor structure with an MOS gate is utilized as a guided-wave electrooptic phase modulator at infrared wavelengths in a silicon-on-insulator (SOI) waveguide. Cathode, gate and anode regions are integrated in the waveguide, longitudinally. The effective phase modulation is given by the voltage-variable overlap of the guided-mode optical field with carrier-induced local changes in the silicon refractive index. An electron-hole plasma is injected under the gate by cathode and anode. Using depletion-layer widening, the plasma channel width and mode overlap are controlled very rapidly by one or two low-power gate electrodes.

39 Claims, 2 Drawing Sheets



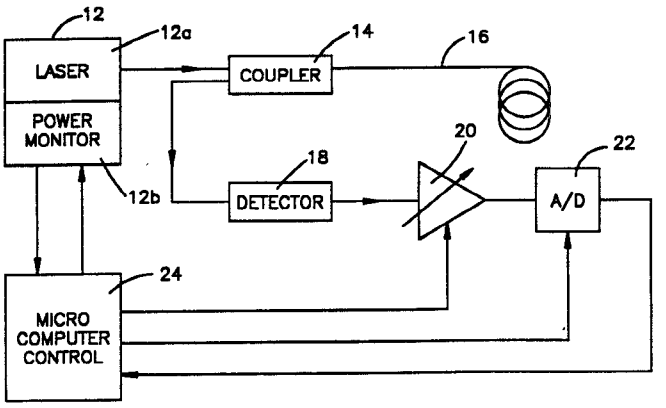
4,958,926 Sept. 25, 1990

Closed Loop Control System for Laser

Inventor: George Bu-Abbud.
Assignee: Reliance Comm/Tec Corporation.
Filed: Oct. 31, 1988.

Abstract—A closed loop control system for a laser that is used in an instrument which may be an optical time domain reflectometer. The system uses the output light of the laser and the light from a fiber to which the laser light is connected to initially set the bias and pulse current amplitudes to the laser and adjust the gain of the receiver that is part of the control system. The control system also responds to light from the fiber to continuously control the pulse current amplitude and receiver gain so that the amplitude of the electrical signal representative of that light is kept within the operating range of the receiver electronics.

17 Claims, 6 Drawing Sheets



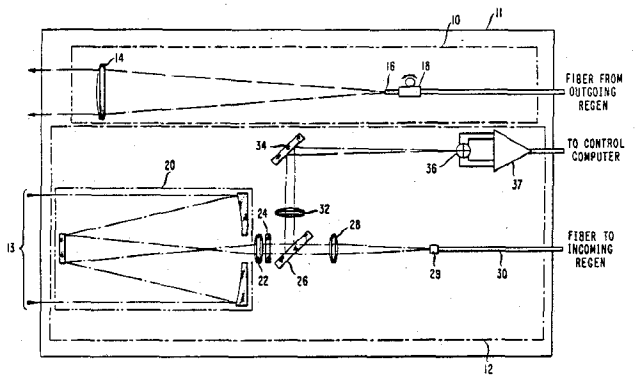
4,960,315 Oct. 2, 1990

Atmospheric Optical Communication Link

Inventors: Hubert Kostal, Rodney C. Luhn, and Donald E. Smith.
Assignee: AT&T Bell Laboratories.
Filed: May 19, 1989.

Abstract—This invention is a mobile, short range, high data rate, high availability atmospheric optical communication link which can be used to temporarily bridge a break in an optical fiber network. Briefly, the invention comprises two transceivers, one at each end of a break, to bridge a severed optical fiber via an atmospheric optical transmission path which can extend for a distance of roughly 5 miles. A special light source is not required. The light transmitted through the atmosphere is the low power light emitted from the end of an optical fiber and generated by an optical regenerator normally used to generate light only for transmission through an optical fiber. The light is first expanded and collimated for atmospheric transmission and then transmitted to a receiver. At the receiver, the diameter of the received beam is optically reduced by focusing it onto the end of an optical fiber for coupling the light into the fiber. The optics for the transmitter and receiver can be mounted on a platform that adjusts in real time to optimize the signal received. Optical alignment can be automatically maintained by computer controlled transmitter steering and receiver tracking. The transmitters and receivers required no communication other than the incoming beam to maintain optical alignment and does not require additional bits in the data stream for telemetry.

6 Claims, 1 Drawing Sheet



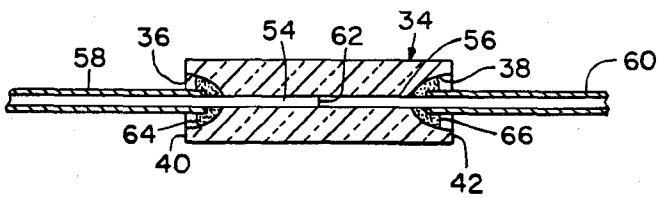
4,960,316 Oct. 2, 1990*

Capillary Splice

Inventor: George E. Berkey.
Assignee: Corning Incorporated.
Filed: Nov. 14, 1988. *The portion of the term of this patent subsequent to Feb. 28, 2006 has been disclaimed.

Abstract—An optical fiber splice and the method of forming it are described wherein a hollow cylindrical glass member is provided, the member having a bore along the longitudinal axis thereof. Fluid at a pressure in excess of ambient pressure is provided to the bore while the member is subjected to localized heating of the member to the softening point of the glass. In this manner, a bubble is formed within the member bore under the influence of said heating and pressure. For more uniform bubbles, the member may be rotated about its longitudinal axis while it is subjected to said fluid pressure and heating. The splice member is subsequently formed by severing the cylindrical member at the location of the bubbles. Optical fibers may be inserted into the ends of the splicing member and cemented in place.

7 Claims, 2 Drawing Sheets



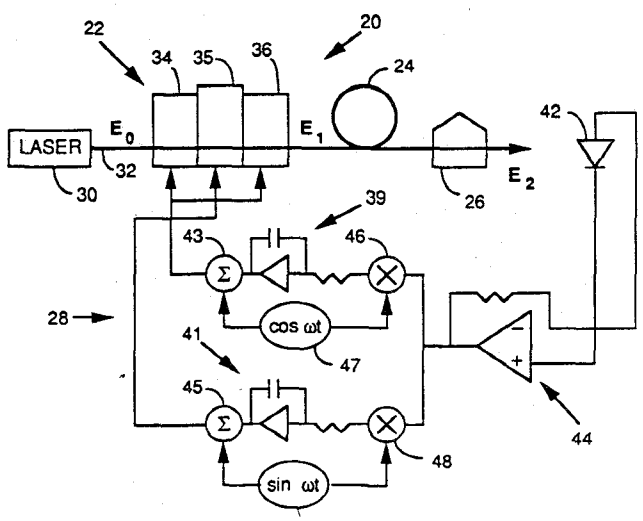
4,960,319 Oct. 2, 1990

Active Polarization Control Servo and Method

Inventor: John A. Dankowych.
Assignee: Litton Systems, Inc.
Filed: Oct. 4, 1989.

Abstract—An active polarization control system, which provided two dimensional optical waveguide birefringence modulation, provides polarization control in systems such as fiber optic rotation sensors and coherent fiber-optic communications systems without the necessity of using costly polarization preserving fiber. In a rotation sensor, the signal output from the sensing loop is used to form feedback signals for correcting polarization state errors. The feedback signals are used to provide the corrective voltage applied to two banks of orthogonally modulated birefringence transducers situated inside the rotation sensing loop. In a coherent fiber-optic communications system orthogonal modulation of two banks of birefringence transducers situated in either the communications or local oscillator signal arms at the receiver provides the required feedback signals for polarization control. The polarization of light guided by an optical waveguide is controlled by adjusting the birefringence of the optical waveguide with a first transducer and a second transducer arranged to act on the optical waveguide along parallel axes and a third transducer being on an axis that is placed between the parallel axes and angularly displaced by 45° therefrom. A first control signal is applied to each of the first and second transducers, and a second control signal in time quadrature with the first control signal is applied to the third transducer.

28 Claims, 5 Drawing Sheets



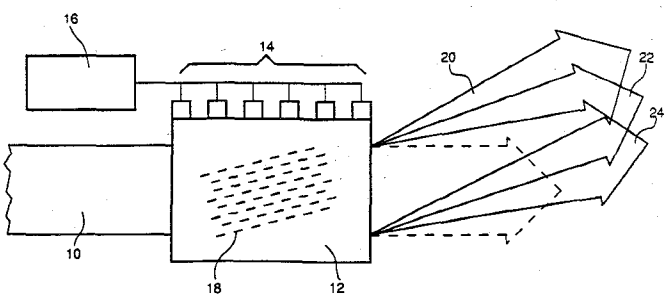
4,960,322 Oct. 2, 1990

Kerr-Bragg Agile Beam Steering Device

Inventors: Mohsen Khoshnevisan and Pochi A. Yeh.
Assignee: Rockwell International Corporation.
Filed: Dec. 23, 1988.

Abstract—An apparatus for steering a coherent input beam of electromagnetic energy includes an optically nonlinear medium for positioning in the path of the input beam. A source of acoustic energy generates acoustic waves in the nonlinear medium with a predetermined frequency and direction. The frequency and direction of the acoustic waves are selected to diffract a portion of the input beam as an output beam at a predetermined angle with respect to the input beam, interference between the input beam and the output beam initially causing an electrostrictive grating to form in the medium, with the grating subsequently causing additional energy to be transferred from the input beam to the output beam by stimulated Brillouin scattering.

13 Claims, 2 Drawing Sheets



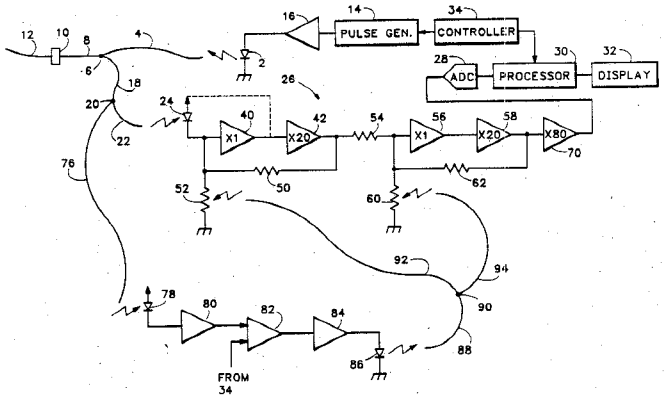
4,960,989 Oct. 2, 1990

Optical Time Domain Reflectometer Having a Receiver with Selectively Controlled Gain

Inventors: John D. Liebenrood and Donald H. McMahon.
Assignee: Photon Kinetics Inc.
Filed: Mar. 28, 1989.

Abstract—An optical time domain reflectrometer comprises a detector device for detecting optical energy received at an end of a fiber under test, an amplifier having an input terminal connected to the detector device, and a photoconductive switch connected between the amplifier input terminal and a reference potential level. The photoconductive switch is selectively illuminated.

13 Claims, 2 Drawing Sheets



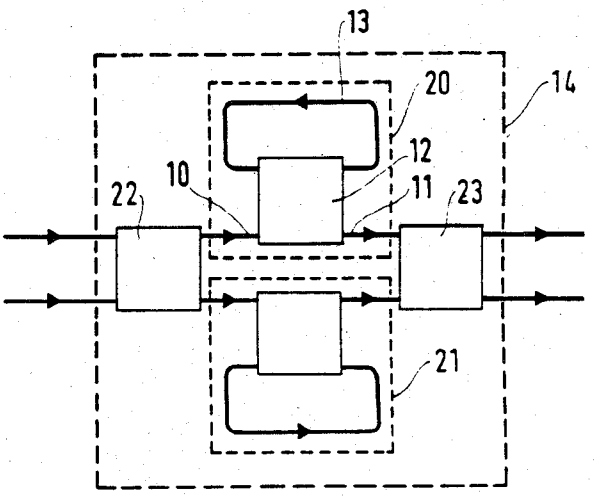
4,961,061 Oct. 2, 1990

Phase-Shifting Combiner for Electromagnetic Waves

Inventors: Jean-Claude Cruchon and Gilbert Prost.
Assignee: Alcatel N.V.
Filed: Apr. 4, 1989.

Abstract—The invention relates to a phase-shifting combiner for electromagnetic waves, the combiner comprising at least one phase-shifting cell constituted by a hybrid coupler (12), an inlet transmission line (10), an outlet transmission line (11), and a loop transmission line (13) connected between the first inlet and the first outlet of the coupler (12), the inlet transmission line (10) being connected to the second inlet of the coupler and the outlet transmission line (11) being connected to the second outlet of the coupler. It is applicable, in particular, to telecommunications.

6 Claims, 5 Drawing Sheets



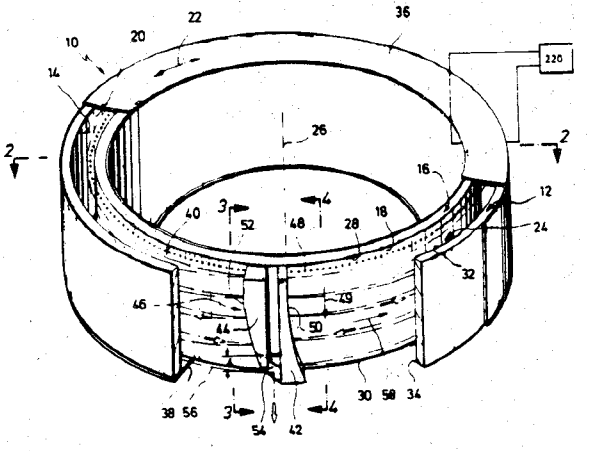
4,961,201 Oct. 2, 1990

Waveguide Configuration

Inventor: Hans Opower.
Assignee: Deutsche Forschungsanstalt fuer Luft- und Raumfahrt.
Filed: Aug. 24, 1989.

Abstract—In order to improve a waveguide configuration for high-frequency-excited, diffusion-cooled gas laser system comprising a waveguide carrier with a cavity closed like a ring in an azimuthal direction in relation to a longitudinal axis and extending in the direction of said longitudinal axis, and a waveguide for guidance of a laser beam along an optical axis, the waveguide being arranged in the cavity and formed by waveguide wall surfaces disposed at a constant spacing from one another, the width of the waveguide wall surfaces transversely to the lengthwise extent of the waveguide in the direction of the optical axis being a multiple of their spacing from one another, and the waveguide wall surfaces enclosing a discharge space between them, such that with a waveguide geometry which is as expedient as possible, i.e., not too large a width, it is still easy to handle and can be operated in a single mode, it is proposed that the waveguide be arranged in the cavity such that its lengthwise extent includes an angle of $\leqq 30$ degrees with the azimuthal direction.

29 Claims, 7 Drawing Sheets



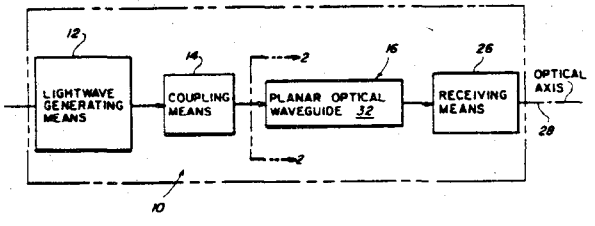
4,961,618 Oct. 9, 1990

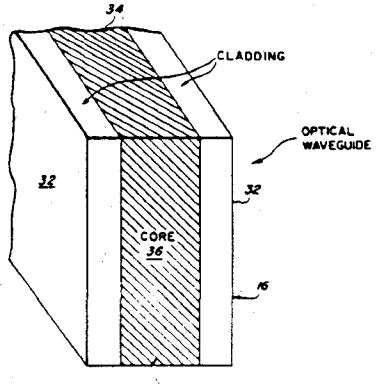
Optical Communication System Having a Wide-Core Single-Mode Planar Waveguide

Inventors: Arthur K. Jordan and S. Lakshmanasamy.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: June 5, 1989.

Abstract—This invention relates to an improved optical communication system having an enhanced wide-core single-mode planar waveguide for transmitting a single-mode light wave in a unique manner. The system is generally made up of light-wave source means, the aforementioned waveguide and receiving means. The waveguide is generally made up of an inhomogeneous wide-core means of block-like configuration and opposed cladding means where one set of opposed sides of the waveguide are provided with the cladding means. The cladding means has a constant permittivity. The core means has an inhomogeneous permittivity profile, a part of which is greater than the cladding means permittivity and another part of which is less than the cladding means permittivity. The analogy of quantum mechanics with optics can provide an algorithm for an equivalent inhomogeneous quantum potential formula of curvilinear shape. This equivalent quantum potential can be computer solved and graphically plotted in relation to a multipole rational function for the transverse reflection coefficient for the intended propagating and radiating modes of the waveguide, all for advantageously determining the width and permittivity profile of the core means. As the result of this width and profile determination, an algorithmic inhomogeneous relative permittivity profile of curvilinear shape of the core means is computer solvable and graphically plottable for indicating the core modal structure and transmission characteristics. One suitable material for the waveguide is $LiNbO_3$ where the core means thereof is provided with a selective amount of Ti dopant.

23 Claims, 4 Drawing Sheets





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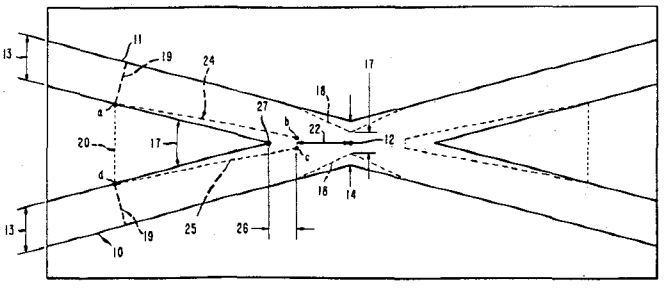
4,961,619 Oct. 9, 1990

Low Loss Waveguide Intersection

Inventors: Jose F. Hernandez-Gil, Steven K. Korotky, Timothy O. Murphy, and John Veselka.
Assignee: AT&T Bell Laboratories.
Filed: Mar. 2, 1989.

Abstract—An optical intersection with reduced transmission loss is described. An embodiment of the inventive interconnection comprises two intersecting waveguides. According to the teachings of the invention, deleterious asymmetric field distortions in the waveguides, associated with the presence of the adjacent waveguides, are reduced by, for example, changing the width of the intersection region, and the widths of the waveguides as they approach the intersection region.

10 Claims, 2 Drawing Sheets



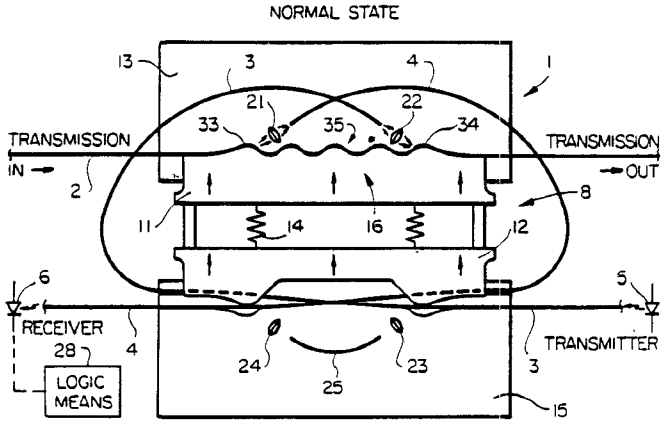
4,961,620 Oct. 9, 1990

Optical Bypass Switch

Inventors: William D. Uken and Akira Tomita.
Assignee: Raychem Corporation.
Filed: Dec. 20, 1989.

Abstract—An optical bypass switch includes a normal state and a bypass state, a transmission optical fiber having a signal withdrawn therefrom and injected thereto in its normal state so as to be capable of use in a ring or bus architecture. In the bypass state of the switch, the transmission optical fiber is substantially disengaged so that a signal being transmitted thereby can bypass the switch, and in this state optical fibers connected to a transmitter and a receiver of the bypass switch are maintained in a bent attitude so as to allow signals to be withdrawn and injected thereinto. A loop back path, e.g., a connector optical fiber, is provided which allows a path between the transmitter and the receiver to be completed in the bypass state of the bypass switch, and logic circuitry is provided for analyzing signals detected by the receiver which should have originated from the transmitter for evaluating a state of operation of the transmitter, receiver, and connecting means therefor. Whenever the logic circuitry detects a malfunction in any of these elements, e.g., the transmitter, the receiver and connecting structure therefor, the optical bypass switch is kept in its bypass state and prevented from reengaging the transmission fiber so as to prevent the bypass switch from optically coupling to the transmission fiber when its electrooptic elements are not functioning properly.

6 Claims, 3 Drawing Sheets



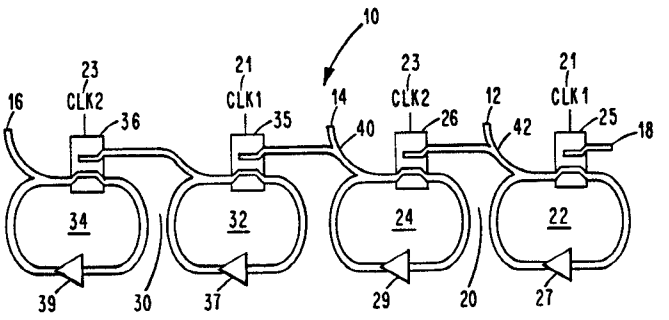
4,961,621 Oct. 9, 1990

Optical Parallel-to-Serial Converter

Inventors: Shing-Fong Su.
Assignee: GTE Laboratories, Inc.
Filed: Dec. 22, 1988.

Abstract—An optical parallel-to-serial converter constructed from at least two optical shift registers coupled in cascade by an optical two-to-one combiner. The input port of the first optical shift register serves as one input to the parallel-to-serial converter, an extra optical combiner optically coupled to the last of said optical shift registers serves as one input port, while the optical combiners coupling said optical shift registers serve as the other input ports receiving parallel optical pulses. The output port of the last of said cascaded optical shift registers serves as the output port of the parallel-to-serial converter. The shift registers are controlled by two clocks, operating at the same rate, but each out of phase with the other, providing control signals to shift and output said optical pulses serially from said shift registers to effect a parallel-to-serial conversion.

13 Claims, 1 Drawing Sheet



4,961,624 Oct. 9, 1990

Optical Fiber Termination with Crimping Body

Inventors: Wallace R. Savitsky, Donald R. Schaffer, and Gary N. Warner.
Assignee: AMP Incorporated.
Filed: Aug. 29, 1989.

Abstract—A termination for a fiber-optic cable has a connector and an optical fiber member having flexible buffer and optical fiber with the connector comprising an alignment ferrule having tubular passageway for encircling the flexible buffer and optical fiber and a tip with centrally-disposed aperture therethrough for receiving an end of the fiber from the tubular passageway. The termination further includes a crimping body of deformable, elastic material intimately surrounding the flexible buffer and optical fiber and attached by crimping thereto and engaged by compression fitting within the tubular passageway and against the walls of the tubular passageway. The compression fit provides a fit resistant to disengagement.

11 Claims, 2 Drawing Sheets