Patent Abstracts

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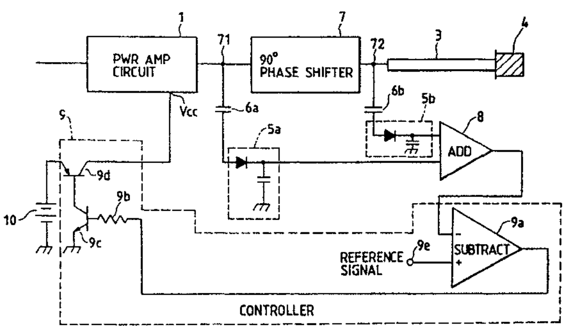
5,252,929 Oct. 12, 1993

RF Power Amplifier

Inventor: Makoto Taroumaru.
Assignee: Matsushita Electric Industrial Co.
Filed: May 28, 1992.

Abstract—An RF power amplifier includes an RF power amplifying section having a variable amplification gain. A phase shifter connected to the RF power amplifying section serves to shift a phase of an output signal of the RF power amplifying section. The phase shifter has an input terminal subjected to the output signal of the RF power amplifying section and an output terminal subjected to a signal which results from shifting the phase of the output signal of the RF power amplifying section. A control-signal generating section serves to generate a control signal on the basis of the signals at the input terminal and the output terminal of the phase shifter. The control signal depends on a power of the output signal of the RF power amplifying section. The amplification gain of the RF power amplifying section is controlled in response to the control signal.

28 Claims, 4 Drawing Sheets



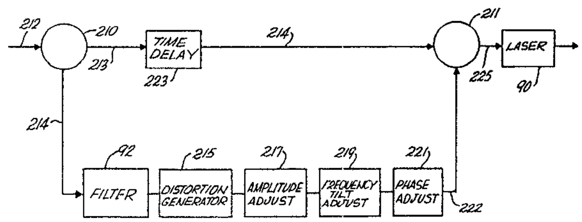
5,252,930 Oct. 12, 1993

Predistorter for Linearization of Electronic and Optical Signals

Inventor: Henry A. Blauvelt.
Assignee: Ortel Corporation.
Filed: July 21, 1992.

Abstract—An electronic circuit provides a linear output from an amplitude modulated transmission device such as an amplifier or a semiconductor laser which has inherent distortion. The distortion of the nonlinear device is compensated by applying a predistorted signal with distortion equal in magnitude and opposite in sign to the distortion introduced by the nonlinear device. The input signal is split into two paths with the primary part of the signal applied directly to the device, with a time delay to compensate for delays in the secondary path. The secondary path generates predistortion which is recombined with the primary signal in proper phase and amplitude for cancelling distortion in the output device. A distortion generator in the secondary path generates adjustable amplitude intermodulation signals. Filtering is used before the distortion generator to compensate for the dependence of the distortion of the nonlinear device on the frequencies of the fundamental signals. Filtering is used after the distortion generator to compensate for the dependence of the distortion of the nonlinear device on the frequency of the distortion. Phase of the distortion signal is adjusted to be in proper phase relation with the distortion of the device. Set points of the predistorter may be adjusted automatically. More than one secondary path may be used.

10 Claims, 4 Drawing Sheets



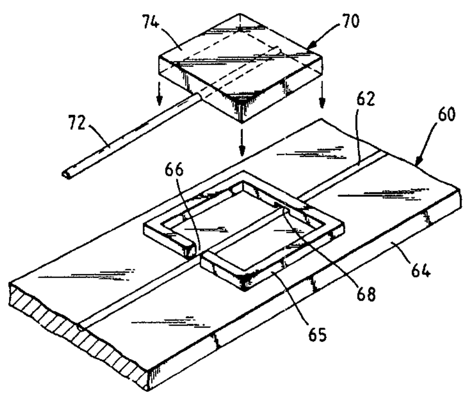
5,253,094 Oct. 12, 1993

Optical Interconnection Network

Inventors: David W. Smith, Stephen A. Cassidy, Peter Healey.
Assignee: British Telecommunications Public Limited Company.
Filed: Feb. 5, 1990.

Abstract—An optical interconnection network includes an optical bus formed by a D-fibre embedded in a thermoplastic substrate with the flat of the D-fibre flusk with the top surface of the substrate. A module similarly constructed is dimensioned to be a push fit in a wall structure formed on the substrate with the fibres and in a position to evanescently couple optical signals from one fibre to the other.

22 Claims, 4 Drawing Sheets



5,253,099 Oct. 12, 1993

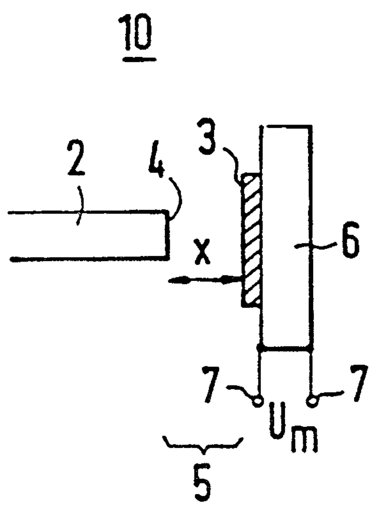
Reflective Optical Modulator

Inventor: Rolf Heidemann.
Assignee: Alcatel N. V.
Filed: Sept. 16, 1991.

Abstract—In a reflective optical modulator light enters through an optical waveguide into a detunable optical resonator which couples it back into the

optical waveguide, the modulation being effective by detuning the resonator. The resonator includes the end face of the optical waveguide through which the light enters and is coupled back, and a first reflective surface disposed opposite this face.

8 Claims, 2 Drawing Sheets



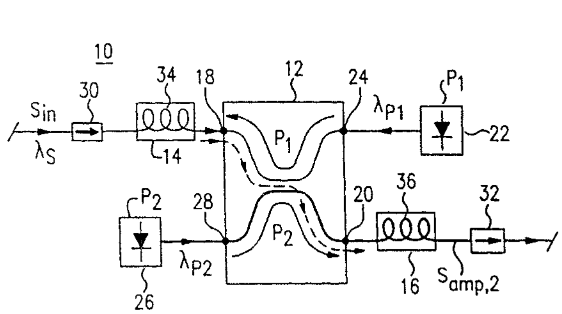
5,253,104 Oct. 12, 1993

Balanced Optical Amplifier

Inventor: Jean-Marc P. Delavaux.
Assignee: AT&T Bell Laboratories.
Filed: Sept. 15, 1992.

Abstract—A balanced doped fiber optical amplifier is disclosed which requires only a single wavelength division multiplexer to provide pump and signal inputs to multiple amplifier stages. In particular, a first section of doped fiber is coupled to an "input" port of the multiplexer and a second section of doped fiber is coupled to an "output" port of the multiplexer. First and second pump signals are coupled to the remaining ports to provide a counter-propagating pump signal to the first doped fiber section and a co-propagating pump signal to the second doped fiber section. The parameters of each doped fiber section (e.g., length, dopant concentration, pump power, pump wavelength) may be individually tailored to provide the desired results (pre-amplification or power boosting, for example). A plurality of balanced optical amplifiers may be cascaded to provide multi-stage amplifiers, and the pump signal levels may be controlled to provide gain equalization. preferably, the balanced amplifier is spliceless and comprises only two sections of doped fiber, the multiplexer formed as a coupling region between the fibers.

21 Claims, 6 Drawing Sheets



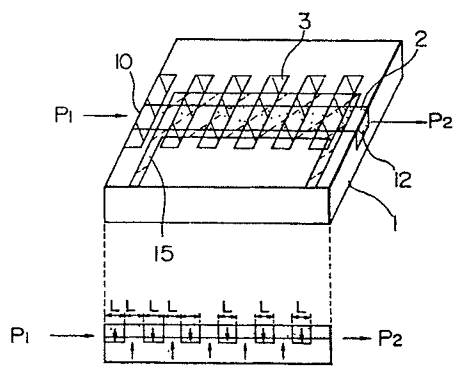
5,253,259 Oct. 12, 1993

Frequency Doubler and Visible Laser Source Having a Heater

Inventors: Kazuhisa Yamamoto, Tetsuo Taniuchi, Kiminori Mizuuchi.
Assignee: Matsushita Electric Industrial Co.
Filed: Jan. 24, 1992.

Abstract—A frequency doubler of the invention employs a nonlinear optical effect of stabilizing the harmonic output from the frequency doubler. The frequency doubler has an LiNbO3 substrate, domain inverted regions and a waveguide, which are formed on the substrate, and a thin-film heater formed on the waveguide by depositing Ni-Cr. The temperature of the frequency doubler is controlled by applying a current to the thin-film heater so as to heat the frequency doubler. Even if the wavelength of a semiconductor laser is changed due to change in the environmental temperature, the frequency doubler can stably be operated by changing the temperature of the frequency doubler.

22 Claims, 13 Drawing Sheets



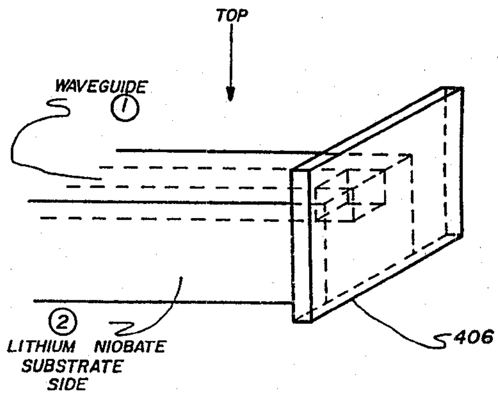
5,253,311 Oct. 12, 1993

Device and Method for Performing Optical Coupling Without Pigtails

Inventors: Albert K. Killen and Cassie M. Lofts.
Assignee: The United States of America as represented by the Secretary of the Army.
Filed: Nov. 2, 1992.

Abstract—Micromachined depressions are created at a surface of lithium crystal/waveguide composite and suitable optical components are inserted into these depressions and precisely aligned with waveguides so that light can be coupled into and out of the waveguides without fiber pigtails. The optical components can be independent or be a part of a mating unit which may incorporate appropriate electronics to support the optical components. Instant invention produces an application-ready integrated optics chip without the necessity for labor-intensive pigtailing or for separate provision of supporting electronics after the user acquires commercially available lithium crystal-waveguide composite.

1 Claim, 3 Drawing Sheets



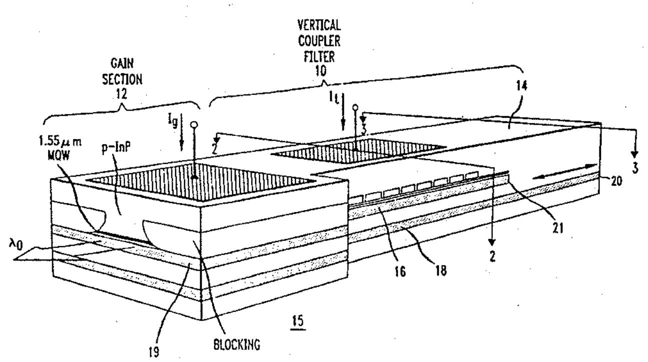
5,253,314 Oct. 12, 1993

Tunable Optical Waveguide Coupler

Inventors: Rodney C. Alferness, Lawrence L. Buhl, Thomas L. Koch, Uziel Koren.
Assignee: AT&T Bell Laboratories.
Filed: Jan. 31, 1992.

Abstract—Various optical functions are generated in accordance with the present invention of a novel broadly tunable monolithic wavelength selective coupler which can be integrated with a gain medium to form a broadly tunable laser. The tunable wavelength selective coupler supports a pair of asynchronous waveguides, an upper waveguide and a lower waveguide, in combination with a phase match course grating for coupling optical energy between said waveguides. One end of the lower waveguide terminates at an output facet. The corresponding end of the upper waveguide terminates in an optical signal absorbing medium. The other end of the lower waveguide is terminated to prevent optical energy from entering the waveguide; and, the corresponding end of the upper waveguide terminates at an input facet. The combination of a gain section and the monolithically tunable wavelength selective coupler forms a broadly tunable laser which is an important source of optical energy for a number of applications such as wavelength division multiplexed networks and switching systems. The laser frequency is determined by that wavelength λo which satisfies the forward coupling phase match condition, $\lambda g = \wedge \mid N_2 - N_1 \mid$ of the coupler where $\wedge$ is the coarse grating period and N_1, N_2 are the effective indices of the two waveguides. Wavelengths which are not coupled from the upper waveguide to the lower waveguide are attenuated in the optical signal absorbing means. Tuning of the laser wavelength is achieved by either injecting current into or applying a reverse bias voltage to the upper waveguide to decrease or increase its index respectively and change the coupled wavelength.

25 Claims, 5 Drawing Sheets



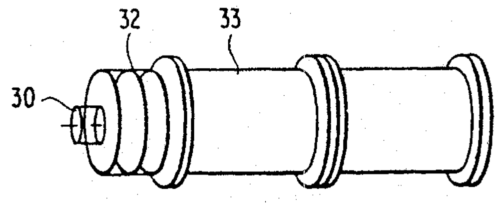
5,254,963 Oct. 19, 1993

Microwave Filter With a Wide Spurious-Free Band-Stop Response

Inventors: Rene R. Bonetti and Albert E. Williams.
Assignee: COMSAT.
Filed: Sept. 25, 1991.

Abstract—The present invention is directed to reducing the number of components required to minimize intermodulation distortion within the wide transmission frequency band used by a satellite communications repeater system. In particular, at least two TM_{010} mode cavity is cascaded to a plurality of TE_{113} mode cavities to form a narrow band-pass, wide band-stop filter for receiving and outputting channel signals to the multiplexer manifold of a satellite repeater. The filter thus constructed realizes the narrow band-pass response required in microwave communications, while eliminating the spurious resonance frequencies normally eliminated by additional filter components. In this manner, the size and weight considerations of the satellite system are improved without loss in performance.

12 Claims, 8 Drawing Sheets



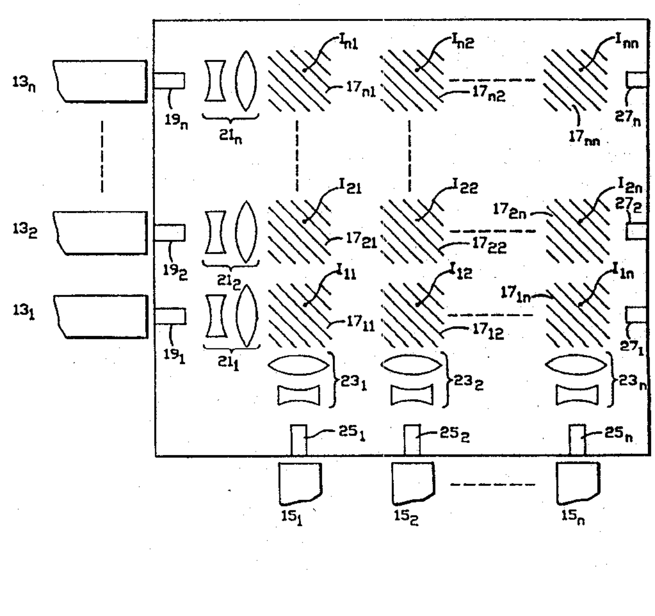
5,255,332 Oct. 19, 1993

NXN Optical Crossbar Switch Matrix

Inventors: David F. Welch, Donald R. Scifres, Robert G. Waarts, Amos A. Hardy, David G. Mehuys, Stephen O'Brien.
Assignee: SDL, Inc.
Filed: July 16, 1992.

Abstract—An optical crossbar switch matrix for use in switching optical signals from a first set of optical fibers to a second set of optical fibers, in any order, which is characterized by having a matrix of rows and columns of diffraction gratings formed in a semiconductor heterostructure. Each grating is independently biased with either a forward or reverse bias voltage to switch the grating between a reflective state and a transmissive state. The gratings are oriented at an angle relative to the rows and columns so that when the Bragg condition for the light received from an optical film is met, a portion of the light is diffracted from the row in which it is propagating into a column toward another optical fiber. The heterostructure may include optical amplifiers to restore the optical signal to its original power level. Beam expanding, collimating and focussing optics may also be integrated into the heterostructure.

13 Claims, 1 Drawing Sheet



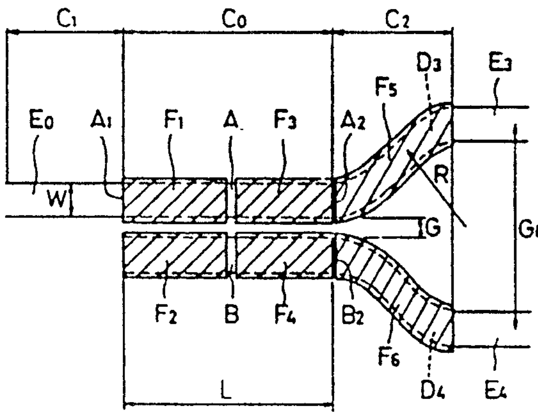
5,255,334 Oct. 19, 1993

Directional Coupler Type Optical Device and a Driving Method Therefor

Inventors: Hon-Ming Mak and Hisaharu Yanagawa.
Assignee: The Furukawa Electric Co., Ltd.
Filed: May 29, 1992.

Abstract—A 1–input/2–output or 2–input/2–output directional coupler type optical device comprising a junction including two optical waveguides arranged parallel to each other and each fitted with an electrode for controlling a propagation constant, the incidence end or ends of one or both of the optical waveguides being connected to curved or straight optical waveguides, thus forming an incidence-side lead section, and the respective mergence ends of the two optical waveguides being optically connected to curved or straight optical waveguides, thus forming an emergence-side lead section. An electrode for suppressing the mode coupling is mounted on each optical waveguide of the emergence- or incidence-side lead section. A high extinction ratio of 30 dB or more can be obtained in either of cross and through modes by activating a required one of the mode coupling suppressing electrodes while applying an electrical signal to each propagation constant control electrode.

26 Claims, 13 Drawing Sheets



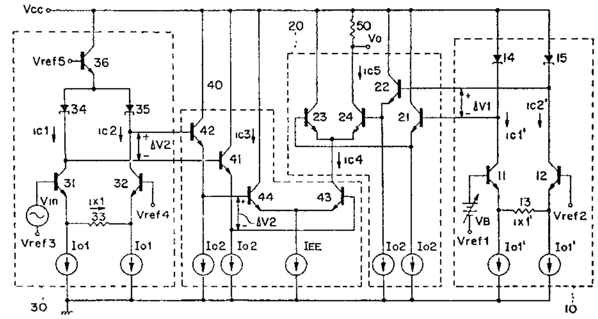
5,256,984 Oct. 26, 1993

Amplifier for Controlling Linear Gain of Wide Band Using External Bias

Inventor: Ga H. Lee.
Assignee: SamSung Electronics Co., Ltd.
Filed: Mar. 30, 1992.

Abstract—An amplifier for controlling the linear gain of wide band using an external bias voltage is disclosed to maintain the gain characteristics stably even for the high frequency input signals by adjusting the external bias voltage to prevent the amplified gain from being distorted or the gain from being decreased when increasing the linearity, where in a first fine voltage is generated with the inverse hyperbolic tangent function of the external bias voltage for adjusting the gain, a first voltage is generated with the hyperbolic tangent function of the first fine voltage and linearly proportional to the external bias voltage, a second fine voltage is generated with the inverse hyperbolic tangent function of the input signal voltage, a second voltage is generated with the hyperbolic tangent function of the second fine voltage for adjusting the first voltage, and the second voltage is converted to the linearly corresponding output signal voltage, thereby amplifying the gain even for the high frequency input signals, without any distortion.

20 Claims, 2 Drawing Sheets



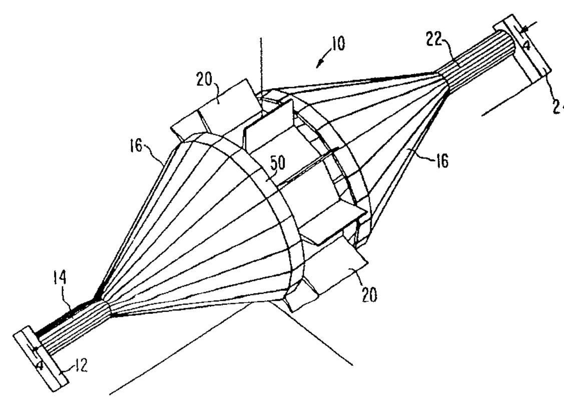
5,256,988 Oct. 26, 1993

Conical Transverse Electromagnetic Divider/Combiner

Inventor: Jamaledin Izadian.
Assignee: Loral Aerospace Corp.
Filed: Sept. 1, 1992.

Abstract—A conical TEM power divider/combiner (10) comprises an input port (12), a first circular waveguide (14), a coaxial device (16), a plurality of amplifiers (18), a plurality of cooling fins (20), a second circular waveguide (22), an output port (24), a conical dividing waveguide (42, 32), a first parallel plate waveguide (40, 50), a second parallel plate waveguide (40,52) and a conical combining waveguide (34, 44). The input port (12) is coupled to the first circular waveguide (14). The first circular waveguide (14) is in turn coupled to the coaxial device (16). The coaxial device (16) divides the signal using the conical dividing waveguide (42, 32), a first parallel plate waveguide (40, 50), and a first plurality of striplines (54). The striplines (54) couple the first parallel plate waveguide (40, 50) to the inputs of the plurality of amplifiers (18). The amplifiers (18) each amplify a respective divided signal and output the result to the second the second parallel plate waveguide (40, 52). The signals are recombined by the second parallel plate waveguide (40, 52) and the conical combining waveguide (34, 44). The amplified signal is then transformed to a rectangular mode signal by the second circular waveguide (22) and port (24).

13 Claims, 9 Drawing Sheets



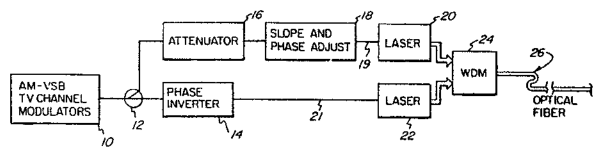
5,257,124 Oct. 26, 1993

Low Distortion Laser System for AM Fiber Optic Communications

Inventors: Joseph B. Glaab and David R. Huber.
Assignee: General Instrument Corporation.
Filed: Aug. 15, 1991.

Abstract—An information signal modulates a first optical carrier. The information signal is inverted to modulate a second optical carrier. The modulated first and second optical carriers are multiplexed into a single optical signal for communication over an optical fiber path. At a receiver, the optical signal is demultiplexed to recover the information signal and the inverted information signal. The recovered signals are combined to provide the information signal in the electrical domain with reduced distortion. A dual-detector balanced optical diode pair can be used to combine the recovered information and inverted information signals and provide an analog RF output. The apparatus is particularly suitable for the transmission of AM-VSB television signals.

17 Claims, 2 Drawing Sheets



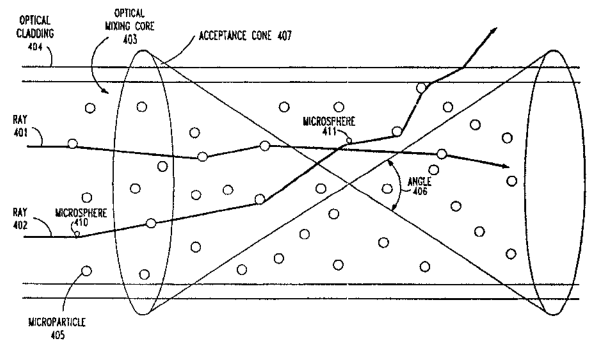
5,257,329 Oct. 26, 1993

Depolarization of Light in an Optical Switching System

Inventors: Lee L. Blyler, Jr., Robert W. Filas, Gary J. Grimes.
Assignee: AT&T Bell Laboratories.
Filed: Nov. 27, 1991.

Abstract—Depolarization of light by utilizing a small concentration of refractive or diffractive microparticles in an optical core of an optical coupler that is coupling light from polarized source to a polarization type optical switch such as a ferroelectric liquid crystal. The result is that light from the laser is bent slightly by either the refractive or diffractive effects of the microspheres which causes scattering; and as a consequence, the light is depolarized in a relatively short distance within the optical core before reaching the liquid crystal switch. The microparticles maybe closely matched to the index of refraction of the core material resulting in smaller deflection angles and lower reflections. In addition, these microparticles match the specific gravity of the core material such that they do not settle out of suspension while the core material is being hardened from a semi-liquid state.

8 Claims, 3 Drawing Sheets



5,257,330 Oct. 26, 1993

Polarization Filter With Intermediate Optical Waveguide Which is Monomodal for One Polarization and Bimodal for the Other

Inventor: Johannes J. G. M. van der Tol.
Assignee: Koninklijke PTT Nederland N. V.
Filed: July 1, 1992.

Abstract— Polarization filter for delivering an output signal so containing only one (TE or TM) of the two polarizations (TE and TM) in an input signal Si, comprising an intermediate guide section (5) between an input section (A) and an output section (B). The output section (B) is a mode splitter having a monomodal output channel (3) for the output signal (So) and a monomodal dummy channel (4) which recedes beyond the interaction distance (D). The output channel (3) has a lower propagation constant than the dummy channel (4). The input section (A) having an input channel (1) and a dummy channel (2) is an inverse mode splitter which may be the mirror image of the output section (B). The guide section (5) is monomodal for one of the two polarizations and bimodal for the other polarization. Both polarizations of the input signal Si entering via the input channel (1) are initially converted into first-order modes, of which only one is a guided mode of that conductor section and reaches the output section, where it propagates further along the channel having the lowest propagation constant. The first-order mode of the other polarization escapes (6).

6 Claims, 3 Drawing Sheets