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.

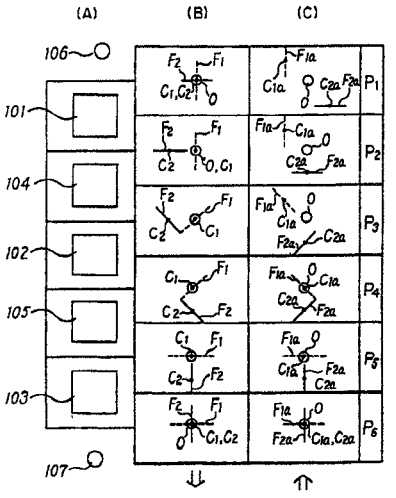
5,151,955 Sept. 29, 1992

Optical Isolator

Inventors: Hiroshi Ohta and Noriyuki Nakamura.
Assignee: Kabushiki Kaisha Shinkosha.
Filed: Nov. 9, 1990.

Abstract—An optical isolator having three or four birefringent crystals and two magneto-optic elements is disposed between two light waveguides to prevent reverse-directed light from returning to the light waveguide on the light-source side. Forward-directed light emitted from the light waveguide on the light-source side is allowed to properly enter into the other light waveguide, whereas the reverse-directed light returning reflectively toward the light waveguide on the light-source side is separated into two polarized component and undergoes polarization rotation while propagating in the optical isolator, to thereby advance out of the optical axis of the light-source side light waveguide.

2 Claims, 3 Drawing Sheets



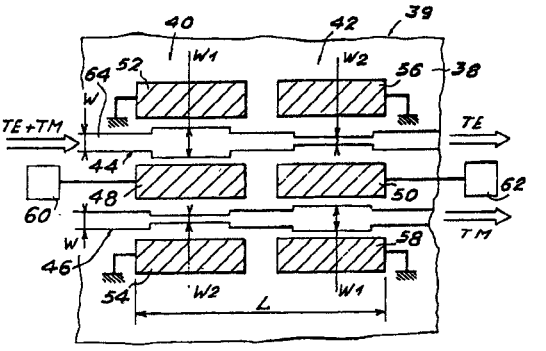
5,151,957 Sept. 29, 1992

Polarization Beam Splitter for Guided Light

Inventors: Luc Riviere.
Assignee: France Telecom Etablissement Autonome de Droit Public (Centre National d'Etudes des Telecommunications).
Filed: Oct. 23, 1991.

Abstract—This (e.g., Z-propagating, X-cut $LiNbO_3$: Ti splitter) comprises an alternating delta beta directional coupler (39) able to introduce, in the absence of a voltage between its electrodes, a delta beta variation between its propagation constants, which is a) independent of the polarization state of the guided lightwave and b) such that the representative point of the coupler on its control diagram is the center of a segment parallel to the abscissa axis of the reference frame in which the diagram is plotted, and defined by two curves respectively corresponding to parallel states and crossed states of the coupler. Application to integrated optics.

8 Claims, 4 Drawing Sheets



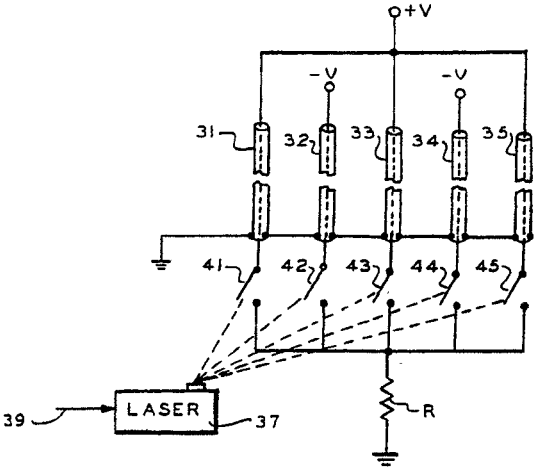
5,153,442 Oct. 6, 1992

High-Power, Solid-State RF Pulse Generators

Inventors: Lawrence J. Bovino, Maurice Weiner, and Anderson H. Kim.
Assignee: The United States of America as represented by the Secretary of the Army.
Filed: Jan. 3, 1991.

Abstract—A high-power, solid-state burst generator for producing RF pulses includes a plurality of transmission lines, such as coaxial cables, having one end connected across a load via a plurality of photoconductive switches, one for each line. The other end of the transmission lines are terminated in open ends and connected to a charging dc voltage. One set of lines is connected to a positive dc voltage +V while other set is connected to a negative dc voltage –V. a laser is coupled to one end of a plurality of fiberoptic lines, each having a different length, for simultaneously launching switch pulses thereon. The other ends of the fiber optic lines are each coupled to a different one of the photoconductive switches for closing and opening the switches in a sequential fashion such that the lines are sequentially discharged through the load to generate a cyclic series of pulses.

9 Claims, 2 Drawing Sheets



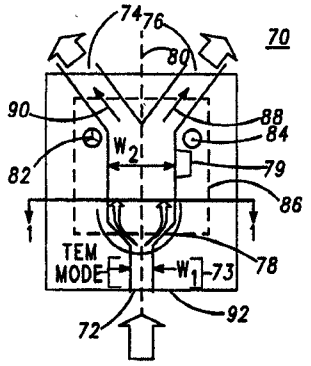
5,153,538 Oct. 6, 1992

Microwave Edge Guide Mode Signal Splitter and Combiner

Inventor: Robert C. Kane.
Assignee: Motorola, Inc.
Filed: June 13, 1991.

Abstract—A broad-band microwave waveguide radio frequency splitter and combiner (70 and 100) can be realized by using TEM mode wave propagation to edge guide mode wave propagation conversion performed by magnetically biased material (16) and directionally opposed magnetic fields (20 and 22) and a waveguide such as a microstrip (10) or a stripline (50) to spatially separate a TEM mode signal into two or more components.

11 Claims, 2 Drawing Sheet



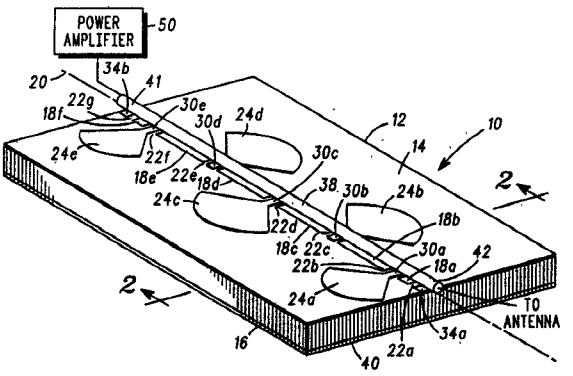
5,153,542 Oct. 6, 1992

Multidielectric Microstrip Filter

Inventors: Lite D. Tai and Michael W. Petersen.
Assignee: Motorola, Inc.
Filed: June 5, 1991.

Abstract—A multidielectric electrical filter is adapted for passing a primary electrical signal at a first frequency while attenuating higher frequency signals, most notably harmonic spurs. The filter comprises an elongated transmission line and one or more radial pads overlying a first surface of a dielectric support opposite a ground plate. The support is formed of a first dielectric material to achieve a desired capacitive coupling between the pad and the ground plate effective to attenuate the higher frequency signals. The support further comprises a region underlying the transmission line and containing a second dielectric material having a dielectric constant distinct from the first material. Preferably, the region includes one or more slots containing air to minimize the capacitive coupling between the transmission line and the ground plate and thereby reduce insertion loss of the primary signal that would otherwise lessen the power of the signal to the antenna.

12 Claims, 1 Drawing Sheet



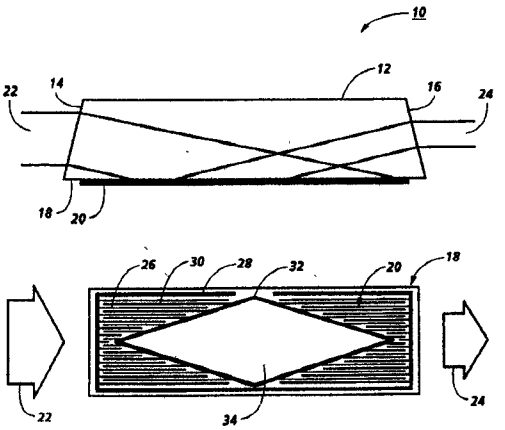
5,153,770 Oct. 6, 1992

Total Internal Reflection Electrooptic Modulator

Inventor: Ellis D. Harris.
Assignee: Xerox Corporation.
Filed: June 27, 1991.

Abstract—The TIR modulator has an electrode array distributed across an area of the reflecting surface of the electro-optic material. The electrode array has interdigitated electrodes extending inward from a rectangular-shaped outer electrode conducting block and outward from a diamond-shaped inner electrode conducting block. A diamond-shaped area with no electrodes is preferably symmetrically within the inner electrode conducting block of the electrode array on the reflecting surface. The uniform voltage difference between the electrodes and the varying lengths of the electrodes creates a fringe electrical field in the electrooptical material and an optical phase grating to diffract the incident light on the reflecting surface. The zero-order nondiffracted light becomes the output beam. The optical phase grating will control the incident beam's optical profile at the modulator (near field) and hence the imaged spot size at a focus at the image plane (far field). Alternatively, the TIR modulator can be a diamond-shaped interdigitated electrode pattern within a rectangular shaped area with no electrodes. Using Schlieren optics, the nonzero order diffracted beam becomes the output beam with a modulated optical beam profile. Alternatively, the TIR modulator can have uniform lengths to a rectangular interdigitated electrode pattern but varying voltage differences between electrodes.

7 Claims, 3 Drawing Sheets



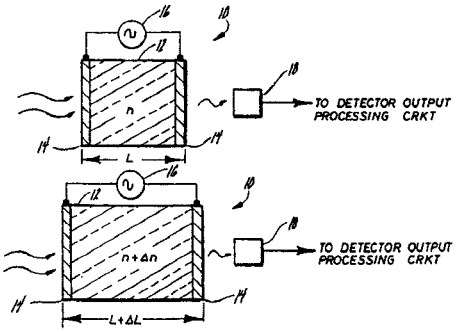
5,153,771 Oct. 6, 1992

Coherent Light Modulation and Detector

Inventors: Charles A. Link and Paul D. Lang.
Assignee: Northrop Corporation.
Filed: July 18, 1990.

Abstract—A acoustooptic Fabry–Perot optical modulator (10) has a crystalline body (12) having a first partially reflective electrode (14) for receiving radiation, including laser radiation having a wavelength or wavelengths of interest, and a second, oppositely disposed partially reflective electrode (14) for emitting the received radiation including the laser radiation. The modulator is driven by an alternating source (16) at a resonant frequency of the crystalline body and intensity modulates at the resonant frequency only the emitted laser radiation. A detector (18) is positioned for receiving the emitted radiation, including the intensity modulated laser radiation, and has an output signal expressive of the intensity of the emitted radiation. Signal processing circuitry (20, 34) is coupled to the detector output signal and is responsive thereto for identifying the intensity modulated laser radiation for indicating when laser radiation is received by the modulator.

15 Claims, 2 Drawing Sheets



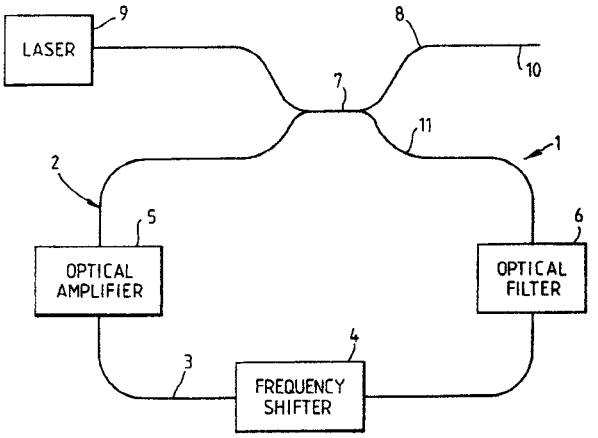
5,153,993 Oct. 6, 1992

Apparatus for Generating a Comb of Optical Teeth of Different Wavelengths

Inventors: David W. Smith, Peter Healey, Ian W. Stanley, Terence G. Hodgkinson, and Phillip Coppin.
Assignee: British Telecommunications public limited company.
Filed: Feb. 26, 1990.

Abstract—Apparatus for generating of a comb having a large number optical teeth and comprises an optical loop (3) including an optical amplifier (5) a frequency shifter (4) and an optical filter (6). A signal from a laser (9) is partially coupled into the loop by a coupler (7) such that a part of it is output at output port (10). The signal in the loop (the feedback signal) is amplified by the amplifier (5) and frequency shifted by the frequency shifter (4) and is then partially coupled out of the loop by coupler (7). The part coupled out of the loop (the output signal) exits via output port (10). This process is repeated to produce the desired number of output signals exiting via output port (10). The signal from the laser (9) may be continuous or pulsed.

13 Claims, 1 Drawing Sheet



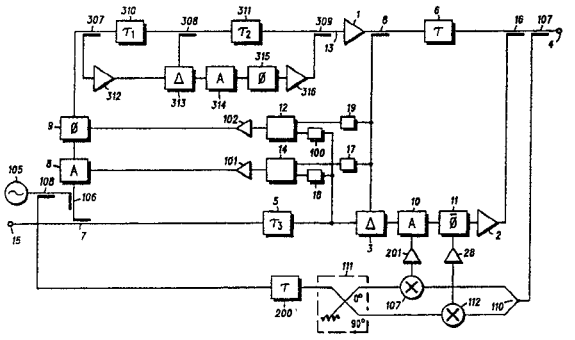
5,155,448 Oct. 13, 1992

Feed-Forward Amplifier Having Increased Compression Point

Inventor: Jack Powell.
Assignee: Motorola, Inc.
Filed: Nov. 12, 1990.

Abstract—In order to improve the distortion performance of a feed forward corrected amplifier, an amplifier arrangement includes a distortion generator (312) which is coupled between an input (15) and a main amplifier (1). The amplifier arrangement is such that the input signal passes to the distortion generator (312) via a coupler (307). The signal passes via a delay network (310) which compensates for the delay of the distortion generator (312) and is tapped by a coupler (308) to be combined by a coupler (313) with the distorted signal from the distortion generator (312). In this way the output of the distortion generator is subtracted from a sample of the input signal so that only the distortion remains to pass via phase (314) and amplitude (315) correction networks to be amplifier by a gain element (316) before being coupled back into the main signal path by a coupler (309). The correction is active over a portion of the main amplifier characteristics such as the compression region of the main amplifier. Hence, the main amplifier (1) compression point may be raised. Raising the compression point increases the overall power handling capability of the main amplifier by increasing the level at which the overall arrangement will saturate to cause distortion.

2 Claims, 2 Drawing Sheets



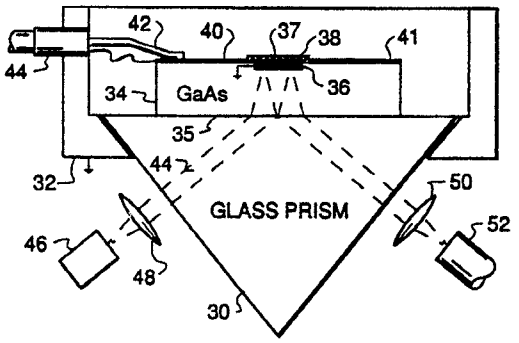
5,155,617 Oct. 13, 1992

Electrooptic Attenuated Total Internal Reflection Modulator and Method

Inventors: Olav Solgaard and John I. Thackara.
Assignee: The Board of Trustees of the Leland Stanford Junior University.
Filed: June 13, 1991.

Abstract—Method and apparatus for electro-optically modulating the intensity of an incident light beam including a coupling prism with a high reflective index, a semiconductor substrate in optical contact with the coupling prism and having a conductive area formed therein, an organic electro-optic film formed on the substrate and covering at least a portion of the conductive area, and a transmission line disposed above the electrooptic film and cooperating with the conductive area to form electrodes for use in applying an electric field across the electro-optic film. Light directed through the substrate by the coupling prism couples with surface plasmons at the film-to-metal interface and is selectively reflected or absorbed depending upon whether or not an electric field is applied.

12 Claims, 5 Drawing Sheets



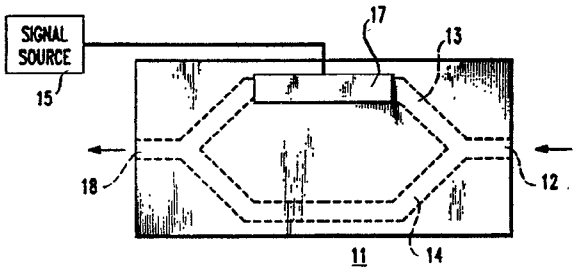
5,155,620 Oct. 13, 1992

Nonlinear Optical Devices and Methods

Inventors: Heidi M. Gordon, William R. Holland, Hung C. Ling, and Gary L. Wolk.
Assignee: AT&T Bell Laboratories.
Filed: June 19, 1991.

Abstract—An optical waveguide circuit including a nonlinear optical device comprises a metal ground plane (21), a polymer core layer (25) in which optical waves are propagated, and polymer clad layers (22 and 26) on opposite sides of the core layer. The waveguide paths are defined by troughs (23) in one of the clad layers. The nonlinear device is made by electro-optically poling part of the core layer which contains a nonlinear moiety. The clad layers (26 and 22) have a significantly higher conductivity than that of the core layer (25) which improves the efficiency of the electrooptic poling.

16 Claims, 2 Drawing Sheets



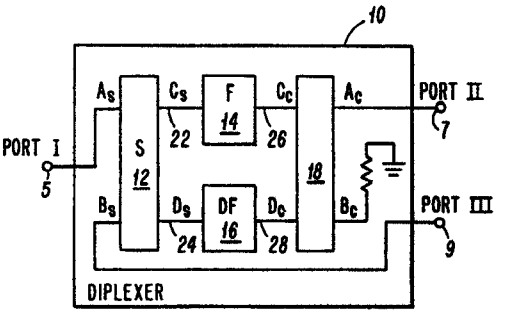
5,155,724 Oct. 13, 1992

Dual Mode Diplexer/Multiplexer

Inventor: Richard C. Edwards.
Assignee: Rockwell International Corporation.
Filed: Sept. 26, 1990.

Abstract—A broad-band diplexer for use in dividing input signals in accordance with frequency and in constructing multiplexers including multiple diplexers. The diplexer includes a pair of 0-degree couplers one of which is configured as a signal splitter while the other is configured as a signal combiner. A pair of filters having identical frequency selection characteristics but opposite impedance and admittance characteristics are connected in between the splitter and the output port of the combiner. In operation, input signals are received at the input port to the splitter and output signals are provided at the isolation port of the splitter and the output port of the combiner. The couplers and filters act in combination to divide the input signals in accordance with frequency so that the output signals have complementary spectra. The use of 0-degree couplers allows for very broadband performance by the diplexer.

11 Claims, 4 Drawing Sheets



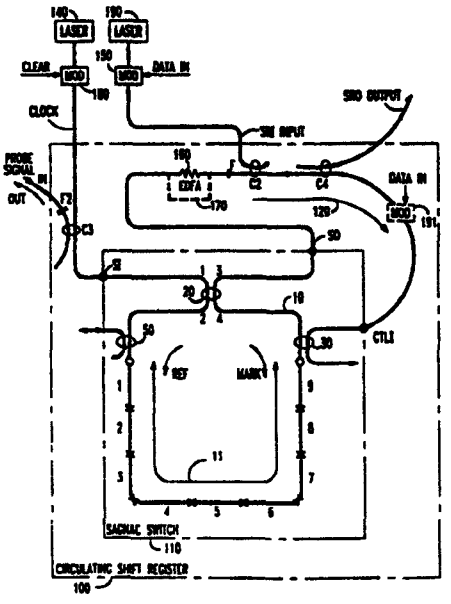
5,155,779 Oct. 13, 1992

Optical Circulating Shift Register

Inventors: Hercules Avramopoulos, Christina Gabriel, Alan Huang, and Norman A. Whitaker, Jr.
Assignee: AT&T Bell Laboratories.
Filed: Nov. 5, 1991.

Abstract—An all-optical circulating shift register encodes a received optical clock signal with a value derived from an encoded optical signal received at a control port thereof. A data input to the shift register is used to modify an encoded optical signal. The resulting encoded clock signal, appearing at an output port, is coupled back to the control port. The shift register uses the encoded clock signal at the control port to encode a subsequently-received clock signal. In one embodiment, the optical shift register is implemented using a Sagnac switch having a feedback path coupled between an output port and a control port of the Sagnac switch.

27 Claims, 4 Drawing Sheets



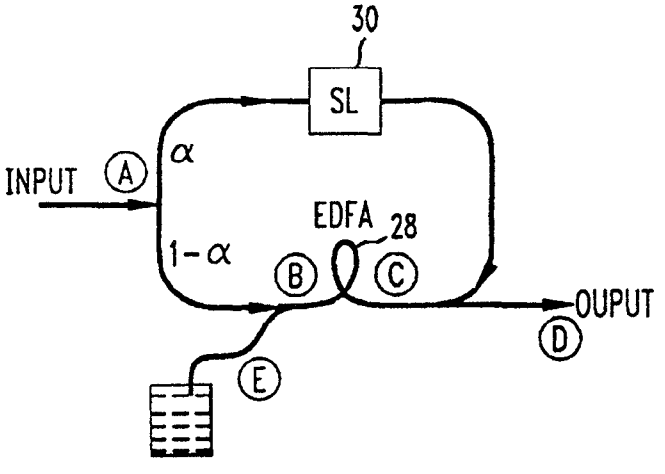
5,155,780 Oct. 13, 1992

Optical Limiting Amplifier

Inventor: Martin Zirngibl.
Assignee: AT&T Bell Laboratories.
Filed: Jan. 27, 1992.

***Abstract*—This invention relates to an optical limiting amplifier which provides an optical output signal of substantially constant power for an optical input signal of varying power which is simple to construct and economical to build. In this invention, an optical signal whose power can fluctuate over a wide range is split into two signals. The first signal is applied to an optical fiber amplifier in the forward feed direction. The second signal is passed through a saturable absorber and then applied to the optical fiber amplifier in the backward feed direction. The signal from the saturable absorber varies at a rate which is greater than the rate that the signal to the saturable absorber varies. Thus, as the signal to the saturable absorber increases, the signal from the saturable absorber will increase at a greater rate; and, as the signal to the saturable absorber decreases, the signal from the saturable absorber will decrease at a greater rate. The backward feed signal effects the gain saturation of the optical fiber amplifier in such a way as to cause the output power of the optical fiber amplifier to be constant regardless of variations to the input signal power.**

11 Claims, 4 Drawing Sheets



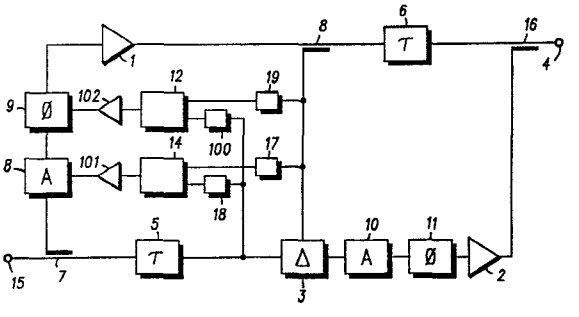
5,157,346 Oct. 20, 1992

RF Wide-Band High-Power Amplifier

Inventors: Jack Powell and Thomas Ha.
Assignee: Motorola, Inc.
Filed: Nov. 12, 1990.

***Abstract*—An RF wide-band high-power amplifier (1) receives an input signal at its input via a coupler (7) whenever a signal for amplification is applied to an input port (15). The output of the amplifier (1) is tapped by a coupler (8) and fed to an input of a comparator (3). The input signal applied at the input port (15) is fed to a second input of the comparator (3) via a delay line (5), arranged to introduce a delay substantially equal to that of the power amplifier (1). The comparator (3) produces at its output an error signal representative of the difference between the input signal fed via the amplified and the delayed path. A combiner (16) serves to introduce the amplified error signal to the amplifier output signal such that the error signal is in anti-phase therewith. Thus, the resultant signal produced at an output port (4) has had feed forward distortion cancellation. In accordance with the present invention the arrangement further includes an amplitude compensating network (8) in the form of a PIN-diode attenuator, controlled by a signal from a comparator (14). The comparator (14) provides a control signal to the attenuator (8) in accordance with the respective levels of signal from a first detector (17) and a second detector (18). The feedback control loops are arranged to function with a fast response time with respect to the period of the highest frequency of the input signal.**

4 Claims, 4 Drawing Sheets



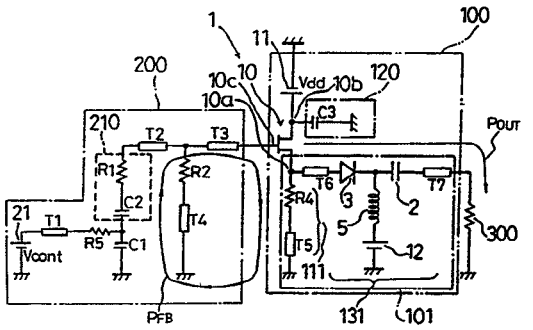
5,157,357 Oct. 20, 1992

Monolithic Microwave IC Iscillator

Inventor: Takayuki Katoh.
Assignee: Mitsubishi Denki Kabushiki Kaisha.
Filed: July 25, 1991.

***Abstract*—A monolithic microwave IC oscillator includes a feedback amplifier having a field effect transistor and a varactor diode. The varactor diode has a junction capacitance that varies according to the bias voltage applied to said diode and capacitively couples the amplifier to an external load. Any variation of the capacitance of the load-coupling capacitor caused by design errors or by variations in the manufacturing process can be easily corrected when the device is used. As a consequence, the oscillator can always be operated with good oscillating characteristics without hindering integration of individual components and without increasing costs.**

15 Claims, 8 Drawing Sheets



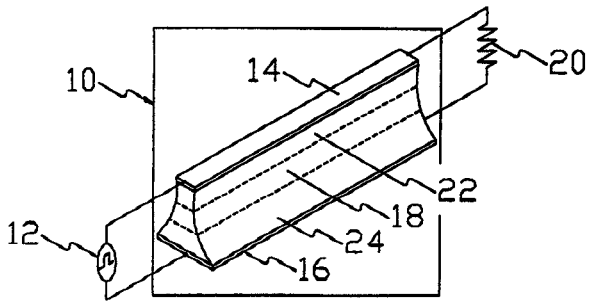
5,157,361 Oct. 20, 1992

Nonlinear Transmission Line

Inventors: Michael E. Gruchalla and David C. Koller.
Filed: May 10, 1991.

Abstract—The present invention comprises a novel semiconductor device which further comprises a nonlinear transmission-line structure. The semiconductor device is that of a very long narrow voltage-dependent capacitor, such as a semiconductor diode or MOS capacitor, where the anode and cathode electrodes comprise the conductors of a transmission line and the depletion region comprises the dielectric of the transmission line. An input signal is applied at one end of the long, narrow structure. Such signal application results in the launch of a traveling wave traveling along the transmission-line structure. At the far end of the transmission-line structure, the signal is coupled out and applied to a load. The temporal and spatial modulation of the depletion capacitance of the semiconductor device as the traveling wave travels along the transmission-line structure results in temporal compression of the input signal. Input signals of comparatively slow transition time therefore have their transition time reduced such that the transition time of the output signal is much faster than that of the input signal. Output signals exhibiting picosecond transition times may be obtained from input signals exhibiting nanosecond transition times. Further, since the nonlinear transmission line according to the present invention may incorporate many of the properties of conventional semiconductor devices, but in a novel configuration, comparatively high-voltage nonlinear transmission lines according the present invention may be fabricated to provide correspondingly high-voltage, or high-current, output signals.

20 Claims, 5 Drawing Sheets



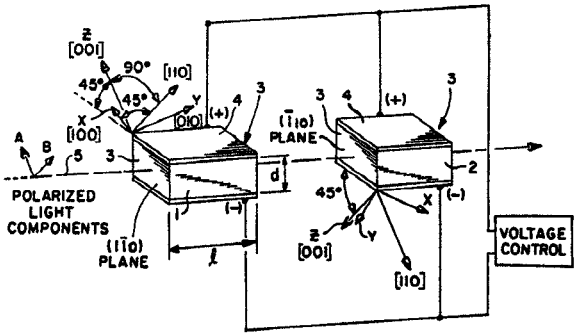
5,157,539 Oct. 20, 1992

Multielement Electrooptic Modulators with Crystal Axes Oriented Obliquely to Direction of Electric Field

Inventor: J. Donald Beasley.
Assignee: Cleveland Crystals, Inc.
Filed: Jan. 22, 1991.

Abstract—The concept of using only a component of an applied electric field to control the electrooptic response in each element of a multi-crystal electrooptic modulator comprising a matched grouping of birefringent electrooptic elements is disclosed. The foregoing concept permits the orientation of the polarization eigenvectors of the grouped elements to compensate for the effects of the static birefringence of the material comprising the elements while retaining the use of parallel applied electric fields and eliminating the need for an interposed optical rotator or waveplate.

19 Claims, 1 Drawing Sheet



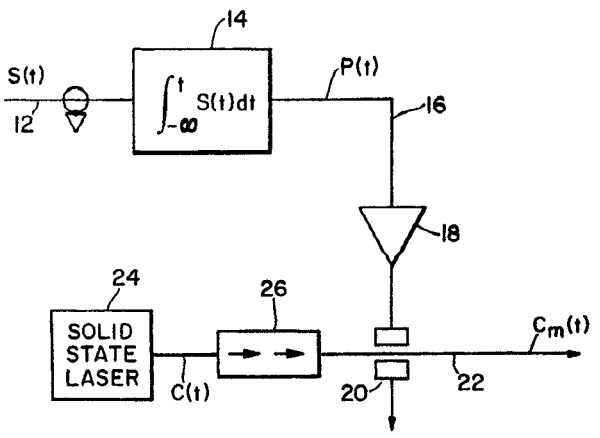
5,157,542 Oct. 20, 1992

Optical FM Modulation System

Inventors: Daniel J. Fitzmartin and Edmund J. Balboni.
Assignee: The Charles Stark Draper Laboratory, Inc.
Filed: Jan. 15, 1991.

Abstract—An optical FM modulation system includes a continuous wave optical light source for producing an optical carrier wave; integration means, responsive to an FM modulating signal, for generating a phase signal representative of the phase variations corresponding to the frequency variations of the FM modulating signal; and an electro-optic phase modulator, responsive to the electrical signal representative of the phase variations, for shifting the phase of the optical carrier wave to modulate the frequency of the optical carrier wave as a function of the modulating signal.

9 Claims, 4 Drawing Sheets



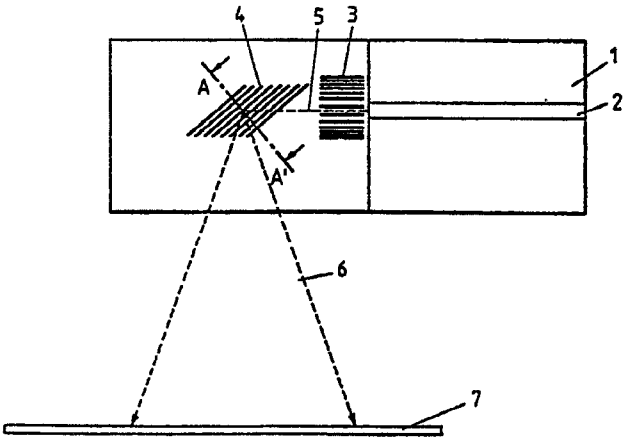
5,157,543 Oct. 20, 1992

Optical Beam Deflector

Inventors: Tadashi Fukuzawa, Storu S. Kano, and Yukata Takahashi.
Assignee: International Business Machines Corporations.
Filed: Dec. 10, 1990.

Abstract—An apparatus for changing the direction of an optical beam comprises a thin film grating deflector; an optical energy source for providing optical energy to strike the deflector at a first angle with respect to gratings of the deflector and to exit the deflector at a second angle with respect to the gratings; and elements for applying a voltage to the deflector to vary the second angle. The optical energy source preferably comprises a laser diode; and a collimator for coupling energy from the laser diode to the grating deflector. The grating deflector is a planar waveguide including a plurality of stacked quantum wells formed of GaAs separated by barriers of AlGaAs. Optical energy provided to the rating deflector in a first direction is deflected in a second direction. These directions define a plane in which the waveguide is disposed. The quantum wells are stacked in a direction perpendicular to a plane of the waveguide. The optical energy source, the thin film grating deflector, the voltage applying elements and the collimator may be integrated into a single chip.

18 Claims, 8 Drawing Sheets



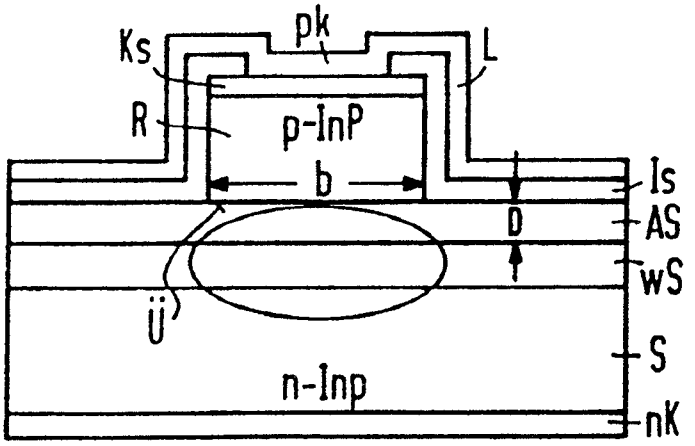
5,157,748 Oct. 20, 1992

Controllable Integrated Optical Directional Coupler

Inventors: Gustav Mueller and Lothar Stoll.
Assignee: Siemens Aktiengesellschaft.
Filed: Aug. 14, 1991.

Abstract—An integrated optical directional coupler is formed of two strip waveguides integrated on a substrate. A strip waveguide section in a coupling section of the directional coupler is designed as a controllable strip waveguide. The strip waveguides outside of this section are passive strip waveguides. In order to guarantee a largely polarization-dependent function of this coupler and of an optical switch realized therewith, the passive waveguides comprise a defined, different strip waveguide structure than the controllable strip waveguide.

17 Claims, 1 Drawing Sheet



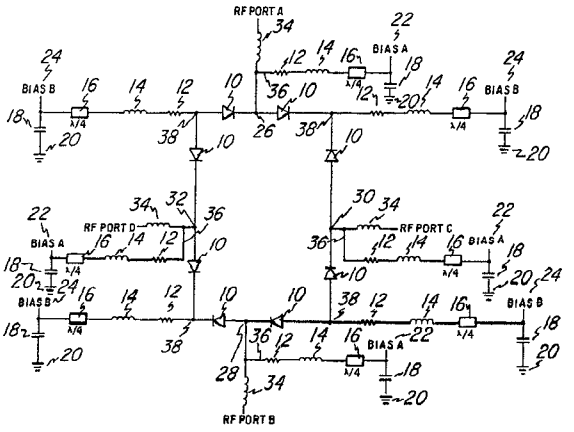
5,159,296 Oct. 27, 1992

Four-Port Monolithic GaAs Pin Diode Switch

Inventor: Stephen R. Nelson.
Assignee: Texas Instruments Incorporated.
Filed: Mar. 28, 1991.

Abstract—This is a monolithic PIN diode switch circuit. The switch comprises: input ports, output ports, bias nodes and PIN diodes. Each port or node is connected to receive a bias signal. Preferably the PIN diodes are fabricated from GaAs or other III–V compounds. This monolithic PIN diode switch offers broader band performance and smaller size. Other methods and devices are disclosed.

9 Claims, 2 Drawing Sheets



5,159,297 Oct. 27, 1992

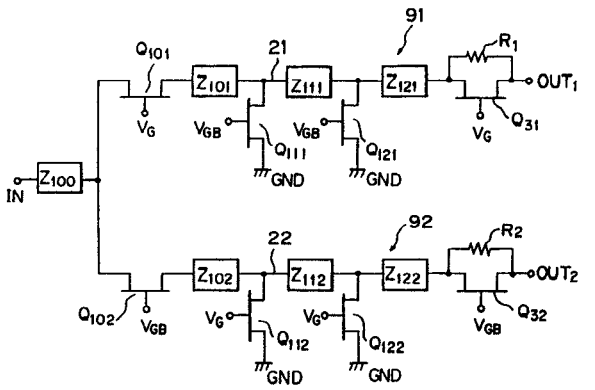
Switching Circuit Having Constant Impedance Regardless Switching Operation Thereof

Inventor: Yasunori Tateno.
Assignee: Fujitsu Limited.
Filed: May 30, 1991.

Abstract—A switching circuit comprises a transmission line having a specific impedance value and connected to an input terminal, a first switching portion including a plurality of first transistors connected in parallel between

the transmission line and the ground, and a second switching portion including a second transistor and a resistor connected in parallel between the transmission line and an output terminal. The first transistors of the first switching portion and the second transistor of the second switching portion are complementally switched. Consequently, the switching circuit can be enabled to impedance-match with an objective circuit (for example, a measurement apparatus, a transceiver, a phased array system, and the like), and loss of signal transfer can be decreased regardless of the switching ON or OFF states of the switching circuit.

16 Claims, 10 Drawing Sheets



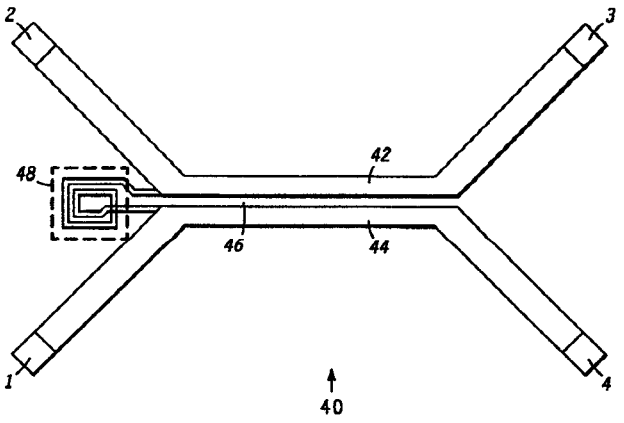
5,159,298 Oct. 27, 1992

Microstrip Directional Coupler with Single Element Compensation

Inventor: Michael Dydyk.
Assignee: Motorola, Inc.
Filed: Jan. 29, 1991.

Abstract—A microstrip directional coupler which employs closed form solutions for compensating capacitance or inductance and odd mode characteristic impedance necessary to realize high directivity or match in microstrip directional couplers valid for tight and loosely-coupled sections. A microwave monolithic integrated circuit (MMIC) directional coupler with single capacitive or inductive compensation derives from a mathematical analysis using symmetry and reflection and transmission coefficients' equivalency. Closed form solutions for the compensating capacitance or inductance and a new odd mode characteristic impedance are generated. The results are implemented in single antisymmetric inductive and antisymmetric and symmetric capacitive compensated versions.

8 Claims, 3 Drawing Sheets



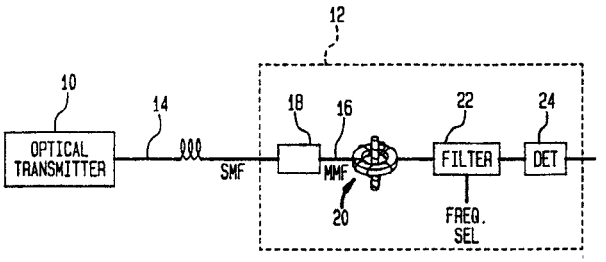
5,159,481 Oct. 27, 1992

Polarization Scrambler for Polarizaiton-Sensitive Optical Devices

Inventor: Mari W. Maeda.
Assignee: Bell Communications Research, Inc.
Filed: Sept. 14, 1990.

Abstract—A polarization scrambler comprising a multi-mode fiber spirally or preferably toroidally wrapped about a cylinder or toroid. The multi-mode fiber receives an optical signal from a long single-mode fiber. The optical output of the scrambler has an equal distribution of the two polarization states. Therefore, it can be passed through a polarization-sensitive filter or other optical device. The invention allows a low-cost receiver in a wavelength-division multiplexing communications system.

18 Claims, 1 Drawing Sheet



5,159,487 Oct. 27, 1992

Optical Parametric Oscillator OPO Having a Variable Line Narrowed Output

Inventors: Allen R. Geiger and Narasima S. Prasad.
Assignee: LaSen, Inc.
Filed: May 29, 1991.

Abstract—An optical parametric oscillator includes a pump laser for producing a pump beam, an optical resonator, an OPO crystal disposed within the optical resonator aligned with and responsive to the pump beam to produce a parametrically generated output, and a device external to the optical resonator for line narrowing the parametrically generated output. In one embodiment of the invention, the device is a grating and in another embodiment of the invention the device is an acoustooptic cell.

17 Claims, 2 Drawing Sheets