

Patent Abstracts

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5,168,242

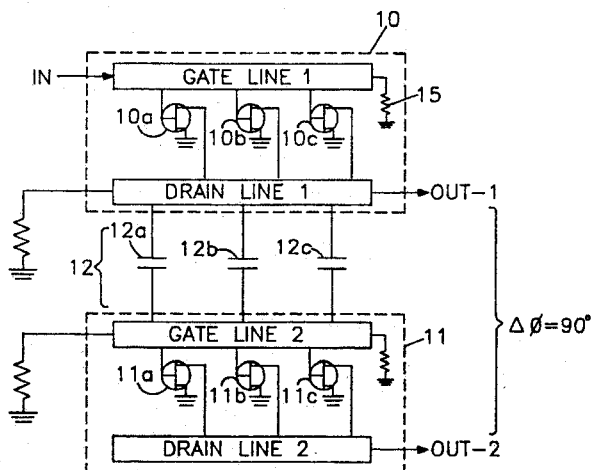
Dec. 1, 1992

Active-Type Broadband Power Divider

Inventors: David A. Willems and Victor E. Steel.
Assignee: ITT Corporation.
Filed: Nov. 20, 1991.

Abstract—An active-type broadband power divider has a pair of distributed amplifiers which are coupled together by a distributed capacitive coupling to provide a predetermined phase shift between respective output signals thereof. The distributed amplifiers are in the form of a row of three-terminal transistors having their gates and drains connected to gate and drain lines. The gate and drain lines are artificial transmission lines. By distributing the capacitive coupling between the gate and/or drain lines, a constant 90 degree phase shift is obtained over the entire bandwidth of the artificial transmission lines. For a 180 degree phase shift, a third distributed amplifier is provided with distributed capacitive coupling between its gate or drain line and that of the second distributed amplifier.

19 Claims, 3 Drawing Sheets



5,168,249

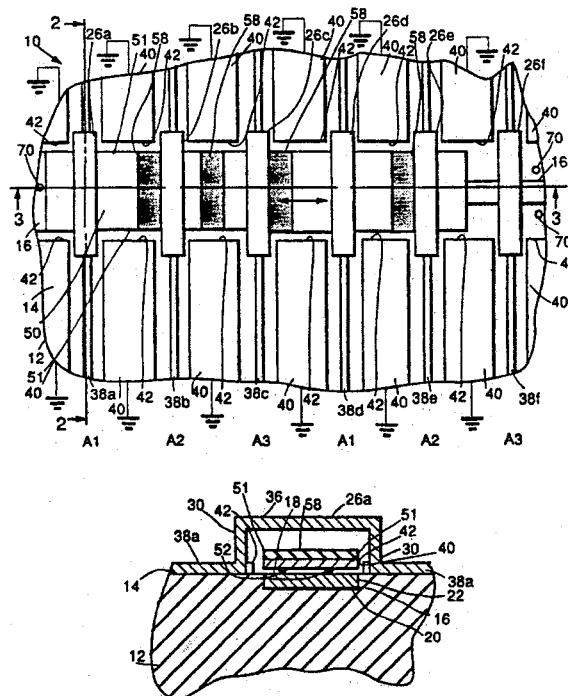
Dec. 1, 1992

Miniature Microwave and Millimeter Wave Tunable Circuit

Inventors: Lawrence E. Larson.
Assignee: Hughes Aircraft Company.
Filed: June 7, 1991.

Abstract—A miniature, electrostatically actuated, dynamically tunable circuit which is operable to tune a transmission line in response to control signals. This circuit is micromachined with the use of integrated circuit processes such that a fixed transmission line is fabricated on a substrate and a movable signal line is fabricated over the substrate and is movable relative to the fixed transmission line in response to electrostatic fields produced when the control signals are selectively applied to an array of air bridge stator control electrodes which span the transmission line.

24 Claims, 2 Drawing Sheets



5,168,534

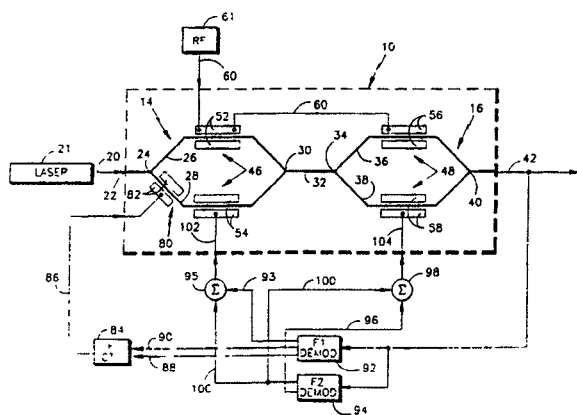
Dec. 1, 1992

Cascaded Optic Modulator Arrangement

Inventors: Gregory J. McBrien and James D. Farina.
Assignee: United Technologies Corporation.
Filed: Dec. 9, 1991.

Abstract—A pair of interferometers, such as Mach-Zehnders, are disposed in a series arrangement in which a signal fed to an input of the first Mach-Zehnder is modulated by an optical modulator, the modulated signal is fed to an input of the second Mach-Zehnder and is modulated by a second optic modulator, the two optic modulators effectively being connected in a series or cascade arrangement. The phase offset of both modulators and the contrast of one modulator are adjusted to minimize both second and third order harmonics inherently generated by the modulation process of each modulator, thereby providing an improved linear response in the output signal of the second Mach-Zehnder.

20 Claims, 3 Drawing Sheets



5,168,538

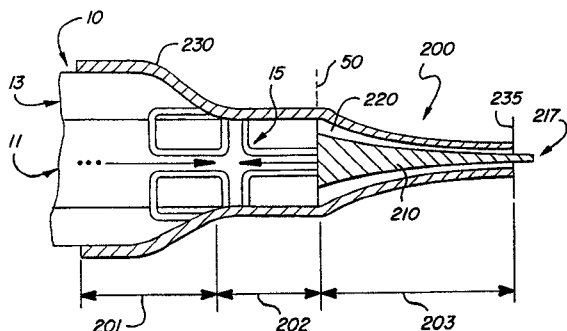
Dec. 1, 1992

Optical Probe Employing An Impedance Matched Sub-Lambda Transmission Line

Inventors: Donald E. Gillespie.
Filed: Jan. 16, 1991.

Abstract—The present invention is an optical probe for emission of light from a region smaller than a wavelength. The optical probe includes a transmission line fed by an optic fiber and an impedance matched coupling. In a first embodiment the optical probe ends with a surface-wave transmission line including a central conductor and a coaxial dielectric. The diameter of the central conductor at the optic fiber is selected to substantially match the transmission impedance of the surface-wave line to that of the optic fiber. The diameter of the central conductor decreases to a diameter smaller than the use wavelength at the tip end. The far end of the dielectric preferably includes a concavity to shape the resulting electric fields. In an alternative embodiment, the optical probe includes a coaxial transmission line. The optic fiber includes a section having a decreasing diameter outer cladding and a section having no outer cladding. The coaxial transmission line includes a central conductor and a dielectric having a diameter substantially equal to the diameter of the core. An outer conductive layer is concentric with the two sections of the optic fiber and the dielectric. In a further alternative embodiment the impedance matched coupling includes a resonant cavity tunable to minimize the voltage standing wave ratio in the optic fiber.

21 Claims, 2 Drawing Sheets



5,170,138

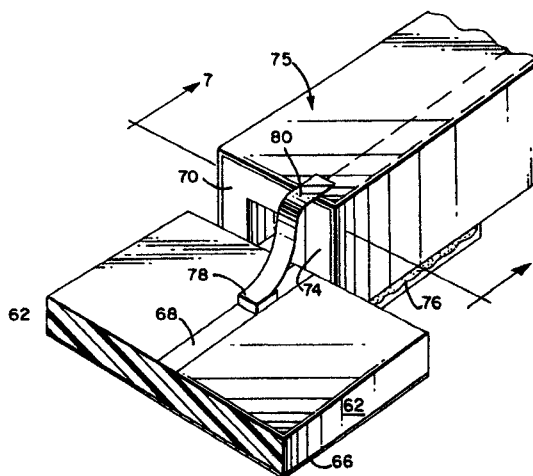
Dec. 8, 1992

Single Toroid Hybrid Mode RF Phase Shifter

Inventors: Roger G. Roberts and Thomas E. Sharon.
Assignee: Electromagnetic Sciences, Inc.
Filed: Mar. 15, 1991.

Abstract—A miniaturized waveguide mode ferrite RF phase shifter is efficiently transitioned to a matched impedance microstrip transmission line mode at either end in an ultra small, efficient and lightweight essentially "planar" phase shifter device having a single ferrimagnetic toroid.

30 Claims, 2 Drawing Sheets



5,170,140

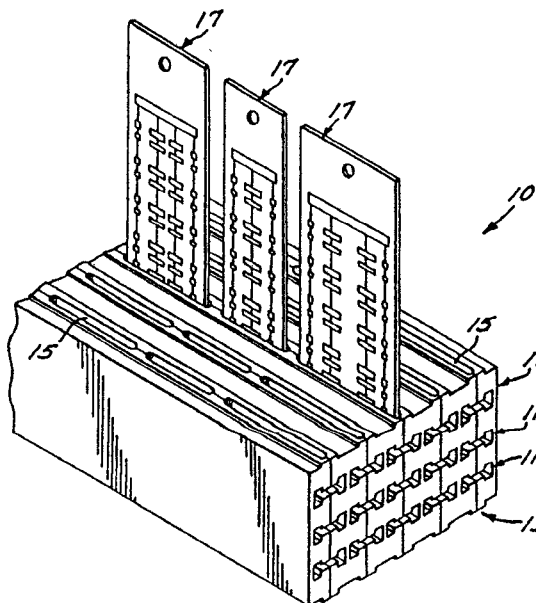
Dec. 8, 1992

Diode Patch Phase Shifter Insertable Into A Waveguide

Inventors: Kathleen Lowe, David D. Lynch, Jr., Steve Panaretos, and Arthur Seaton.
Assignee: Hughes Aircraft Company.
Filed: Mar. 21, 1990.

Abstract—A phased array waveguide antenna having a plurality of longitudinally extending parallel waveguides arranged in rows and columns, and electrically controlled phase shifter strips disposed in longitudinally extending slots centrally located in respective columns of waveguides. The electrically controlled phase shifter strips include conductive patches that are selectively conductively connected together by microwave diodes to provide for variable susceptances.

4 Claims, 2 Drawing Sheets



5,170,174

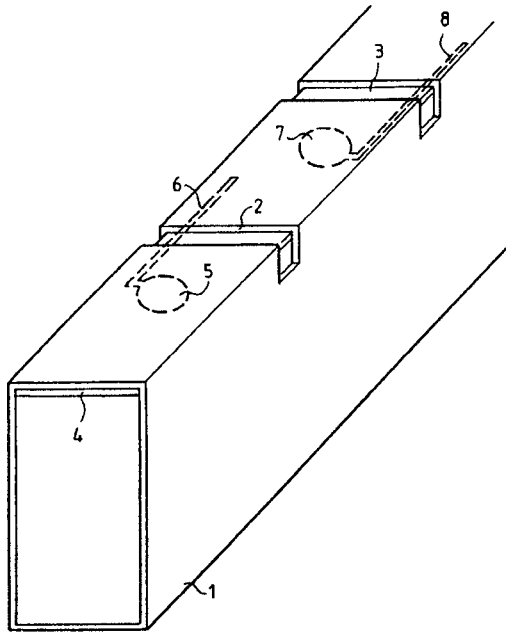
Dec. 8, 1992

Patch-Excited Non-Inclined Radiating Slot Waveguide

Inventors: Daniel Caer, Jean Le Foll, and Joseph Roger.
 Assignee: Thomson-CSF.
 Filed: Oct. 25, 1990.

Abstract—In a waveguide (1) having slots (2, 3) perpendicular to the axis of the waveguide and cut in a narrow wall of the waveguide, a printed circuit plate (4) is positioned. This plate has patches (5, 7) for coupling with the energy being propagated in the waveguide and microstrip lines (6, 8) connected to the patches to excite the slots (2, 3) with the energy thus tapped. These slot waveguides can be used particularly in array antennas.

7 Claims, 2 Drawing Sheets



5,170,275

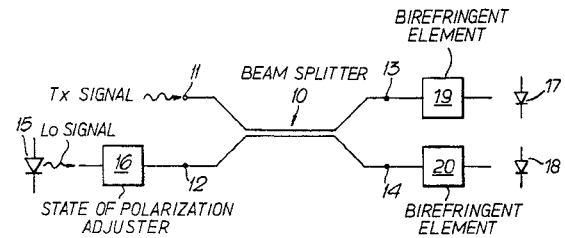
Dec. 8, 1992

Optical Mixing for Heterodyne Detection

Inventors: Timothy A. Large.
 Assignee: Northern Telecom Limited.
 Filed: June 14, 1991.

Abstract—A transmitted (TX) signal received from the remote location is mixed in a polarization resolving beam splitter (10) with a local oscillator (LO) signal from a laser (15). The LO and TX signal components emerging from the beam splitter (10) are orthogonally polarized, but their polarization states are brought into alignment by passage through two birefringent elements (19, 20) before falling on two photodetectors (17, 18). Adjustment of a polarization controller (16) ensures that approximately equal LO power falls on each photodetector.

16 Claims, 1 Drawing Sheet



5,170,450

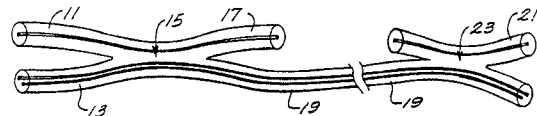
Dec. 8, 1992

Dual-Core Fiber Launching Coupler

Inventors: Robert P. Dahlgren.
 Assignee: The Charles Stark Draper Laboratory, Inc.
 Filed: Apr. 3, 1991.

Abstract—A fiber optic coupler and method of manufacture of same in which a single core optical fiber is twisted about a dual core optical fiber and is heated to softening while drawing the melted junction out to form a biconical taper for providing a controlled splitting ratio for light from the single optical fiber into the dual core fiber. In another embodiment two single core fibers are fused to form a dual core fiber without coupling between the cores.

11 Claims, 2 Drawing Sheets



5,172,081

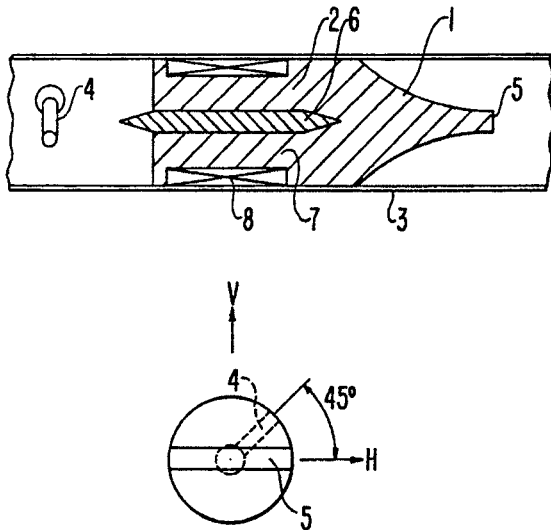
Dec. 15, 1992.

Polarizer Arrangement

Inventors: Timothy A. Gabriel and David G. Spencer.
 Assignee: Plessey Semiconductors Limited.
 Filed: Apr. 8, 1991.

Abstract—A polarizer arrangement in accordance with the invention includes a circular depolarizer combined in a common component with a linear polarizer. The depolarizer material includes a recess within which a ferrite rod is located, a bias coil being wound around the polarizer and the rod. In another arrangement, a polyrod waveguide feed is also included in the component, being integrated with the circular depolarizer and the linear polarizer.

13 Claims, 1 Drawing Sheet



5,172,084

Dec. 15, 1992

Miniature Planar Filters Based On Dual Mode Resonators of Circular Symmetry

Inventors: Slawomir J. Fiedziuszko and John A. Curtis.

Assignee: Space Systems/Loral, Inc.

Filed: Dec. 18, 1991.

Abstract—Planar dual mode filters (30) are formed by a conductive resonator (20) having circular symmetry and two pairs of symmetrically oriented planar conductive leads (22, 26 and 24, 28). The conductive leads (22, 26 and 24, 28) are aligned colinearly with two orthogonal diameters (32, 34, respectively) of the circular conductive resonator (20) and are electrically isolated from said resonator (20). A perturbation (38) located on an axis (36) oriented symmetrically with respect to the two pairs of conductive lead (22, 26 and 24, 28) couples electromagnetic modes which are injected into the resonator (20) by the planar conductive leads (22, 26 and 24, 28). Higher order filter circuits can be realized by combining multiple filters (30) of the present invention. The filters (30) are amenable to printed circuit (microstrip to stripline) fabrication using superconductors for the conductive elements.

9 Claims, 4 Drawing Sheets

5,172,082

Dec. 15, 1992

Multi-Octave Bandwidth Balun

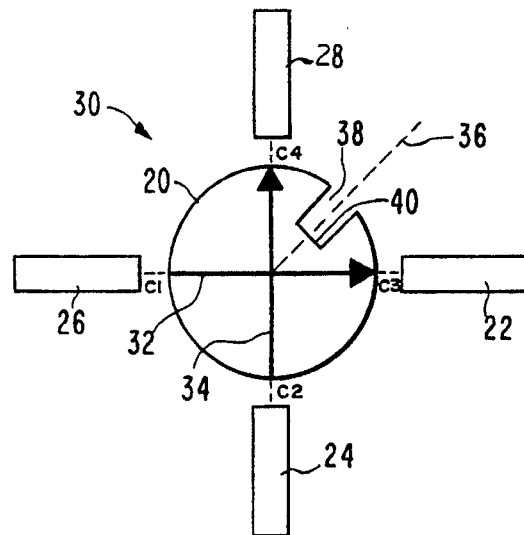
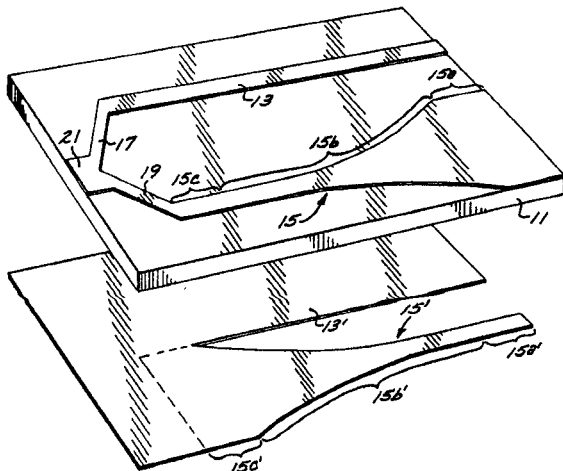
Inventors: Stan W. Livingston, Jar J. Lee, and Nam S. Wong.

Assignee: Hughes Aircraft Company.

Filed: Apr. 19, 1991.

Abstract—A balun structure including a dielectric substrate having top and bottom surfaces on which are formed a splitter/combiner, a reference transmission line of length A and substantially constant characteristic impedance, and an inverting transmission line of length A and substantially constant characteristic impedance. The inverting transmission line in particular includes a first tapered planar section disposed on the top surface of the substrate and transitioning along its length from a narrow width to a wide width, and a second tapered planar section disposed on the bottom surface of the substrate and transitioning along its length from a wide width to a narrow width, such that the first and second tapered planar sections are rotated mirror images of each other.

6 Claims, 4 Drawing Sheets



5,172,262

Dec. 15, 1992

Spatial Light Modulator and Method

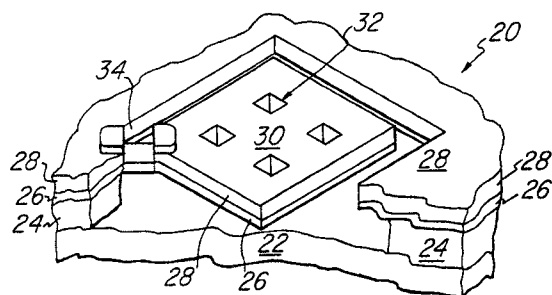
Inventors: Larry J. Hornbeck.

Assignee: Texas Instruments Incorporated.

Filed: Apr. 16, 1992.

Abstract—An electrostatically deflectable beam spatial light modulator with the beam composed of two layers of aluminum alloy and the hinge connecting the beam to the remainder of the alloy formed in only one of the two layers; this provides a thick stiff beam and a thin compliant hinge. The alloy is on a spacer made of photoresist which in turn is on a semiconductor substrate. The substrate contains addressing circuitry in a preferred embodiment.

12 Claims, 9 Drawing Sheets



5,173,666

Dec. 22, 1992

Microstrip-to-Inverted-Microstrip Transition

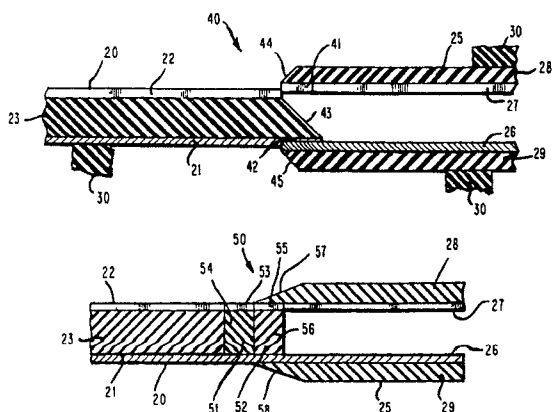
Inventors: Richard W. Babbitt, Thomas E. Koscica, and Adam Rachlin.

Assignee: The United States of America as represented by the Secretary of the Army.

Filed: Mar. 27, 1992.

Abstract—A microstrip-to-inverted-microstrip transition for providing a low-loss connection of a microstrip to an inverted microstrip in planar microwave devices. One embodiment includes tapered dielectric and conductor sections that provide a gradual or tapered change in the effective dielectric constant and a substantially constant characteristic impedance across the transition. A second embodiment employs a series of microstrip transformers that are one-quarter wavelength long. The transformers have dielectric members that have successively decreasing dielectric constants to provide a gradual dielectric match. The geometries of the microstrip transformers are chosen so that there will be an impedance match across the transition. A third embodiment employs the microwave interaction that takes place with the supporting dielectrics of the inverted microstrip to produce a dielectric match. The conductor spacing of the inverted microstrip is adjusted such that the effective dielectric constant of the inverted microstrip is close to or equal to that of the microstrip.

17 Claims, 3 Drawing Sheets



5,173,714

Dec. 22, 1992

Slot Array Antenna

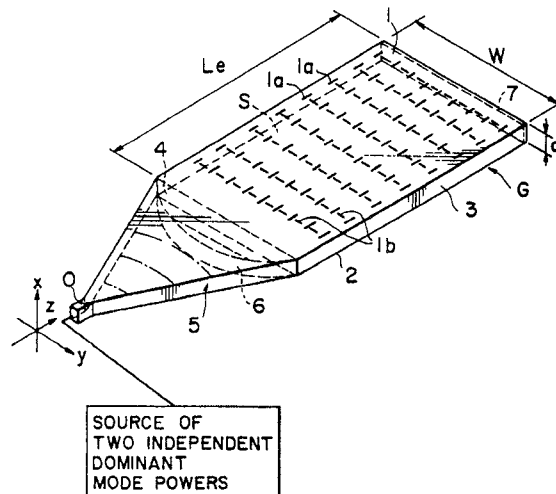
Inventors: Kunitaka Arimura, Fumio Takenaga, Hiroshi Kasuga, and Akira Tsukada.

Assignee: Arimura Giken Kabushiki Kaisha.

Filed: May 3, 1990.

Abstract—A slot array antenna is composed of a rectangular waveguide formed by means of oppositely disposed plates and side plates, and a power feeder means connected to the rectangular waveguide at a power feed opening. A plurality of wave radiation slots are formed within one of the plates. The power feeder means is arranged such that two powers fed therein are changed into two plane waves, at the power feed opening, having two independent dominant modes. The slots comprise longitudinal slots extending in a longitudinal direction of the waveguide and lateral slots extending in a lateral direction of the waveguide so as to radiate two plane waves respectively.

19 Claims, 16 Drawing Sheets



5,173,743

Dec. 22, 1992

Fiber Optical Time-Division-Multiplexed Unbalanced Pulsed Interferometer With Polarization Fading Compensation

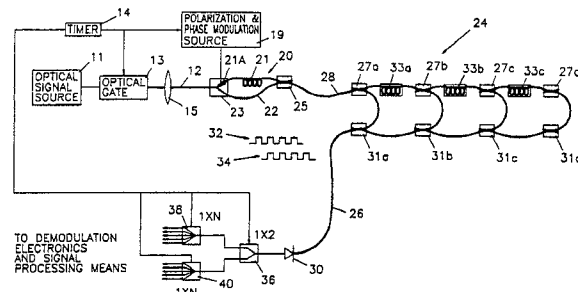
Inventors: Byoung Y. Kim.

Assignee: Litton Systems, Inc.

Filed: May 28, 1991.

Abstract—Apparatus and methods for reducing and preventing polarization fading in unbalanced measuring interferometers. An extended interferometer having a plurality of sensors and a compensating interferometer are used. They are driven from a pulsed optical signal source wherein the optical signal comprises sequences of two pulses each. To prevent polarization fading the polarization of a predetermined one of each two-pulse sequence is switched, preferably orthogonally, from sequence to sequence. Interference pulse output groups are produced for each two-pulse driving sequence. Each output group has the same number of usable pulses as the number of sensors in the interferometer.

27 Claims, 3 Drawing Sheets



5,173,915

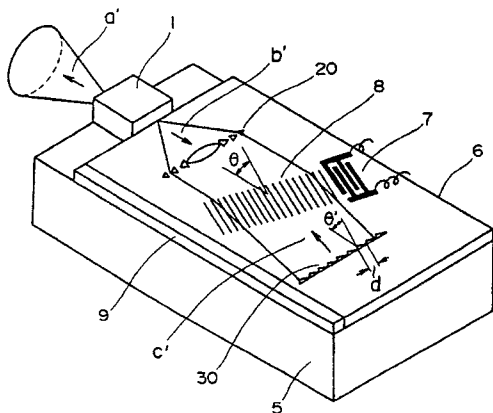
Dec. 22, 1992

Semiconductor Laser Device

Inventors: Masayuki Kubota.
 Assignee: Mitsubishi Denki Kabushiki Kaisha.
 Filed: July 2, 1991.

Abstract—A variable wavelength light source using a semiconductor laser element suitable for use in optical communications is provided. Light emitted from one end surface of the semiconductor laser element is led along a path through a light wavefront converting element (e.g., a Fresnel lens) and a spatial light modulating element which are both formed in a waveguide layer, to a diffraction grating which is also formed in the waveguide layer. Light reflected from the diffraction grating is caused to travel back along the same path but in the opposite direction and to impinge on the semiconductor laser element. Wavelength selection of by the spatial light modulating element and the diffraction grating is utilized for generating and maintaining oscillation at a selected wavelength in the laser element. The wavelength of light is selected by selecting the wavelength of a surface acoustic wave generated the spatial light modulating element, i.e., by changing the frequency of a high frequency electrical signal applied to the modulating element.

17 Claims, 1 Drawing Sheet



5,173,956

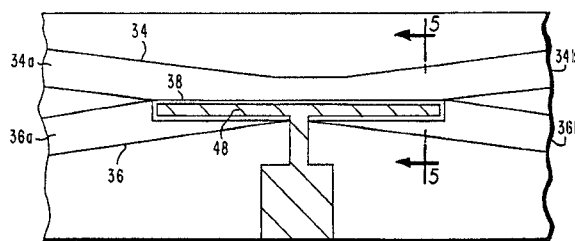
Dec. 22, 1992

Thermally Driven Optical Switch Method and Apparatus

Inventors: Robert R. Hayes.
 Assignee: Hughes Aircraft Company.
 Filed: Feb. 1, 1991.

Abstract—Optical switching between two waveguides with a common cladding interguide region is achieved by passing a current through the interguide region to heat it and thereby alter its refractive index, and controlling the current to control optical switching between the two guides. Rib waveguides on a common semiconductor layer are preferably used, with the interguide region having a lesser thickness than the core regions. Current is transmitted by forward biasing a Schottky contact to the interguide region. The switch is capable of operation at switching rates of 1 MHz.

27 Claims, 3 Drawing Sheets



5,173,957

Dec. 22, 1992

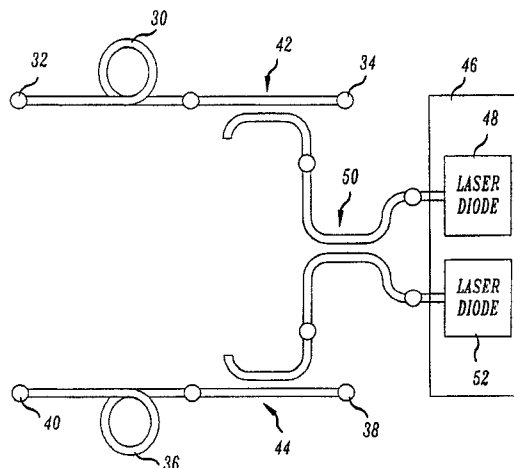
Pump Redundancy for Optical Amplifiers

Inventors: Neal S. Bergano, Richard F. Druckenmiller, Franklin W. Kerfoot III, and Patrick R. Trischitta.
 Assignee: AT&T Bell Laboratories.
 Filed: Sept. 12, 1991.

Abstract—Currently laser diode pump redundancy for an optical fiber amplifier is obtained by selectively connecting one of two diode pumps to an optical amplifier via an optical switch. When the diode laser pump which is connected to the amplifier becomes defective, the optical switch is activated, either remotely or automatically, and the good laser diode is substituted for the defective laser diode pump. In another arrangement, two laser diodes are coupled to an optical fiber amplifier via a polarization-dependent optical coupler. In each instance, a second laser diode is required to provide pump redundancy for an optical fiber amplifier.

In this invention, at least, two laser diodes are coupled via a 3 dB optical coupler to supply pump power to each of the two optical fiber amplifiers simultaneously. If one of the laser diode pumps fails, the other laser diode pump provides pump power to each of the optical fiber amplifiers. Thus, with the addition of a 3 dB coupler, pump redundancy for a pair of optical fiber amplifiers is obtained with only two laser diode pumps instead of the normally required four laser diode pumps. In practice, only one of the two pumps can be active, and the other turned on only when the first pump fails. In another embodiment, the two laser diode pumps can be active at all times where each laser diode pump is operated at either full or less than full power. In the arrangement where the laser diode pumps are operated simultaneously at less than full power, when a pump failure occurs the power output of the good laser diode pump can be increased to compensate for the loss of power from the defective pump.

7 Claims, 3 Drawing Sheets



5,175,518

Dec. 29, 1992 5,175,520

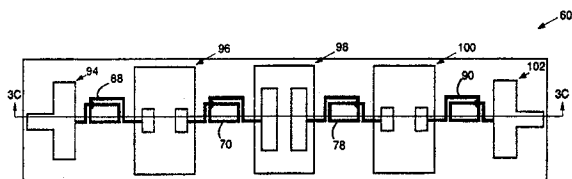
Dec. 29, 1992

Wide Percentage Bandwidth Microwave Filter Network and Method of Manufacturing Same

Inventors: Daniel G. Swanson, Jr.
 Assignee: Watkins-Johnson Company.
 Filed: Oct. 15, 1991.

Abstract—A high percentage bandwidth microwave filter network, according to an embodiment of the present invention, comprises a T-network of capacitors implemented with thin-film techniques by applying a groundplane to one side of an alumina substrate and a first plate to the other side. A silicon nitride dielectric layer having a high density of capacitance is deposited over the first plate, and then a second and third capacitor plate are deposited on the dielectric over the first plate.

6 Claims, 3 Drawing Sheets



5,175,519

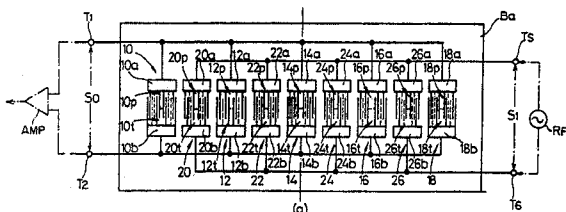
Dec. 29, 1992

Surface Elastic Wave Filter Having Finger Omitted Transducers to Eliminate Side Lobes

Inventors: Hiromi Yatsuda and Yoshihiko Takeuchi.
 Assignee: Nihon Musen Kabushiki Kaisha.
 Filed: Apr. 18, 1990.

Abstract—A surface elastic wave filter includes a plurality of input interdigital transducers for receiving a high-frequency input signal, and a plurality of output interdigital transducers for producing an output signal derived from the input signal and having predetermined frequency characteristics. Each of the input and output interdigital transducers having a pair of confronting connectors for receiving the input signal and extracting the output signal, respectively, and a pair of groups of interdigitating electrode fingers extending from the connectors. The input and/or output interdigital transducers include finger-withdrawn interdigital transducers with electrode fingers selectively withdrawn in different positions. With such withdrawal weighing, the interdigital transducers have different sidelobe characteristics, i.e., frequency blocking characteristics, so that the surface elastic wave filter operates with a greater side-lobe suppression.

24 Claims, 10 Drawing Sheets

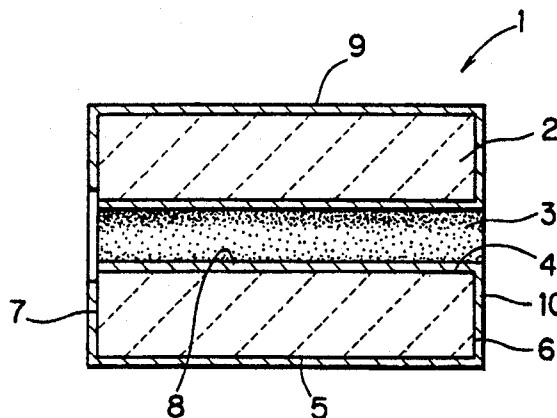


High Frequency Coaxial Resonator

Inventors: Atsushi Inoue.
 Assignee: Murata Manufacturing Co., Ltd.
 Filed: July 3, 1990.

Abstract—A high-frequency coaxial resonator including a tubular dielectric member having a through hole and provided with inner and outer peripheral surfaces and a pair of end surfaces which axially oppose each other. An inner conductor is formed on the inner peripheral surface and an outer conductor is formed on the outer peripheral surface, the outer conductor extending onto one or both end surfaces of the tubular dielectric member so as to approach the inner conductor through a prescribed clearance, thereby forming a capacitance between the inner and outer conductors for adjusting the resonant frequency of the resonator.

27 Claims, 5 Drawing Sheets



5,175,521

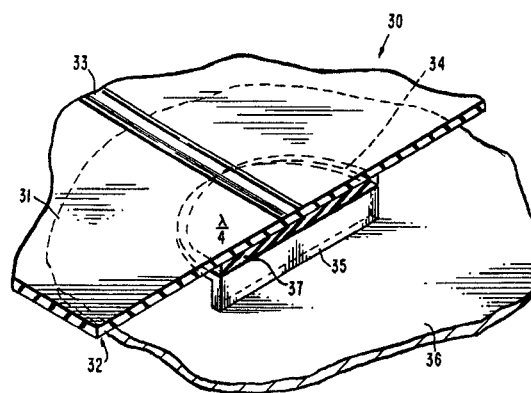
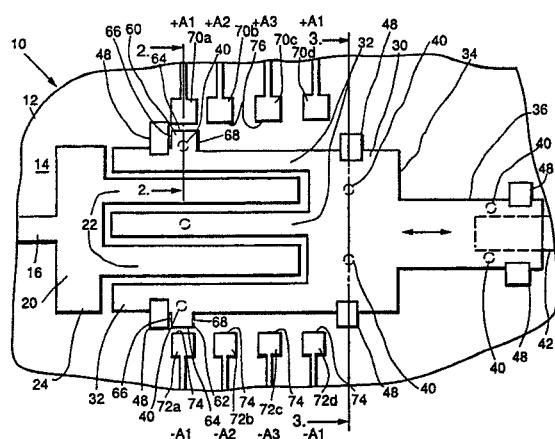
Dec. 29, 1992

Miniature Dynamically Tunable Microwave and Millimeter Wave Device

Inventors: Lawrence E. Larson.
 Assignee: Hughes Aircraft Company.
 Filed: May 31, 1991.

Abstract—A miniature, electrostatically actuated, variable impedance circuit element which is operably tunable in response to control signals. With integrated circuit, thin film processing a fixed circuit member is fabricated on a substrate and a movable circuit member is fabricated over the substrate and is movable relative to the fixed circuit member in response to electrostatic fields produced at armature tabs when the control signals are selectively applied to rows of control electrodes. Embodiments include a variable capacitor and a variable ring resonator.

18 Claims, 2 Drawing Sheets



5,175,522

Dec. 29, 1992

Ground Plane Choke for Strip Transmission Line

Inventors: Robert T. Clark and Dean C. Quick.
 Assignee: Hughes Aircraft Company.
 Filed: May 9, 1991.

Abstract—The ends of two strip transmission line substrates which meet at an interface are supported by resting on top of a sandwich structure made up of a dielectric, a circular metal choke member and a conductive pedestal. The choke member, the dielectric and the ground planes of the substrates form a low-loss RF ground connection to bridge the gap at the interface. The choke member, the dielectric and the ground planes form a quarter wave open circuited transmission line stub in the form of a circular structure. This structure acts as an RF choke and reflects a short circuit into the region between the ground planes, making a virtual connection between the ground planes and the metal choke member. The strip transmission line substrates and the metallic choke member are not rigidly connected, thus allowing for relative movement between the substrate and choke member due to differences in thermal expansion or contraction. A semicircular choke is employed at an interface between a strip transmission line substrate and a coaxial connector, or at an interface between a strip transmission line substrate and a microwave circuit element such as a high-power solid state microwave power amplifier transistor.

6 Claims, 2 Drawing Sheets

5,175,778

Dec. 29, 1992

Integrated Optic Waveguide Coupler With Reduced Wavelength Sensitivity

Inventors: Noorallah Nourshargh and Simon P. Shipley.
 Assignee: Gec-Marconi Limited.
 Filed: Aug. 15, 1991.

Abstract—An integrated optic waveguide coupler having an interaction length throughout which two waveguides lie parallel and in contact with each other, in which the interaction length incorporates at least one straight section and, adjoining the straight section, there is provided at least one additional interaction length having a predetermined curvature. The curvature and the length of the interaction length together minimize wavelength sensitivity.

6 Claims, 3 Drawing Sheets

