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.

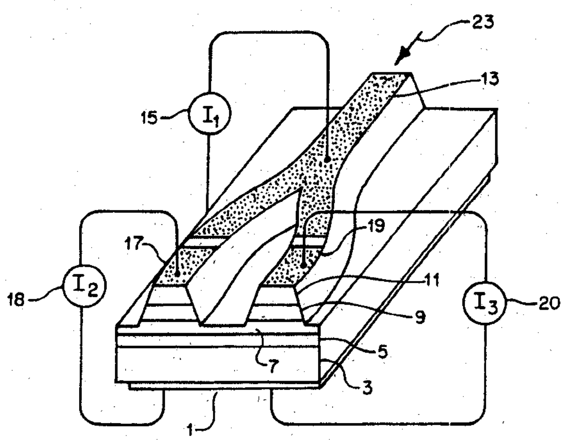
5,013,113 May 7, 1991

Lossless Noninterferometric Electrooptic III–V Index-Guided-Wave Switches and Switching Arrays

Inventor: Richard A. Soref.
Assignee: The United States of America as represented by the Secretary of the Air Force.
Filed: Aug. 31, 1989.

Abstract—Lossless guided-wave switches with more than 30 dB of crosstalk-isolation are comprised of branched channel waveguides with laser-like cross-sections. Optical gain, sufficient to overcome power-splitting losses, is provided by carrier-injection currents. Due to its low-noise properties, the single-quantum-well structure is found to be optimum for cascading switches into a multistage network. A lossless $1 \times N$ network with 1024 switched outputs should be feasible.

32 Claims, 4 Drawing Sheets



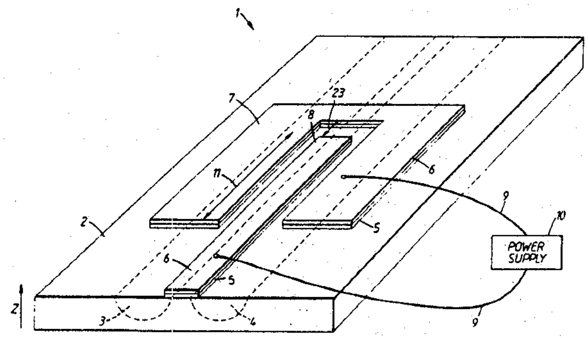
5,013,114 May 7, 1991

Optical Switch Apparatus

Inventor: Terrence P. Young.
Assignee: The General Electric Company, p.l.c.
Filed: July 3, 1991.

Abstract—An optical switch apparatus comprises two optical waveguides, which may be formed by diffusing titanium into a lithium niobate body. Electrode are bonded to the surface of the body and are arranged such that an electric field may be applied across the body, resulting in the distance between the waveguides being reduced. Hence, a change is produced in the coupling constant of the waveguides and the switching response of the switch may be enhanced.

21 Claims, 2 Drawing Sheets



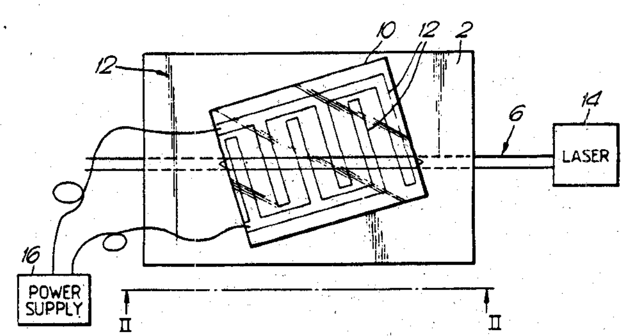
5,013,115 May 7, 1991

Polarization Insensitive Optical Frequency Mixer

Inventor: Raman Kashyap.
Assignee: British Telecommunications p.l.c.
Filed: Feb. 15, 1989.

Abstract—A polarization insensitive optical frequency mixer comprising an optical fiber coupler block (2), a silica fiber (6) with a region whose cladding (4) has been polished off close to the core (8) on which is rotatably mounted interdigitated electrodes (12) spaced from the coupler block (2) by a polymer film spacer (12). The electrodes (12) induce a spatially periodic electric field within the core (4) which reverses every half period that provides frequency doubling of light passing through the fiber (6) over the whole grating length. The electrodes are dimensioned to provide polarization insensitized frequency mixing by providing that the electric field components within the optical waveguide are substantially equal in two mutually orthogonal directions transverse the waveguide.

10 Claims, 2 Drawing Sheets



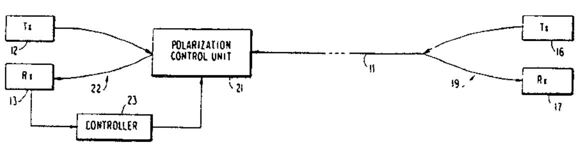
5,013,116 May 7, 1991

Polarization Control of Bidirectionally Transmitted Beams by a Single Polarization Controller

Inventors: Shuntaro Yamazaki and Takashi Ono.
Assignee: NEC Corporation.
Filed: May 23, 1990.

Abstract—In an optical communication system where first and second transmitter devices (12, 16) bidirectionally transmit first and second signal beams through an optical fiber (11) and first and second receiver devices (13, 17) receive the second and the first signal beams, respectively, a polarization control system comprises a polarization control unit (21) between the optical fiber and the first transmitter and receiver devices and a controller (23) for controlling the polarization control unit by a detected signal produced by the first receiver device so as to supply the second signal beam to the first receiver device with a constant reference polarization state. The first signal beam may be an FDM signal beam. In this event, the second receiver device comprises tunable receivers (RX1/100) which may be installed in a hub together with the second transmitter device and connected to terminal units through metal cables. Preferably, the first transmitter device generates the first signal beam with a polarization state adjusted either parallel or orthogonal to the reference polarization state. More preferably, the first and the second signal beams should have frequencies determined in consideration of polarization dispersion.

19 Claims, 4 Drawing Sheets



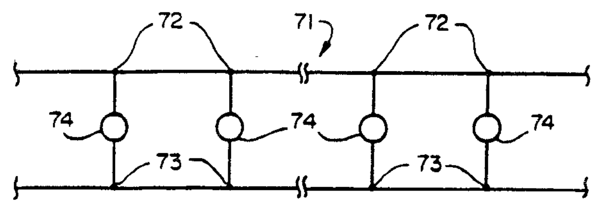
5,013,118 May 7, 1991

Filtering High-Order Modes of Short Wavelength Signals Propagating in Long Wavelength Single Mode Fibers

Inventor: Lucjan Sniadower.
Assignee: Raynet Corporation.
Filed: Dec. 22, 1989.

Abstract—An optical fiber network includes a single mode silica core/cladding optical fiber having a cutoff wavelength in the range of about 1000–1200 nanometers, and a plurality of optical couplers serially disposed on the optical fiber so as to form a bus network, with each optical coupler injecting its own unique optical signal into the optical fiber so as to be multiplexed in time, each optical signal injected having a dominant light intensity wavelength below the cutoff wavelength of the optical fiber. Each injected signal propagates initially via a plurality of modes. According to the invention the optical couplers are designed or other means are provided for preferentially attenuating all modes in each optical signal above that of the fundamental modes such that an optical receiver at an end of the optical fiber is capable of detecting signals at a data rate so as to result in a bandwidth far in excess of the multimode bandwidth normally associated with such a fiber at the dominant wavelength of the light emitters. An additional advantage is that an intensity of the fundamental mode is enhanced by mode shifting of optical power from the higher order modes of each optical signal initially supported by the optical fiber.

11 Claims, 3 Drawing Sheets



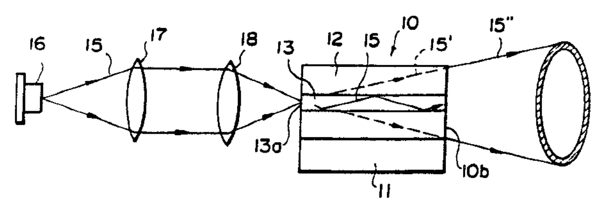
5,013,129 May 7, 1991

Optical Wavelength Converter Device and Method of Manufacturing Same

Inventors: Akinori Harada and Yoji Okazaki.
Assignee: Fuji Photo Film Co., Ltd.
Filed: Apr. 3, 1990.

Abstract—An optical wavelength converter device is in the form of a three-dimensional optical waveguide and comprises a cladding and a waveguide element embedded in the cladding and having a refractive index higher than that of the cladding. Each of the cladding and the waveguide element is made of a III–V group, mixed-crystal compound semiconductor material or a II–VI group, mixed-crystal compound semiconductor material. The cladding includes homogeneous portions covering all surfaces of the waveguide element that fully reflect the fundamental wave being guided in the waveguide element.

5 Claims, 1 Drawing Sheet



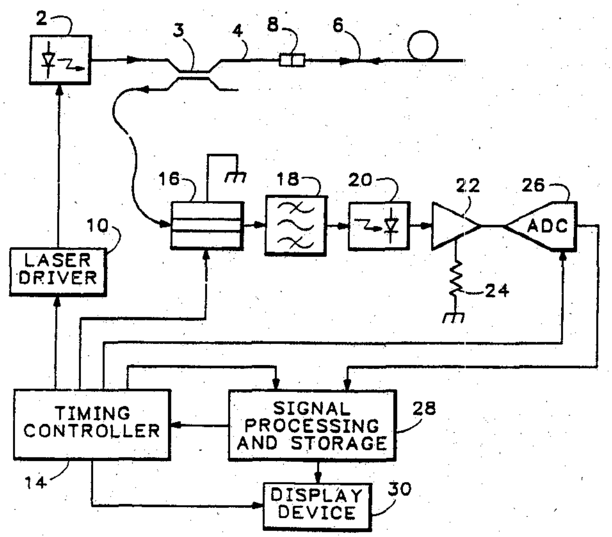
5,013,907 May 7, 1991

Optical Time-Domain Testing Instrument

Inventor: Glenn Bateman.
Assignee: Tektronix, Inc.
Filed: Mar. 27, 1990.

Abstract—An optical time-domain testing instrument comprises a laser light source that is optically coupled to an optical fiber under test. The instrument further comprises a photodetector for receiving light from the fiber, and an optical amplifier optically coupled between the fiber and the photodetector.

10 Claims, 1 Drawing Sheet



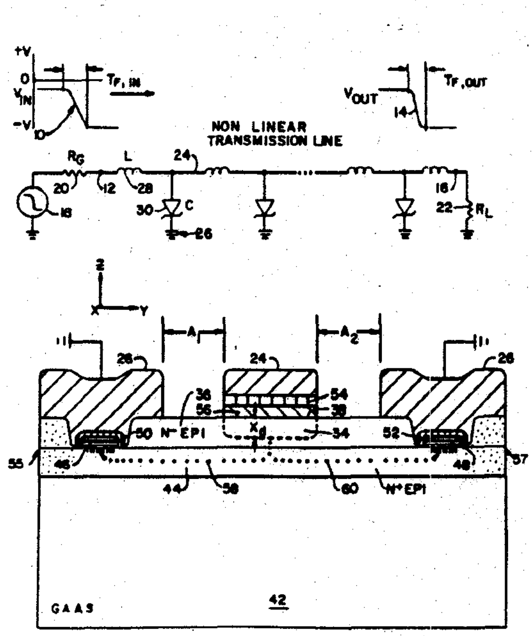
5,014,108 May 7, 1991

Nonlinear Transmission Line for Generation of Picosecond Electrical Transients

Inventors: Mark J. W. Rodwell and David M. Bloom.
Assignee: Stanford University.
Filed: Oct. 6, 1987.

Abstract—There is disclosed herein a nonlinear transmission line comprised of a 50-ohm coplanar monolithic waveguide formed on top of a gallium arsenide substrate having a layer of lightly doped epitaxial gallium arsenide with a heavily doped buried layer, said epitaxial layer having spaced, electrically isolated islands. A self-aligned Schottky diode junction is formed at the intersection of each isolation island with the center conductor of the transmission line. The second conductor of the transmission line is coupled through a contact window and an ohmic contact to the buried layer in each isolation island.

17 Claims, 6 Drawing Sheets



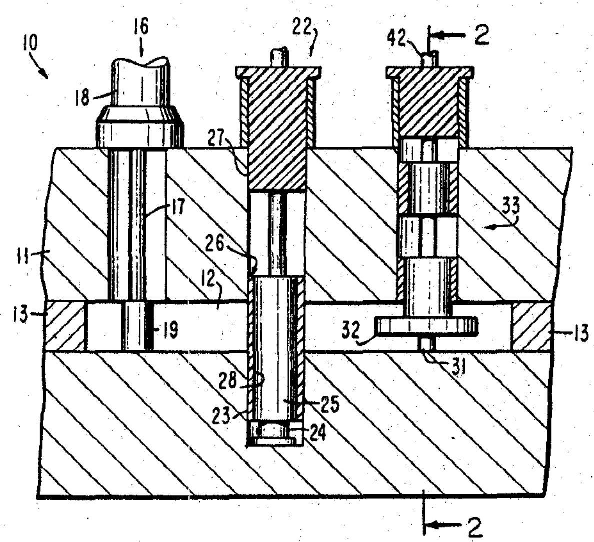
5,014,021 May 7, 1991

Frequency Linearization Circuit for a Microwave VCO in Ridged Waveguide

Inventors: Ralston S. Robertson, Jr. and John N. Poelker.
Assignee: Hughes Aircraft Company.
Filed: Feb. 8, 1990.

Abstract—A voltage controlled oscillator having improved frequency linearization characteristic. A radial line, (tophat) disc geometry in conjunction with a varactor diode are disposed in a broad-band, ridged waveguide oscillator circuit to produce a frequency linearized voltage controlled oscillator. A negative resistance device is recessed into the ridged waveguide and coaxially coupled via an impedance transformer to the ridged waveguide cavity. The present invention uses a disc resonator in a ridged waveguide to transform the microwave impedance of a non-RF generating element, a varactor diode, to values that provide improved voltage controlled oscillator tuning linearity. The disc resonator or radial line is located above the varactor diode. The radial line transforms the microwave impedance of the varactor diode to a new value that is then coupled into the ridged waveguide circuit and subsequently to the RF generating diode. The circuit impedance, which is a function of the varactor voltage, acts to linearize the frequency versus voltage characteristic of the diode. A comparison of the operation of the circuit with and without the radial line-tuning disc shows a 13:1 improvement in the frequency linearity. Experimental results show that the circuit configuration of the present invention is ideal for use in microwave and millimeter-wave voltage controlled oscillators that require inherent frequency versus voltage linearity. Since the voltage controlled oscillator frequency linearity is a critical factor in phase locked loop performance, it is especially suited for use in microwave and millimeter-wave radar or communication systems that are frequency agile.

9 Claims, 2 Drawing Sheets



5,014,022 May 7, 1991

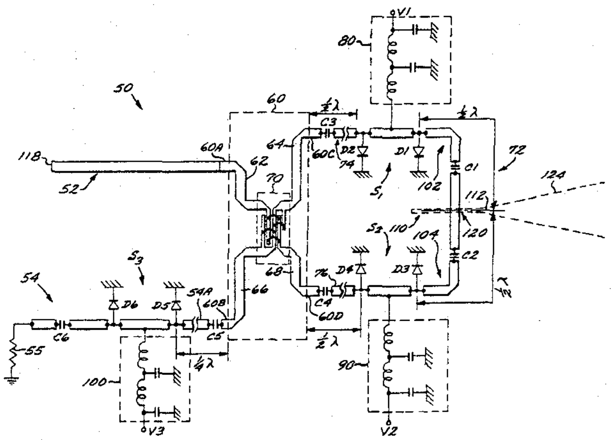
Switched-Loop/180 Degree Phase Bit with Aperture Shutter Capabilities

Inventors: Ronald I. Wolfson and Clifton Quan.
Assignee: Hughes Aircraft Company.
Filed: Dec. 13, 1989.

Abstract—A switched loop/180° phase shift device is disclosed, having the additional capability of an aperture shutter that can be selected to produce either a noncorrelated reflection in one mode of operation, or to absorb RF

energy that enters the radiating aperture port in the other mode.

16 Claims, 2 Drawing Sheets



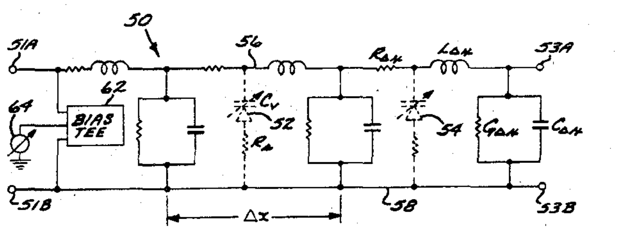
5,014,023 May 7, 1991

Nondispersive variable Phase Shifter and Variable Length Transmission Line

Inventor: John E. Mantele.
Assignee: Hughes Aircraft Company.
Filed: Mar. 29, 1989.

Abstract—A varactor controlled phase shifter device is disclosed wherein the phase velocities through the device are substantially equal at all frequencies, thus resulting in the phase constant of the phase shifter device being proportional to frequency. The magnitude of phase shift is selectable over a predetermined range by a continuously variable external control voltage, and this phase shift is linearly proportional to frequency. The device may also be used as a variable length transmission line, useful for such applications as frequency selective impedance matching.

22 Claims, 5 Drawing Sheets



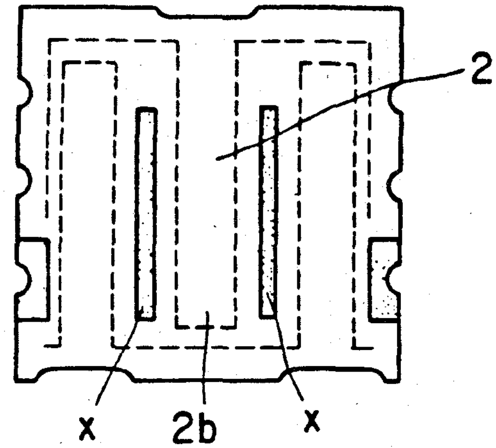
5,014,024 May 7, 1991

Bandpass Filter and Method of Trimming Response Characteristics Thereof

Inventors: Hiroyuki Shimizu, Kenji Ito, and Naomasa Wakita.
Assignee: NGK Spark Plug Co., Ltd.
Filed: July 27, 1990.

Abstract—A bandpass filter is disclosed which comprises a pair of opposing, first and second dielectric substrates each having an outer surface provided with a ground conductor, and a conducting resonator member provided between the first and second dielectric substrates and including a plurality of parallel resonator fingers each having an open circuit end and a base end electrically connected to said ground conductor, characterized in that a part of the ground conductor is removed to form an opening therein between adjacent two fingers, thereby to increase the bandwidth of frequency to which the filter responds.

4 Claims, 4 Drawing Sheets



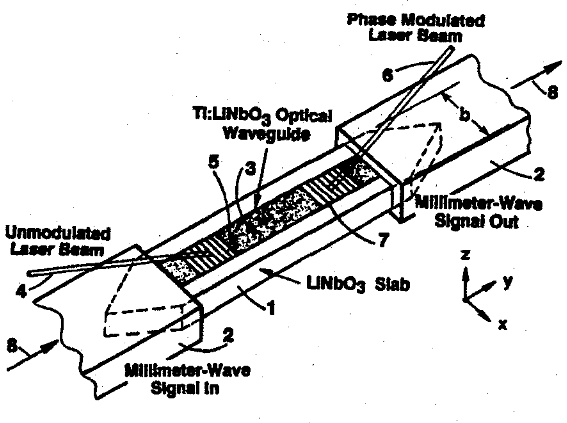
5,015,052 May 14, 1991

Optical Modulation at Millimeter-Wave Frequencies

Inventors: Richard W. Ridgway, Milton R. Seiler, Van E. Wood, and George T. Ruck.
Assignee: Battelle Memorial Institute.
Filed: July 20, 1989.

Abstract—Apparatus for modulation of optical signals at millimeter-wave frequencies comprises a thin elongate dielectric slab (1) of lithium niobate to partially confine and guide therein a polarized electrical signal (8) at millimeter-wave frequencies; a thinner optical waveguide (3) of lithium niobate with titanium diffused therein to substantially confine and guide therein an optical signal (9), having at least one elongate surface adjacent to an elongate surface of the dielectric slab (1); an optical grating (5) of arsenic trisulfide for directing a polarized optical signal (9) into the waveguide (3) to propagate in a lengthwise direction therein; an optical grating (7) of arsenic trisulfide for directing the optical signal (9) out of the waveguide (3) after it has traversed a predetermined distance therein; and a metallic waveguide (2) for directing an electrical signal (8) into the dielectric slab (1) in the same direction as that of the optical signal (9) in the waveguide (3), and at a center frequency such that it propagates at a phase velocity substantially matching the phase velocity of the optical signal (9).

17 Claims, 2 Drawing Sheets



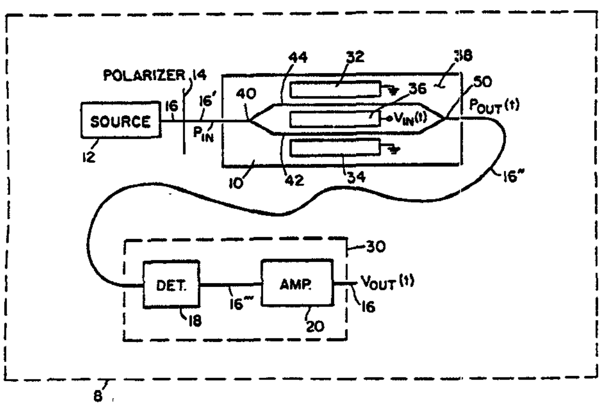
5,015,053 May 14, 1991

Reduction of Modulator Nonlinearities with Independent Bias Angle Control

Inventor: Leonard M. Johnson.
Assignee: Massachusetts Institute of Technology.
Filed: Sept. 8, 1989.

Abstract—An electrooptical modulating system has a light source for producing a carrier wave. The carrier wave is polarized by a polarizer so as to adjust the power of the carrier wave in transverse electric (TE) polarization mode and in transverse magnetic (TM) polarization mode. In addition to a polarizer the electrooptical modulating includes at least one set of electrodes for adjusting phase biases of the TE and TM polarization mode components of the carrier wave. The electrodes allow independent control of the phase biases of the respective TE polarization mode components and TM polarization mode components. Multiple sets of electrodes for adjusting the phase biases may be used. A modulating means is also included for modulating the carrier wave so as to encode information. The modulating system preferably also includes an interferometric modulator comprised of at least two branches. The modulation and phase bias adjustment take place on both of the respect branches.

43 Claims, 8 Drawing Sheets



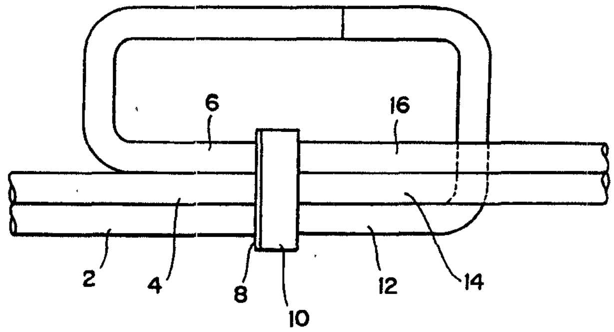
5,015,055 May 14, 1991

Polarization Coupler

Inventors: Hisashi Takamatsu, Norihisa Naganuma, and Kenichi Abe.
Assignee: Fujitsu Limited.
Filed: June 18, 1990.

Abstract—A polarization coupler in which a polarization maintaining fiber is employed and a process of producing such polarization coupler are disclosed. Where the polarization coupler is used, beams of light from two laser diodes can be introduced into a single optical fiber and light for the monitoring can be split from a main signal output. Since minimum components required to realize the function are a rotator, a birefringent plate and two or three polarization maintaining fibers, the polarization coupler is superior in operability in production and is suitable for miniaturization. The branching ratio of light for monitoring can be adjusted by adjustment of the angle of rotation of light by the rotator.

11 Claims, 5 Drawing Sheets



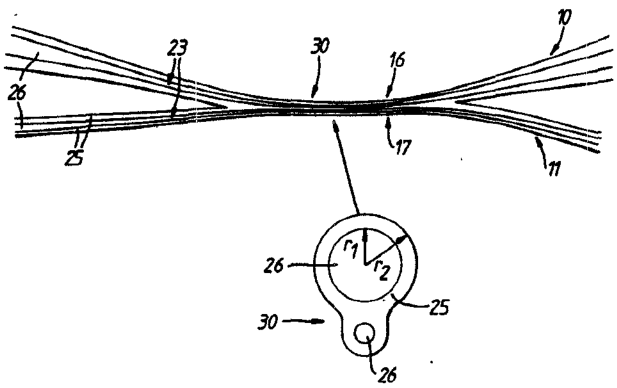
5,015,058 May 14, 1991

Asymmetric Fiber-Optic Couplers and Their Fabrication

Inventors: David A. Thorncraft, Peter R. A. Lyons, Scott C. Rashleigh, Johnathan A. Maine, and John D. Love.
Assignee: The Commonwealth of Australia.
Filed: June 6, 1988.

Abstract—An asymmetric multimode fiber-optic coupler is assembled from two or more multimode optical fibers of different core and cladding diameters, but substantially equal cladding refractive indices. The fibers are selected so as to have substantially equal effective refractive indices for their respective highest order cladding modes, at least in the fabricated coupler.

15 Claims, 3 Drawing Sheets



STEP F

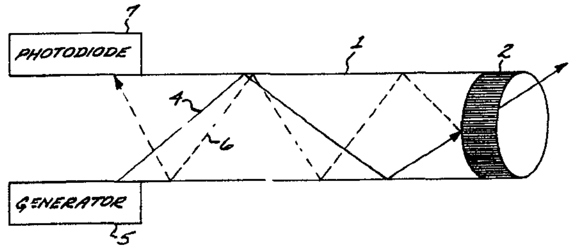
5,015,067 May 14, 1991

Optical Fiber Power Output Measuring Means

Inventor: Jeffrey I. Levatter.
Assignee: Acculase, Inc.
Filed: Jan. 6, 1989.

Abstract—An apparatus and method for detecting and measuring optical fiber output by measuring backscatter fluorescence from at least a partial coating or layer of fluorescent material at approximately the end of the optical fiber.

5 Claims, 1 Drawing Sheet



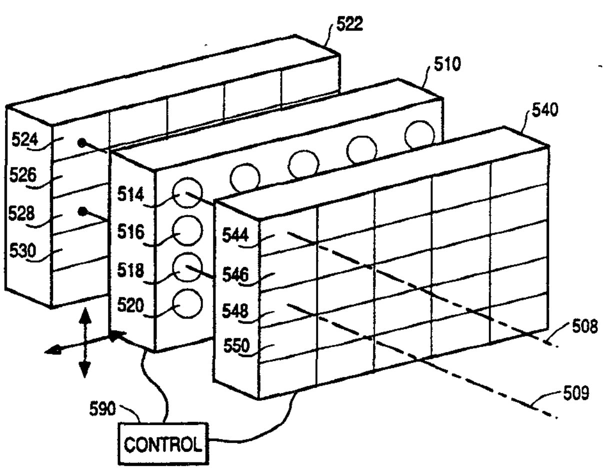
5,015,080 May 14, 1991

Continuous Wide Angle Beam Steerer Using Lens Translation and Phase Shifter

Inventors: William J. Cassarly and Kevin M. Flood.
Assignee: The General Electric Company.
Filed: Mar. 26, 1990.

Abstract—A beam steering arrangement includes at least one lens array in which the lenses of the array are spaced at the source spacing, and the array is translated perpendicular to the beams to achieve scanning. Beam-to-beam piston phase differences result in grating lobes, with the result that the steered beam occurs as grating lobes only at discrete angles. An array of phase shifters registered with the lens array is controlled to correct the piston phase difference, thereby providing continuous scanning. In a particular embodiment of the invention the sources of the source array produce collimated beams, and a second lens array is interposed in the beam path. The efficiency of the array is improved by translating both lens arrays rather than one.

19 Claims, 9 Drawing Sheets



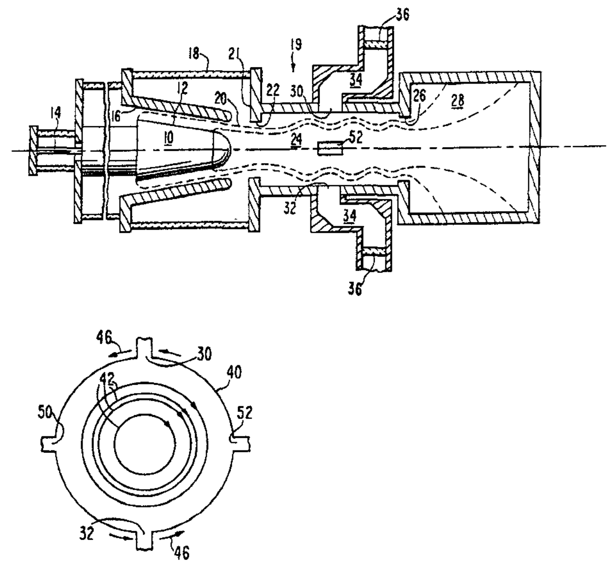
5,015,914 *May 14, 1991

Couplers for Extracting RF Power from a Gyrotron Cavity Directly into Fundamental Mode Waveguide

Inventors: Robert L. Ives, Howard R. Jory, and Albert D. LaRue.
Assignee: Varian Associates, Inc.
*The portion of the term of this patent subsequent to July 25, 2006 has been disclaimed.
Filed: Dec. 9, 1988.

Abstract—In a gyrotron cavity resonator, generated energy is extracted into a symmetric set of fundamental-mode waveguides by ports disposed to couple energy in phase from the operating electromagnetic mode but in antiphase with respect to an unwanted mode of lower cutoff frequency than the operating mode, thereby neutralizing coupling to the unwanted mode. A second set of interspersed ports may be disposed to load degenerate, orthogonal modes.

13 Claims, 3 Drawing Sheets



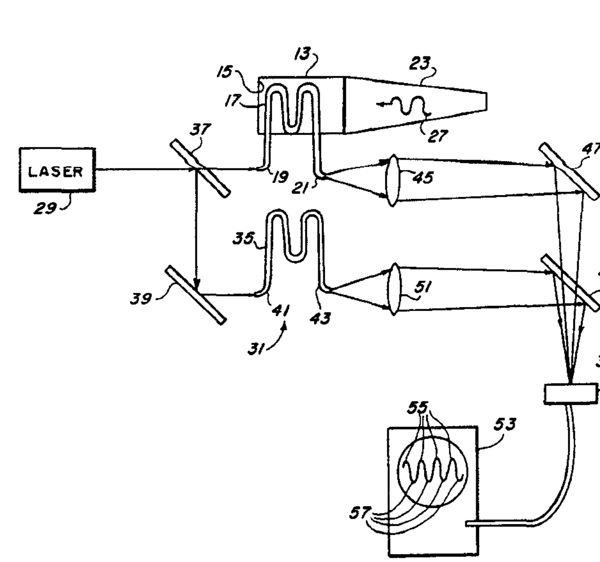
5,015,943 May 14, 1991

High-Power, High-Sensitivity Microwave Calorimeter

Inventors: Frederick M. Mako and John A. Pasour.
Assignee: The United States of America as represented by the Secretary of the Navy.
Filed: May 22, 1989.

Abstract—A microwave calorimeter is disclosed for substantially measuring the total microwave energy in an applied microwave pulse. The microwave calorimeter includes: a housing having a highly reflective interior surface, a microwave absorbing device disposed in the housing for substantially absorbing microwave energy transmitted into the housing and for producing a thermal response proportional to the amount of microwave energy being absorbed, and a measurement device responsive to the thermal response for determining the amount of microwave energy being absorbed by the microwave absorbing device.

10 Claims, 3 Drawing Sheets



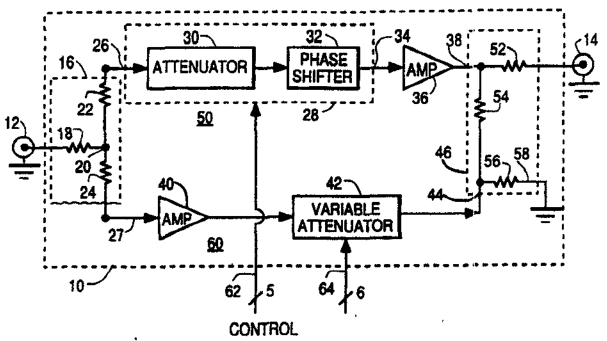
5,015, 965 May 14, 1991

Predistortion Equalizer with Resistive Combiners and Dividers

Inventors: Allen Katz and Robert R. Urban.
Assignee: The General Electric Company.
Filed: Nov. 22, 1989.

Abstract—A predistortion equalizer for a power amplifier includes a linear channel and a nonlinear channel. A phase shifter is associated with the linear channel and an attenuator is associated with the nonlinear channel. A resistive power divider divides the received signal that is to be predistorted and divides it into two parts, each of which is applied to one of the channels. The two parts may be equal in magnitude. The linear and nonlinear signals at the outputs of the linear and nonlinear channels, respectively, are combined out-of-phase in a resistive combiner to produce a predistorted signal for application to a power amplifier. The resistive combiner and divider maximize bandwidth.

14 Claims, 4 Drawing Sheets



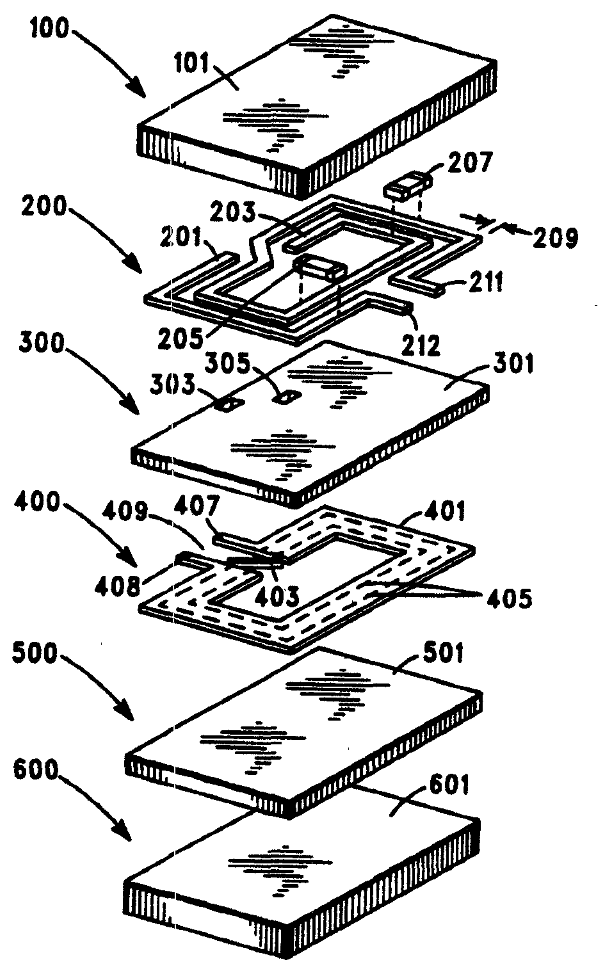
5,015,972 May 14, 1991

Broad-Band RF Transformer

Inventors: Lawrence F. Cygan, Helga O. Granberg, Richard S. Bickman, and Carl Missele.
Assignee: Motorola, Inc.
Filed: Aug. 17, 1989.

Abstract—A broad-band RF transformer design is described that facilitates the construction of a broadband impedance transformer in a compact, planar format, while retaining ease of assembly and manufacture. Broad-band operation is achieved through the use of a slotted low-impedance winding structure, common-manufacture ferrite elements, and the optional placement of reactive elements between winding turns. By virtue of construction, thermal performance is enhanced, allowing operation at power levels not previously possible. The invention accommodates functional tuning via laser or abrading techniques. Also, the winding configuration eliminates the need to access the center of a spiral for the purposes of establishing a ground connection.

4 Claims, 3 Drawing Sheets



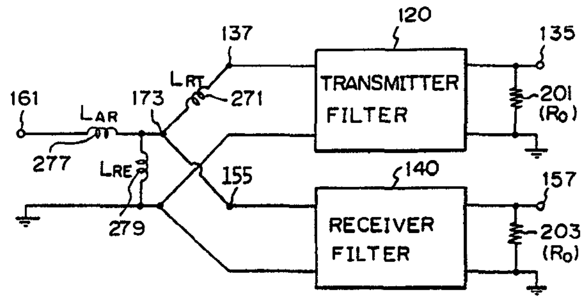
5,015,973 May 14, 1991

Duplexer with an Isolating Circuit on a Dielectric Plate

Inventors: Izumi Kawakami, Tomokazu Komazaki, Katsuhiko Gunji, Norio Onishi, Yoshimitsu Sakurai, Hiroyuki Horii, and Akira Mashimo.
Assignee: Oki Electric Industry Co., Ltd.
Filed: Aug. 26, 1988.

Abstract—A circuit, such as a duplexer, that isolates a first and second frequency signals respectively directed to and from an antenna terminal. A transmitter filter has an output terminal connected to a connecting point through a first inductor. A receiver filter has an input terminal connected to the connecting point. The connecting point is connected to the antenna terminal, and to ground through a second inductor. In a modified circuit, the output terminal of the transmitter filter and the input terminal of the receiver filter are the input terminal of the receiver filter are respectively connected to the connecting point through first and second capacitors. In the preferred embodiments, the transmitter filter and the receiver filter are mounted to one side of a dielectric plate and the inductor and/or capacitors are formed by electrically conductive step lines and a capacitance patterns formed on the opposite side of the dielectric plate.

15 Claims, 12 Drawing Sheets



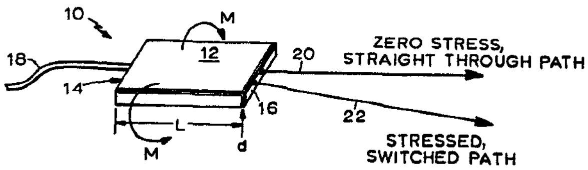
5,016,957 May 21, 1991

Photoelastic Optical Switch and Optical Systems Employing the Optical Switch and a Method of Use Thereof

Inventor: George Seaver.
Filed: Nov. 20, 1989.

Abstract—An optical switch that comprises a photoelastic, optically transparent material whose index of refraction is changed by mechanical stress and that propagates an optical beam or beams from an inlet window to an outlet window in the material, with the inlet window adapted to receive an optical beam from an optical source and the outlet window adapted to pass an optical beam from the photoelastic material to an optical output receptor, and a means of applying a stress gradient to said photoelastic material to change the index of refraction and hence, the optical path of the optical beam between a normal, unstressed optical beam path and a bent, stressed optical beam path. Optical systems are described in which the optical switch is employed to receive an optical beam from a source and to switch a beam after passing it through the photoelastic optical material to and from an optical receptor. The disclosure also includes a method of optically switching an optical beam between normal and stressed optical beam positions by applying a predetermined mechanical force to a photoelastic optically transparent material to form a mechanical stress gradient within the optical transparent photoelastic material that provides an index of refraction gradient therein and causes the switching of the optical beam.

21 Claims, 5 Drawing Sheets



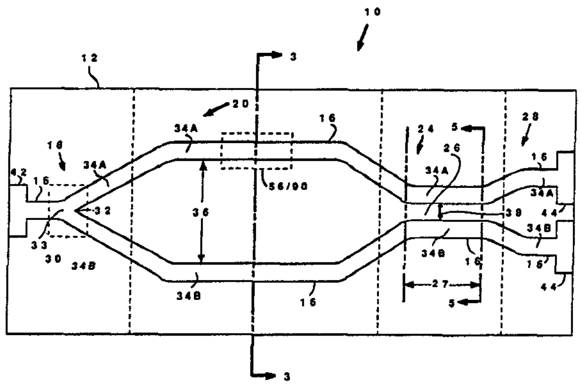
5,016,958 May 21, 1991

Optical Switch Having a Phase Change Region Therein

Inventor: Bruce L. Booth.
Assignee: E. I. du Pont de Nemours and Company.
Filed: Feb. 7, 1989.

Abstract—An optical switch for switching light from one leg of an optical circuit to another leg is characterized by an arrangement for altering the index of refraction of one of the legs with respect to the other leg. This results in a disparity in light velocity and a change in phase relationship for the light being propagated through the legs. When the legs are brought into a coupling region, there occurs a predetermined transfer of light from one leg to the other, depending upon the magnitude of the alteration in phase relationship between the light propagated in the legs.

26 Claims, 14 Drawing Sheets



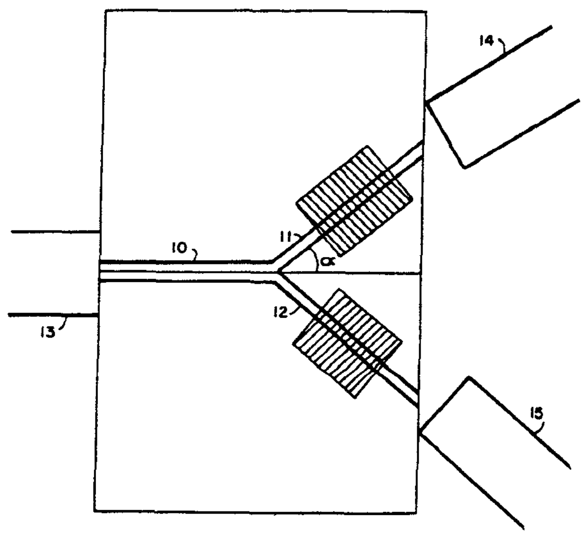
5,016,960 May 21, 1991

Hybrid Optical Y-Junction

Inventors: Elliot Eichen and Paul Melman.
Assignee: GTE Laboratories Incorporated.
Filed: Dec. 22, 1989.

Abstract—A hybrid optical Y-junction device includes a $1 \times N$ optical fiber coupler connected to N waveguide structures fabricated on a single substrate. When the waveguide structure is a semiconductor optical amplifier, the hybrid Y-junction device is operable as either a modulator or lossless power divider. A nonblocking optical switch is constructed by coupling $M \times 1$ optical fiber couplers to the outputs of the waveguide structures in the hybrid Y-junction. The switch is also effective as a wavelength division multiplexer when periodic gratings are integrated into the waveguide amplifiers.

7 Claims, 2 Drawing Sheets



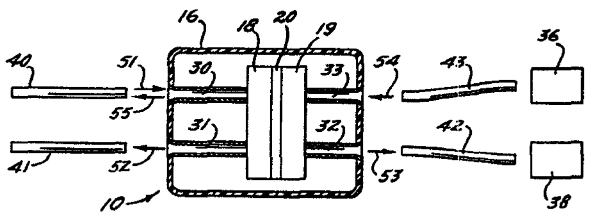
5,016,966 May 21, 1991

Asymmetric Optical Fiber Tap

Inventors: Terry P. Bowen and John R. Rowlette.
Assignee: AMP Incorporated.
Filed: Apr. 12, 1990.

Abstract—An asymmetric optical fiber for tap optically coupling an ingoing fiber, an outgoing fiber, a tap fiber and optionally an optical source fiber, includes a housing, and at least one wavelength compensated holographic optical element (HOE) disposed in the housing. The housing includes first, second and third guides therein for guiding the ingoing fiber, and the outgoing fiber, and the tap fiber, and optimally a fourth guide means for guiding the optical source fiber, respectively, adjacent to the HOE. The HOE is adapted to couple optical energy from the ingoing fiber to both the outgoing and tap fiber, and to launch optical energy from the optical source fiber to the ingoing fiber. The disclosed taps are simple in design, easy to manufacture and connect, and cause minimal attenuation of the ongoing optical signal. The taps are also compact; optical fiber alignment is facilitated and they allow for an optical signal to be efficiently launched in an uphill direction into the ingoing fiber.

51 Claims, 2 Drawing Sheets



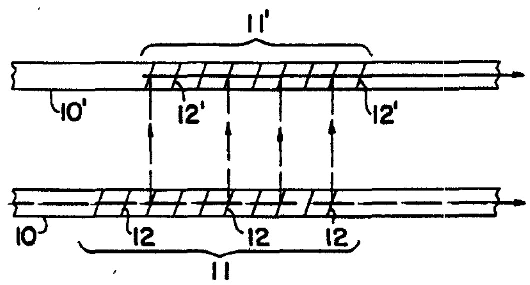
5,016,967 May 21, 1991

Multicore Optical Waveguide Bragg Grating Light Redirecting Arrangement

Inventors: Gerald Meltz and William W. Morey.
Assignee: United Technologies Corporation.
Filed: Dec. 26, 1989.

Abstract—An optical waveguide light redirecting arrangement includes an optical waveguide having at least two solid portions each of which guides light in a path along a longitudinal axis, with at least one grating region being embedded in each solid portion. Each grating region includes a multitude of grating elements extending at such identical longitudinal spacings and at such an identical angle relative to the longitudinal axis as to redirect light reaching the grating elements between the path of one and the path of the other of the waveguiding portions.

4 Claims, 1 Drawing Sheet



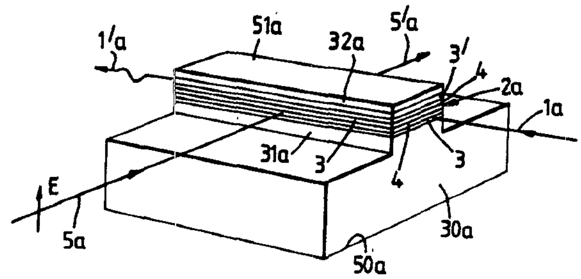
5,016,990 May 21, 1991

Method of Modulating an Optical Beam

Inventor: Peter J. Dobson.
Assignee: U. S. Philips Corp.
Filed: Jan. 26, 1989.

Abstract—A method of modulating an optical beam (1) and apparatus for use in such a method are described. An etalon structure (2) is provided that has an absorption edge in the vicinity of the wavelength of the optical beam (1) and that comprises material of a smaller band gap, for example, gallium arsenide, sandwiched between layers of material of a larger band gap, for example aluminium gallium arsenide, so that the smaller band gap material forms a quantum size effect confinement region for electrons and holes. The smaller band gap material may consist of layers (4) separated by barrier layers (3) of the larger band gap material so that the layers (4) form quantum wells. The optical beam (1) is directed through quantum size effect confinement region of the etalon structure (2) and a polarized control optical beam (5) is directed at the etalon structure (2) perpendicular to a direction of quantum size effect confinement of the etalon structure (2), thereby causing the optical beam (1) to be modulated by the control optical beam (5).

12 Claims, 3 Drawing Sheets



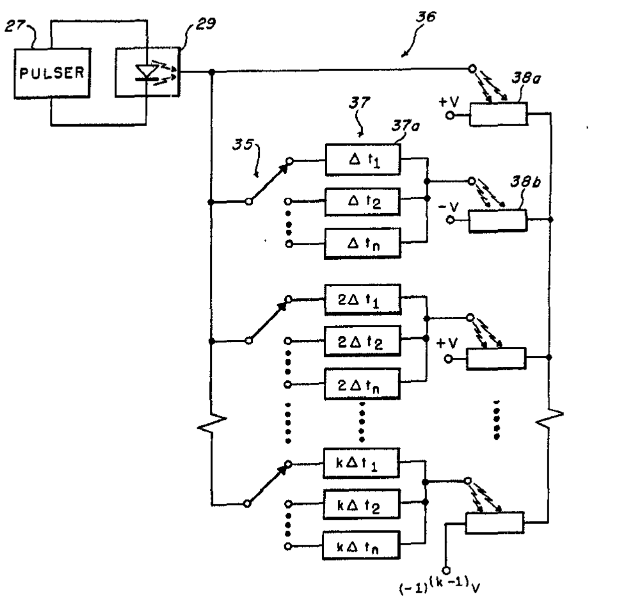
5,017,793 May 21, 1991

Optically Driven RF Generator

Inventors: James D. Halsey, Robert F. Riggs, Lawrence H. Gilligan, and David W. Gerdt.
Assignee: Sperry Marine, Inc.
Filed: Sept. 26, 1989.

Abstract—An optically driven signal generator utilizes optical switches having a common output port and input ports alternately coupled to first and second potentials of opposite polarities. Optical pulses, with interpulse periods commensurate with a desired output frequency, sequentially operate the switches so that electrical signals of opposite polarities are alternately coupled to a common output port in a manner to establish a continuous electrical signal at a frequency that is commensurate with the interpulse periods.

10 Claims, 4 Drawing Sheets



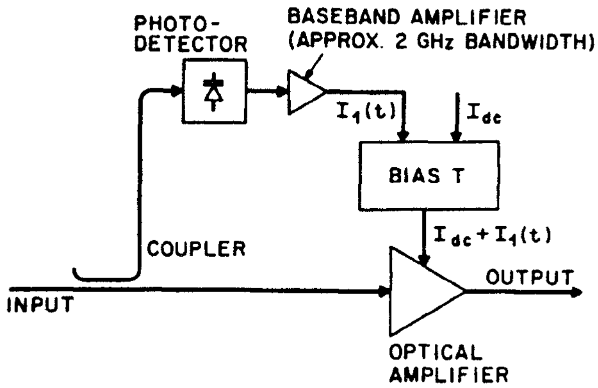
5,017,885 May 21, 1991

Optical Amplifier with Reduced Nonlinearity

Inventor: Adel A. M. Saleh.
Assignee: AT&T Bell Laboratories.
Filed: Sept. 28, 1990.

Abstract—An improved optical amplifier is disclosed with reduced signal-induced, deleterious, nonlinear effects, such as crosstalk, inter-modulation distortion and other saturation-induced effects. The invention comprises an optical amplifier with a compensation loop, such as a feed-forward or a feed-backward loop. This loop provides additional pumping to the gain medium associated with the amplifier, thereby compensating for what would otherwise be deleterious, signal-induced variations in the gain of the optical amplifier.

6 Claims, 9 Drawing Sheets



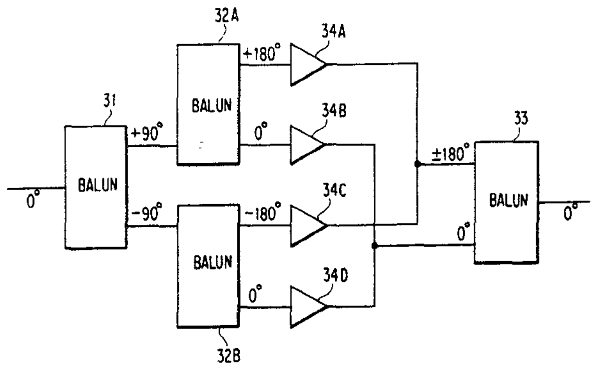
5,017,886 May 21, 1991

RF Power Combiner Using Baluns

Inventor: Bernard D. Geller.
Assignee: Comsat.
Filed: Dec. 12, 1989.

Abstract—An RF power combiner combines the power of several microwave high-power FET amplifiers. A plurality of baluns that convert a balanced transmission line to an unbalanced transmission line and have outputs which are 180 out of phase from each other may be connected at the inputs and the outputs of the FET's. This connection allows for very high ouput power while matching impedances of the input and the output of the power combiner. Additionally, loss in the output circuit can be minimized by connecting equi-phase outputs of the FET's a parallel/push–pull manner.

11 Claims, 3 Drawing Sheets



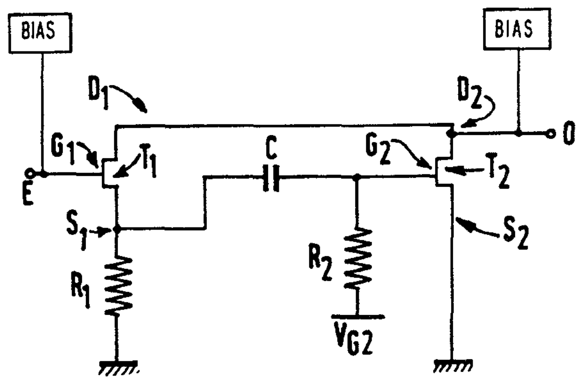
5,017,887 May 21, 1991

High-Frequency IC Power Amplifier

Inventor: Patrice Gamand.
Assignee: U. S. Philips Corporation.
Filed: Dec. 7, 1989.

Abstract—An integrated semiconductor arrangement comprising a high-frequency power amplifier stage, which comprises two field-effect transistor having first connection means to influence the output power by means of the unit gate width of the amplifier stage, and second connection means to influence the value of the input capacitance of the amplifier stage. This stage also comprises means to ensure the feedback of direct current to ground and also includes dc biasing means.

28 Claims, 5 Drawing Sheets



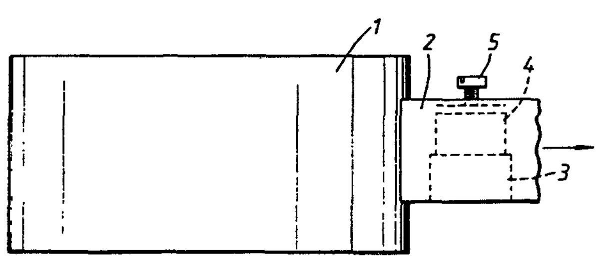
5,017,891 May 21, 1991

Magnetrons with Resonator Element for Stablizing Output Radiation Frequency

Inventors: Paul A. Jerram and Stephen Bainbridge.
Assignee: EEV Limited.
Filed: Nov. 13, 1989.

Abstract—The performance of a magnetron may be degraded by its output frequency changing. This degradation may be reduced by fixing a resonator element in the magnetron's output waveguide enabling temperature stabilization to be achieved and also permitting the output spectrum of the radiation to be narrowed.

8 Claims, 2 Drawing Sheets



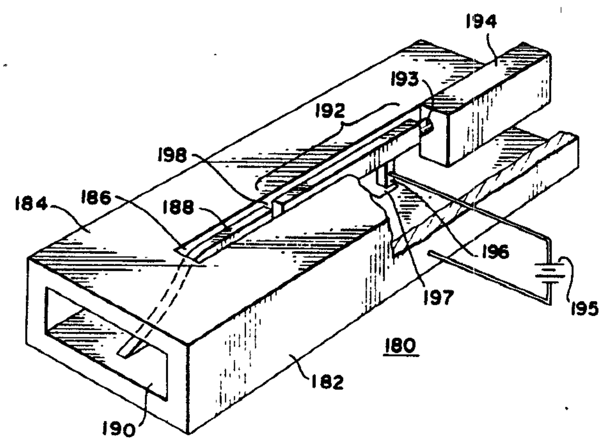
5,017,892 May 21, 1991

Waveguide Adaptors and Gunn Oscillators Using the Same

Inventor: G. Conrad Dalman.
Assignee: Cornell Research Foundation, Inc.
Filed: Feb. 7, 1990.

Abstract—A waveguide adaptor or transition for interfacing a microwave waveguide to a coplanar transmission line or electronic device is disclosed. The adaptor includes a waveguide section having an integral coplanar transmission line formed in a longitudinal slot in a top wall thereof. A metallic fin is disposed in the waveguide which extends into the slot. The transmission line is coplanar because the edges of the slot on either side of the fin both act as ground planes. A tapered portion of the fin gradually rises from the bottom surface of the waveguide into the slot that acts as an impedance matching structure between the waveguide and the transmission line. Numerous circuit elements can be connected to the transmission line so that the adaptor can be used to fabricate oscillators, amplifiers, filters, and other devices. In particular, a Gunn oscillator formed with the adaptor is disclosed. In another embodiment, the fin is made out of insulating material having conductive patterns disposed on both sides to form a conventional waveguide to coplanar waveguide transition.

38 Claims, 10 Drawing Sheets



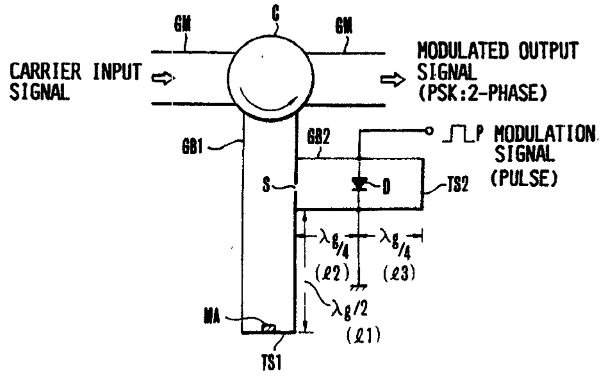
5,017,893 May 21, 1991

Microwave Modulator

Inventors: Tetsujirou Izumi and Akihiko Iida.
Assignee: Robotech Laboratory Co., Ltd.
Filed: Feb. 22, 1990.

Abstract—A waveguide modulation circuit branches a first short circuit from a main waveguide and branches a second short circuit from the first short circuit. The second short circuit is branched by an H-plane slit coupling at a position distant from the short-terminal of the first short circuit by a length of a half wavelength or some multiples thereof and this second short circuit is short-circuited or conductively terminated at a length of a half wavelength or some multiples thereof distant from its branch point. In the second short circuit, a switching diode is loaded at a predetermined position distant from the short-terminal towards the branch point. A pulse train of the modulation signal is applied to this diode to attain a 2–phase PSK-modulation circuit. A wave absorber may be attached to the short-terminal of the first short circuit, whenever necessary. A 4–phase PSK signal can also be obtained.

5 Claims, 4 Drawing Sheets



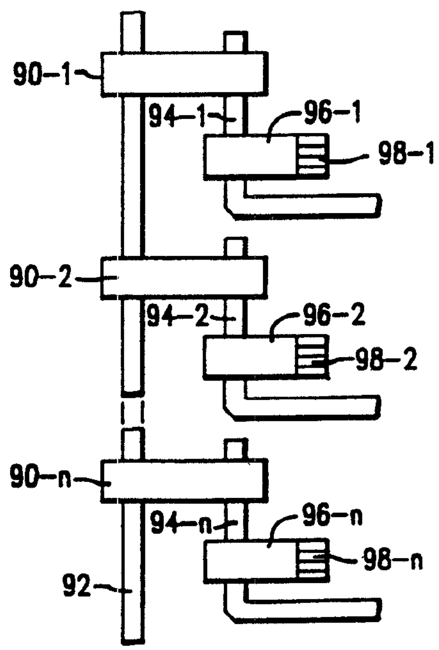
5,017,895 May 21, 1991

Magnetostatic Wave (MSW) Filter with Sharp Upper Cutoff Frequency and Channelizer Formed Therefrom

Inventors: Daniel C. Buck and Steven N. Stitzer.
Assignee: Westinghouse Electric Corp.
Filed: Sept. 11, 1989.

Abstract—In the present invention, the upper edge of the frequency response of the magnetostatic wave (MSW) filter is sharpened. A band-limiting element (BLE) is coupled to the MSW filter, preferable in the filter element ouput. In one embodiment, the BLE absorbs signals above a certain frequency in the upper band edge for the MSW. In another embodiment, the BLE reinforces the output response.

14 Claims, 5 Drawing Sheets



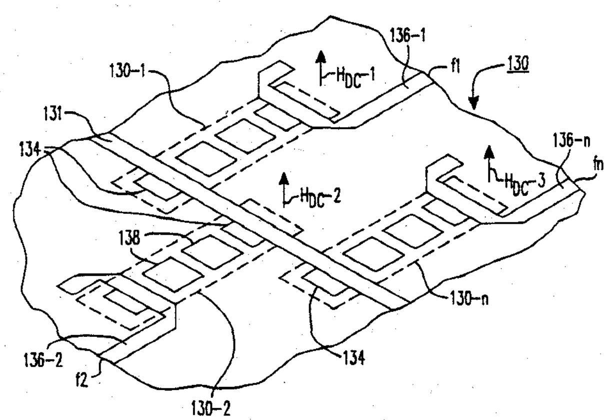
5,017,896 May 21, 1991

Mode Trapped Magnetostatic Wave (MSW) Filters and Channelizer Formed Therefrom

Inventors: John D. Adam and Salvador H. Talisa.
Assignee: Westinghouse Electric Corp.
Filed: Jan. 16, 1990.

Abstract—In the present invention, magnetostatic wave (MSW) filters of the delay line and resonator type responsive to multimode MSW signals trap a desired MSW mode of the signal and attenuate untrapped modes of the signal in order to provide a higher order band rejection characteristic. In a preferred embodiment, a low loss YIG film is disposed on a substrate. An apertured metallization layer on the YIG film defines a region of MSW propagation within the aperture and a metallization layer at the opposite side of the YIG film traps a selected MSW mode in said aperture. A region of high attenuation for MSW waves adjacent the desired propagation region absorbs untrapped MSW waves.

21 Claims, 5 Drawing Sheets



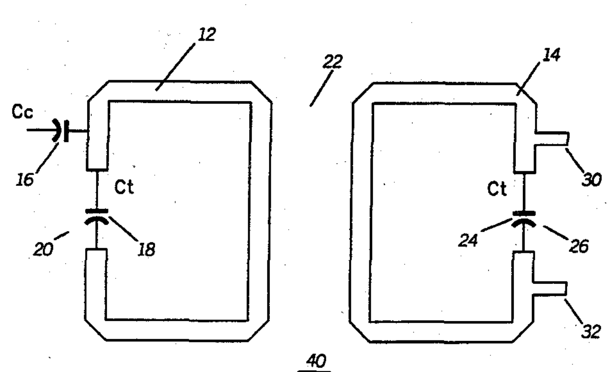
5,017,897 May 21, 1991

Split Ring Resonator Bandpass Filter with Differential Output

Inventors: Leng H. Ooi, Peter J. Yeh, and Branko Avanic.
Assignee: Motorola, Inc.
Filed: Aug. 6, 1990.

Abstract—A bandpass filter (40) comprises a first microstrip split-ring resonator (12), having at least a first edge and a second edge, the first edge having a gap (20) therein, and an input. The bandpass filter (40) also comprises a second microstrip split-ring resonator (14), having at least a first edge and a second edge, the first edge being coupled to the second edge of the first microstrip split-ring resonator, and the second edge of the second microstrip split-ring resonator comprising a gap (26) therein and a balanced ouput (30, 32).

12 Claims, 2 Drawing Sheets



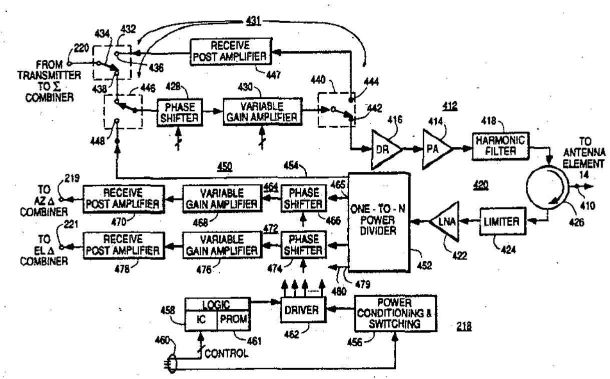
5,017,927 May 21, 1991

Monopulse Phased Array Antenna with Plural Transmit–Receive Module Phase Shifters

Inventors: Ashok K. Agrawal and Norman R. Landry.
Assignee: The General Electric Company.
Filed: Feb. 20, 1990.

Abstract—A monopulse antenna array arrangement includes a transmit–receive processor (TR Proc) associated with each antenna element. Each TR Proc has a port associated with the radiating element and at least two further ports, one for a sum beamformer and another for a difference beamformer. Within each Tr Proc, a switching arrangement allows transmitter signal to flow through a phase shifter and transmit amp during transmission, and allows received signal to flow through a low-noise amp and the same phase shifter on reception. Each Tr Proc includes a coupling arrangement with a second phase shifter and a second output port, adapted to be coupled to a difference beamformer during reception.

4 Claims, 7 Drawing Sheets



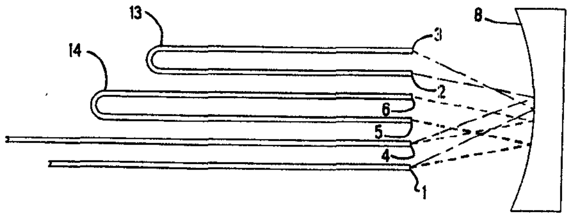
5,018,816 May 28, 1991

Optical Delay Switch and Variable Delay System

Inventors: Dale D. Murray and Paul R. Reitz.
Assignee: AMP Incorporated.
Filed: June 11, 1990.

Abstract—An optical fiber switch (9) comprises a group of optical fiber end faces (1), (2), (3), (4), (5), (6), including a first optical fiber end face (1) via which light is transmitted as an input signal and at least second and third optical end faces (2), (3) being the end faces of an optical loop (13). The group further includes a fourth fiber end face (4) via which light is transmitted as an output signal, and fifth and sixth fiber end faces (5), (6) being the end faces of an optical fiber loop (14). In a first position, light from the first fiber end face (1) is imaged into the second fiber end face (2) and is propagated through the fiber loop (13) to the third fiber end face (3) and imaged into the fourth fiber end face (4). In the second position, light from the first fiber end face (1) is imaged into the fifth fiber end face (5) and propagated through the fiber loop (14) through the sixth fiber end face (6) and imaged into the second fiber end face (2). Further, a fiber-optic variable discrete delay system for electrical system includes one or more of the optical fiber switches (9) comprising a group of optical fiber end faces (1), (2), (3), (4), (5), (6) and means (8) for displacing the group of end faces (1), (2), (3), (4), (5), (6) relative to one another.

20 Claims, 2 Drawing Sheets



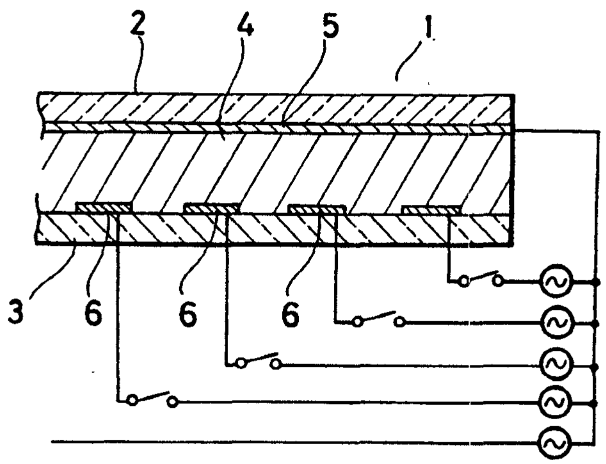
5,018,838 May 28, 1991

Method and Device for Achieving Optical Spatial Phase Modulation

Inventors: Thomas H. Barnes, Kiyofumi Matsuda, and Naotake Ooyama.
Assignee: Agency of Industrial Science and Technology, Ministry of International Trade and industry.
Filed: July 6, 1989.

Abstract—Optical spatial phase modulation is achieved by positioning a liquid crystal layer in the path of a light beam to be modulated and controlling the spatial distribution of refractive index of the liquid crystal layer by controlling the spatial distribution of the electrical field generated across the liquid crystal layer.

5 Claims, 5 Drawing Sheets



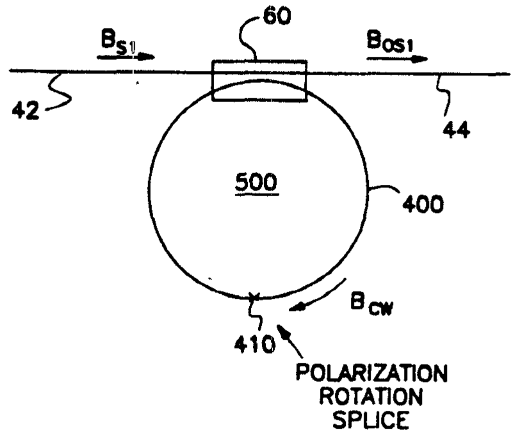
5,018,857 May 28, 1991

Passive Ring Resonator Gyro with Polarization Rotating Ring Path

Inventors: Glen A. Sanders, Robert B. Smith, and Gordon F. Rouse.
Assignee: Honeywell, Inc.
Filed: Sept. 15, 1988.

Abstract—A passive ring resonator gyro is constructed of an electromagnetic waveguide ring path that causes a specified rotation of the polarization of the waves, once for each round trip through the ring path. For an optical fiber ring path, a splice at some point is introduced in the ring path in which the fiber ends are rotated relative to each other in order to effect polarization rotation.

21 Claims, 5 Drawing Sheets



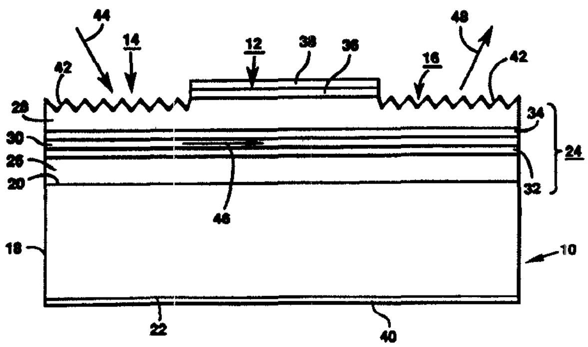
5,019,787 May 28, 1991

Optical Amplifier

Inventors: Nils W. Carlson, Gary A. Evans, Jacob M. Hammer, and Michael Ettenberg.
Assignee: David Sarnoff Research Center, Inc.
Filed: Oct. 30, 1989.

Abstract—An optical amplifier comprising a substrate of a semiconductor material having a pair of opposed surfaces and a body of semiconductor material on one of the surfaces. The body includes a pair of clad layers of opposite conductivity types having an intermediate quantum wall region therebetween. The clad layers are of a semiconductor material that form a heterojunction with the material of the quantum well region. The clad layers and quantum well region forms a waveguide which extends along the body. A gain section is in the body along the waveguide. The gain section includes a capping layer over the outermost clad layer, a contact on the capping layer and a contact on the other surface of the substrate to allow a voltage to be applied across the gain section. The gain section is adapted to generate light in the active region when a voltage is applied thereacross. A light input section having a grating extending across the body is at one end of the gain section. The light input section is adapted to direct light into the body and along the waveguide. A light output section having a grating extending across the body is at the other end of the gain section. The light output section is adapted to direct the amplified light from the gain section out of the body. The periods of the gratings are such that no self-oscillation of the light in the waveguide occurs.

18 Claims, 2 Drawing Sheets



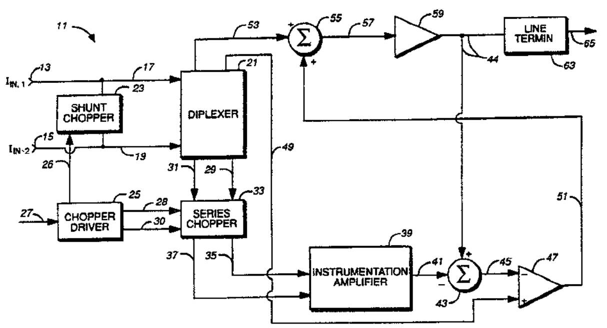
5,019,788 May 28, 1991

Amplifier with Wide Dynamic Range

Inventors: Michael C. Fischer and William E. Strasser.
Assignee: Hewlett-Packard Company.
Filed: Aug. 16, 1989.

Abstract—Method and apparatus for amplification of an electrical signal whose frequency may range from zero to 300 MHz, and whose voltage level may range from 0.5 volt to 0.5 volt, with intermittent resetting of the zero voltage level provided for. One or two incoming signals are divided into low-frequency and high-frequency components, and amplification of each of these components is optimized by passage of the component through a separate amplification circuit. Input signals to the high and low frequency amplification circuits are intermittently chopped to allow resetting of the zero voltage levels of the amplifier.

52 Claims, 18 Drawing Sheets



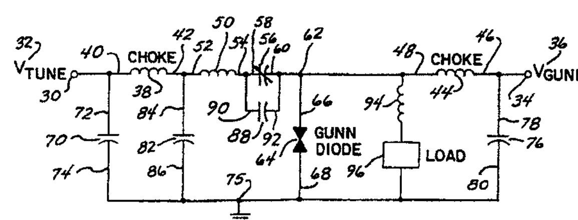
5,019,791 May 28, 1991

Millimeter-Wave Oscillator with Flicker (1/F) Noise Suppression

Inventor: Leonard D. Cohen.
Assignee: All Systems, Inc.
Filed: Aug. 6, 1990.

Abstract—Flicker (1/f) noise is suppressed in an oscillator by reducing oscillator voltage-frequency pushing to zero. A varactor (56) is incorporated in the resonator circuit and is biased with a tuning voltage setting the varactor to a capacitance value providing the zero oscillator pushing at a given frequency. A common bias connection (62) is provided between the varactor and the active element (64) such that a random perturation voltage change across the active element also causes a change in voltage across the varactor, to compensate a change in oscillator frequency otherwise caused thereby. The varactor capacitance versus voltage characteristic is shaped such that a change in active element voltage provides a change in varactor voltage, and the combination of these voltage changes results in a zero change in oscillator frequency. The tuning slope of the oscillator provided by the varactor is opposite the tuning slope of the oscillator resulting from a change in active element voltage.

30 Claims, 4 Drawing Sheets



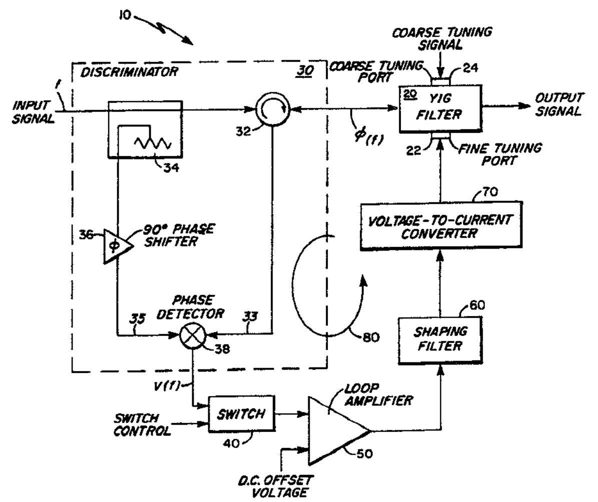
5,019,792 May 28, 1991

Signal Tracking Electronically Tunable Filter

Inventors: Robert Di Biase, Zvi Galani, and Raymond C. Waterman, Jr.
Assignee: Raytheon Company.
Filed: Oct. 23, 1989.

Abstract—A tunable bandpass filter for radio frequency energy with a phase-locked loop for tracking an input signal and to control the filter to keep the center frequency of the passband coincident with the frequency of the input signal is shown. Using a Yttrium Iron Garnet (YIG) filter as a frequency determining element and as a passive dispersive reference element for a frequency discriminator, the bandpass filter uses the output signal of the discriminator to form a fine tuning signal to control the center frequency of the passband of the YIG filter.

9 Claims, 1 Drawing Sheet



5,019,793 May 28, 1991

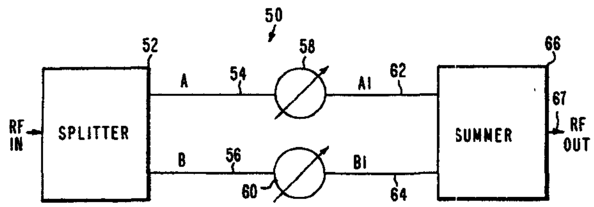
Digitally Implemented Variable Phase Shifter and Amplitude Weighting Device

Inventor: Kevin M. McNab.
Assignee: Hughes Aircraft Company.
Filed: May 21, 1990.

Abstract—A variable phase shifter and amplitude weighting (VPSAW) device capable of selectively varying the phase and amplitude of an incoming RF signal (RF_{IN}) in such a manner as to produce an output RF signal (RF_{OUT}) having a selected phase and amplitude, by means of splitting the RF_{IN} signal into first and second signal components, selectively shifting the phase of each of these two components, and then combining the thusly selectively phase-shifted first and second signal components. In the presently contemplated best mode of the present invention, the VPSAW device includes digitally-implemented componentry, e.g., microprocessor-controlled direct, digital synthesizers, for generating first and second control signals, e.g., selectively phase-shifted sinusoidal signals, indicative of first and second phase shift increments ϕ_a and ϕ_b, respectively, to be imparted to the first and second signal components, respectively. The VPSAW device of the best mode further includes first and second signal mixers for mixing together the first and second control signals with the corresponding first and second signal components, to thereby phase shift the first and second signal components by the first and second phase increments ϕ_a and ϕ_b, respectively. The first and

second phase shift increments, ϕ_a and ϕ_b, satisfy a prescribed algorithm that results in the RF_{OUT} signal having the selected phase (ϕ_C) and the selected amplitude (C), e.g., $\phi_a = \phi_c + \cos^{-1}\left(\frac{1}{2}C\right)$ and $\phi_b = \phi_c - \cos^{-1}\left(\frac{1}{2}C\right)$. Additionally, the first and second mixers may serve to downconvert the RF_{IN} signal by subtracting the frequency of the first and second control signals from the frequency of the first and second signal components.

15 Claims, 3 Drawing Sheets



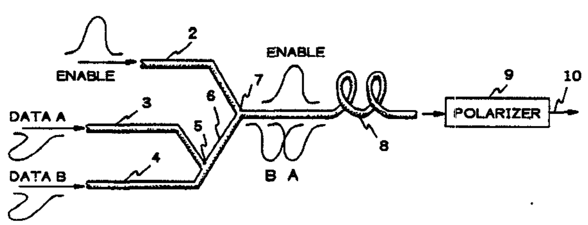
5,020,050 May 28, 1991

Cascadable Optical Combinatorial Logic Gates

Inventor: Mohammed N. Islam.
Assignee: AT&T Bell Laboratories.
Filed: Oct. 13, 1989.

Abstract—Combinatorial logic devices are presented in which data signals interact with an enable signal in the device to move the enable signal outside its prescribed time slot when one or both of the data signals are present. Data signals are discarded within the device to avoid propagation through subsequent logic device stages. Such logic devices are particularly well suited to all-optical realizations in which soliton pulse signals are used. These devices exhibit high gain, cascadability and potentially large fanout capability.

11 Claims, 3 Drawing Sheets



5,020,148 May 28, 1991

Image Suppression Harmonic Frequency Converter Operating in the Microwave Field

Inventor: Paolo Bonato.
Assignee: Siemens Telecommunicazioni S.p.A.
Filed: Dec. 22. 1988.

Abstract—An image suppression harmonic frequency converter capable of operating in any microwave range is described. Frequency conversion is obtained by making use of a local frequency which is half that of a conventional converter. In particular, the RF reception signal is converted into an intermediate frequency signal with suppression of the converted image band. Similarly, the intermediate frequency signal to be transmitted is converted into a single side-band RF transmission signal. The converter comprises two harmonic mixers, a first inquadrature RF hybrid coupler, a second inquadrature intermediate frequency hybrid coupler, two appropriate duplexer filters, two low-pass filters, two matching circuits, and two decoupling circuits.

15 Claims, 2 Drawing Sheets