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.

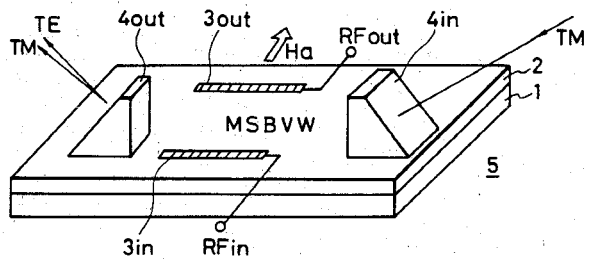
4,898,440 Feb. 6, 1990

Optical Waveguide Device

Inventors: Hitoshi Tamada, Masahiko Kaneko, and Tsutomu Okamoto.
Assignee: Sony Corporation.
Filed: Sept. 14, 1988.

Abstract—An optical waveguide device is disclosed that utilizes an interaction between a guided optical wave and a magnetostatic wave. The optical waveguide device comprises a layer of bismuth substituted magnetic garnet that guides an optical wave. A pair of electrodes coupled to the layer of the magnetic garnet generates a magnetostatic backward volume wave in the layer of the magnetic garnet under an application of a certain bias magnetic field. The guided optical wave and the magnetostatic wave interact with each other wherein adverse effect caused by a spin effect is avoided to realize high efficiency at high frequency.

3 Claims, 2 Drawing Sheets



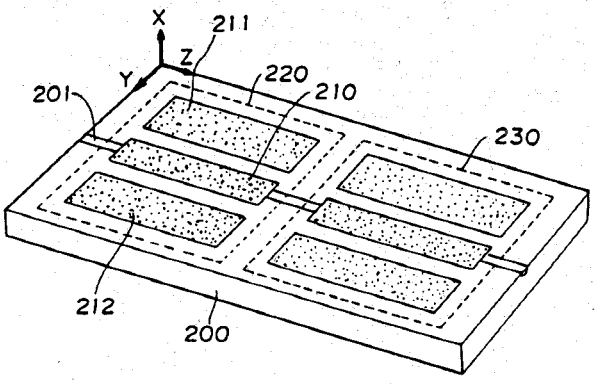
4,898,441 Feb. 6, 1990

Polarization Controller

Inventor: Haruhito Shimizu.
Assignee: NEC Corporation.
Filed: May 2, 1988.

Abstract—A polarization controller comprises a plurality of devices connected in series to each other. Each device includes an optical channel waveguide which is common to the plurality of the devices, and an electrode positioned on the optical channel waveguide and two electrodes positioned on both sides of the optical channel waveguide. A retardation induced by electrooptic effect in each device is adjusted by voltages applied to the electrode and the two electrodes. The voltages are not kept increasing or decreasing, but changed periodically so that there is no limitation in an operating range for controlling a polarization of light which is propagated through the optical channel waveguide.

3 Claims, 3 Drawing Sheets



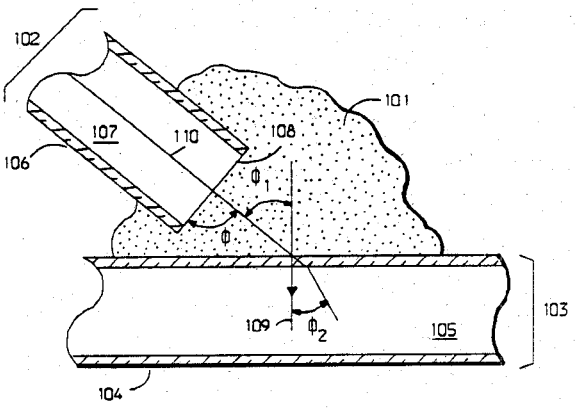
4,898,444 Feb. 6, 1990

Noninvasive Optical Coupler

Inventors: Gary J. Grimes, Lawrence J. Haas, and Jon R. Sauer.
Assignees: American Telephone and Telegraph Company, AT&T Information Systems Inc.
Filed: Nov. 30, 1988.

Abstract—A noninvasive optical fiber coupler for coupling light into an optical fiber bus through the cladding surrounding the optical fiber bus without bending the optical fiber bus. The coupler comprises a tap optical fiber free end adjacent to and facing a region of straight optical fiber bus with the tap fiber free end and optical fiber bus region encapsulated with a junction media having substantially the same index of refraction as the cladding of the optical fiber bus. Since the bus cladding is not removed nor is the optical fiber bus bent, there is no additional light lost due to the coupler from the optical fiber bus.

15 Claims, 3 Drawing Sheets



4,900,113 Feb. 13, 1990

Optical Spectrum Analyzer

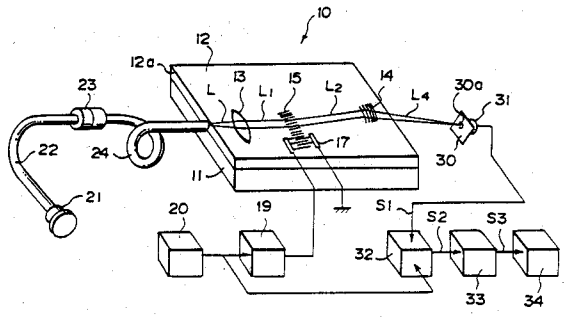
Inventor: Masami Hatori.
Assignee: Fuji Photo Film Co., Ltd.
Filed: July 20, 1988.

Abstract—An optical spectrum analyzer comprises an optical waveguide formed of a material allowing propagation of surface acoustic waves therethrough, and a surface acoustic wave generator for generating a surface

1051-8207/91/0200-0038$01.00 © 1991 IEEE

acoustic wave, the frequency of which changes continuously and which advances in a direction intersecting an optical path of a guided optical wave as light-to-be analyzed entered to the optical waveguide and advancing inside of the optical waveguide and diffracts and deflects the guided optical wave, in the optical waveguide. A photodetector is provided for detecting the optical level of the optical wave guided, deflected by the surface acoustic wave and radiated out of the optical waveguide. A frequency detector is provided for detecting the frequency of the surface acoustic wave at the time the photodetector detects the optical level of the optical wave guided, deflected by the surface acoustic wave and radiated out of the optical waveguide.

5 Claims, 4 Drawing Sheets



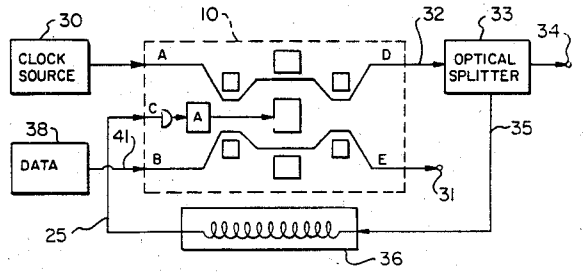
4,900,115 Feb. 13, 1990

Optical Logic Circuit Useful for Bit Serial Optic Computing

Inventors: Vincent P. Heuring, Harry F. Jordan, and Jonathan P. Pratt.
Assignee: University of Colorado Foundation, Inc.
Filed: Jan. 31, 1989.

Abstract—Optical elements are combined into modules capable of performing logic functions in response to light pulses which are received from a source as clock pulses or data pulses. The module is effectively an all optical switching network. An optical delay line provides optical memory. The pulses that are produced at the delay line output are restored by selective reentry of light pulses from a continuously operable source so that the pulse information is storable indefinitely. The module is useful for a variety of computer and computer related design functions.

3 Claims, 3 Drawing Sheets



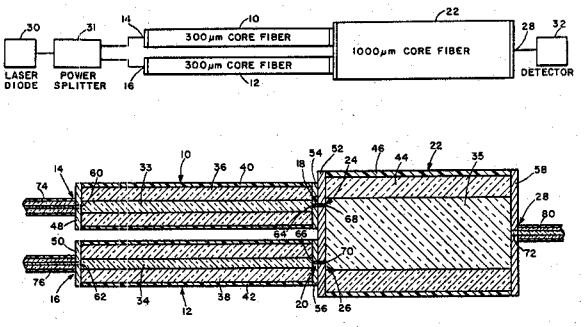
4,900,116 Feb. 13, 1990

Multiple Pole Optical Fiber

Inventor: Ronald F. Mathis.
Assignee: General Dynamics Corporation, Electronics Division.
Filed: Dec. 30, 1988.

Abstract—A multiple pole optical bandpass filter comprises at least two input filter elements each having an input at one end and an output at the opposite end, and an output filter element having at least two inputs at one end coupled to the respective outputs of the input filter elements, and an output at the opposite end. Each of the filter elements comprises a segment of multimode optical fiber of predetermined length having mirrors at its opposite input and output ends. An intensity modulated light signal is provided at one of the input filter element inputs, while the same signal shifted by 180 degrees is provided at the other input filter element input.

4 Claims, 2 Drawing Sheets



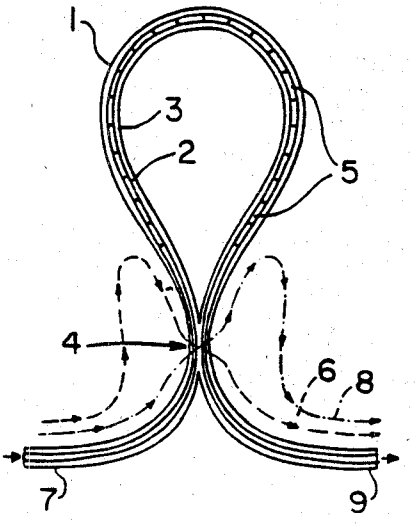
4,900,119 Feb. 13, 1990

Wavelength Selective Optical Devices Using Optical Directional Coupler

Inventors: Kenneth O. Hill, Derwyn C. Johnson, Francois Bilodeau, and Sylvain Faucher.
Assignee: Canadian Patents & Development Ltd.
Filed: Apr. 1, 1988.

Abstract—New types of narrowband wavelength selective optical devices are described. Various configurations are possible, according to the invention, that perform as narrowband wavelength selective transmission or reflection filters or as narrowband wavelength selective optical taps or combiners. The optical devices of the invention include a 3-dB optical directional coupler and wavelength selecting elements such as Bragg reflection gratings or Fabry-Perot resonators usually positioned in optical symmetry with respect to the directional coupler. Two or more wavelength selecting elements can be used to obtain desired filtering characteristics.

10 Claims, 2 Drawing Sheets



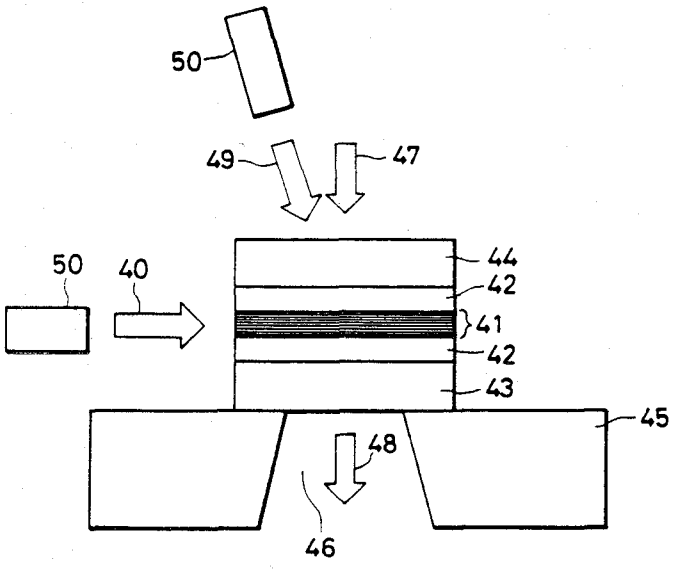
4,900,134 Feb. 13, 1990

Optical Device

Inventors: Hiroaki Inoue, Toshio Katsuyama, Hiroyoshi Matsumura, Shinji Sakano, and Hitoshi Nakamura.
Assignee: Hitachi, Ltd.
Filed: Dec. 29, 1987.

Abstract—An optical device having a material exhibits an optical rectification effect is disclosed. The optical device utilizes direct current polarization which is induced in the material by a control light. The induction of the direct current polarization in the material by the control light changes the refractive index and absorption spectrum of the material. This is based on the so-called electrooptic effect and Franz-Keldysh effect. The present invention provides the optical device according to which external incident light can be modulated at high speed with the control light by utilizing the change of the refractive index or the change of the absorption spectrum.

28 Claims, 5 Drawing Sheets



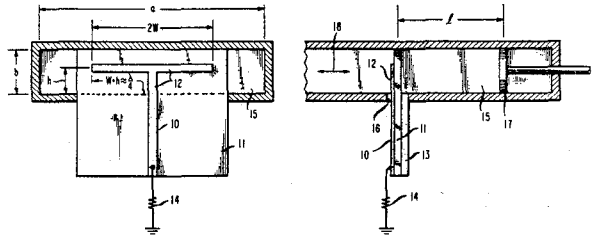
4,901,040 Feb. 13, 1990

Reduced-Height Waveguide-to-Microstrip Transition

Inventors: William G. Ahlborn, Harry F. Lenzing, and You-Sun Wu.
Assignees: American Telephone and Telegraph Company, AT&T Bell Laboratories.
Filed: Apr. 3, 1989.

Abstract—The present invention relates to a transition wherein a microstrip line, formed on one major surface of a substrate, is capacitively coupled to a reduced-height waveguide, comprising a predetermined width-to-height ratio, by means of a T-bar conductive pattern formed on a substrate at the end of the microstrip line. Such T-bar transitions can also be connected on opposite end of the microstrip line to provide connections between two waveguide sections.

7 Claims, 4 Drawing Sheets



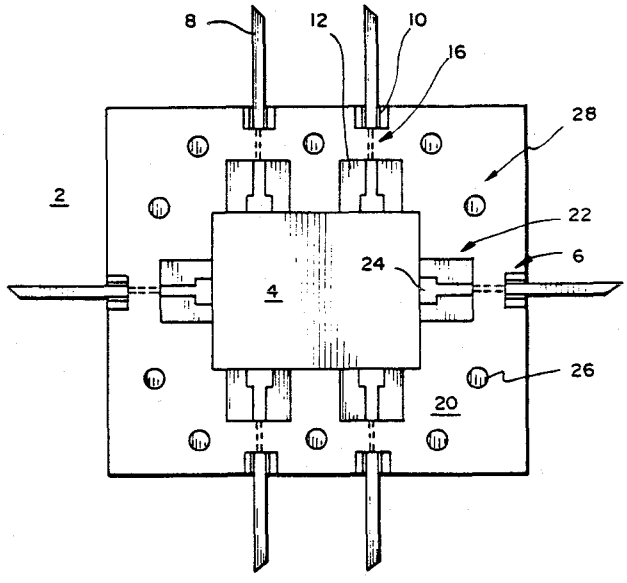
4,901,041 Feb. 13, 1990

High-Performance Package for Monolithic Microwave Integrated Circuits

Inventor: Raymond S. Pengelly.
Assignee: Grumman Corporation.
Filed: Sept. 30, 1988.

Abstract—The present invention incorporates a specially-designed low-pass filter into the feedthrough of a monolithic microwave integrated circuit (MMIC) to provide compensation for discrepancies from the impedance required for an MMIC package to be matched to a transmission line. The compensation allows all parameters to be adjusted and the complete filter to be printed. The main features of the invention include minimum width for the under-wall conductor and brazing metallization, two open-circuited stubs at the package-die interface for wire bonding ease, and metal-filled vias connecting the ground plane base and the lid sealing ring to bring the lid sealing ring to RF ground. The present invention also includes a method for designing the desired feedthrough that obviates the need for scale-model feedthrough design before printing, a prior art method that requires precision in the scale model. An electrical model of a feedthrough is first derived. The electrical model is then adjusted according to the parameters desired for a new, compensated feedthrough using any known method, including software such as Touchstone. Finally, the new feedthrough is fabricated based upon the adjusted electrical model.

6 Claims, 2 Drawing Sheets



4,901,042 Feb. 13, 1990

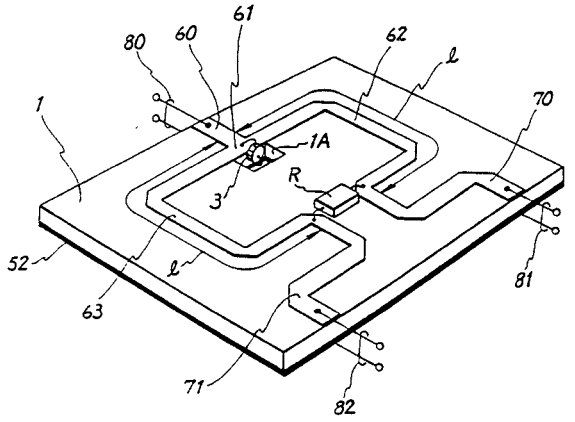
High-Frequency Power Divider

Inventors: Takashige Terakawa, Noriyuki Akaba, and Sadayoshi Hattori.
Assignee: Tokyo Keiki Co.
Filed: Mar. 17, 1988.

Abstract—A high-frequency power divider having an input line, a pair of input–output lines, and a pair of high-impedance transmission lines diverging from the input line and interconnecting the first and second input–output lines. An isolation resistor is interposed between and connected to a pair of portions of the high-impedance transmission lines proximate the input–output lines. A capacitive component, corresponding to the capacitive component of the

resistor, is provided at a diverging point at which the high-impedance transmission lines diverge from the first input–output line. The second capacitive component is defined by a capacitor or electrode surface.

6 Claims, 4 Drawing Sheets



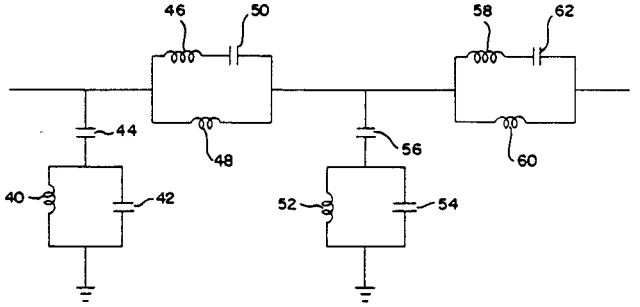
4,901,043 Feb. 13, 1990

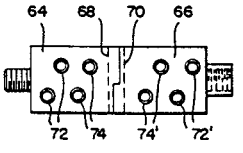
Compact Filter Having a Multicompartment Housing

Inventor: Raymond W. Palinkas.
Assignee: Andrew F. Tresness.
Filed: July 2, 1987.

Abstract—A filter comprises components arranged in a plurality of compartments which are magnetically shielded from each other. Each compartment includes components for filtering two frequencies wherein these frequencies are separated by an amount such that inductive coupling is substantially prevented. The compartments are combined to increase the attenuation, and any number of compartments may be utilized to filter the desired number of frequencies.

8 Claims, 2 Drawing Sheets





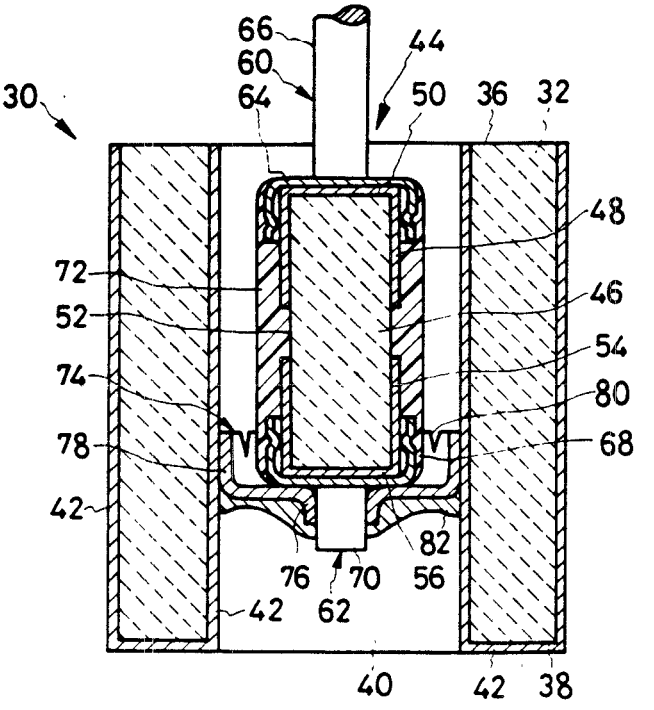
4,901,044 Feb. 13, 1990

Distributed-Constant Filter

Inventors: Masao Igarashi, Isao Akiyama, Kazuhiro Kumagai, Yoshinobu Takeda, Mamoru Yamaki, Yoshiaki Iguchi, and Satoshi Kazama.
Assignee: Taiyo Yuden Co.
Filed: Jan. 5, 1989.

Abstract—A quarter-wave distributed-constant dielectric filter or resonator having a ceramic body which typically is composed principally of barium titanate. The ceramic filter body has one or more resonance holes extending therethrough. A conductive covering of silver or the like on the filter body has a portion formed on the surface defining each resonance hole. Mounted in each resonance hole is a prefabricated capacitor having a first terminal extending from within the resonance hole. The second terminal is electrically coupled to the conductive covering on the surface of the resonance hole. The capacitance of the capacitor or capacitors can be known before they are mounted to the filter body, so that the filter is readily manufacturable to exact electrical characteristics desired.

25 Claims, 13 Drawing Sheets



4,902,985 Feb. 20, 1990

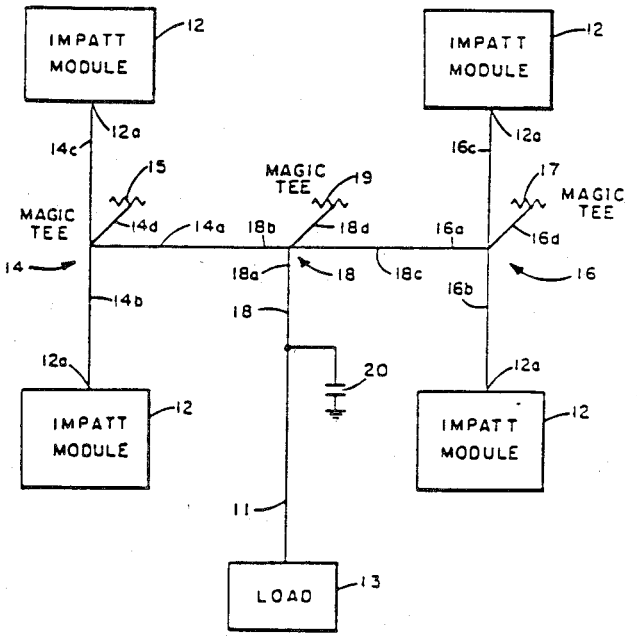
Microwave Reflection Amplifiers Having Increased Bandwidth

Inventors: Thomas K. Arthur, Michael H. Cobb, and James W. McClymonds.
Assignee: Raytheon Company.
Filed: Feb. 25, 1988.

Abstract—A four diode reflection amplifier having a relatively wide bandwidth of at least 5 percent over the frequency range of 43.5–45.5 GHz includes three magic T's arranged to provide a 4-way passive power combiner. The 4-way passive power combiner symmetrically couples each of the four diode amplifiers to an input/output port of the reflection amplifier. To provide the improved bandwidth performance, a perturbation impedance in the form of a single shunt capacitance is inserted at the input/output port of the

reflection amplifier to provide a selected perturbation in the load impedance and hence the reflection characteristic seen by the reflection amplifier over a selected band of operation of the amplifier.

12 Claims, 4 Drawing Sheets



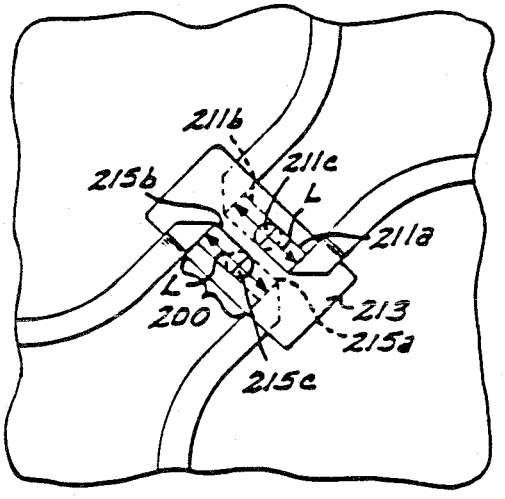
4,902,990 Feb. 20, 1990

Thick Film Microwave Coupler

Inventor: Terry C. Cicso.
Assignee: Hughes Aircraft Company.
Filed: Sept. 26, 1988.

Abstract—A microwave coupler including a first transmission line having one or more strip sections, and a second transmission line having one or more strip sections respectively associated with corresponding sections of the first transmission so as to form associated pairs of coupled strip sections. The associated coupled strip sections are substantially uniformly separated from each other and noncoplanar. Dielectric material dielectrically separates the associated strip sections of the first and second transmission lines.

10 Claims, 3 Drawing Sheets



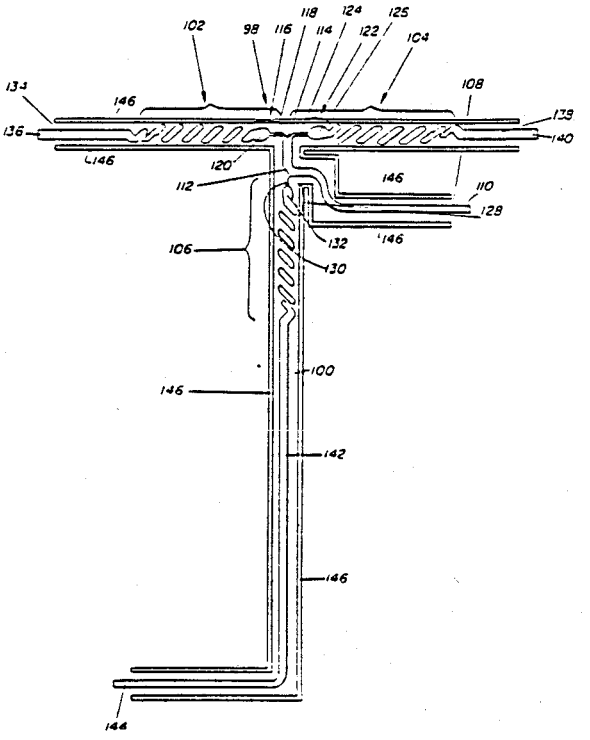
4,902,992 Feb. 20, 1990

Millimeter-Wave Multiplexers

Inventors: David Rubin and Kurt Reinke.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: Mar. 29, 1988.

Abstract—A planar millimeter wave circuit for splitting a very wide input frequency band into three or more lesser bands utilizes bandpass filters exclusively. A triplexer is made by connecting the bandpass filters with coupled line equivalents fed by a conductor with a characteristic impedance the same as the input conductor to the filters and of an appropriate length so as to make the diplexer appear open or nearly open circuited over the adjacent frequency range of a third bandpass filter used in the triplexer or, alternatively, over the adjacent frequency range of a second diplexer connected so as to form a quadruplexer.

10 Claims, 2 Drawing Sheets



4,904,036 Feb. 27, 1990

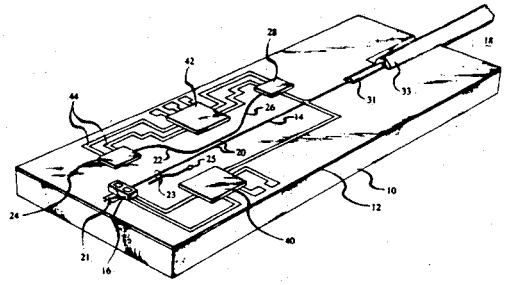
Subassemblies for Optoelectronic Hybrid Integrated Circuits

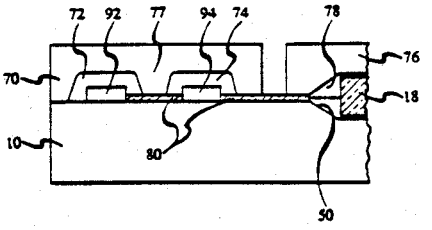
Inventor: Greg E. Blonder.
Assignee: American Telephone and Telegraph Company, AT&T Bell Laboratories.
Filed: Mar. 3, 1988.

Abstract—Optoelectronic chips, such as Group III-V compound lasers and photodiodes, are mounted on a single-crystal silicon base, and are optically interconnected to one another by silica waveguides and couplers integrally formed on the base. Integrated circuit chips to provide electronic function are also mounted on the base. Various schemes for optically coupling and aligning lasers, photodiodes and optical fibers to the waveguides are described. Also described is the use of a single-crystal silicon lid, which serves to provide optical and electrical isolation between chips on the base, as well as a plug-in

arrangement in which the edges of the base are adapted to receive parallel guide rods.

21 Claims, 7 Drawing Sheets





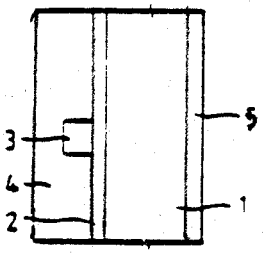
4,904,037 Feb. 27, 1990

Waveguide Type Optical Device with Thermal Compensation Layers

Inventors: Katsuyuki Imoto, Hirohisa Sano, and Yasuo Hira.
Assignee: Hitachi, Ltd.
Filed: July 28, 1988.

Abstract—A waveguide type optical device in which a waveguide layer for propagating light is provided on the front surface of a substrate, and a compensation layer having a coefficient of thermal expansion substantially equal to that of the waveguide layer formed on the front surface is provided on the rear surface of the substrate.

5 Claims, 3 Drawing Sheets



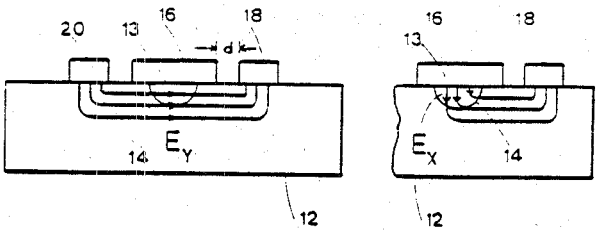
4,904,038 Feb. 27, 1990

Guided Wave Optical Frequency Shifter

Inventor: Chin-Lung Chang.
Assignee: Litton Systems, Inc.
Filed: May 30, 1984.

Abstract—This invention is a frequency shifter for receiving an optical carrier signal input and producing an output including a sideband that is shifted in frequency from the carrier. The frequency shifter includes an optical waveguide formed in a substrate of an electrooptically active material such as lithium niobate. A plurality of electrodes formed on the substrate cooperate with a signal generator to apply two perpendicular electric fields to the optical waveguide. The resultant of the two fields is a rotating electric field which produces a rotating birefringence in the optical waveguide. The rotating birefringence acts as a rotating wave plate, which shifts the frequency of optical signals input to the optical waveguide. The wave plate is preferably a half wave plate, which converts all of the input optical energy into the sideband.

29 Claims, 3 Drawing Sheets



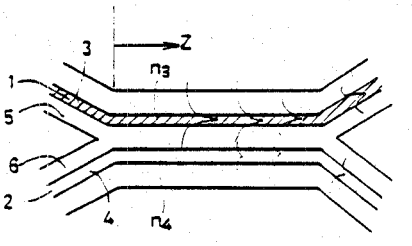
4,904,040 Feb. 27, 1990

Optical Waveguide Coupler for Monitoring

Inventors: Toshiharu Takesue and Hiroyoshi Yamamoto.
Assignee: Seiko Instruments Inc.
Filed: June 8, 1988.

Abstract—An optical waveguide coupler comprises at least two optical waveguides such as optical fibers closely spaced apart for allowing light propagating in one optical waveguide to couple into the other. Optical waveguide portions of the waveguides are made of materials having different refractive indexes respectively. The feature stabilizes the splitting ratio against a slight change in coupling length, whereby control of the coupling ratio during manufacture becomes easy, and deviations in splitting ratio can be greatly reduced.

8 Claims, 2 Drawing Sheets



4,904,042 Feb. 27, 1990

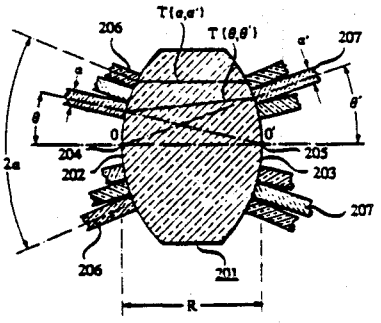
N×N Optical Star Coupler

Inventor: Corrado Dragone.
Assignees: American Telephone and Telegraph Company, AT&T Bell Laboratories.
Filed: May 3, 1988.

Abstract—An efficient $N \times N$ star optical coupler suitable for mass production in integrated form is disclosed. The coupler can be realized using silicon technology to form a dielectric coupler slab and two arrays of strip waveguides all on a single glass substrate. Power transfer between the two

arrays is accomplished through radiation in the dielectric slab with theoretical efficiency exceeding 30% under optimized conditions.

9 Claims, 2 Drawing Sheets



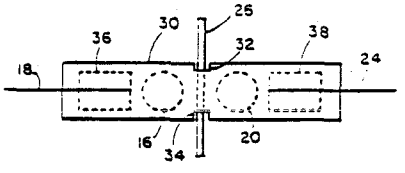
4,904,044 Feb. 27, 1990

Continuously Variable Fiber Optic Attenuator

Inventor: Thomas W. Tamulevich.
Assignee: Light Control Systems, Inc.
Filed: Sept. 8, 1988.

Abstract—A continuously variable fiber optic attenuator that can be constructed in a size amenable to direct mounting on optical data application apparatus is presented. The attenuator utilizes a flexible filter of varying optical density which is oriented in an optical coupling region between two optical fibers. The filter can be displaced in a manner to vary the filter density in the optical coupling region and thereby vary the attenuation across the device. A resistor coupled to the attenuator provides means for calibration of the attenuator to provide a highly accurate and reproducible attenuation.

26 Claims, 1 Drawing Sheet



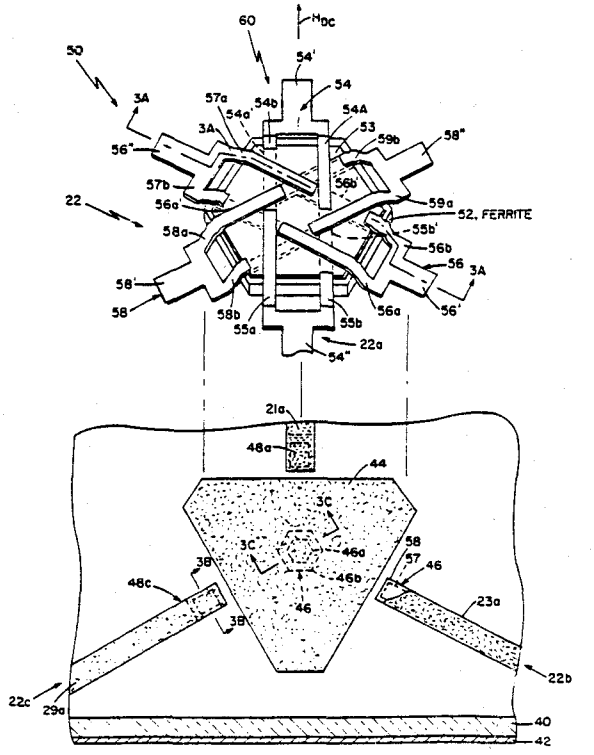
4,904,965 Feb. 27, 1990

Miniature Circulator for Monolithic Microwave Integrated Circuits

Inventors: Ronald F. Blight, Robert L. Mozzi, and Ernst F. R. A. Schloemann.
Assignee: Raytheon Company.
Filed: Dec. 27, 1988.

Abstract—A miniature circulator which is microwave integrated circuit compatible and based on microstrip transmission techniques is described. The circulator includes a dielectric or semiconductor substrate having microstrip transmission lines formed thereon and a patterned metalization formed as the node metalization for the circulator. The substrate may carry other circuits such as power combiners, amplifiers, and switches. The substrate further includes monolithic capacitors over the substrate at the center of the circulator in a first embodiment or disposed along the periphery of the patterned metalization in the second embodiment. The capacitors are used to capacitively couple the patterned metalization or node metalization to the ground plane conductor. The value of capacitance is selected to provide value broadband performance. A ferrite disc, preferably hexagonal in shape, is disposed over the substrate and has disposed thereon a coupling structure, preferably an interwoven coupling structure comprised of two layers of metalization separated by an intermediate layer of insulating material. Preferred techniques for providing said coupling structure are described.

15 Claims, 11 Drawing Sheets



4,904,966 Feb. 27, 1990

Suspended Substrate Elliptic Rat-Race Coupler

Inventor: David Rubin.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: Sept. 24, 1987.

Abstract—A suspended substrate rat-race coupler utilizes an elliptic configuration of the usual circular rat-race coupler on a circuit card positioned within below cut-off suspended substrate housing channels. The channels within the suspended substrate housing are positioned to receive the arms of the elliptical rat-race coupler. The longitudinal axis of two of the suspended substrate channels are offset with respect to each other to accommodate the rat-race arms and are positioned either on the same side of a primary suspended substrate channel or on opposite sides of the primary suspended substrate channel. Connections to the four ports of the rat-race can thus be made without disrupting the TEM propagation mode within the suspended substrate device.

13 Claims, 6 Drawing Sheets