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.

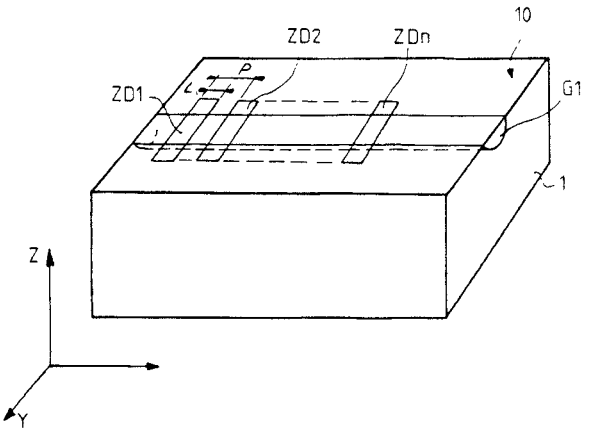
5,052,770 Oct. 1, 1991

Optical Device for the Processing of an Optical Wave, Its Fabrication Method and a Frequency Doubler

Inventor: Michel Papuchon.
Assignee: Thomson-CSF.
Filed: Jan. 22, 1990.

Abstract—Disclosed is an optical device for the processing of an optical wave by nonlinear effects, comprising, on the surface, a guide and doping zones arranged transversally to the direction of the guide. The distribution pitch of these zones is equal to an even multiple of the length of coherence for the interaction envisaged. The length of each zone along the direction of the guide is equal to an odd multiple of the length of coherence.

2 Claims, 1 Drawing Sheet



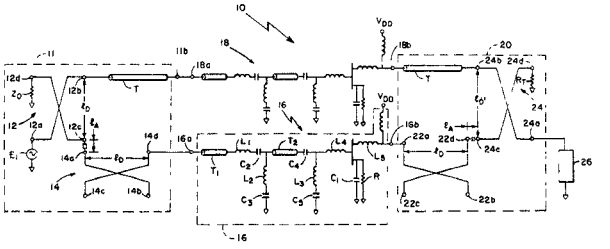
5,053,719 Oct. 1, 1991

Wide-Band Push–Pull Amplifier

Inventor: Ming-Chi Tsai.
Assignee: Raytheon Company.
Filed: Aug. 13, 1990.

Abstract—A radio frequency amplifier includes a first pair of quadrature couplers arranged to provide in response to an input signal first and second radio frequency signals having equal amplitudes and a first single-ended amplifier is fed by said first radio frequency signal to provide at an output thereof an amplified first signal having frequency components corresponding to a fundamental frequency of the input signal and second order products of the input signal. A second single-ended amplifier is fed by said second radio frequency signal for providing at an output thereof an amplified, second signal having second order products of the input signal and 180° phase shifter frequency of the input signal. The amplifier further includes a second pair of quadrature couplers arranged to provide, in response to said amplified first and second signals an output signal having a frequency corresponding substantially to the fundamental frequency of said output signal with said second order products of said first and second output signals being substantially cancelled.

6 Claims, 2 Drawing Sheets



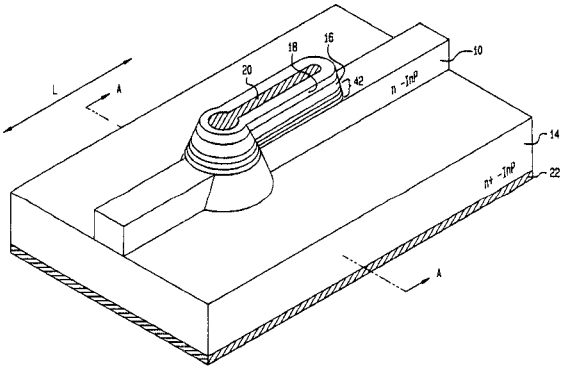
5,054,871 Oct. 8, 1991

Semiconductor Waveguide and Impedance-Matched Detector

Inventors: Robert J. Deri and Osamu Wada.
Assignees: Bell Communications Research, Inc. and Fujitsu Limited.
Filed: July 2, 1990.

Abstract—An impedance-matched semiconductor detector formed on a portion of a waveguide. The waveguiding layer of the waveguide has one refractive index and the light absorbing layer of the detector has another refractive index. An impedance matching layer is formed between the waveguiding layer and the light absorbing layer and has a refractive index intermediate between those of the waveguiding layer and the light absorbing layer.

19 Claims, 11 Drawing Sheets



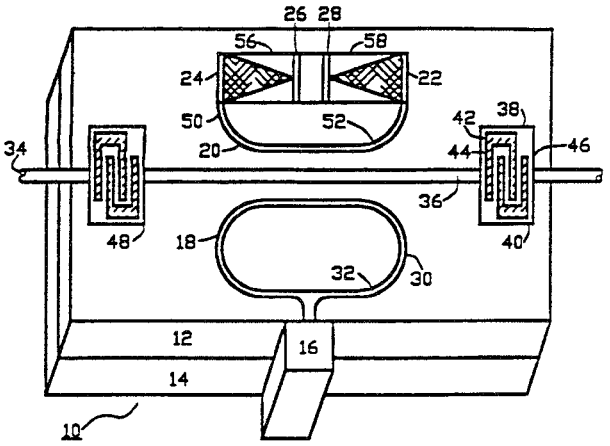
5,054,873 Oct. 8, 1991

High-Density Integrated Optical Multiplexer/Demultiplexer

Inventors: Richard L. Davis and Harold M. Stoll.
Assignee: Northrop Corporation.
Filed: Dec. 4, 1990.

***Abstract*—A tunable, integrated WDM optic coupler for coupling optical energy to and from channel waveguides in response to the application of surface acoustic waves (SAW's), and a distributed processor computer control system utilizing the couplers. A first range of SAW's is used to couple optical energy of selected wavelengths from a channel waveguide drive by a LED to multiplex optical energy to a common optic loop and a second, non-overlapping range of SAW's is used to couple optical energy from the loop to a second channel waveguide. The second, receiving channel waveguide includes a Bragg deflector, planar waveguide and photodetector arrays to demultiplex the optical energy by focusing selected wavelengths of optical energy on selected portions of the photodetector arrays. Changes in the acoustic wavelengths and amplitudes permit tuning of the coupler and computer system by altering the portion and wavelengths, respectively, of optical energy coupled by each section of each coupler.**

27 Claims, 2 Drawing Sheets



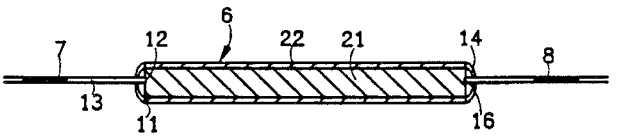
5,054,875 Oct. 8, 1991

Fiber-Optic Equalizer

Inventor: Mark. E. Curran.
Assignee: General Dynamics.
Filed: Aug. 1, 1990.

***Abstract*—A multimode optical fiber segment having partially reflecting mirrors on each end functions as a resonant cavity with respect to the modulation frequency when the length of the fiber is equal to one-half the modulation wavelength of the light injected into the fiber. Modulated light is injected through a hole in the mirror at one end, either from a fiber, a waveguide, or directly from a laser diode. The core diameter of the cavity fiber is limited only by the requirement that it must be much larger than the input hole. Light exits through a hole in the mirror opposite the input hole. Upon entry into the resonant cavity, light is subject to multimodal propagation resulting in dispersion. The resultant output light of the fiber is lower overall in intensity, but its useful frequency response is expanded by the bandpass half-skirt of the fiber-optic filter.**

6 Claims, 1 Drawing Sheet



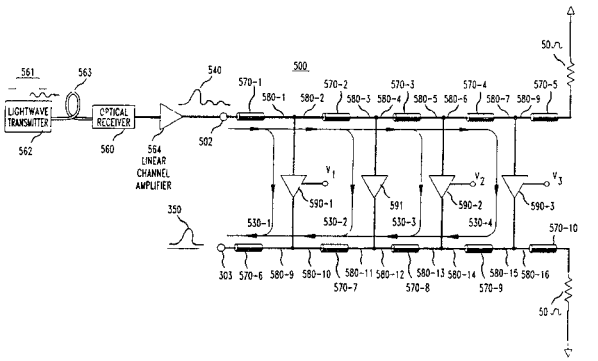
5,055,795 Oct. 8, 1991

Traveling Wave Type Transversal Equalizer

Inventors: Bryon L. Kasper and Osamu Mizuhara.
Assignee: AT&T Bell Laboratories.
Filed: May 29, 1990.

***Abstract*—A transversal equalizer is realized by employing variable gain and delay in the amplification branches of a traveling wave amplifier. Specifically, by adjusting the gain and delay in each branch, the traveling wave type transversal equalizer may be adjusted to having a complementary frequency response in order to compensate for linear channel gain and phase ripples. This approach permits the transversal equalizer to be designed without the use of resistive splitter and combiner networks and, therefore, without the use of high-gain amplifiers. Without such amplifiers, splitters and combiners, the smaller physical size, which is afforded thereby, allows the transversal equalizer to be easily assembled as a hybrid integrated circuit.**

12 Claims, 7 Drawing Sheets



5,055,798 Oct. 8, 1991

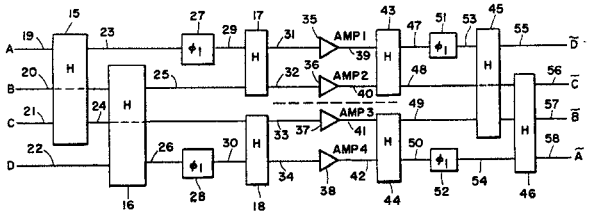
Hybrid Matrix Amplifier Systems, and Methods for Making Thermally-Balanced Hybrid Matrix Amplifier Systems

Inventor: Christine Heinzelmann.
Assignee: Hughes Aircraft Company.
Filed: Oct. 9, 1990.

***Abstract*—A hybrid matrix amplifier system that yields balanced thermal loads with minimal input signal constraints includes an input multiport hybrid coupler system having outputs joined to a plurality of amplifiers, and an output multiport hybrid coupler system joined to the outputs of the amplifiers. The input multiport hybrid coupler system, and the output multiport hybrid coupler system, each include n stages where n is an integer equal to or greater than 1, with each stage including 2^{n-1} couplers. These coupler systems may also include strategically-placed phase shifters. Such systems also include N amplifiers where N is equal to 2^n, with N inputs from the outputs of the input multiport hybrid coupler system, and with the outputs of the amplifiers connected as inputs to the output multiport hybrid coupler system.**

This configuration permits a division of the N amplifiers into two groups that each dissipates substantially the same quantity of heat energy.

21 Claims, 3 Drawing Sheets



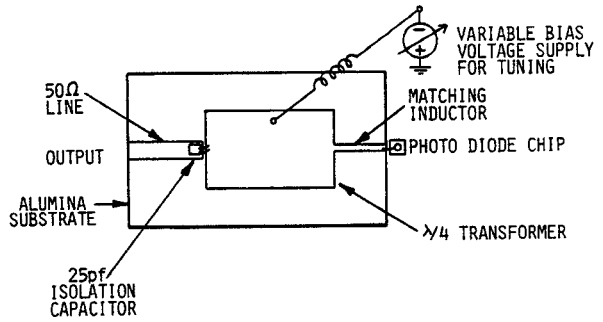
5,055,810 Oct. 8, 1991

Ultra-High-Speed Light Activated Microwave Switch/Modulation Using Photoreactive Effect

Inventors: Michael de La Chapelle and Hui-Pin Hsu.
Assignee: Hughes Aircraft Company.
Filed: Aug. 29, 1990.

Abstract—The RF/microwave switch/modulator uses an optically controlled diode 20. The reactance of the diode may be varied by varying the illumination intensity. In this fashion, the photodiode in conjunction with an external circuit can switch or modulate a microwave signal by varying the reactance of the diode using a laser light source or the like. The bias voltage may be varied to electronically tune the diode so that the microwave frequency of operation can be electronically controlled.

23 Claims, 6 Drawing Sheets



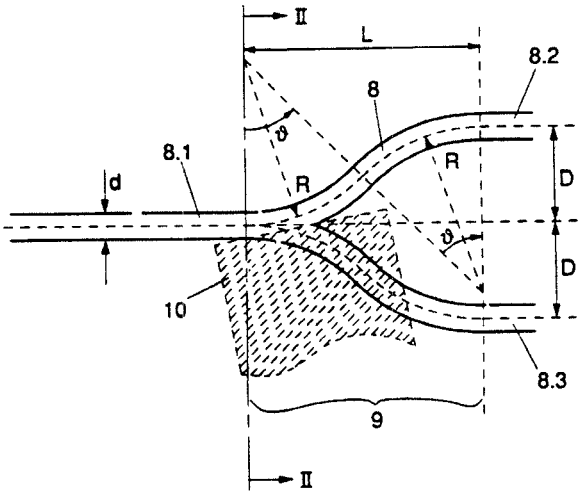
5,056,883 Oct. 15, 1991

Integrated Optical Polarization Splitter

Inventors: Martinus B. J. Diemeer and Johannes J. G. Maria van der Tol.
Assignee: Koninklijke Ptt Nederland N. V.
Filed: Jan. 25, 1991.

Abstract—The invention relates to an integrated optical polarization splitter based on the mode filter principle, in which the asymmetry, necessary therefor, of the waveguides is obtained by using a polable glassy polymer as optical waveguide material, which material is polarization-sensitive in the poled state and is not, or virtually not polarization-sensitive in the unpoled state. A Y-shaped optical waveguide pattern 8 of polable glassy polymer comprises a continuous optical waveguide formed by the optical waveguide sections 8.1(incoming) and 8.2 (outgoing) in which the polymer is in the unpoled state and an outgoing optical waveguide section 8.3 that connects to said optical waveguide at an acute angle and in a tapered fashion and in which the polymer is in the poled state. Since the poled material is also electro-optical, an electric field, for example generated between electrodes 2 and 10, can still correct any small deviations in the asymmetry. Advantages are simple production, with relatively high tolerances, and a short integration length of the component.

4 Claims, 1 Drawing Sheet



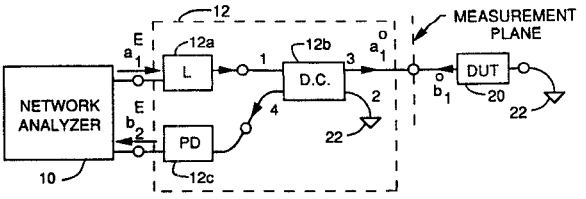
5,056,915 Oct. 15, 1991

Fiber-Optic Calibration Standard Apparatus

Inventor: David D. Curtis.
Assignee: The United States of America as represented by the Secretary of the Air Force.
Filed: May 25, 1990.

Abstract—A fiber-optic calibration standard apparatus having a fiber-optic cable pair which have difference in length of one quarter the wavelength of the applied modulated signal and are coupled to a mirrored reflecting surface to provide reflection reference signals that are utilized to generate error correction signals. A matched termination has one end of an optical fiber sealed in a vial of index matching fluid to absorb the optical power incident to the fiber.

20 Claims, 2 Drawing Sheets



5,058,972 Oct. 22, 1991

Integrated Semiconductor Device Including an Optoelectronic Switching Element

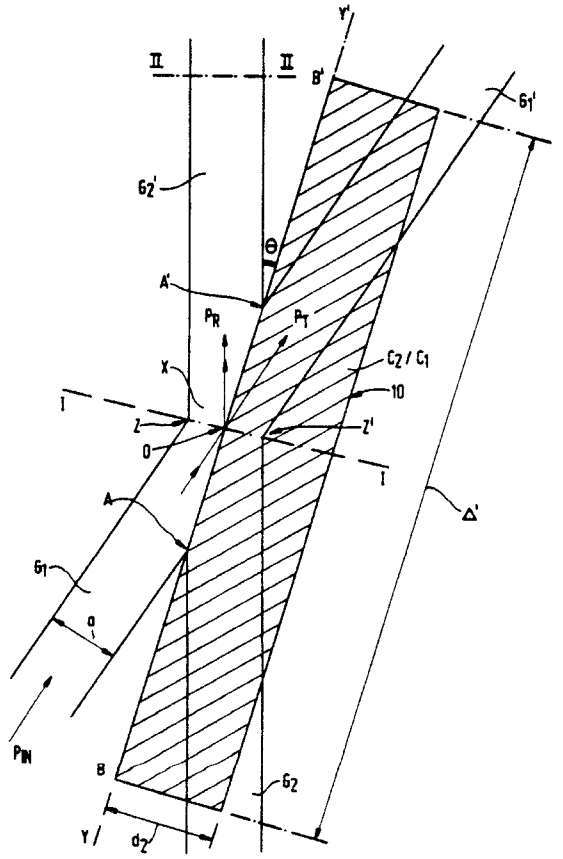
Inventors: Marko Erman and Philippe Autier.
Assignee: U.S. Philips Corp.
Filed: Nov. 17, 1989.

Abstract—An integrated semiconductor device including at least one optoelectronic switching element, which comprises:

- two rectilinear monomode optical guides crossing each other at an angle 2θ composed of at least one heterostructure of III-V material, which comprises a substrate S of a confinement material and a guiding layer CG as well as a guiding strip RB.
- a $p-n$ junction formed in the crossing region asymmetrically with respect to the bisecting longitudinal plane of the crossing angle,

characterized in that the longitudinal dimension of the $p-n$ junction largely exceeds that of the crossing region, and in that the $p-n$ junction is arranged so as to project symmetrically on either side of this region in this longitudinal direction.

21 Clams, 16 Drawing Sheets



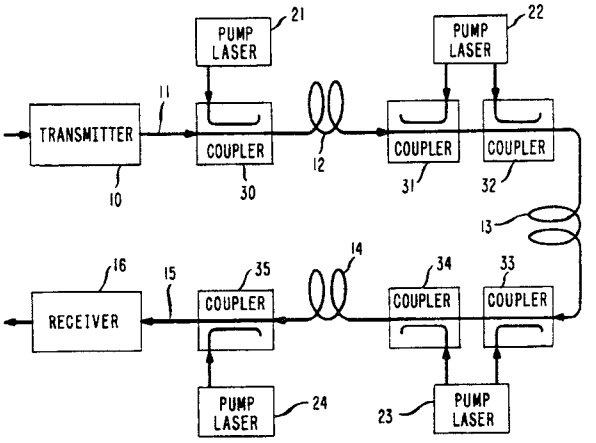
5,058,974 Oct. 22, 1991

Distributed Amplifications for Lightwave Transmission System

Inventor: Linn F. Mollenauer.
Assignee: AT&T Bell Laboratories.
Filed: Oct. 6, 1989.

Abstract—Bidirectional lightwave transmission is restored and uniform amplification of lightwave signals over long spans of optical fiber is achieved by employing distributed amplification over the spans. Distributed amplification is achieved with an amplifying optical fiber that includes a long length of optical fiber having a dilute rare-earth dopant concentration substantially in the fiber core region, and a corresponding pump signal generator at at least one end of the doped fiber having the appropriate wavelength and power to cause amplification of optical signals by both Raman effects and stimulated emission from the rare-earth dopants. Dilute concentrations are understood as the range of concentrations substantially satisfying the condition that the gain from the rare-earth dopant, when near saturation, is substantially equal to the fiber loss.

17 Claims, 3 Drawing Sheets



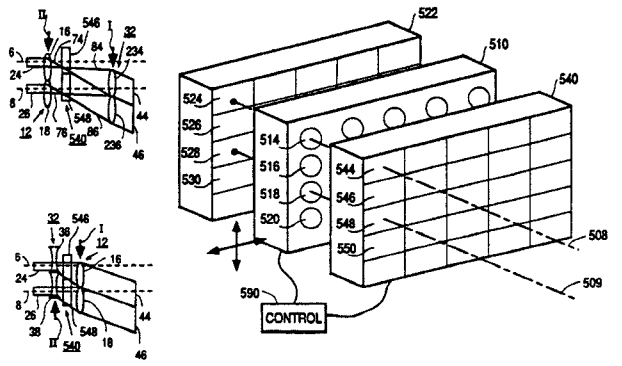
5,059,008 Oct. 22, 1991

Wide-Angle Beam Steerer Using Translation of Plural Lens Arrays

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

Abstract—A beam steering arrangement for a plurality of beams of electromagnetic radiation from a like plurality of sources arrayed with a preselected source-to-source spacing includes a first lens array. The period of the lenses corresponds to that of the sources. The lenses of the first array may be converging or diverging lenses, but when illuminated by the sources, each produces a beam of light including at least a diverging portion. A second lens array is cascaded with the first lens array, with the lenses of the second array illuminated by the diverging beam portions. The second lens array collimates the diverging beam portions. The second lens array is translated in a direction approximately transverse to the undeflected beam direction in order to scan or deflect the collimated beams. This may result in overfilling of the input apertures of the lenses of the output lens array, with consequent reduction in the amplitude of the main beam, and with generation of beams of lower intensity in other directions. The first lens array is translated in a fashion which scans the diverging beam portions to prevent aperture overfilling. In particular embodiments of the invention, the lenses of the output lens array are converging lenses, and the input lens array may include either converging or diverging lenses. In another embodiment of the invention, the pair of translatable lens arrays is cascaded with an array of phase shifters for providing piston phase correction by which a continuous range of scan directions may be achieved.

17 Claims, 9 Drawing Sheets



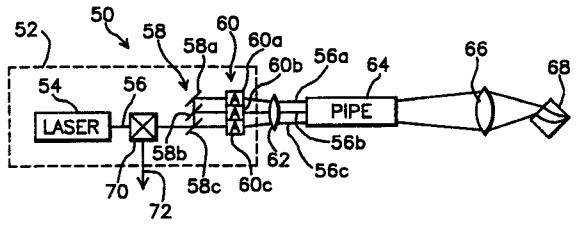
5,059,917 Oct. 22, 1991

Optical Phase Conjuagation Apparatus Including Light Pipe for Multiple Beam Combination

Inventor: Ronald R. Stephens.
Assignee: Hughes Aircraft Company.
Filed: Apr. 20, 1990.

Abstract—A rectangular light pipe (38) and associated optical elements (36), (40) are used to produce an overlapped combination of an array of aberrated laser beams (32), (34) inside a phase conjugate mirror (42). The beam array (32), (34) is focussed onto the entrance face (38a) of the light pipe (38) in such a way that each beam (32), (34) spreads by diffraction and internal reflections to fill the exit face (38b) of the light pipe (38). An image of the exit face (38b), which is completely filled by the overlapped beams (32), (34), is focussed into the phase conjugate mirror (42) such as to produce an overlap spot (46) size that is independent of beam aberation level. The apparatus preserves the linear polarization of the input beams (32), (34), has low optical loss, and may be incorporated into a 2 pass (50), (74), or 4 pass (80) phase conjugate master-oscillator power amplifier.

22 Claims, 2 Drawing Sheets



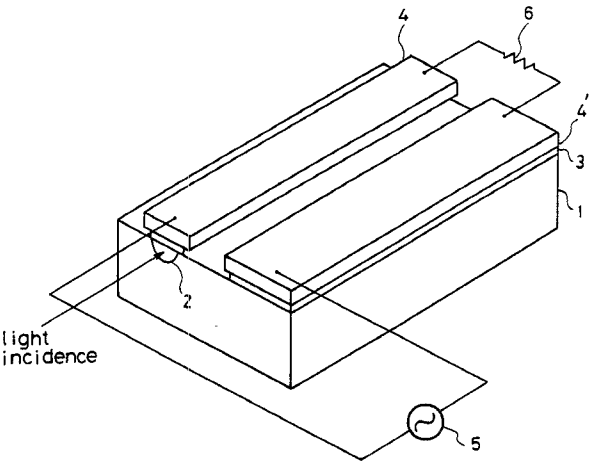
5,061,030 Oct. 29, 1991

Optical Integrated Modulator

Inventors: Hiroshi Miyamoto and Hideto Iwaoka.
Assignee: Optical Measurement Technology Development Co., Ltd.
Filed: Aug. 14, 1990.

Abstract—This invention enables low-voltage operation and improves matching in velocities of the radio frequency and of light by lowering effective index and to thereby expand modulation frequency bandwidth by structuring an optical modulator where a substrate of the material of which refractive index changes by an application of electric field description, and the insulating buffer layers are eliminated from the regions other than the electrodes. By structuring the modulator in a manner to satisfy the prescribed conditions with dimensions of each unit, the light can be matched in complete phase matching (group velocity matching) with radio frequency while characteristic impedance of the electrodes is fixed at a desired value.

8 Claims, 20 Drawing Sheets



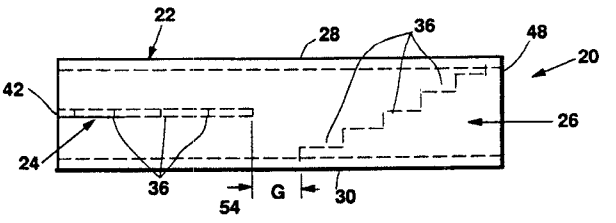
5,061,037 Oct. 29, 1991

Dual Septum Polarization Rotator

Inventors: Mon N. Wong and Gregory D. Kroupa.
Assignee: Hughes Aircraft Company.
Filed: Oct. 22, 1990.

Abstract—A dual septum polarization rotator that, in the presently preferred embodiment thereof, includes a square waveguide and a pair of stepped septums disposed in spaced, orthogonal relation of each other within opposite end portions of the square waveguide. A first one of the septums extends horizontally between the side walls of the waveguide, parallel to the top and bottom walls of the waveguide, and the other/second one of the septums extends vertically between the top and bottom walls of the waveguide, parallel to the side walls of the waveguide. The first septum, in cooperation with the waveguide, defines first and second input ports, and, the second septum, in cooperation with the waveguide, defines first and second output ports. The spacing between the first and second septums defines a central, open, nonseptum region within the waveguide. In operation, the first septum functions to convert the polarization of a first excitation signal introduced into the first input port from a first polarization to second polarization, and the second septum functions to convert the second polarization into a third polarization orthogonal to the first polarization, for output, via the first output port, as a first output signal. For example, if the first polarization is horizontal polarization, then the second polarization is circular polarization, and the third polarization is vertical polarization. The polarization rotator of the present invention is also capable of dual mode operation, whereby the polarization of a second excitation signal introduced into the second input port is simultaneously rotated for output, via the second output port, as a second output signal.

20 Claims, 3 Drawing Sheets



5,061,038 Oct. 29, 1991

Fiber Type Wavelength Converter

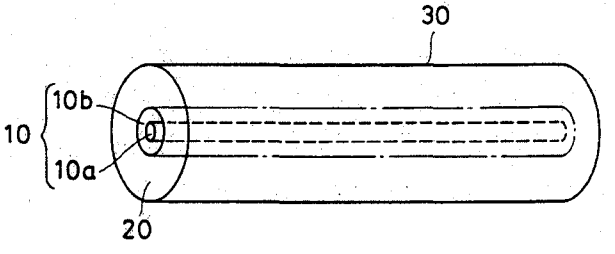
Inventors: Kiyofumi Chikuma and Sota Okamoto.
Assignee: Pioneer Electronic Corporation.
Filed: Jan. 11, 1991.

Abstract—A fiber type wavelength converter formed of a core and a clad surrounding the core, the core consisting of a first core formed of a nonlinear crystalline material, for which, when the refractive index to the primary light incident on and guided by the core is represented by ηG^{ω} and the refractive index to a converted second harmonic is represented by $\eta G^{2\omega}$, the relationship $\eta G^{2\omega} > \eta G^{\omega}$ holds, and a second core formed of optical glass covering the first core. Specifically, the optical glass for the second core is such optical glass, for which, when the refractive index thereof to the primary light incident thereon is represented by ηGL^{ω}, the relationship

$$0.9 < \frac{\eta_{GL}^{\omega}}{\eta_{G^{\omega}}} < 1.1$$

holds.

2 Claims, 2 Drawing Sheets



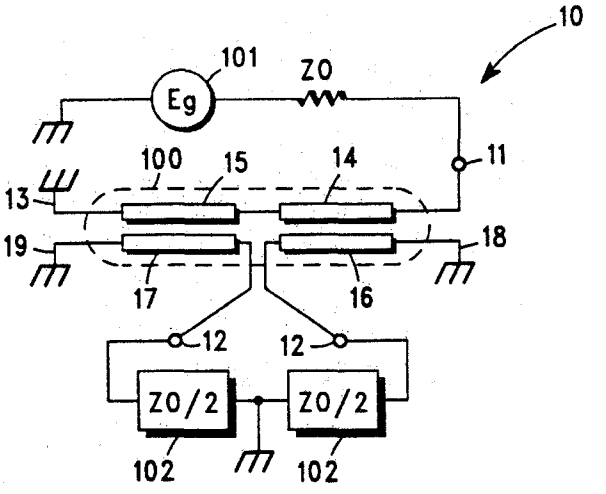
5,061,910 Oct. 29, 1991

Balun transformers

Inventor: Jean J. Bouny.
Assignee: Motorola, Inc.
Filed: Aug. 27, 1990.

Abstract—A balun is formed by printed tracks (20, 22) on a printed circuit board. A first conductor to one side of the board extends between ground (13) and single-ended signal port 11. A second conductor to the other side of the board extends between ground 21 and a balanced signal port (12) in electrical symmetry. The arrangement provides a construction wherein the balanced side of the balun is entirely on one side of the board, resulting in symmetrical parasitic effects in the balanced limbs. Also cross board connections are not required. The balun allows a printed circuit form to be used where parasitic effects are likely, such as high frequency power amplifiers with their associated large heat sink, replacing other forms, such as coaxial cable types.

8 Claims, 2 Drawing Sheets



5,061,912 Oct. 29, 1991

Waveguide Coupler having Opposed Smooth and Opposed Corrugated Walls for Coupling $HE_{1,1}$ Mode

Inventor: Charles P. Moeller.
Assignee: General Atomics.
Filed: July 25, 1990.

Abstract—Apparatus for generating high-power microwaves and for radiating the microwave power in the $HE_{1,1}$ mode into a confined plasma is disclosed. The apparatus includes a microwave generator and mode converters to convert the generated microwave power into the rectangular $HE_{1,1}$ mode. An hermetically sealed rectangular $HE_{1,1}$ mode power coupler is used between the plasma and a main waveguide run to seal the main waveguide run and the generator from the plasma. The power coupler comprises an input rectangular $HE_{1,1}$ mode waveguide, an output rectangular $HE_{1,1}$ mode waveguide and a plurality of dielectric sealed apertures through a common wall between the input and output waveguides. Power absorbed by the power coupler is removed by cooling fluid that is circulated through the common wall between the apertures.

14 Claims, 3 Drawing Sheets