

# Patent Abstracts

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5,291,569

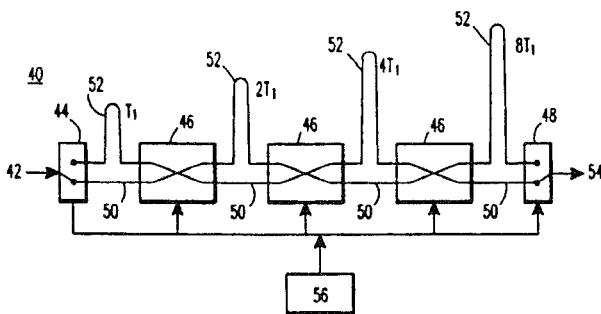
Mar. 1, 1994

## Fiberoptic Delay Line for Generating Replicas of an RF Signal with Variable Replica-to-Replica Time Resolution

Inventors: Anastasios P. Goutzoulis and David K. Davies.  
Assignee: Westinghouse Electric Corp.  
Filed: May 8, 1992.

**Abstract**—A fiberoptic delay line architecture for generating multiple replicas of an input RF signal with variable replica-to-replica time resolution is provided in which the required hardware is kept to a minimum. A series of cascaded binary fiberoptic segment delay lines is used in which each cascaded binary fiberoptic segment delay line has an equal and defined number of segments but variable minimum time resolution. The minimum time resolution of each cascaded binary fiberoptic segment delay line increases by a multiple of two compared to the prior cascaded binary fiberoptic segment delay line. In this manner, the required number of segments and switches increases in a  $\log_2 \times \log_2$  relationship as the number of desired replicas and possible replica-to-replica delay values increases.

14 Claims, 2 Drawing Sheets



5,293,037

Mar. 8, 1994

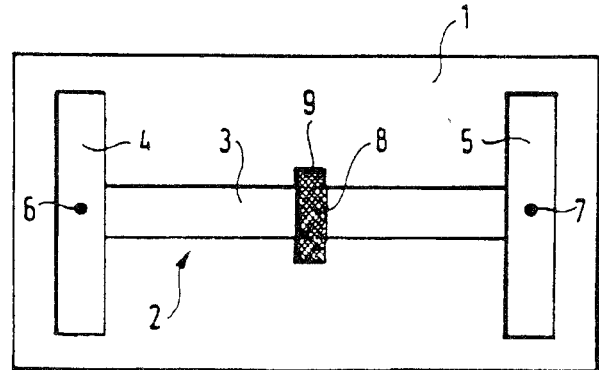
## Opto-Electronic Converter with Electron Mirrors and Quantum Wire

Inventors: Alain Le Mehaute and Christian Joachim.  
Assignee: Alcatel Alsthom Compagnie Generale d'Electricite.  
Filed: July 20, 1992.

**Abstract**—An opto-electronic converter comprises a mesoscopic resonant cavity constituted by a quantum wire made of a material that is a conductor or a semiconductor and situated between two electron mirrors of nanometer

size, the said wire being interrupted over a gap having a width of a few tens of Å, into which gap a photosensitive material is inserted, tabs being provided at the ends of said cavity to pass an electrical current.

13 Claims, 1 Drawing Sheet



5,293,436

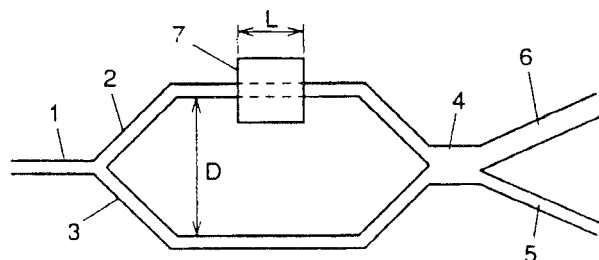
Mar. 8, 1994

## Integrated Optical Device Adjustable as a Polarization Splitter by Means of a Mach-Zehnder Interferometer

Inventor: Martinus B. J. Diemeer.  
Assignee: Koninklijke PTT Nederland N.V.  
Filed: Oct. 20, 1992.

**Abstract**—The invention relates to an integrated optical device which comprises an adjustable Mach-Zehnder interferometer. The waveguide structure of the device is fabricated on the basis of polable unpoled material, the material in one (2) of the branches (2, 3) of the MZ interferometer being poled in a certain area (7). In the case of maximum poling in advance, the degree of poling of the poled material can subsequently be adjusted under conditions of accelerated thermal relaxation. Advantage: the device can first be fabricated, as far as its structure is concerned, using fabrication techniques which are standard for the selected material without additional attention to correct sizing, after which the interferometer section can then be adjusted in a simple manner to the optical pathlength differences required for the specific function of the device. As an example, a passive polarisation splitter is described.

7 Claims, 1 Drawing Sheet



5,293,545

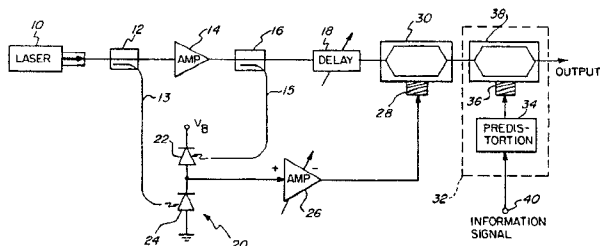
Mar. 8, 1994

**Optical Source with Reduced Relative Intensity Noise**

Inventor: David R. Huber.  
 Assignee: General Instrument Corporation.  
 Filed: July 27, 1992.

**Abstract**—Apparatus is provided for producing an optical carrier with low relative intensity noise. A portion of light output from a light source is sampled. An error signal representative of the relative intensity noise contained in the light output is generated. The error signal is subtracted from the light output from the light source to provide an optical carrier in which the relative intensity noise has been substantially reduced. The error signal can be subtracted using either an external optical intensity modulator or by converting the electrical signal to an optical signal and directly coupling it to the light output from the light source.

16 Claims, 3 Drawing Sheets



5,294,899

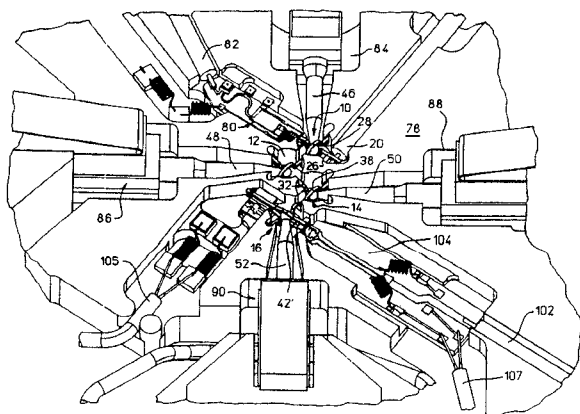
Mar. 15, 1994

**Yig-Tuned Circuit with Rotatable Magnetic Polepiece**

Inventor: Hassan Tanbakuchi.  
 Assignee: Hewlett-Packard Company.  
 Filed: July 29, 1992.

**Abstract**—A tunable ferrimagnetic resonator circuit includes a fixed magnetic polepiece, a rotatable magnetic polepiece spaced from the fixed polepiece, an electromagnet for varying a magnetic field between the fixed and rotatable polepieces and a plurality of ferrimagnetic resonators connected in series and located in the magnetic field between the fixed and rotatable polepieces. The ferrimagnetic resonators include an initial resonator having an input port, a final resonator having an output port and one or more intermediate resonators. The rotatable polepiece preferably has a poleface having a first surface region that causes a constant magnetic field to be applied to the intermediate resonators as the polepiece is rotated, and second and third surface regions that cause variable magnetic fields to be applied to the initial and final resonators, respectively, as the polepiece is rotated. The polepiece is rotated to a position where each of the resonators is tuned to substantially the same resonance frequency.

19 Claims, 7 Drawing Sheets



5,295,013

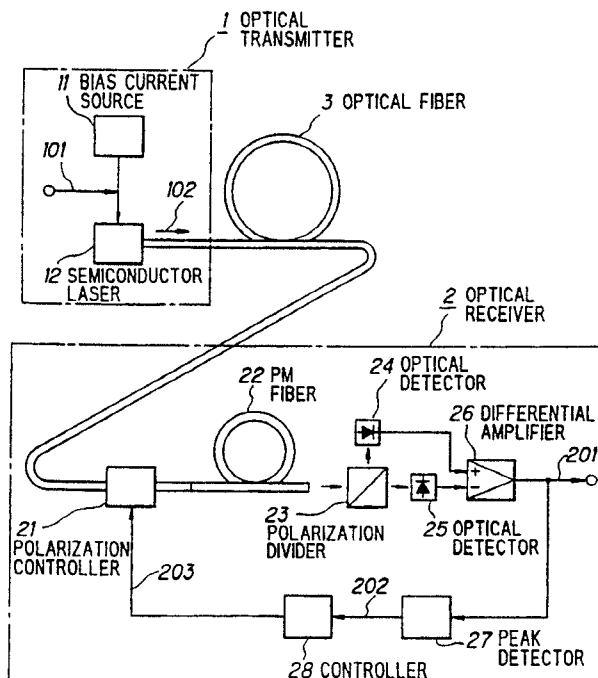
Mar. 15, 1994

**Optical Receiver of Direct Detection Type**

Inventor: Takashi Ono.  
 Assignee: NEC Corporation.  
 Filed: Mar. 22, 1993.

**Abstract**—An optical receiver according to the present invention is used for detecting FSK or PSK signal light directly. The receiver has a PM fiber and a peak detector. The peak detector detects an amplitude of a demodulated output signal. In accordance with an output signal of the peak detector, a polarization condition of a signal light to be supplied to the PM fiber is controlled so as to keep the output of the peak detector maximum.

9 Claims, 4 Drawing Sheets



5,295,015

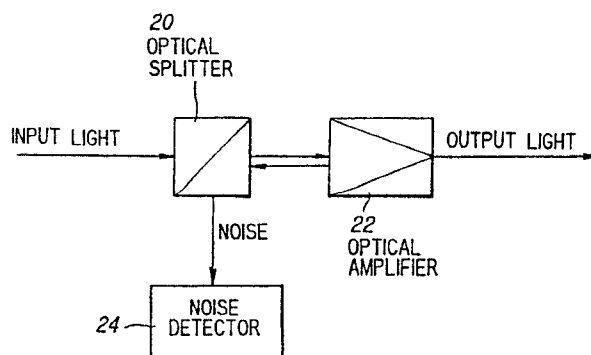
Mar. 15, 1994

**Optical Amplifying Apparatus**

Inventor: Kenichi Yoneyama.  
 Assignee: NEC Corporation.  
 Filed: Mar. 1, 1993.

**Abstract**—An optical amplifying apparatus of the present invention has an optical amplifier for directly amplifying an input signal, and an optical splitter for reflecting a noise light which occurs in the amplifier and is supplied backward therefrom. An amount of the backward noise light is used to detect an S/N ratio of an output light or the like.

11 Claims, 2 Drawing Sheets



5,295,016

Mar. 15, 1994

5,296,821

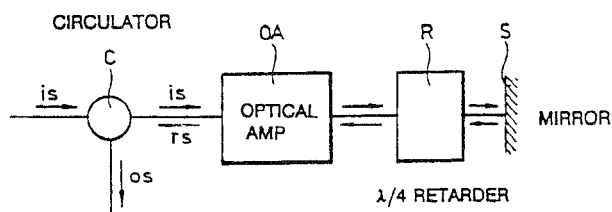
Mar. 22, 1994

### Polarization Insensitive Amplification Device

Inventor: Mattijs O. Van Deventer.  
 Assignee: Koninklijke Ptt Nederland, N.V.  
 Filed: May 29, 1992.

**Abstract**—A polarization-independent amplification device comprising an optical semiconductor amplifier. The amplification device input signal is fed to one side of the amplifier and a reflector is provided at the other side. The amplification device output signal, formed by the amplification device input signal reflected by the reflector and amplified by the amplifier, is taken off at the first side of the amplifier. The reflector is reciprocal, a signal or signal component fed thereto and having a polarization perpendicular to the principal axis of the amplifier being reflected as a reflection signal having a polarization which is virtually parallel to said principal axis and vice versa.

15 Claims, 1 Drawing Sheet



5,295,218

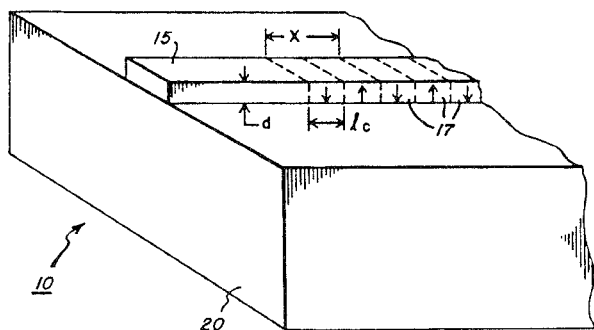
Mar. 15, 1994

### Frequency Conversion in Inorganic Thin Film Waveguides by Quasi-Phase-Matching

Inventors: John A. Agostinelli, Mool C. Gupta, Jose M. Mir.  
 Assignee: Eastman Kodak Company.  
 Filed: Sept. 29, 1992.

**Abstract**—A frequency converter/mixer has a crystalline substrate which supports an inorganic, crystalline, nonlinear optical thin film having a higher index of refraction than the substrate, to form an optical waveguide. Input radiation of frequency  $\omega_1$  which enters the waveguide propagates through the waveguide and exits as radiation having a different frequency  $\omega_2$ . The frequency conversion of the input radiation is accomplished by first-order quasi-phase-matching the input and output signals as a result of the periodicity of the sign-alternating nonlinear dielectric susceptibility coefficient of the optical thin film over an active region of the waveguide. A method of first-order quasi-phase-matching is also disclosed.

22 Claims, 1 Drawing Sheet

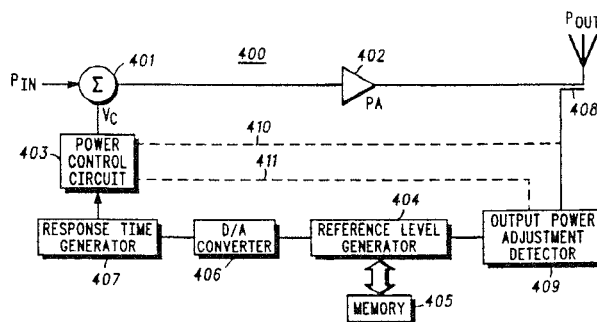


### Method and Apparatus for Controlling Transient Responses in a Power Amplifier

Inventors: Michael W. Petersen and Clark D. Fischbach.  
 Assignee: Motorola, Inc.  
 Filed: May 3, 1993.

**Abstract**—Controlling transient responses in power amplifiers may be accomplished in the following manner. Upon detecting an output power adjustment request, a reference level is accessed from memory, wherein the reference level is based on a previous output condition that is substantially equal to the requested output condition. From the reference level, a first response time is calculated and supplied to a control circuit of the power amplifier such that the power amplifier operates at a first gain level. When the first response time elapses, the power amplifier operates at a second gain level, where the first gain level is greater than the second gain level.

13 Claims, 3 Drawing Sheets



5,297,154

Mar. 22, 1994

### Fiber-Optic Amplifier with Feedback-Insensitive Pump Laser

Inventors: Rolf Heidemann and Jürgen Otterbach.  
 Assignee: Alcatel SEL A.G.  
 Filed: Apr. 30, 1993.

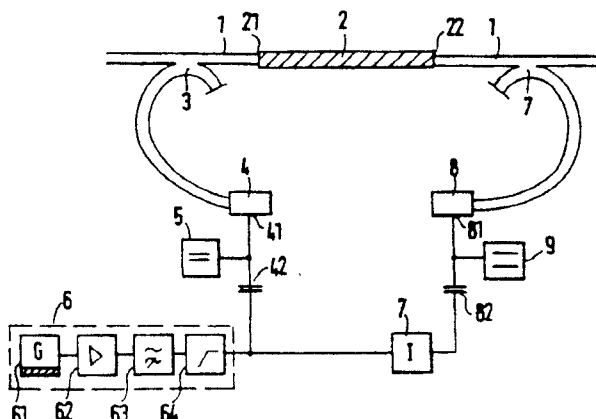
**Abstract**—Prior art fiber-optic amplifiers which are used in a fiber-optic link to amplify the light signals to be transmitted have the disadvantage that the semiconductor lasers employed as pump lasers are highly sensitive to feedback, so that the stability of the light-signal transmission is impaired by pump light reflected back into the pump lasers.

According to the invention, the operating current for such pump lasers (4) contains a noise current, so that the pump laser emits its pump light in many modes, which makes it insensitive to feedback.

To prevent the noise component of the pump light which is caused by the noise current from affecting the amplification of the light signals to be transmitted, the noise current is filtered in such a way that its spectral components have frequencies which lie above the reciprocal lifetime of that

energy level of the active laser medium which causes the amplification of the light signals.

#### 4 Claims, 1 Drawing Sheet



5,297,223

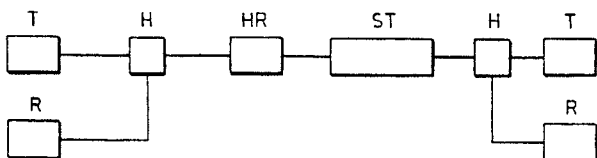
Mar. 22, 1994

### Transmission Systems for Polarization-Independent Transmission of Signals

Inventor: Mattijs O. van Deventer.  
Assignee: Koninklijke PTT Nederland N.V.  
Filed: Sept. 1, 1992.

**Abstract**—Transmission system for the polarization-insensitive transmission of signals over a signal route (ST) between a first system connection point (S1) for a transmitter (T) and a second system connection point (S3) for a receiver (R), and between two further system connection points (S2 and S4) for an additional transmitter and a receiver. On one side the high-order retarder (HR) is disposed between the system connection points and the signal route (ST). The system comprises a first and a second hybrid circuit (H1, H2) each provided with two unidirectional connection points and a bidirectional connection point. The unidirectional connection points form the system connection points (S1 to S4 inclusive). The bidirectional connection point of one of the hybrid circuit (H1) is connected via the high-order retarder (HR), and the bidirectional connection point of the other hybrid circuit (H2) is connected directly, to the signal route (ST).

#### 33 Claims, 3 Drawing Sheets



5,298,740

Mar. 29, 1994

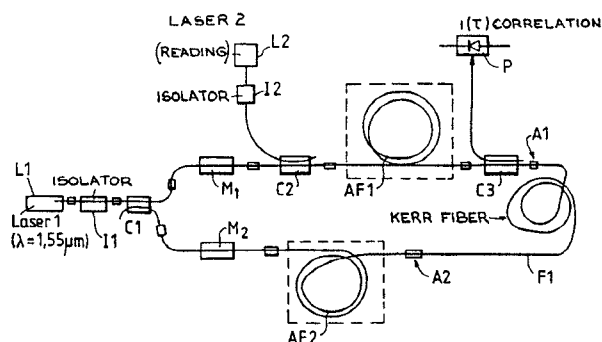
### Frequency Correlator Having a Non-Linear Optical Fiber

Inventors: Jean-Luc Ayrat, Daniel Dolfi, Jean-Pierre Huignard.  
Assignee: Thomson-CSF.  
Filed: Sept. 30, 1992.

**Abstract**—A non-linear optical fiber receives two light waves by its two ends, each light wave being modulated by means of two modulators. These light waves create photoinduced index variations in the fiber which are

proportional to the intensity of the optical field. A reading source emits a reading wave in the fiber. This reading wave is reflected at least partially by the index variation or variations. A detector receives the reflected wave and makes it possible, through the computation of the returning time of the wave, to determine the position of the index variations. Applications: very wide passband signal correlators.

#### 6 Claims, 3 Drawing Sheets



5,298,755

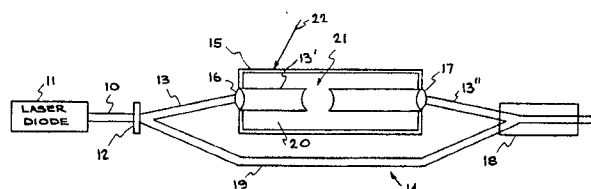
Mar. 29, 1994

### Optical Ionization Detector

Inventors: Craig R. Wuest and Mark E. Lowry.  
Assignee: The United States of America as represented by the United States Department of Energy.  
Filed: Feb. 1, 1993.

**Abstract**—An optical ionization detector wherein a beam of light is split so that one arm passes through a fiber optics and the other arm passes through a gas-filled region, and uses interferometry to detect density changes in a gas when charged particles pass through it. The gas-filled region of the detector is subjected to a high electric field and as a charged particle traverses this gas region electrons are freed from the cathode and accelerated so as to generate an electron avalanche which is collected on the anode. The gas density is effected by the electron avalanche formation and if the index or refraction is proportional to the gas density the index will change accordingly. The detector uses this index change by modulating the one arm of the split light beam passing through the gas, with respect to the other arm that is passed through the fiber optic. Upon recombining of the beams, interference fringe changes as a function of the index change indicates the passage of charged particles through the gaseous medium.

#### 20 Claims, 1 Drawing Sheet



5,298,911

Mar. 29, 1994

5,299,054

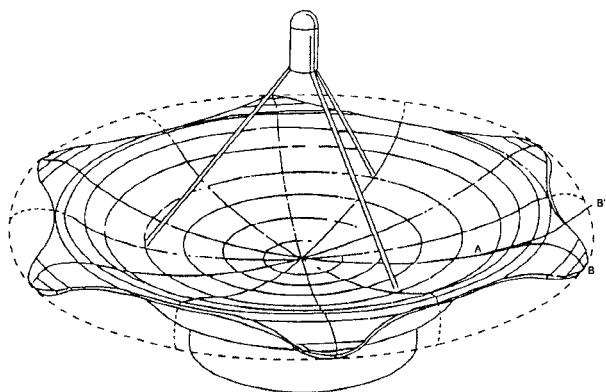
Mar. 29, 1994

### Serrated-Roll Edge for Microwave Antennas

Inventor: Ming-Chang Li.  
Filed: Sept. 30, 1991.

**Abstract**—The invention presents an optimum method and mean for reducing the side lobes of microwave antennas whether mounted or through the serrated-roll treatment of their edges. The reduction of side lobes leads to the enhancement of the main lobe, the suppression of the unwanted electromagnetic interference, the improvement of antenna performance, as well as lowering the size of antenna.

5 Claims, 5 Drawing Sheets



5,299,047

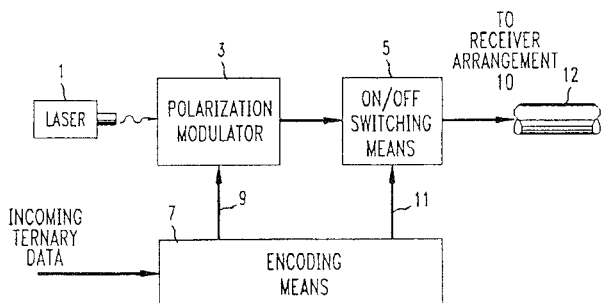
Mar. 29, 1994

### Ternary Data Communication Using Multiple Polarizations

Inventors: Sanjay Kasturia and Jack H. Winters.  
Assignee: AT&T Bell Laboratories.  
Filed: Apr. 2, 1992.

**Abstract**—Higher information rates are achieved in lightwave communication systems by using optical signals of different polarizations to represent data as ternary digits. Each ternary digit assumes a value, for example, of either zero, logic 1 (e.g., an amplitude on one unit) on a first polarization, or logic 1 on a second polarization. The ternary digits are transmitted to a receiver through a single optical fiber by modulating the optical signals in time with one of these two polarizations or zero. The receiver determines the value of each ternary digit by determining that the received optical signal has a value of either zero or logic one on a particular one of the two polarizations.

17 Claims, 7 Drawing Sheets

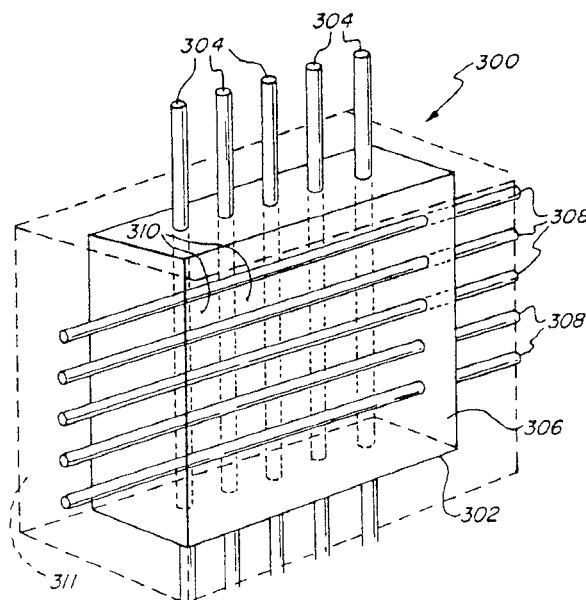


### Optical Switch

Inventor: Allen R. Geiger.  
Assignee: PetroLaser, Inc.  
Filed: Apr. 14, 1992.

**Abstract**—An optical medium, which may be nonlinear, is provided with a matrix of conductors ("select lines") parallel to a face (planar surface) of the optical medium. The select lines are preferably superconductive, and are arranged in a two offset planar, preferably orthogonal sets. Adjacent pairs of select lines in both sets of select lines define discrete volumes, or "cells" within the optical medium. Light directed through the cells is refracted at angles determined by the quiescent optical properties of the optical medium, and may be "steered" to different angles by current passing through the select lines.

24 Claims, 10 Drawing Sheets



5,299,057

Mar. 29, 1994

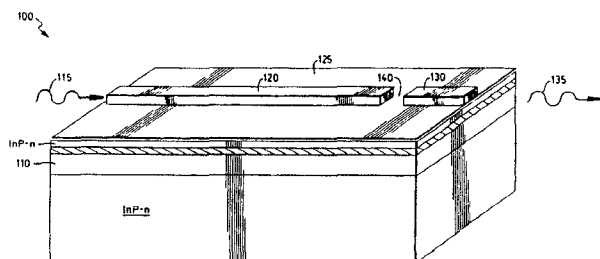
### Monolithically Integrated Optical Amplifier and Photodetector Tap

Inventors: William C. Rideout, Robert Olshansky,  
Elliott G. Eichen.  
Assignee: GTE Laboratories Incorporated  
Filed: Oct. 29, 1992.

**Abstract**—A semiconductor optical amplifier with a high speed photodetector acting as an optical tap is disclosed. The device functions simultaneously as an in-line optical amplifier and as a high-speed photodetector tap. An in-line optical amplifier is combined with a waveguiding, high speed (low

capacitance) reverse-biased photodetector that absorbs only a percentage of the amplified signal, allowing the remainder to pass through without distortion.

#### 9 Claims, 2 Drawing Sheets



5,301,008

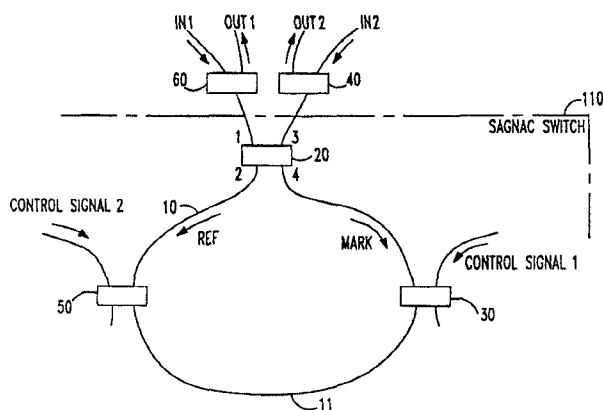
Apr. 5, 1994

### Optical Crossbar Exchange Arrangement

Inventors: Alan Huang and Norman A. Whitaker, Jr.  
 Assignee: AT&T Bell Laboratories.  
 Filed: May 20, 1993.

**Abstract**—An optical crossbar exchange arrangement is implemented using a modified Sagnac switch. During the absence of a control signal, two separately numbered inputs are coupled to the same numbered outputs of the Sagnac switch (i.e., input1 to output1, etc.). During the presence of a control signal each of the two numbered inputs are switched and are coupled to a different numbered output (e.g., input1 to output2, etc.).

#### 20 Claims, 3 Drawing Sheets



5,301,009

Apr. 5, 1994

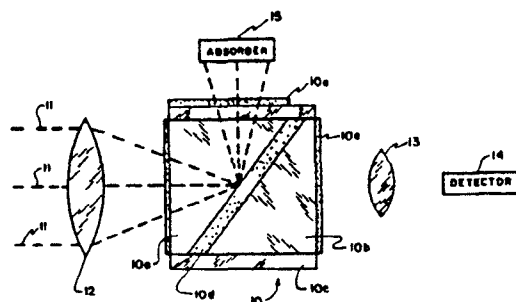
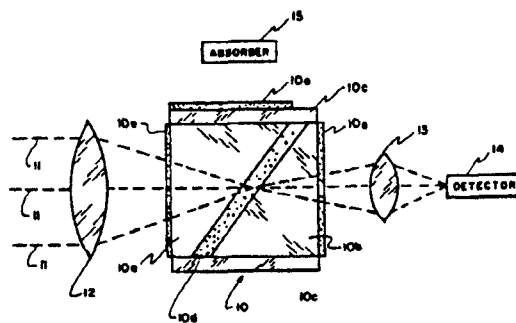
### Frustrated Total Internal Reflection Optical Power Limiter

Inventor: Richard R. Shurtz, II.  
 Assignee: The United States of America as represented by the Secretary of the Army.  
 Filed: Apr. 28, 1983.

**Abstract**—In order to protect a delicate photo-detector from high-intensity optical radiation such as from a laser, a device for limiting power to the detector is interposed between the radiation and detector. This device has two embodiments and is made such that high-intensity radiation is totally reflected. In the absence of high-intensity radiation, total reflection is frustrated, and desired radiation passes to the detector. Both embodiments use two prisms with parallel surfaces skewed to incident radiation and with a slightly absorbent optical material between the surfaces. Desired radiation normally passes through the prisms and the material to the detector. In one embodiment, the material is a liquid which vaporizes in response to high-intensity radiation, and in the other embodiment, the material expands and pushes the prisms apart.

In either case, transmission of radiation halts, and the radiation is totally reflected by a prism skewed surface.

#### 7 Claims, 2 Drawing Sheets



5,301,046

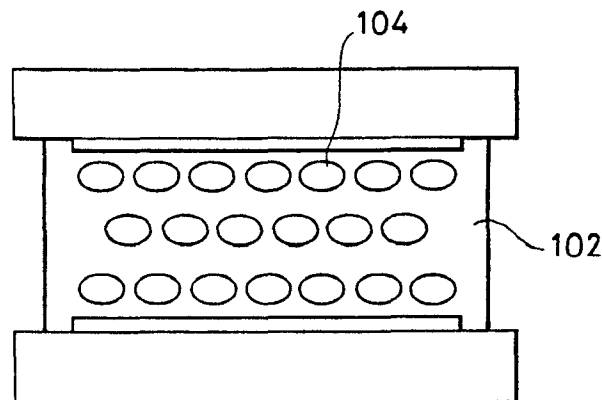
Apr. 5, 1994

### Electro-Optical Device Having a Layer Comprising an Oblate Liquid Crystal Dispersed in a Resin and Method for Forming the Same

Inventors: Toshimitsu Konuma, Toshiji Hamatani, Shunpei Yamazaki.  
 Assignee: Semiconductor Energy Laboratory Co., Ltd.  
 Filed: Sept. 21, 1992.

**Abstract**—A liquid crystal electro-optical device based on a dispersion-type liquid crystal, comprising a pair of substrates at least one of which is light-transmitting, having established thereon electrodes and an electro-optical modulating layer having incorporated between said pair of substrates, said electro-optical modulating layer being composed of a resin support having dispersed therein a liquid crystal material, wherein, the liquid crystal material as viewed in the cross section is dispersed in the resin support as droplets flattened along the direction parallel to the substrates. The dispersion-type liquid crystal electro-optical device according to the present invention has a high scattering efficiency and provides an excellent light-transmittance upon application of an electric field.

#### 24 Claims, 3 Drawing Sheets



5,301,058

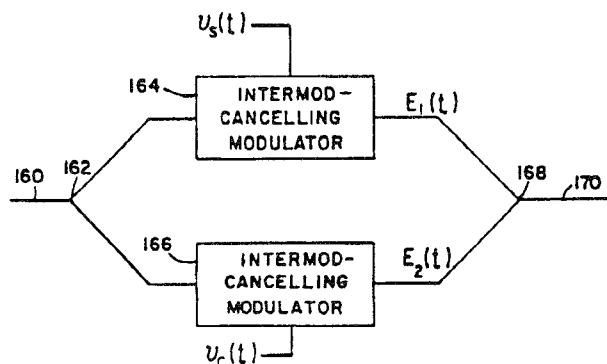
Apr. 5, 1994

### Single Sideband Optical Modulator for Lightwave Systems

Inventor: Robert Olshansky.  
 Assignee: GTE Laboratories Incorporated.  
 Filed: Dec. 31, 1990.

**Abstract**—Optical communication methods and apparatus are disclosed for transmitting two or more optical signals with different optical carrier frequencies on a single optical fiber with high spectral efficiency. Each optical carrier is typically modulated with multiple modulated subcarriers. In one embodiment, an optical phase modulator provides cancellation of second order intermodulation products in each optical signal, thereby permitting the optical carrier frequencies to be spaced by  $2f_{max}$ , where  $f_{max}$  is the maximum modulation frequency. In another embodiment, a single sideband optical phase modulator provides cancellation of second order intermodulation products and one signal sideband, thereby permitting the optical carrier frequencies to be spaced by  $f_{max}$ .

25 Claims, 10 Drawing Sheets



5,301,069

Apr. 5, 1994

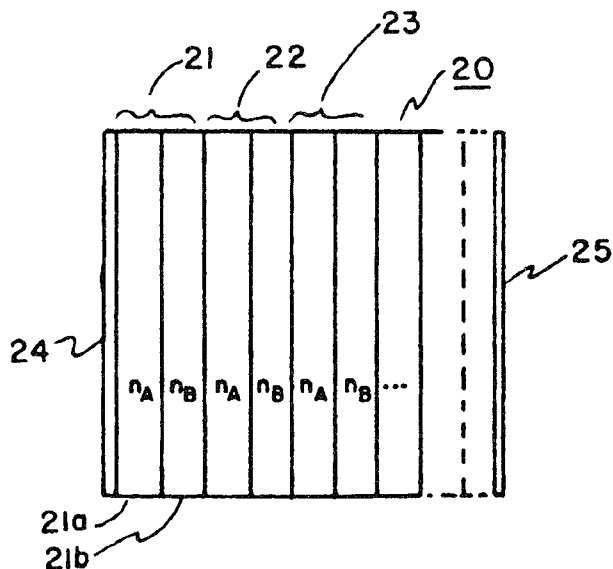
### Nonlinear Rugate Optical Limiter

Inventors: Gary L. Wood, Wolfgang Elser, Edward J. Sharp.  
 Assignee: The United States of America as represented by the Secretary of the Army.  
 Filed: Mar. 9, 1989.

**Abstract**—The present invention provides layered polymeric media to control the spatial and spectral distribution of energy in optical beams, particularly high intensity, broadband, multi-line laser beams. This structure

is an improved version of prior art thin-film (vacuum deposited) interference filters and "rugate" structure filters.

9 Claims, 2 Drawing Sheets



5,302,922

Apr. 12, 1994

### Equalizer for Optically Transmitted Analog Information Signals

Inventors: Rolf Heidemann, Heinz Krimmel, Bernhard Junginger.  
 Assignee: Alcatel N.V.  
 Filed: June 29, 1992.

**Abstract**—To compensate for nonlinear distortions in analog optical communication transmission systems, caused by laser chirps and the chromatic dispersion of the optical fiber, an equalizer in the form of an LC component is known, whose capacitance is formed by a variable capacitance diode. If this equalizer is to be adjusted for considerable signal distortions (long transmission path length), it must operate at great capacitance, which reduces its bandwidth. In order to be able to equalize large bandwidth signals (e.g. 600 MHz) containing considerable distortions, the invention indicates an LC chain circuit with LC components of the known type, as the equalizer. Further developments of this solution concern the appropriate polarizing of the variable capacitance diode and maintaining the frequency response constant, when adjusting the equalization.

10 Claims, 4 Drawing Sheets

