# 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.

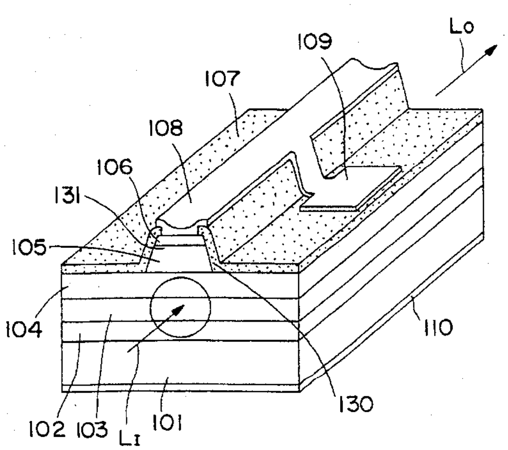
**5,455,433** Oct. 3, 1995

## Semiconductor Optical Guided-Wave Device

Inventor: Keiro Komatsu.
Assignee: NEC Corporation.
Filed: May 4, 1994.

*Abstract*—A semiconductor optical guided-wave device that makes quantization and integration possible and is fine in structure and low in loss is provided, which comprises a semiconductor substrate, at least one ridge-type semiconductor optical waveguide formed thereon, and at least one pair of electrodes for applying an electric field to the waveguide. The ridge of the optical waveguide is formed by a selective crystal growth process. The ridge can be realized preferably in such a method that a mask having an opening at a position where a ridge is formed is patterned to a layer on which the ridge is formed, and the crystal growth of a material for forming the ridge is made by a crystal growth technology such as the MOVPE method. The mask to be used for the crystal growth purpose is preferably a thin dielectric film such as, for example, $SiO_2$ film. The semiconductor optical waveguide preferably comprises grown layers including a first semiconductor cladding layer, a semiconductor guiding and a second semiconductor cladding layer grown in this order, and a ridge having a third semiconductor cladding layer and a semiconductor capping layer laminated in this order on the second semiconductor cladding layer.

**6 Claims, 7 Drawing Sheets**



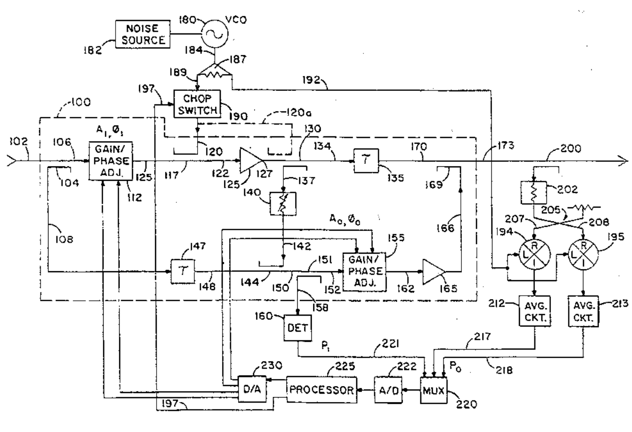

**5,455,537** Oct. 3, 1995

## Feed-Forward Amplifier

Inventors: Robert S. Larkin and David L. Wills.
Assignee: Radio Frequency Systems, Inc.
Filed: Aug. 19, 1994.

*Abstract*—In a feed-forward amplifier (**100**), a main amplifier (**125**) is coupled between an input (**102**) at which an input signal is received and an output (**173**) at which an output signal is provided. The output signal is an amplification of the input signal. A sample of the output signal is compared (**144**) with a sample of the input signal to produce a difference signal indicative of distortions introduced by the main amplifier (**125**). An error amplifier (**165**) provides a distortion signal, which is an amplification of the difference signal, and the distortion signal is combined (**169**) with the output signal to compensate for main amplifier distortions. A random frequency, constant amplitude sine wave pilot signal is combined (**117**) with the input signal, and a correlation power detector (**194, 195, 202, 202, 212, 213**) is provided to determine the magnitude of the pilot signal in the output signal. The gain and phase of the difference signal is then adjusted (**155**) to minimize the magnitude of the pilot signal in the output signal. Additionally, a distortion signal power signal, which is indicative of the magnitude of the difference signal, is provided (**151, 158**), and the gain and phase of the input signal is adjusted (**112**) to minimize the magnitude of the distortion signal power signal.

**14 Claims, 5 Drawing Sheets**




**5,455,671** Oct. 3, 1995

## Optical Circuit for a Measuring System for Measuring the Reflection Sensitivity of an Optical Transmission System

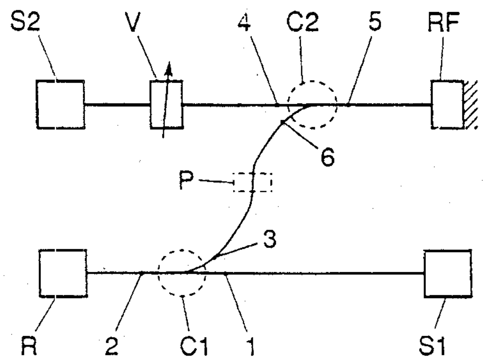
Inventor: Mattijs O. van Deventer.
Assignee: Koninklijke PTT Nederland N. V.
Filed: Mar. 30, 1994.

*Abstract*—Optical circuit for a measuring system for measuring the reflection sensitivity of an optical transmission network, comprising a first and a second connection point (1, 4) for a first and a second optical signal source (S1, S2), respectively, a third connection point (2) for optical receiving means (R), optical reflection means (RF), and coupling means. The coupling means consist of a first waveguide junction (C2) via which the second connection

Publisher Item Identifier S 1051-8207(96)08542-X.

point (4) is coupled in the forward signal direction to the reflection means, and a second waveguide junction (C1) via which the first connection point (1) is coupled in the forward signal direction to the third connection point. The two junctions are coupled in such a way that the reflection means are coupled in the forward signal direction to the third connection point via the first and second junctions. Advantages: All the effects on which the reflection sensitivity of an optical transmission system depends can be influenced, as far as possible, separately and to a sufficient degree. Signal sources to be connected are not coupled in the forward signal direction.

**24 Claims, 2 Drawing Sheets**



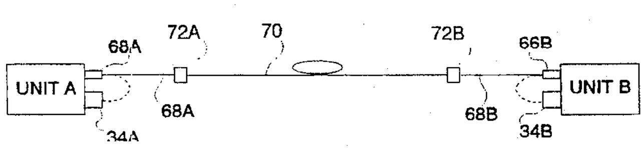

**5,455,672** Oct. 3, 1995

## Measurement of Attenuation of an Optical Fiber Using Bidirectional Transmission of Information Via the Fiber

Inventors: Joseph E. G. Lamonde, Jean LaFlamme, and Michel Cyr.
Assignee: Exto-Electro-Optical Engineering Inc.
Filed: Apr. 18, 1994.

*Abstract*—Attenuation of an optical fiber is measured by transmitting an optical signal having a predetermined wavelength to the fiber and by FSK modulating the optical signal with information identifying the wavelength and transmitted power of the optical signal. At a receiver, the optical signal is detected and the information is recovered by demodulation. Wavelength-dependent sensitivity information for the detector is read from a store in dependence upon the wavelength information and used to control the gain of an amplifier for amplifying a subsequently transmitted continuous wave optical signal used for attenuation measurement. The received power level of this optical signal is converted into a digital value and used with the transmitted power information to determine the fiber attenuation at the predetermined wavelength. Reference power levels are determined by connecting a jumper between a port and an external detector. Measurement of attenuation and communication data over the fiber under test may be effected using two transceiver units, one at each end of the fiber. In addition to the external detector, each unit has an internal detector and sources connected to a port, which is connected to the fiber under test by a jumper. Determination of the attenuation of the fiber then takes account of the loss of each fiber using reference power levels determined by initial calibration measurements.

**19 Claims, 3 Drawing Sheets**



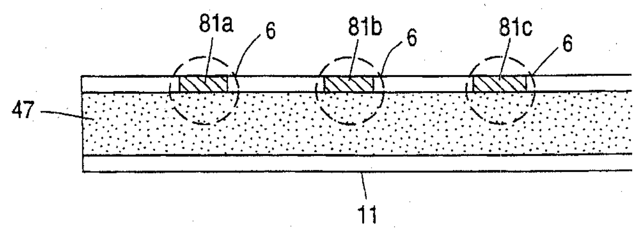

**5,455,883** Oct. 3, 1995

## Optical Wave Guide and an Optical Input Device, Fabrication Methods Thereof, and a Liquid Crystal Display Apparatus Using the Optical Wave Guide and the Optical Input Device

Inventors: Mitsuhiro Shigeta and Keisaku Nonomura.
Assignee: Sharp Kabushiki Kaisha.
Filed: Apr. 7, 1993

*Abstract*—An optical wave guide, an optical input device, fabrication methods thereof, and a liquid crystal display apparatus using the optical wave guide and optical input device are disclosed. The optical wave guide includes: a core region having a refractive index $n_c$ through which an optical signal is transmitted and a cladding layer in which low refractive index layers having a refractive index $n_1$ and high refractive index layers having a refractive index $n_h$ are alternately deposited. A side face of the core region is covered with the cladding layer, and the refractive indices satisfy conditions of $n_1 < n_h$, and $n_1 < n_c$. The optical input device includes: a transparent substrate; the optical wave guide formed in the transparent substrate; an optical input portion; and a plurality of optical output portions for connecting a side face of the optical wave guide to a surface of the transparent substrate. The optical signal from the optical input portion is transmitted through the optical wave guide and output from the optical output portions to the outside of the transparent substrate. The liquid crystal display apparatus includes: a display medium; a plurality of pixel electrodes for driving the display medium; a plurality of signal lines; a plurality of photoconductors having photoconductive portions provided for the pixel electrodes, respectively; and the optical input device. The optical input device allowing the optical signal to selectively illuminate the photoconductive portions of the photoconductors for connecting or disconnecting the signal lines to or from the pixel electrodes.

**10 Claims, 12 Drawing Sheets**




**5,457,422** Oct. 10, 1995

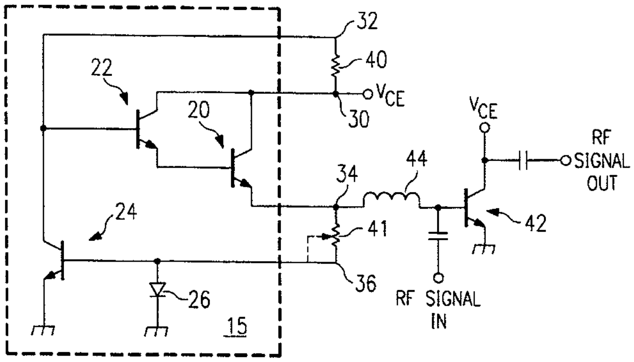
## Device for Biasing an RF Device Operating in Quasi-Linear Modes with Voltage Compensation

Inventor: Craig J. Rotay.
Assignee: SGS-Thomson Microelectronics, Inc.
Filed: June 30, 1994.

*Abstract*—A biasing device for actively biasing the base of an RF device operating in quasi-linear modes. The biasing device provides a source of low-impedance current and high current capability. The biasing device includes three transistors, each having a base, collector and emitter, and one low turn-on diode. The first and second transistors are connected such that changes in the base-emitter voltage of the biased RF device can be detected. The third transistor is configured in a Darlington configuration with the first transistor in order to provide 1) increased sensitivity to voltage changes

detected by the second transistor and 2) additional collector voltage for the second transistor to prevent it from operating in saturation. The low turn-on diode is a compensating diode that thermally tracks and compensates for operating changes in the second transistor due to temperature.

**9 Claims, 3 Drawing Sheets**



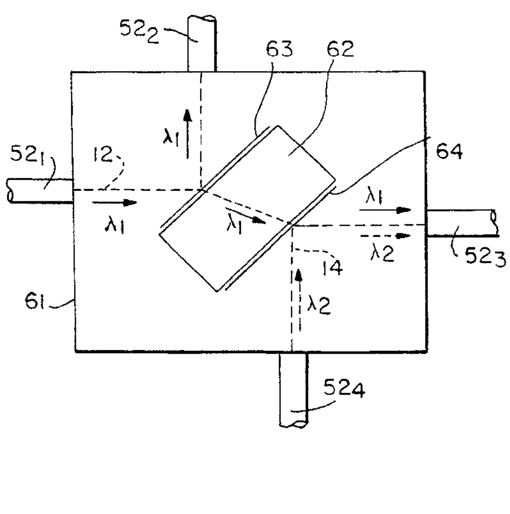

**5,457,558** Oct. 10, 1995

## Optical Waveguide Multiplexer for Optical Fiber Amplifiers

Inventor: Jun Yokoyama.
Assignee: NEC Corporation.
Filed: June 28, 1994.

*Abstract*—An optical waveguide multiplexer for use in optical fiber amplifiers or the like, which is simple in configuration, permits manufacturing at high productivity, and is reduced in size and, moreover, is susceptible to little insertion loss is to be realized. A multiplexer-branching filter is provided with first to fourth input/output (I/O) terminals. Part of an optical signal emitted from the first I/O terminal is reflected by a branching film, formed over one face of a glass plate, and led to the second optical I/O terminal. The rest of the optical signal penetrates the glass plate and further penetrates an optical multiplexing film, formed on the other face, to be led to the third optical I/O terminal. The invention has a particular characteristic that the thickness t of the substrate is set so as to satisfy the condition of $t \geqq w/\cos\theta \times \tan[\sin^{-1}\{(\sin\theta/n)\}]$ where n is the refractive index of the substrate; w is the beam diameter of the output light of the optical I/O terminal for multiplexing the signal light with a pomping light; and $\theta$ is the angle of incidence from this terminal to the substrate. By setting the substrate thickness at or above the value stated above, the optical path of any leak light from the pomping light side is deviated from that toward the monitor side, and no pomping light can enter into the monitor. It is also possible, by adding an aperture film to the substrate, to further reduce the leak light.

**16 Claims, 4 Drawing Sheets**



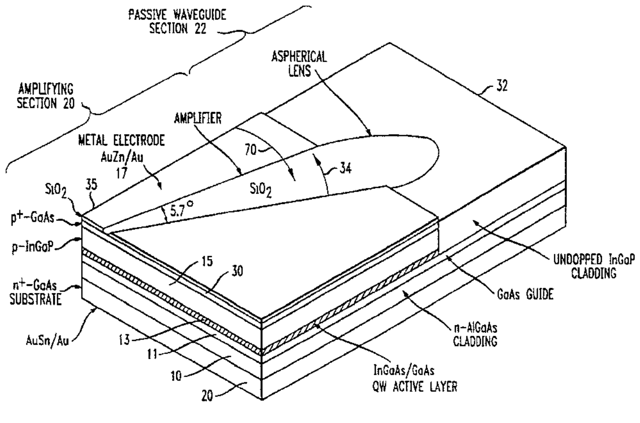

**5,457,569** Oct. 10, 1995

## Semiconductor Amplifier or Laser Having Integrated Lens

Inventors: Kang-Yih Liou and Martin G. Young.
Assignee: AT&T IPM Corp.
Filed: June 30, 1994.

*Abstract*—An optical device includes a semiconductor optical amplifier and a lens for receiving optical energy from the optical amplifier. The lens and the optical amplifier are monolithically integrated on a common substrate. The optical amplifier may be of the type having a tapered active region. Rather than an optical amplifier, a semiconductor laser may be integrated with the lens. The lens may be formed by changing the refractive index of the waveguide core, which is formed in the semiconductor material. This refractive index change may be produced by changing the thickness of a portion of the waveguide core layer.

**18 Claims, 4 Drawing Sheets**



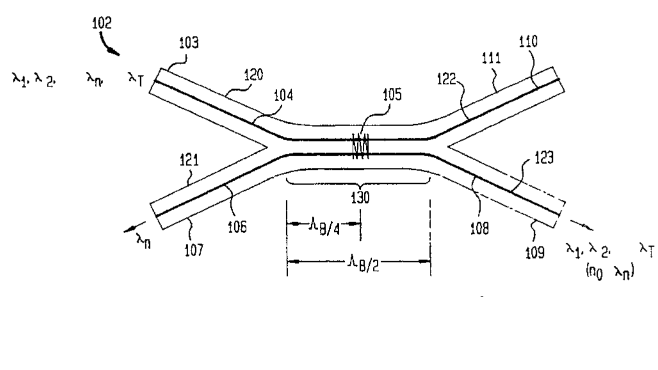

**5,457,758** Oct. 10, 1995

## Add-Drop Device for a Wavelength Division Multiple, Fiber Optic Transmission System

Inventor: Elias Snitzer.
Assignee: Rutgers University.
Filed: Oct. 19, 1993.

*Abstract*—Device for use in adding or dropping light signals at predetermined center wavelengths to or from a wavelength division multiplex, fiber optic transmission system. The device includes an evanescent wave coupler having a coupling region formed from two single-mode waveguides, the coupling region being formed so that there is substantially complete evanescent field coupling of light from one waveguide to the other in a predetermined wavelength band. Further, the device has a Bragg grating disposed in the coupling region in each of the waveguides.

**18 Claims, 3 Drawing Sheets**



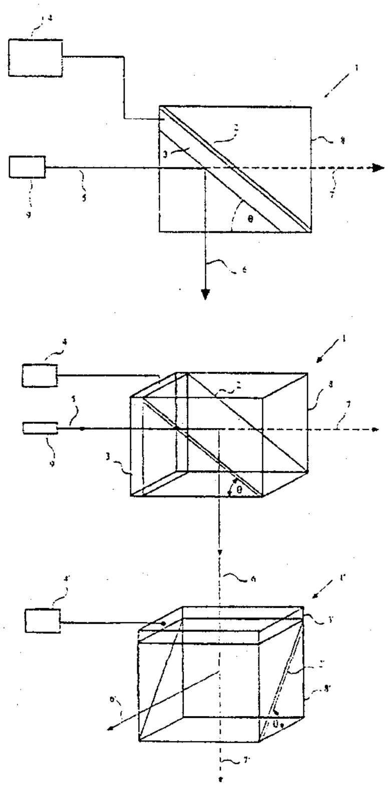
**5,459,591** Oct. 17, 1995

## Electromagnetic Energy Beam Steering Devices

Inventor: Sadeg M. Faris.
Filed: Mar. 9, 1994

*Abstract*—The present invention relates to beam-steering and beam-scanning devices that utilize an imaging cell that incorporates a solid-state cholesteric liquid crystal (CLC) element, an electronically controlled, variable half-wave retarder, and a source of circularly polarized light. The CLC element is disposed at an angle (45°) relative to the path along which light from the source is projected and is designed to reflect, at a given wavelength, one circular polarization of light and transmit the other. Using this characteristic, light of one polarization or the other is presented to the variable retarder and, depending on whether or not it is actuated, light is either diverted into another orthogonal path or remains in the original path. If another similar imaging cell is disposed in the orthogonal path, light incident on that cell can also be diverted into yet another path or transmitted along the orthogonal path under control of a half-wave retarders associated with said another imaging cells. By arranging a plurality of imaging cells in the form of an array and accessing each row of the cells of the array with a column of similar imaging cells and by selectively activating half-wave retarders associated with each of the cells, monochromatic or polychromatic light from a single source or multiple sources may be steered to a selected cell and reflected from its associated CLC element or elements. Utilizing successive cells in the array and causing reflection of a modulated beam or beams provides a frame in the manner of the usual TV set, which is viewed by the eyes as an integrated picture. Successive frames, of course, provide the usual moving images.

**50 Claims, 3 Drawing Sheets**



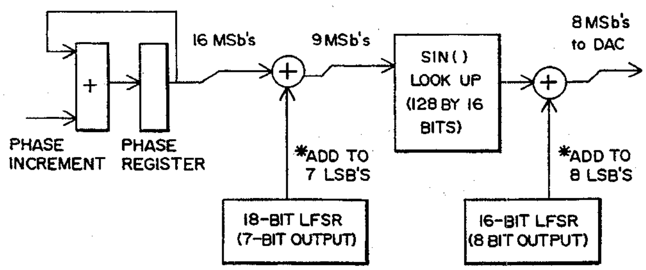
**5,459,680** Oct. 17, 1995

## Method and Apparatus for Spur-Reduced Digital Sinusoid Synthesis

Inventors: George A. Zimmerman and Michael J. Flanagan.
Assignee: The United States of America as represented by the Administrator of the National Aeronautics and Space Administration.
Filed: Oct. 20, 1993.

*Abstract*—A technique for reducing the spurious signal content in digital sinusoid synthesis. Spur reduction is accomplished through dithering both amplitude and phase values prior to word-length reduction. The analytical approach developed for analog quantization is used to produce new bounds on spur performance in these dithered systems. Amplitude dithering allows output word-length reduction without introducing additional spurs. Effects of periodic dither similar to that produced by pseudo-noise (PN) generator are analyzed. This phase dithering method provides a spur reduction of $6(M+1)$ dB per phase bit when the dither consists of $M$ uniform variates. While the spur reduction is at the expense of an increase in system noise, the noise power can be made white, making the power spectral density small. This technique permits the use of a smaller number of phase bits addressing sinusoid look-up tables, resulting in an exponential decrease in system complexity. Amplitude dithering allows the use of less complicated multipliers and narrower data paths in purely digital applications, as well as the use of coarse-resolution, highly linear digital-to-analog converters (DAC's) to obtain spur performance limited by the DAC linearity rather than its resolution.

**10 Claims, 7 Drawing Sheets**



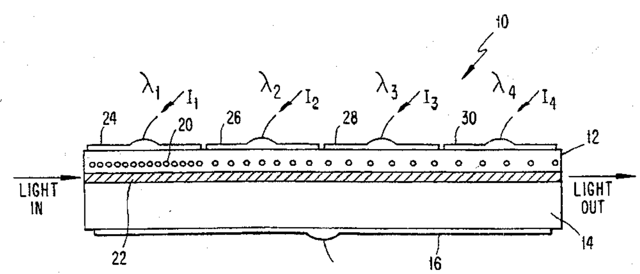

**5,459,799** Oct. 17, 1995

## Tunable Optical Filter

Inventor: Jean-Pierre Weber.
Assignee: Telefonaktiebolaget LM Ericsson.
Filed: Aug. 12, 1994.

*Abstract*—A tunable optical filter for use in wavelength-division multiplexing systems. The optical filter contains a plurality of tunable reflection gratings that block all of the channels in the incoming lightwave. An electrode or a heating element is provided for each reflection grating to tune the reflection gratings so that their reflection bands do not coincide with a desired channel or channels, thereby allowing the desired channel or channels to pass through the filter.

**24 Claims, 3 Drawing Sheets**



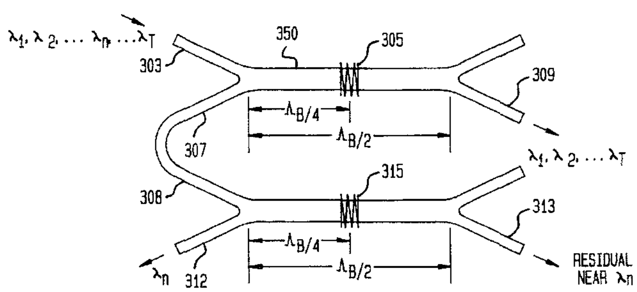
**5,459,801** Oct. 17, 1995

## Coupler Used to Fabricate Add-Drop Devices, Dispersion Compensators, Amplifiers, Oscillators, Superluminescent Devices, and Communications Systems

Inventor: Elias Snitzer.
Assignee: Rutgers University.
Filed: Jan. 19, 1994

*Abstract*—Device for use in adding or dropping light signals at predetermined center wavelengths to or from a wavelength division multiplex, fiber optic transmission system. The device includes an evanescent wave coupler having a coupling region formed from two single-mode waveguides, the coupling region being formed so that there is substantially complete evanescent field coupling of light from one waveguide to the other in a predetermined wavelength band. Further, the device has a Bragg grating disposed in the coupling region in each of the waveguides.

**5 Claims, 9 Drawing Sheets**



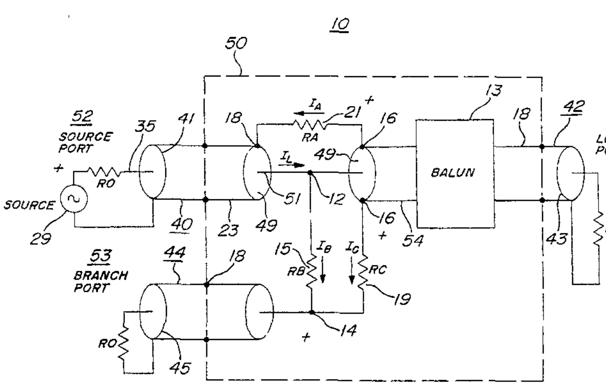

**5,461,349** Oct. 24, 1995

## Directional Coupler Tap and System Employing Same

Inventor: Keneth A. Simons.
Filed: Oct. 17, 1994.

*Abstract*—A lumped-element directional coupler tap is disclosed especially adapted for a system providing bidirectional communications. The directional coupler tap includes three resistors and a balun. A radio frequency signal may be tapped off of a main transmission line to feed a plurality of branch lines as in a cable television system. The coupler exhibits a high degree of isolation between tap and load ports and good performance over a usually broad frequency range.

**20 Claims, 8 Drawing Sheets**



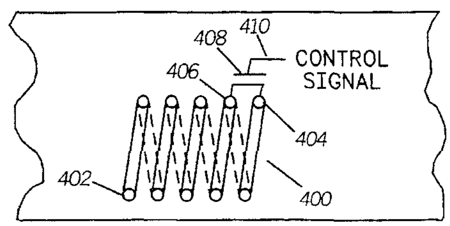

**5,461,353** Oct. 24, 1995

## Printed Circuit Board Inductor

Inventor: John E. Eberhardt.
Assignee: Motorola, Inc.
Filed: Aug. 30, 1994.

*Abstract*—A multilayer printed circuit board (**100**) includes a plurality of layers (**101**, **102**, **104**, **106**, **108** and **110**). Located within intermediate layer (**106**) is an inductor (**200**), which is shielded by top layer ground plane (**202**) and bottom layer ground plane (**204**). In another embodiment of the present invention, the inductor (**200**) can have its inductance adjusted by way of a inductance adjustment runner (**316**, **318**) or by an electronic inductance adjustment device (**408**).

**11 Claims, 4 Drawing Sheets**



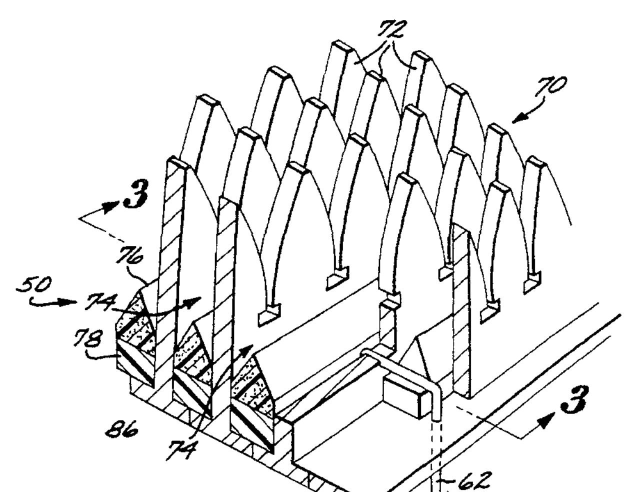

**5,461,392** Oct. 24, 1995

## Transverse Probe Antenna Element Embedded in a Flared Notch Array

Inventors: Charles J. Mott and Clifton Quan.
Assignee: Hughes Aircraft Company.
Filed: Apr. 25, 1994.

*Abstract*—Low-frequency radiating elements are embedded in a flared notch array. The flared notch array forms a series of parallel troughs in which absorptive loads are placed to reduce the antenna radar cross section. The low-frequency radiating elements are embedded in the array transverse to the troughs at or below the level of the absorptive loads and excite several troughs. The absorptive load material is absorptive in the operating band of the flared notch array, but appears as a relatively low loss dielectric at the lower frequencies of operation of the low-frequency radiating elements. The low-frequency radiating elements can perform Identify Friend or Foe functions in the UHF and L-band regions of the spectrum, while the flared notch array operates at X-band.

**34 Claims, 6 Drawing Sheets**



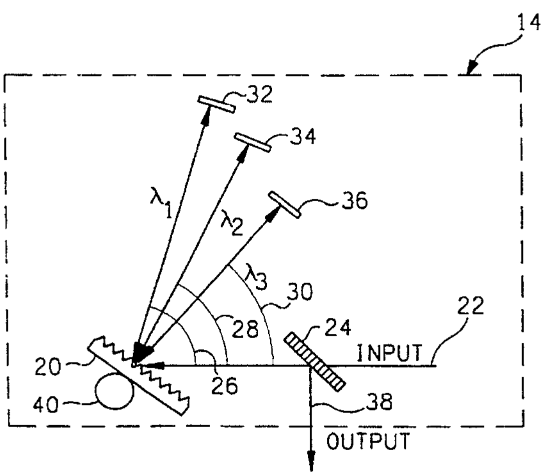
**5,461,687** Oct. 24, 1995

## Wavelength-Controlled Optical True Time Delay Generator

Inventor: John C. Brock.
Assignee: TRW Inc.
Filed: Mar. 18, 1992.

*Abstract*—A wavelength-controlled optical true time delay generator (**14**) utilizes passive switching to direct an optical beam to different length paths depending on the input wavelength. In one embodiment a dispersive element (**20**) is used to reflect the input beam at different angles depending on the incident wavelength. Different optical paths are then provided for the light reflected at different angles. In another embodiment, an optical fiber (**50**) is provided with reflective gratings (**52**), each of which are reflective at different wavelengths. The gratings (**52**) are positioned at different lengths along the optical fiber (**50**) to provide for different path lengths of light reflected by the gratings and back down the optical fiber (**50**) to an optical output (**38**). The true time delay generator (**14**) provides for a true time delay of any length in a low-loss switching mechanism, which is relatively inexpensive and compact.

**18 Claims, 5 Drawing Sheets**



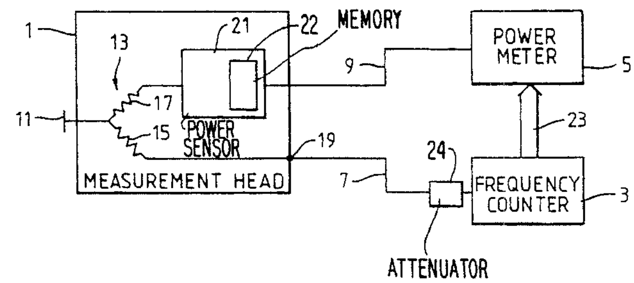

**5,463,310** Oct. 31, 1995

## Instrument for Measuring the Frequency and Power of a Microwave Signal

Inventors: Timothy J. Pegg, George Hjipieris, and Andrew G. Bullock.
Assignee: Marconi Instruments Limited.
Filed: Nov. 2, 1994.

*Abstract*—An instrument that provides a measurement of the frequency and power of a microwave signal supplied to an input port of the instrument. The instrument includes: a resistive device that divides the microwave signal supplied into first and second microwave divisions thereof; a frequency counter that measures the frequency of the first microwave division, thereby providing the measurement of the frequency of the microwave signal supplied; and a power sensor and power meter combination that measures the power of the second microwave division. The power sensor and meter combination makes a calibration correction dependent on the frequency measured by the frequency counter to its power measurement, thereby providing the measurement of the power of the microwave signal supplied.

**12 Claims, 1 Drawing Sheet**



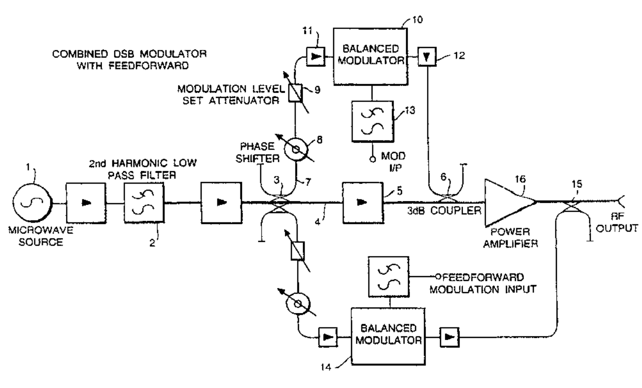

**5,463,357** Oct. 31, 1995

## Wide-Band Microwave Modulator Arrangements

Inventor: Mervyn K. Hobden.
Assignee: Plessey Semiconductors Limited.
Filed: June 17, 1994.

*Abstract*—A wide-band microwave modulator arrangement for an information transmission system, such as a video signal distribution system, in which signals from a microwave carrier signal source are split and directed over a first path comprising an attenuator and a second path comprising phase shift means and a balanced modulator, the output signals from the two paths being combined for transmission. Signals from the carrier signal source may also be directed over a third path including phase shift means and a second balanced modulator, amplified output signals from the first two paths being combined with output signals from this third path before transmission.

**5 Claims, 6 Drawing Sheets**



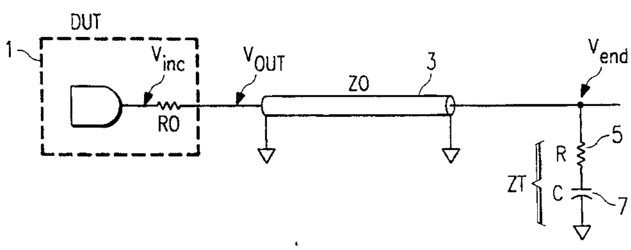
**5,463,359** Oct. 31, 1995.

## Impedance Matching Network for Low-Output Impedance Devices

Inventor: Dale A. Heaton.
Assignee: Texas Instruments Inc.
Filed: Mar. 21, 1994.

*Abstract*—An impedance matching circuit which includes an RC network placed at the end of the transmission line and which will absorb reflections. The values of the resistor and capacitor are selected such that the output voltage at the end of the transmission line is attenuated only during the duration of the reflected waves and the overall gain from the incident signal to the end of the transmission line is 1 : 1. The values of the resistor and capacitor selected are based upon the impedance mismatch and the length of the transmission line.

**2 Claims, 1 Drawing Sheet**



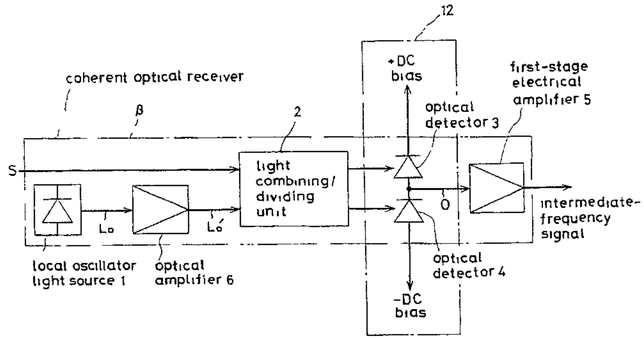

**5,463,461** Oct. 31, 1995

## Coherent Optical Receiver Having Optically Amplified Local Oscillator Signal

Inventors: Yukio Horiuchi and Shiro Ryu.
Assignee: Kokusai Denshin Denwa Company, Ltd.
Filed: Jan. 9, 1995.

*Abstract*—The coherent optical receiver is characterized in that it comprises a local oscillator light source for amplifying a local oscillator light, a light combining/dividing unit, a dual balanced receiver which comprises two optical detectors, and an electrical amplifier. Therefore, the coherent optical receiver has the characteristic that the length of the nonrepeating section of an optical communication system including the device and employing heterodyne detection can be increased, or the dynamic range of an optical measuring system including this receiver and employing heterodyne detection can be widened.

**14 Claims, 6 Drawing Sheets**




**5,463,705** Oct. 31, 1995

## Optical Waveguide Isolation

Inventors: Rolf Clauberg, Christoph Harder, Christan Heusch, and Heinz Jaeckel.
Assignee: International Business Machines Corporation.
Filed: Aug. 10, 1994.

*Abstract*—Optical waveguide isolator (**121**) for monolithic integration with semiconductor light-emitting diodes such as Fabry-Perot or ring laser diodes. The present optical isolator (**121**), with optical input port (**95**) and output pod (**96**), comprises a branching waveguide coupler (**56**). This branching waveguide coupler (**56**) has a waveguide stem (**60**) splitted at one end into two waveguide branches (**57, 58**) such that a light wave fed via said input pod (**95**) into a first of these branches (**58**), is guided via the waveguide stem (**60**) and the output pod (**96**) out of the device. A light wave fed to the isolator's output pod (**96**) is guided along the stem (**60**) and coupled into the second waveguide branch (**57**).

**17 Claims, 10 Drawing Sheets**