# Patent Abstracts

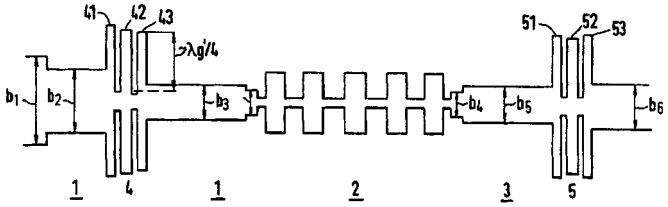
**6,285,267** September 4, 2001 **22 Claims, 4 Drawing Sheets**

## Waveguide Filter

Inventors: Wolfgang Hauth (Backnang, DE) and Dietmar Schmitt (Kleinaspach, DE).
Assignee: Robert Bosch GmbH (Stuttgart, DE)
Filed: July 28, 1998.

***Abstract*—**A waveguide filter having a stepped transformer area on the input and/or output sides, with at least one band-stop filter composed of geometrically closely spaced stop elements integrated into this stepped transformer area. These features make it possible to build waveguide filters with a high edge steepness and a short overall length.

**10 Claims, 2 Drawing Sheets**

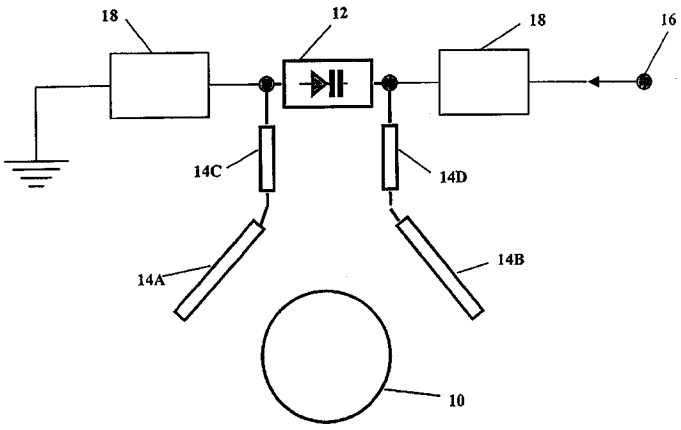



**6,285,268** September 4, 2001

## Coupling Network and Method for Widening the Varactor Diode Tuning Band of Microstrip Dielectric Resonators

Inventor: Umberto Lodi (Merate, IT)
Assignee: Alcatel (Paris, FR)
Filed: July 6, 1999.

***Abstract*—**A coupling network and a method are described for widening the varactor diode tuning band of microstrip dielectric resonators, for instance in microwave oscillators or in filtering arrangements. The present invention substantially provides for modifying the single-line asymmetric structure of a conventional network still utilizing a single varactor diode mounted on the plane of the microstrip circuit. In other words, the transmission line is duplicated thus creating a dipole structure which assures a tighter coupling with the dielectric resonator. Thanks to the duplication of the transmission line and to the fact that the center of the dipole is the location where currents are higher, it is possible to obtain far wider tuning bands as compared with a known and conventional configuration.



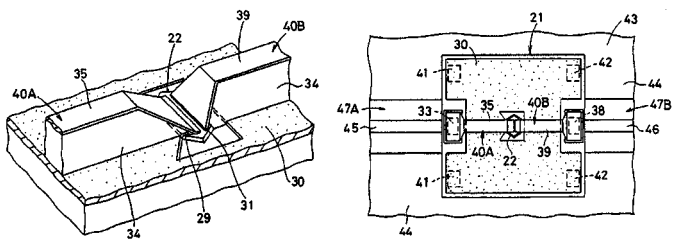

**6,285,269** September 4, 2001

## High-Frequency Semiconductor Device Having Microwave Transmission Line Being Formed by a Gate Electrode Source Electrode and a Dielectric Layer in Between

Inventors: Yohei Ishikawa (Kyoto, JP), Koichi Sakamoto (Otsu, JP), Sadao Yamashita (Kyoto, JP), and Takehisa Kajikawa (Osaka, JP).
Assignee: Murata Manufacturing Co., Ltd. (JP)
Filed: July 10, 1997.

***Abstract*—**A drain electrode and a source electrode are provided for an intrinsic device section on a GaAs substrate with a gate electrode placed therebetween. Almost all or substantial parts of the GaAs substrate is covered by an extending source electrode extending from the source electrode. A belt-shaped extending drain electrode is provided on the extending source electrode with a dielectric layer placed therebetween and thereby an output-side microstripline is formed. A belt-shaped extending gate electrode is also provided on the extending source electrode with a dielectric layer placed therebetween and thereby an input-side microstripline is formed.

**18 Claims, 8 Drawing Sheets**




Publisher Item Identifier S 1531-1309(02)03626-7.

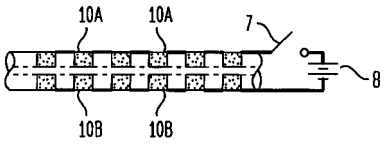
**6,285,812** September 4, 2001

## Switchable and Reconfigurable Optical Grating Devices and Methods for Making Them

Inventors: Karl R. Amundson (Morristown, NJ, US) , Benjamin J. Eggleton (Berkeley Heights, NJ, US), John A. Rogers (New Providence, NJ, US), and Jefferson L. Wagener (Charlottesville, VA, US).
Assignee: Lucent Technologies Inc. (Murray Hill, NJ, US)
Filed: July 17, 1998.

***Abstract*—**In accordance with the invention, an optical fiber grating device is made by providing a fiber with an electrically actuable component optically responsive to voltage or current and a plurality of conductive elements to locally activate the component and thereby to produce local optical perturbations in the fiber. In a preferred embodiment, a fiber is provided with a core of liquid crystal material and a plurality of periodically spaced microelectrode pairs. Application of a voltage to the microelectrodes results in a periodic sequence of perturbations in the core index which produces a grating. When the voltage is switched off, the grating switches off. Other embodiments utilize helical conductive elements.

**13 Claims, 2 Drawing Sheets**



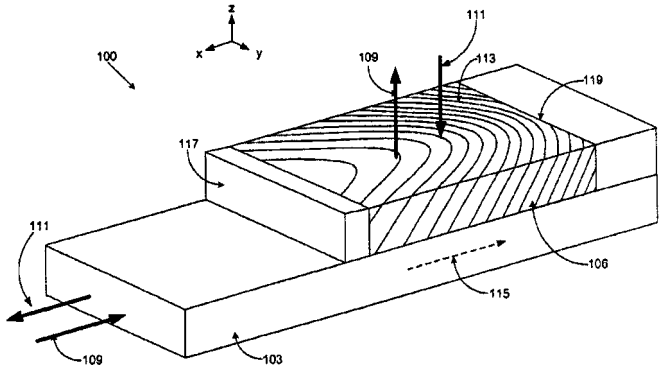

**6,285,813** September 4, 2001

## Diffractive Grating Coupler and Method

Inventors: Stephen M. Schultz (Marietta, GA, US), Thomas K. Gaylord (Atlanta, GA, US), Elias N. Glytsis (Atlanta, GA, US), and Nile F. Hartman (Stone Mountain, GA, US).
Assignee: Georgia Tech Research Corporation (Atlanta, GA, US)
Filed: October 2, 1998.

***Abstract*—**The present invention entails a volume grating for use as an optical coupler and a method for creating the same which comprises a predetermined surface grating pattern having a decreasing surface grating period along a waveguide light propagation direction to focus coupled light in a first dimension with a predetermined light intensity profile along a grating-cover interface plane of the volume grating. In addition, the predetermined surface grating pattern further includes an increasing radius of curvature along the waveguide light propagation direction to focus the light in a second dimension. The present invention further comprises a system and method for designing an apparatus for fabricating the volume grating.

**52 Claims, 13 Drawing Sheets**



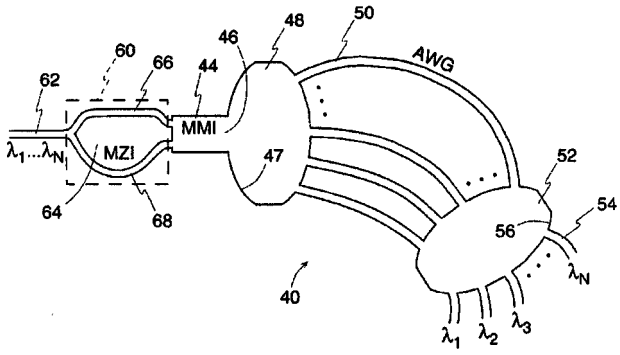

**6,289,147** September 11, 2001

## Passband Flattening of a Phasar

Inventors: Hindrick F. Bulthuis (Enschede, NL) and Martin R. Amersfoort (Enschede, NL).
Assignee: BBV Design BV (NL)
Filed: November 1, 1999.

***Abstract*—**A passband-flattened phasar including two free space regions coupled by a plurality of waveguides having predetermined differences between their lengths so as to act as an arrayed waveguide grating. The phasar is particularly useful in a wavelength-division multiplexed (WDM) optical communication system transmitting multiple wavelength systems arranged in a wavelength comb with a constant wavelength channel spacing. The input waveguide is coupled to the first free space region through a Mach-Zehnder interferometer (MZI) having two waveguide arms of differing lengths receiving approximately equal amounts of the input signal. The arms differ in lengths so as to produce a phase difference between them. In a WDM network, the waveguide arm produce a phase difference such that the free spectral range of the MZI equals the wavelength channel spacing, such that the wavelength response of the MZI is the same for each of the WDM wavelengths. The two outputs of the MZI are coupled into the input end of a multi-mode interferometer (MMI) with a lateral separation which provides a lateral spatial dispersion in the MMI equaling the lateral spatial dispersion of the conventional phasar. Thereby, a larger portion of the passband is equally passed through the phasar.

**19 Claims, 8 Drawing Sheets**



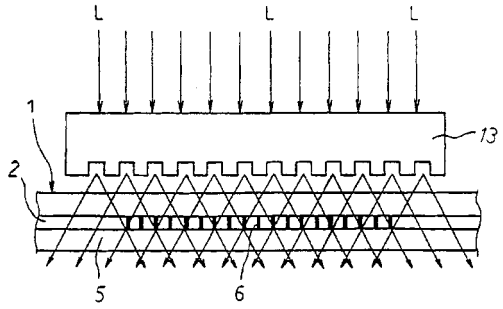
**6,289,154** September 11, 2001

## Grating-Type Optical Component and Method of Manufacturing the Same

Inventors: Toshiaki Tsuda (Tokyo, JP), Ikuo Ota (Tokyo, JP), Toshihiko Ota (Tokyo, JP), Yasuhiro Ibusuki (Tokyo, JP), and Shigehito Yodo (Tokyo, JP).
Assignee: The Furukawa Electric Co., Ltd. (Tokyo, JP)
Filed: November 3, 1998.

***Abstract*—**A grating-type optical component having high isolation ability at a light-blocking band and a small clad layer mode combination loss at a signal transmission band and its manufacturing method are provided. A selected area on a core of an optical fiber is irradiated by ultraviolet beams emitted form an excimer laser source through a phase mask in order to produce high index of refraction areas and low index of refraction areas arranged alternately and periodically along the longitudinal axis of the optical fiber. This ultraviolet irradiation is terminated before the index of refraction, which is incresing due to the ultraviolet irradiation, reaches a target value. Then, the phase mask is removed, and the selected area of the core is again irradiated by ultraviolet beams, thereby completing the grating-type optical fiber.

**7 Claims, 19 Drawing Sheets**



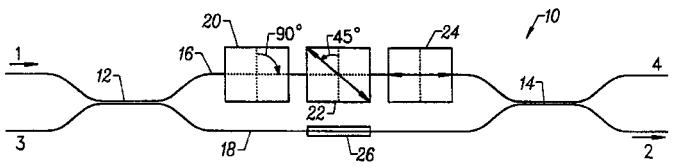

**6,289,156** September 11, 2001

## Low Cost Fiber Optic Circulator

Inventors: Jing-Jong Pan (Milpitas, CA, US) and Feng Q. Zhou (San Jose, CA, US).
Assignee: JDS Uniphase Corporation (San Jose, CA, US)
Filed: April 5, 2000.

***Abstract*—**Improved optical devices, systems and methods for selectively directing optical signals generally based on a Mach-Zehnder interferometer. Through accurate control of the phase relationship, the Mach-Zehnder interferometer allows optical signals to either be cumulatively combined so as to enhance the transmitted signal strength, or destructively combined so as to effectively prevent transmission from an optical signal port. This phase relationship can be controlled using a nonreciprocal device having a pair of retarder plates disposed along one of the two legs of the Mach-Zehnder interferometer so as to provide an optical isolator or circulator.

**3 Claims, 5 Drawing Sheets**



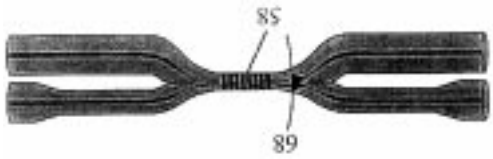

**6,289,699** September 18, 2001

## Wavelength Selective Optical Couplers

Inventors: Anthony S. Kewitsch (Hacienda Heights, CA, US), George A. Rakuljic (Santa Monica, CA, US), and Amnon Yariv (San Marino, CA, US).
Assignee: Arroyo Optics, Inc. (Santa Monica, CA, US)
Filed: March 6, 1998.

***Abstract*—**A wavelength selective optical fiber coupler having various applications in the field of optical communications is disclosed. The coupler is composed of dissimilar waveguides in close proximity. A light induced, permanent index of refraction grating is recorded in the coupler waist. The grating filters and transfers energy within a particular range of wavelengths from a first waveguide to a second waveguide. Transversely asymmetric gratings provide an efficient means of energy transfer. The coupler can be used to combine or multiplex a plurality of lasers operating at slightly different wavelengths into a single fiber. Other embodiments such as a dispersion compensator and gain flattening filter are disclosed.

**10 Claims, 20 Drawing Sheets**



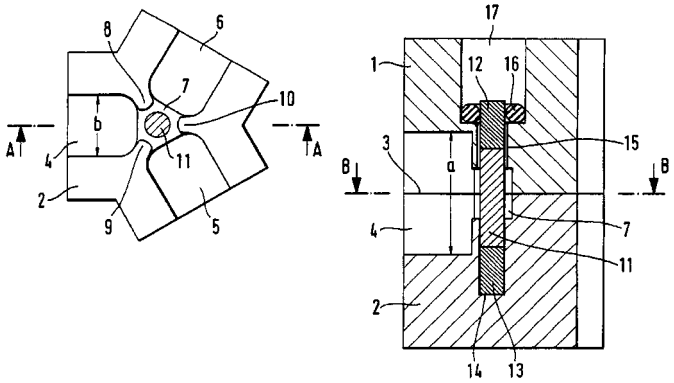

**6,292,068** September 18, 2001

## E-Plane Waveguide Circulator With a Ferrite in the Total Height of the Reduced Height Region

Inventor: Siegbert Martin (Oppenweiler, DE)
Assignee: Robert Bosch GmbH (Stuttgart, DE)
Filed: January 19, 1999.

***Abstract*—**An E-plane waveguide-circulator has a height-reducing branching region, a ferrite body located in the branching region so that a magnetic field extends through the ferrite body, the ferrite body being formed as a bar which extends through a total height of the branching region.

**6 Claims, 1 Drawing Sheet**



**6,292,601** September 18, 2001

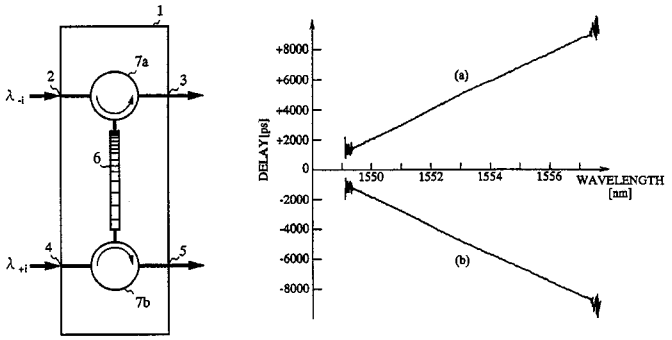
**21 Claims, 12 Drawing Sheets**

## Dispersion Compensation in Optical Fiber Transmission

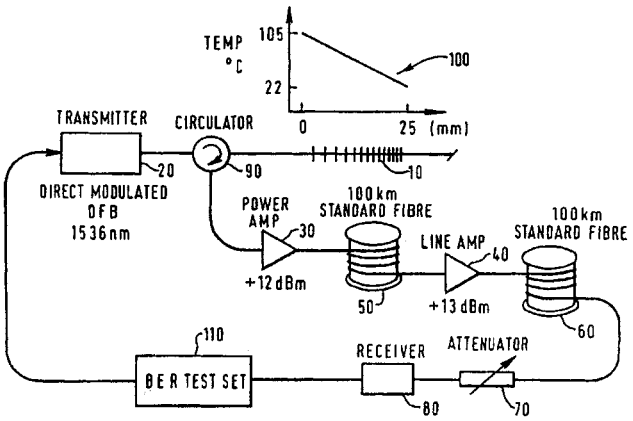
Inventors: Richard I. Laming (Southampton, GB), Martin Cole (Southampton, GB), and Laurence Reekle (Southampton, GB).
Assignee: Pirelli Cavi E Sistemi S.p.A. (Milan, IT)
Filed: January 29, 1996.

***Abstract*—**An optical fiber transmission system comprises an optical signal source operable to generate an optical signal at a predetermined bit rate and at a signal wavelength; an optical fiber transmission link connected at a first end to the signal source, the link having dispersion characteristics at the signal wavelength; an optical amplifier serially disposed in the link; and a signal receiver connected at the second end of the Lank; in which a grating is connected in the link, the grating being chirped by an amount providing at least partial compensation of the dispersion characteristics of the link, the compensation such as to provide a signal, at the second of the link, compatible with the sensitivity requirements of the receiver at the second end of the link.

**13 Claims, 13 Drawing Sheets**




**6,292,606** September 18, 2001




## Optical Fiber Including a Short Filter

Inventors: Isabelle Riant (Palaiseau, FR) and Pierre Sansonetti (Palaiseau, FR).
Assignee: Alcatel (Paris, FR)
Filed: May 21, 1999.

***Abstract*—**To adjust the spectral band of an attenuating optical fiber, a section of the optical fiber is formed that has a sloping Bragg grating. To smooth the spectral band of the attenuation, it is shown that the filter section must be short. Independently of selectivity, the smoothing makes it possible to avoid distorting the filtered signal. The length of the filter section is preferably 0.7 mm.

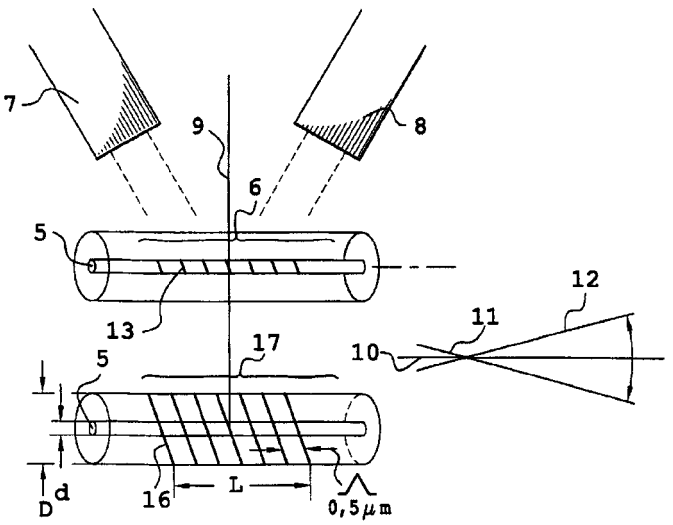
**12 Claims, 4 Drawing Sheets**

**6,292,603** September 18, 2001

## Dispersion Compensation Device

Inventors: Takashi Mizuochi (Tokyo, JP), Tadayoshi Kitayama (Tokyo, JP), Hideaki Tanaka (Tokyo, JP), and Koji Goto (Tokyo, JP).
Assignees: Kokusai Denshin Denwa Co., Ltd. (Tokyo, JP) and Mitsubishi Denki Kabushiki Kaisha (Tokyo, JP).
Filed: December 8, 1998.

***Abstract*—**A dispersion compensation device comprises a chirped grating, and a first optical unit for guiding at least a lightwave signal with a wavelength of $\lambda_i$ that needs a positive dispersion compensation and is applied thereto to one end portion of the chirped grating whose grating pitch is shorter, and for furnishing light reflected by the chirped grating to outside the device. The device further comprises a second optical unit for guiding at least a lightwave signal with a wavelength of $\lambda_i$ that needs a negative dispersion compensation and is applied thereto to another end portion of the chirped grating whose grating pitch is longer, and for furnishing light reflected by the chirped grating to outside the device. Both the first and second optical units can be either optical circulators or optical couplers.



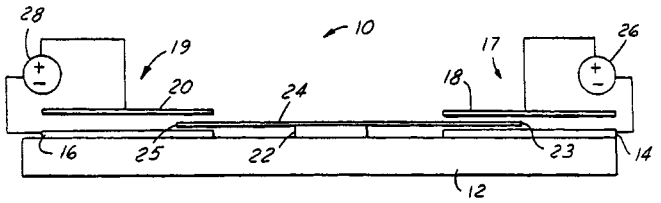
**6,294,847** September 25, 2001

## Bistable Micro-Electromechanical Switch

Inventor: Hector J. De Los Santos (Inglewood, CA, US)
Assignee: The Boeing Company (Seattle, WA, US)
Filed: November 12, 1999.

***Abstract*—**A bistable micro-electromechanical switch (**10**) having two parallel plate capacitors (**17**, **19**) spaced a distance from each other on a substrate (**12**). A transmission line (**30**), having a detached segment (**22**), that is movable or the substrate (**12**), is located on the substrate (**12**) between the parallel plate capacitors (**17**, **19**). A dielectric beam (**24**) is attached to the movable transmission line segment (**22**) and the ends of the dielectric beam (**24**) protrude into each of the parallel plate capacitors (**17**, **19**). When a voltage (**26**, **28**) is applied to one of the capacitors (**17** or **19**), the dielectric beam (**24**) is pulled into the capacitor (**17** or **19**) and brings the movable transmission line segment (**22**) with it. As the transmission line segment (**22**) is moved either into, or out of, alignment with the transmission line (**30**), a path through the transmission line is either closed, or opened.

**7 Claims, 2 Drawing Sheets**



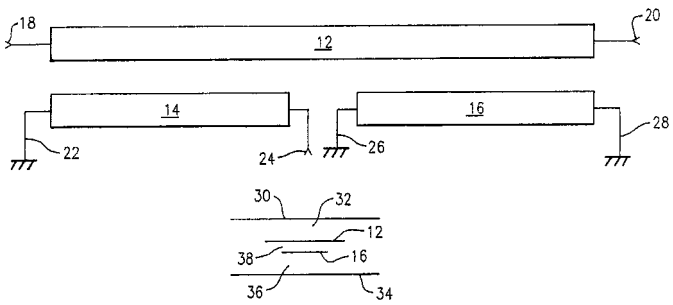

**6,294,965** September 25, 2001

## Stripline Balun

Inventors: Jeffrey C. Merrill (East Syracuse, NY, US) and Hans P. Ostergaard (Jamesville, NY, US).
Assignee: Anaren Microwave, Inc. (Syracuse, NY, US)
Filed: March 11, 1999.

***Abstract*—**A surface mount balun includes a first stripline segment having a first and second end, a first balanced port connected to the first end, and a second balanced port connected to the second end, a second stripline segment overlapping and coupled to the first stripline segment, and having a third end adjacent to the first end of the first stripline segment and a fourth end disposed approximately adjacent to the center of the first stripline segment, a third stripline segment overlapping and coupled to the first stripline segment, and having a fifth end adjacent to the second end of the first stripline segment and a sixth end disposed approximately adjacent to the center of the first stripline segment, and a third, unbalanced port connected to the sixth end of the third stripline segment.

**10 Claims, 4 Drawing Sheets**



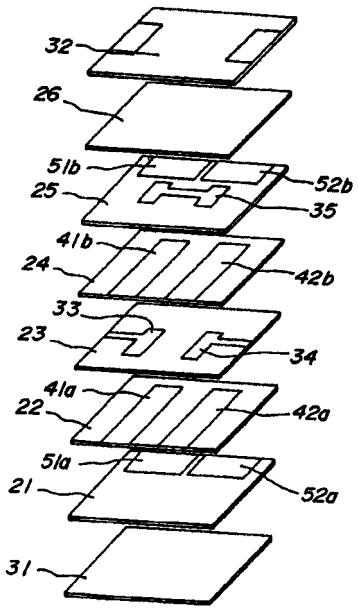

**6,294,967** September 25, 2001

## Laminated Type Dielectric Filter

Inventors: Takami Hirai (Aichi Pref., JP), Kazuyuki Mizuno (Tokoname, JP), and Yasuhiko Mizutani (Komaki, JP).
Assignee: NGK Insulators, Ltd. (JP)
Filed: March 17, 1999.

***Abstract*—**A laminated type dielectric filter including a first stage symmetric type strip line resonator and a last stage symmetric type strip line resonator each having at least two resonating elements arranged to oppose one another via dielectric layers, said resonators being aligned in a direction perpendicular to a stacking direction in which said resonating elements are stacked, an input electrode for coupling the first stage symmetric type strip line resonator to an input terminal, an output electrode for coupling the last stage symmetric type dielectric filter to an output terminal, an earth electrode substantially surrounding an outer surface of the laminated type dielectric filter, plural interlayer earth electrodes connected to the earth electrode, and one or more coupling electrode for coupling said plural symmetric type strip line resonators, said the resonating elements, input electrode, output electrode, interlayer earth electrodes and coupling electrodes are isolated by means of dielectric layers, and electrodes of at least one kind of electrode among the above mentioned electrodes are arranged between adjacent resonating elements such that capacitances between the resonating elements and these electrodes are increased to improve filter characteristics.

**35 Claims, 33 Drawing Sheets**




**6,294,968** September 25, 2001

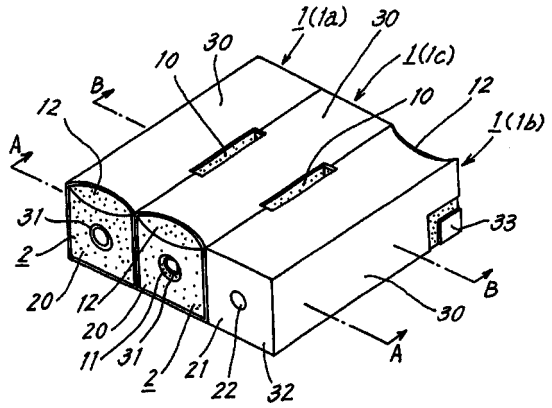
## Dielectric Filter and Process for Producing Same

Inventors: Atsushi Ito (Ena, JP) and Satoru Ota (Hirakata, JP).
Assignees: Sanyo Electric Co., Ltd. (Moriguchi, JP) and Sanyo Electronic Components Co., Ltd. (Daito, JP).
Filed: September 11, 2000.

***Abstract*—**A dielectric filter including at least three coaxial dielectric resonators of predetermined size which are bonded as arranged side by side. The resonators serving respectively as an input stage and an output stage are each formed with an external connection electrode positioned on the peripheral surface other than the adjoining surface in proximity to an exposed end face and

insulated from an outer conductor layer. An inner conductor layer of the resonator serving as an intermediate stage is removed over only a suitable region from an exposed end face thereof so as to approximately match the resonance frequency of the input-stage and the output-stage resonators. The dielectric filter may include at least three coaxial dielectric resonators which are bonded as arranged side by side. An interstage coupling window is formed in each of the adjoining surfaces of the adjacent resonators, approximately at an axial midportion thereof by removing an outer conductor layer. An external connection electrode, insulated from the layer, is formed on each of the resonators serving as an input stage and an output stage approximately at an axial midportion of the outer peripheral surface other than the adjoining surface.

**9 Claims, 9 Drawing Sheets**



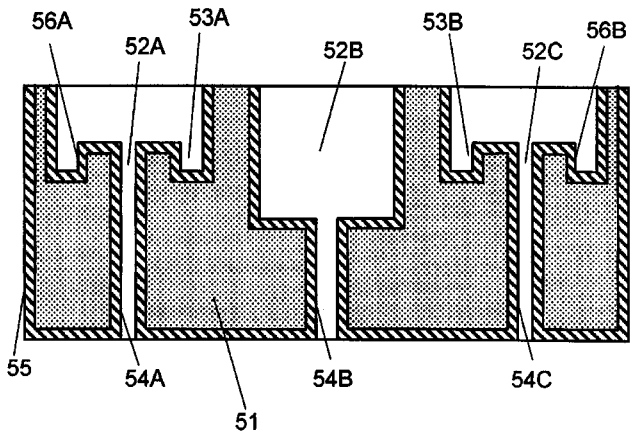

**6,294,969** September 25, 2001

## Dielectric Filter and RF Apparatus Employing Thereof

Inventors: Michiaki Matsuo (Kanagawa, JP), Hiroyuki Yabuki (Kanagawa, JP), and Morikazu Sagawa (Tokyo, JP).
Assignee: Matsushita Electric Industrial Co., Ltd. (Osaka, JP)
Filed: November 8, 1999.

***Abstract*—**A dielectric filter includes a dielectric block having multiple through holes which are created in parallel and grooves which are created around the opening of the through holes. A conductor is formed inside the grooves and the through holes. The inside conductors and in-groove conductors are connected at the opening of the through hole surrounded with the groove. The inside conductors and an outside conductor are connected at a second end. The opening of the through hole is formed inside an open-circuit end of the dielectric block.

**38 Claims, 7 Drawing Sheets**



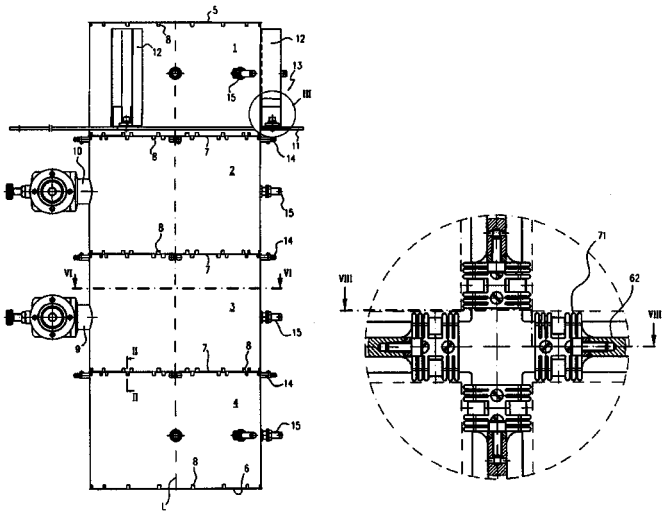

**6,294,970** September 25, 2001

## Bandpass Filter

Inventors: Franz Pitschi (Rottach-Egern, DE), Manfred Lang (Taufkirchen, DE), Werner Appel (München, DE), and Hans Pinzel (Bruckmühi, DE).
Assignee: Spinner GmbH Elektrotechnische Fabrik (München, DE)
Filed: December 11, 1998.

***Abstract*—**A bandpass filter, includes a series of waveguide resonators positioned along a common longitudinal axis so as to define at least a first resonator and a last resonator, whereby adjacent resonators are mechanically linked to one another by a common coupling plate of sheet metal member which is formed with coupling slots for electrically coupling the resonators, with the first and last resonators each being closed by an end plate of sheet metal. Each resonator is formed from a longitudinally welded sheet metal, and the end plates and the common coupling plate are each formed with circumferentially spaced tabs which are bent so as to extend along the adjoining waveguide, whereby the tabs are welded to the waveguide and the joints between the end plates and the common coupling plate, on the one hand and the adjacent waveguides, on the other hand, are soldered.

**14 Claims, 4 Drawing Sheets**



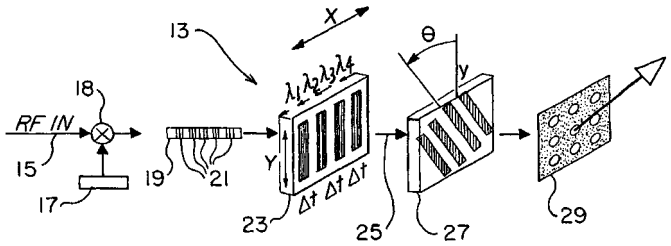
**6,295,395** September 25, 2001

## True Time Delay Generation Utilizing Broadband Light Source With Fiber Chirp Grating Array and Acousto-Optic Beam Steering and 2-D Architectures

Inventor: Eung G. Paek (Germantown, MD, US)
Assignee: The United States of America as represented by the Secretary of Commerce (Washington, DC, US)
Filed: January 20, 1998.

***Abstract*—**System and method for rapidly reconfigurable two-dimensional true time delay generation for phased array antennas is described. The system utilizes a broadband light source, an array of fiber chirp gratings in a single fiber and an acousto-optic spectrometer to generate a time-delayed linear grating. The grating is subsequently rotated to the desired angle utilizing an acousto-optic device having no moving parts.

**16 Claims, 3 Drawing Sheets**




**6,295,399** September 25, 2001

## Non-Linear Temperature Compensating Device for Fiber Gratings and a Package Therefor

Inventor: Jon W. Engelberth (Denville, NJ, US)
Assignee: Lucent Technologies Inc. (Murray Hill, NJ, US)
Filed: September 8, 2000.

***Abstract*—**A nonlinear temperature compensating device for optical fiber gratings includes first and second expansion members having different coefficients of thermal expansion. The expansion members are elongated in a direction parallel to the fiber grating and levers are secured to both ends of the expansion members. Each lever has a first end flexibly secured to a respective end of the first expansion member and a middle portion flexibly secured to a respective end of the second expansion member. The other end of each lever is secured to a respective end of the fiber grating through a respective quartz block. The dimensions of the expansion members and the quartz blocks, as well as the materials of the expansion members, are selected to achieve a nonlinear temperature response which substantially compensates the nonlinear temperature response of the fiber grating. The expansion members, the levers and the fiber grating all lie substantially in a single plane. There is also disclosed a package for holding four of the temperature compensating devices in two rows of two devices each, with their fiber gratings adjacent each other so that when viewed in a plane orthogonally to the longitudinal axes of the fiber gratings, the fiber gratings are each at a respective corner of a rectangle.

**13 Claims, 3 Drawing Sheets**