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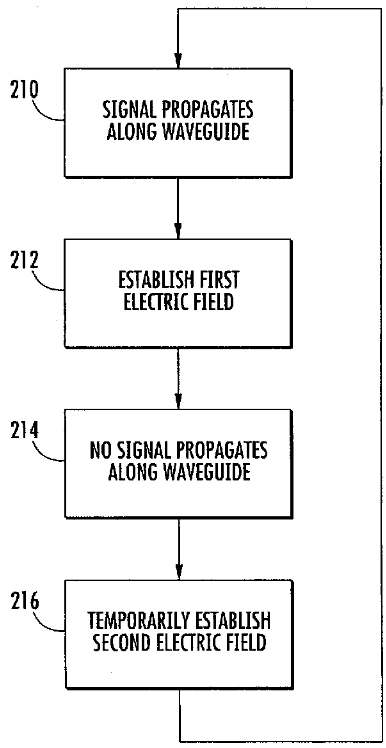

FIG. 2

(57) Abstract: An apparatus for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium is provided. The apparatus includes signal guiding means for guiding a signal. The signal guiding means may include a dielectric material and has an operative state in which the at least one signal propagates therealong and an inoperative state in which no signal is propagated therealong. Also included is field establishing means for establishing a variable electric field within the dielectric material. The field establishing means may establish a first electric field directed in a first direction when the signal guiding means is in the operative state and may at least temporarily establish a second electric field directed in a second direction that is different from the first direction and rotated at least 90 degrees from the first direction when the signal guiding means is in the inoperative state.

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APPARATUS AND METHOD FOR AFFECTING AN ELECTRIC FIELD DURING A COMMUNICATION

FIELD OF APPLICATION

Embodiments of the present invention relate generally to apparatuses and methods for communicating, and, more particularly, to apparatuses and methods for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium.

BACKGROUND INFORMATION

A dielectric, or electrical insulator, is a substance that is highly resistant to electric current. As a consequence of this relative lack of internal charge mobility (when compared, say, to a conductor), dielectric materials are subject to a phenomenon wherein charges within constituent atoms or molecules are redistributed in response to exposure to an applied electric field. Such charge redistribution can be due either to an alteration of the geometry of the molecules or to a spatial reorientation of the molecules. In either case, the properties of a dielectric may be dependent on the electric field to which the dielectric material is currently exposed. When an applied electric field is removed, the material may return to an unaltered or "ground" state. The rate at which the dielectric material returns to the ground state when the applied electric field is removed, or the rate of "relaxation," may depend on the mechanism by which the charges were redistributed (*i.e.*, whether the charge redistribution was due to reshaping or reorienting the molecules).

Dielectric materials are often incorporated into structures such as waveguides that are utilized in signal or energy transfer. These dielectrics may be incorporated as the main wave transmission medium, as a component that separates electrical conductors, or in both capacities. Regardless of the manner in which a dielectric is incorporated into a waveguide, the transmission properties of the waveguide will often depend on the properties of the incorporated dielectric material. In several applications, transmission properties of dielectrics have been controlled through the application of external electric fields, thereby tailoring the transmission properties for the application at issue. For example, in optical beam emission applications, a location-dependent electric field can be applied to a planar dielectric being irradiated with a planar optical wave. Due to the resultant spatially-varying dielectric constant of the dielectric material, the wave is reoriented on passing through the planar dielectric. As such, the electric fields can be adjusted to steer the beam. However, while some applications do exist for tuning the dielectric properties of a dielectric via the application of a varying electric field, the number of applications for which this strategy has been utilized has been limited by the relaxation rate for these materials.

BRIEF SUMMARY

In light of the foregoing background, provided are improved apparatuses and methods for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium. By affecting the strength and/or direction of an electric field experienced by the medium, the manner in which signals travel in the medium may be modified.

In one aspect, an apparatus is provided that includes a signal guide configured to have an operative state, in which a signal propagates therealong, and an inoperative state, in which no signal is propagated therealong. The signal guide may include a dielectric component, such as a dielectric component comprised of a liquid crystal polymeric material. At least first and second electrodes may be disposed on opposing sides of the signal guide. For example, the signal guide may be configured to propagate the signal along a propagation direction and the electrodes may be disposed along a transverse direction that is generally orthogonal to the propagation direction. A voltage controller may charge the first and second electrodes with common polarity to one another when the signal guide is in the operative state, and may at least temporarily charge the first electrode with polarity opposite to that of the second electrode when the signal guide is in the inoperative state. The apparatus may include a detection unit in communication with the voltage controller and configured to detect whether the signal guide is in the operative or inoperative state.

In one embodiment of the apparatus, the signal guide may include a conductor that generally defines an electrode plane with the first and second electrodes, as well as a reference layer spaced from the conductor in a first direction generally orthogonal to the electrode plane. A dielectric component may be disposed between the conductor and the reference layer. The apparatus may be configured such that, when the signal guide is in the operative state, a potential difference exists between the conductor and the reference layer that is substantially the same as respective potential differences between each of the first and second electrodes and the reference layer. The apparatus may be further configured such that, when the signal guide is in the inoperative state, a potential difference exists between the conductor and the reference layer that is at least temporarily small relative to a potential difference between the first and second electrodes.

In another aspect, another apparatus is provided that includes a signal guide having a conductor and a reference layer, and, in some cases, a dielectric component disposed therebetween. A signal source communicates with the signal guide and is configured to have a signaling state that is substantially immediately followed by a non-signaling state. In the signaling state, a first potential difference is established between the conductor and the reference layer, while in the non-signaling state, a second potential difference is transiently established between the conductor and the reference layer, the second potential difference being of opposite polarity to the first potential difference.

In yet another aspect, an apparatus is provided that includes signal guiding means for guiding a signal. The signal guiding means may include a dielectric material and is configured to have an operative state in which the at least one signal propagates therealong and an inoperative state in which no signal is propagated therealong. Also included is field establishing means for establishing a variable electric field within the dielectric material. The field establishing means is configured to establish a first electric field directed in a first direction when the signal guiding means is in the operative state and to at least temporarily establish a second electric field directed in a second direction that is different from the first direction and rotated at least 90 degrees from, and in some cases substantially opposed to, the first direction when the signal guiding means is in the inoperative state. The field establishing means may be configured to establish the first electric field for a first time period and to establish the second electric field substantially immediately subsequent to the first time period.

In still another aspect, a method is provided that includes providing a signal guide including a dielectric material. A signal is propagated along the signal guide, thereby establishing an operative state, the signal guide otherwise being in an inoperative state. A first electric field directed in a first direction is established when the signal guide is in the operative state. A second electric field directed in a second direction that is different from the first direction and rotated at least 90 degrees from the first direction is at least temporarily established when the signal guide is in the inoperative state.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

Fig. 1A is a schematic side view of an exemplary embodiment of a microstrip waveguide that includes a conductor, a reference layer, and a dielectric material between the two;

Fig. 1B is a schematic perspective view of the microstrip waveguide of Fig. 1A, illustrating signal propagation along the waveguide;

Figs. 1C and 1D are schematic side views of the microstrip waveguide of Fig. 1A, illustrating the establishment of first and second electric fields when the waveguide is in an operative or inoperative state, respectively;

Fig. 2 is a flow chart representing an exemplary embodiment of a method for affecting the direction of the respective electric field experienced by the dielectric material of a waveguide;

Fig. 3A is a schematic perspective view of an embodiment of an apparatus for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium;

Fig. 3B is a schematic side view of the apparatus of Fig. 3A;

Figs. 3C and 3D are schematic side views of the apparatus of Fig. 3A, illustrating the variable charging of the electrodes;

Figs. 4A is a schematic side view of another embodiment of an apparatus for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium; and

Figs. 4B and 4C are schematic side views of the apparatus of Fig. 4A, illustrating the operation of the apparatus.

DETAILED DESCRIPTION

The present inventions now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

The present application is generally directed to methods and apparatuses for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium. By affecting the electric field experienced by the medium, the transmission properties of the medium may, in some embodiments, be consequently affected. As an example of an apparatus in which the direction of an electric field experienced by a communications medium may be affected while communicating via that medium, referring to Figs. 1A and 1B, therein is shown signal guiding means **102** in the form of a microstrip waveguide that includes a conductor **104** and a reference layer or ground plane **106**. Other types of signal guides, whether electromagnetic waveguides or optical waveguides, may be used for signal guiding means **102**, including, for example, a coaxial transmission line, or a strip transmission line. Signal guiding means **102** may be an isolated communications path, or may be part of a larger circuit or communications system. Signal guiding means **102** may include a dielectric material **108**, such as, for example, porcelain, glass, or plastic. In one exemplary embodiment, the dielectric material **108** may be a liquid crystal polymeric material, such as 4,4'-dimethoxy azoxybenzene, N-(4-methoxybenzylidene)-4'-n-butylaniline, and/or 4-cyano-4'-n-pentylbiphenyl.

Referring to Figs. 1B, 1C, and 1D, signal guiding means **102** may be configured to allow signals *s* to propagate therealong, for example, between a signal source and a signal receiver (neither of which is shown). As such, signal guiding means **102** will have an operative state (Figs. 1B and 1C) in which a signal propagates along signal guiding means **102** and an inoperative state (Fig. 1D) in which no signal so propagates. It is understood that as a signal *s* propagates along signal guiding means **102** in the operative state, the effects of the signal *s*, such as resulting electric and magnetic fields, may extend beyond conductor **104**, and may extend into the dielectric material **108** between the conductor **104** and the reference layer **106**.

Field establishing means (not shown in Figs. 1A-1D, but shown and described elsewhere) may be utilized to establish a variable electric field within dielectric material **108**. For example, the field establishing means may be configured to establish, perhaps temporarily, a first electric field *E1* directed in a first direction *D1* when signal guiding means **102** is in the operative state, this condition being demonstrated in Fig. 1C. The field establishing means may be further configured to establish, perhaps temporarily, a second electric field *E2* directed in a second direction *D2* when said signal guiding means **102** is in the inoperative state, this condition being demonstrated in Fig. 1D. Second direction *D2* is different from, and is rotated at least 90 degrees from, the first direction *D1*. In some embodiments, second direction *D2* may be rotated about 180 degrees from the first direction *D1*, such that the second direction *D2* is approximately opposed to the first direction *D1*. The establishment of the first electric field may be for a first time period that is substantially immediately followed by a second time period in which the second electric field is established. It is noted that the propagation of signal *s* along signal guiding means **102** will likely affect the field present in and experienced by the dielectric material. Field establishing means may be chosen and configured to account for this effect. Examples of different types of field establishing means are provided below.

Referring to Figs. 1A-1D and 2, the structure described for signal guiding means **102** allows for affecting the direction of the respective electric field experienced by dielectric material **108** when signal guiding means **102** is in the operative or inoperative state. At various times, a signal may propagate along signal guiding means **102** (see Block **210**), this signal propagation establishing the operative state of signal guiding means **102**. At the times when signal guiding means **102** is in the operative state, the first electric field *E1* is established in dielectric material **108** so as to be directed in the first direction *D1* (see Block **212**). When signal guiding means **102** is not in the operative state (Block **214**), the second electric field *E2* may be established (Block **216**), at least temporarily, and directed in the second direction *D2*. For example, the first electric field may be established for a first time period, possibly coincident with the extent of an existing operative state, and the second electric field may be established substantially immediately subsequent to the first time period, or upon exiting the prior operative state. This second electric field may be transiently established for a period of time shorter than the extent of an existing inoperative state. The process can then be repeated for subsequent signals (*i.e.*, returning to Block **210**), which may or may not have similar electromagnetic properties to earlier signals (*i.e.*, voltage, wavelength, etc.).

Referring to Figs. 3A-3D, in one exemplary embodiment, field establishing means may include at least a first electrode **320a** and a second electrode **320b** positioned at opposing sides of a signal guide **302**. For example, signal guide **302** may include a conductor **304**, which together with first electrode **320a** and second electrode **320b** may generally define an electrode plane *PE*. Signal guide **302** may also include a reference layer **306** spaced from conductor **304** in a direction *D* generally orthogonal to the electrode plane *PE*, and a dielectric component **308** disposed between conductor **304** and reference layer **306**. Signal guide **302** may be configured to communicate with a signal source (not shown) and a signal receiver (not shown), such that signals propagate along signal guide **302** in a propagation direction *p*. First and second electrodes **320a, 320b** may be disposed transversely to conductor **304** , where the transverse direction *t* that is generally orthogonal to the propagation direction *p*, and may extend along the propagation direction *p*.

The exemplary embodiment of the field establishing means may further include a voltage controller **322** that is in communication with, and configured to independently and variably charge, first and second electrodes **320a, 320b**. For example, voltage controller **322** may include first and second variable voltage sources **324a, 324b** associated with first and second electrodes **320a, 320b**, along with a processing unit **326** or other logical component that allows for control of the output of the variable voltage sources **324a, 324b**. In an alternative example, voltage controller **322** may include circuitry that appropriately conditions a single voltage source for use in charging both first and second electrodes **320a, 320b**.

When signal guide **302** is in the operative state, voltage controller **322** may charge first and second electrodes **320a, 320b** with common polarity to one another, for example, so that both electrodes **320a, 320b** are charged positively. When signal guide **302** is in the inoperative state, voltage controller **322** may charge first electrode **320a** to have a polarity opposite to that of second electrode **320b**, for example, so that first electrodes **320a** is negatively charged and second electrode **320b** is positively charged. Voltage controller **322** may include or communicate with a detection unit **328**, perhaps coupled to processing unit **326**, which detects whether signal guide **302** is in the operative or inoperative state. Subsequent to establishing the inoperative state, signal guide may again move to an operative state, which may or may not be similar to the prior operative state.

In some embodiments, using voltage controller **322** to charge electrodes **320a, 320b** in the manner described above may lead to two distinct states of the signal guide **302**. First, when signal guide **302** is in the operative state, a potential difference may exist between conductor **304** and reference layer **306** that is substantially the same as respective potential differences between each of first and second electrodes **320a, 320b** and reference layer **306**. In this condition, an electric field *E* may exist in dielectric material **308** that is substantially aligned with direction *D*. Second, when signal guide **302** is in the inoperative state, a potential difference may exist between conductor **304** and reference layer **306** that is small relative to a potential difference between first electrode **320a** and second electrode **320b**. In this condition, an electric field *E* may exist in dielectric material **308** that is substantially aligned with direction *t*.

Referring to Figs. 4A-4C, therein is shown another exemplary embodiment of an apparatus for communicating via a medium while affecting the strength and/or direction of an electric field experienced by the medium. The apparatus includes another exemplary embodiment of the field establishing means, which in this case includes a signal source **430** that communicates with a signal guide **402** having a conductor **404**, a reference layer **406**, and a dielectric material **408** between the two. Signal source **430** may be, for example, a variable voltage supply, a variable current supply, or a function generator. Signal source **430** may be configured to have a signaling state that is substantially immediately followed by a non-signaling state. In the signaling state, a first potential difference may be established between conductor **404** and reference layer **406**. In the non-signaling state, a second potential difference of opposite polarity to the first potential difference may be established, perhaps transiently, between conductor **404** and reference layer **406**.

For example, signal source **430** may be a variable voltage source that emits a voltage that varies over time as shown in Fig. 4A. The voltage has a first value *V1* in the time period *T1*, the voltage *V1* being associated with a signal (*i.e.*, *T1* is the duration of a signaling state). The voltage has a second value *V2* over a second time period *T2* that immediately follows *T1*. Time period *T2* may be part of time period *T3*, which corresponds to a non-signaling state. *V2* is generally not associated with the communication of information, and is simply provided in order to influence the condition of the signal medium. By operating signal source **430** in this manner, electric fields of opposite direction may be respectively established in dielectric material **408** during the time periods *T1* and *T2* (or *T1* and *T3*). In some cases, the duration of *T2* may be short, such that voltage *V2* is essentially a pulse. In other cases, the signal source **430** may be configured to have a first signaling state during time period *T1* in which a voltage *V1* is applied and a second signaling state during time period *T3* in which some other voltage is applied, and may be configured to emit a non-signaling voltage *V2* at a time between the first and second signaling states.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. For example, it is also noted that conductors incorporated as part of signal guides need not carry zero or a trivial applied voltage when in the "inoperative state," but may simply carry a voltage that is different from that applied during the "operative state." As such, it may be possible to propagate a signal during the "inoperative state," albeit one that is different from that propagated during the operative state. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

THAT WHICH IS CLAIMED:

1. An apparatus comprising:

a signal guide configured to have an operative state in which a signal propagates therealong and an inoperative state in which no signal is propagated therealong,

at least first and second electrodes disposed on opposing sides of said signal guide; and

a voltage controller configured to charge said first and second electrodes with common polarity to one another when said signal guide is in the operative state and to at least temporarily charge the first electrode with polarity opposite to that of said second electrode when said signal guide is in the inoperative state.

2. An apparatus according to Claim 1, wherein said signal guide includes a dielectric component.

3. An apparatus according to Claim 2, wherein said dielectric component is comprised of liquid crystal polymeric material.

4. An apparatus according to Claim 1, wherein said signal guide includes a conductor that generally defines an electrode plane with said first and second electrodes and a reference layer spaced from said conductor in a first direction generally orthogonal to the electrode plane, and wherein said apparatus is configured such that, when said signal guide is in the operative state, a potential difference exists between said conductor and said reference layer that is substantially the same as respective potential differences between each of said first and second electrodes and said reference layer, and when said signal guide is in the inoperative state, a potential difference exists between said conductor and said reference layer that is at least temporarily small relative to a potential difference between said first and second electrodes.

5. An apparatus according to Claim 4, wherein said signal guide includes a dielectric component disposed between said conductor and said reference layer.

6. An apparatus according to Claim 1, wherein said signal guide is configured to propagate the signal along a propagation direction and said electrodes are disposed along a transverse direction that is generally orthogonal to the propagation direction.

7. An apparatus according to Claim 1, further comprising a detection unit in communication with said voltage controller and configured to detect whether said signal guide is in the operative or inoperative state.

8. An apparatus comprising:

a signal guide including a conductor and a reference layer; and

a signal source in communication with said signal guide and configured to have a signaling state in which a first potential difference is established between said conductor and said reference layer and a non-signaling state substantially immediately following the signaling state in which a second potential difference is transiently established between said conductor and said reference layer, the second potential difference being of opposite polarity to the first potential difference.

9. An apparatus according to Claim 8, wherein said signal guide includes a dielectric component disposed between said conductor and said reference layer.

10. An apparatus according to Claim 9, wherein said dielectric component is comprised of liquid crystal polymeric material.

11. An apparatus comprising:

signal guiding means for guiding a signal, said signal guiding means including a dielectric material and configured to have an operative state in which the at least one signal propagates therealong and an inoperative state in which no signal is propagated therealong; and

field establishing means for establishing a variable electric field within said dielectric material, said field establishing means being configured to establish a first electric field directed in a first direction when said signal guiding means is in the operative state and to at least temporarily establish a second electric field directed in a second direction that is different from the first direction and rotated at least 90 degrees from the first direction when said signal guiding means is in the inoperative state.

12. An apparatus according to Claim 11, wherein said field establishing means is configured to establish the second electric field directed in the second direction substantially opposed to the first direction.

13. An apparatus according to Claim 11, wherein said field establishing means is configured to establish the first electric field for a first time period and is further configured to establish the second electric field substantially immediately subsequent to the first time period.

14. An apparatus according to Claim 11, wherein said dielectric material includes liquid crystal polymeric material.

15. A method comprising:

providing a signal guide including a dielectric material;

propagating a signal along the signal guide and thereby establishing an operative state, the signal guide otherwise being in an inoperative state;

establishing a first electric field directed in a first direction when the signal guide is in the operative state; and at least temporarily establishing a second electric field directed in a second direction that is different from the first direction and rotated at least 90 degrees from the first direction when the signal guide is in the inoperative state.

16. A method according to Claim 15, wherein said establishing the second electric field includes establishing the second electric field directed in the second direction substantially opposed to the first direction.

17. A method according to Claim 15, wherein said establishing the first electric field includes establishing the first electric field for a first time period and said establishing the second electric includes establishing the second electric field substantially immediately subsequent to the first time period.

18. A method according to Claim 17, wherein said establishing the second electric field includes transiently establishing the second electric field.

19. A method according to Claim 15, wherein said providing the signal guide including the dielectric material includes providing the signal guide including liquid crystal polymeric material.

20. An apparatus comprising:

a signal guide configured to have a first state in which a first signal propagates therealong and a second state in which a second signal is propagated therealong,

at least first and second electrodes disposed on opposing sides of said signal guide; and

a voltage controller configured to charge said first and second electrodes with common polarity to one another when said signal guide is in the first state and to at least temporarily charge the first electrode with polarity opposite to that of said second electrode when said signal guide is in the second state.

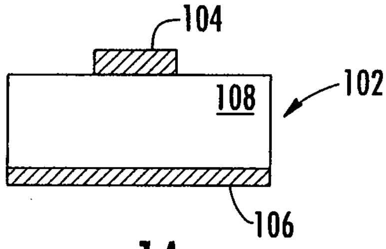


FIG. 1A

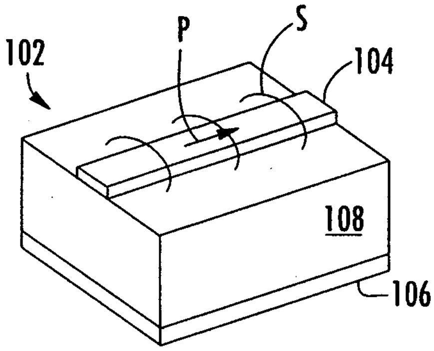


FIG. 1B

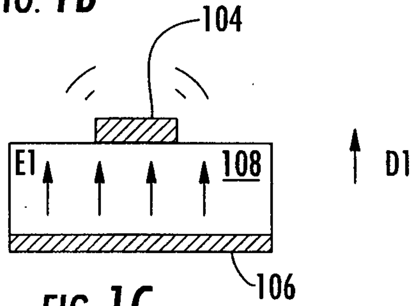


FIG. 1C

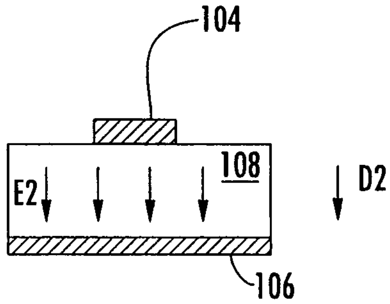
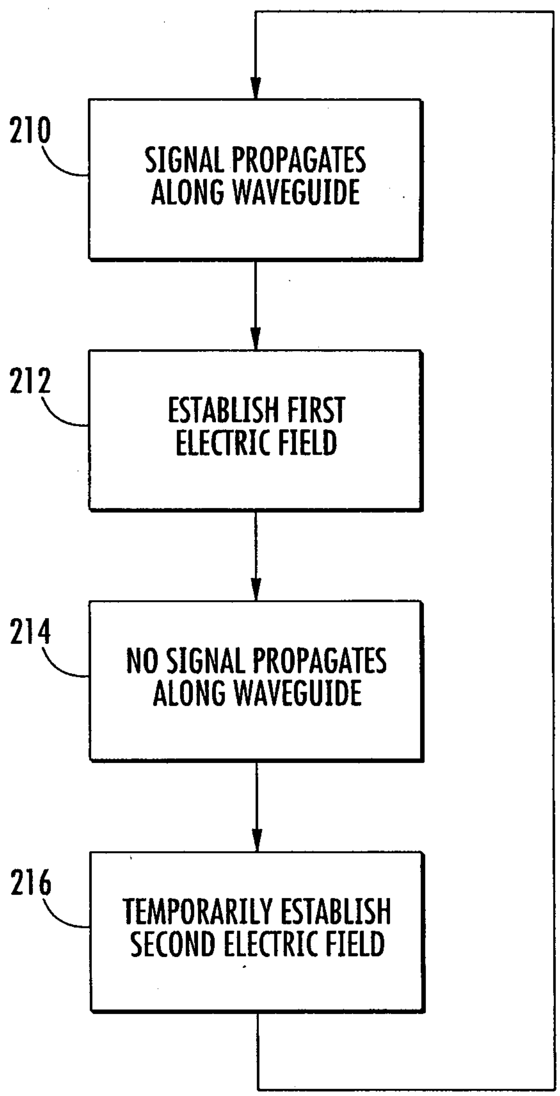


FIG. 1D


210
SIGNAL PROPAGATES ALONG WAVEGUIDE
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ESTABLISH FIRST ELECTRIC FIELD
214
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216
TEMPORARILY ESTABLISH SECOND ELECTRIC FIELD

FIG. 2

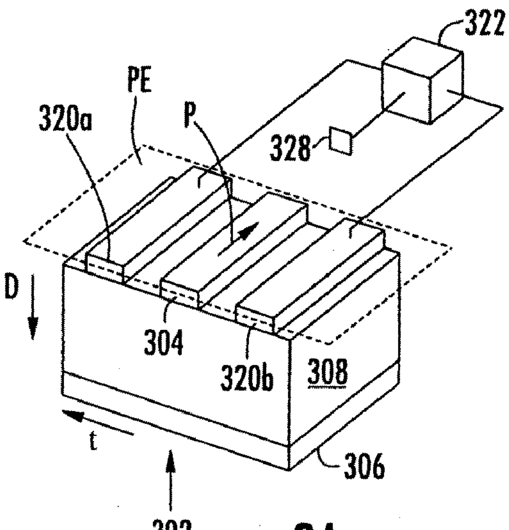


FIG. 3A

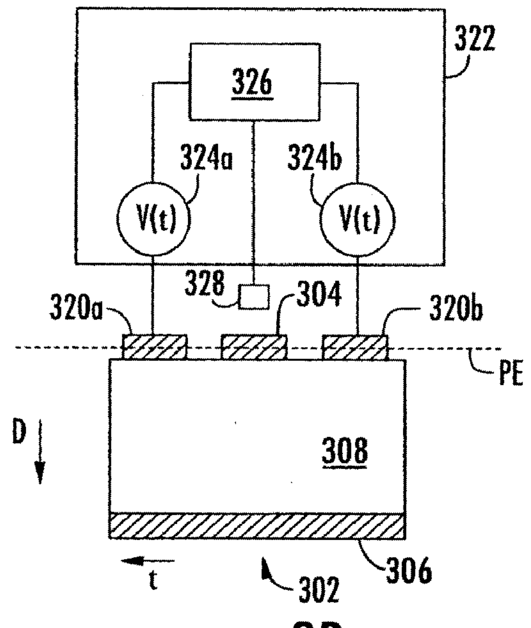


FIG. 3B

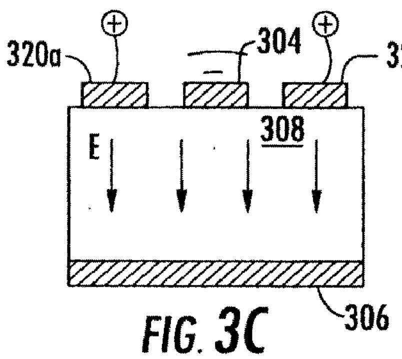


FIG. 3C

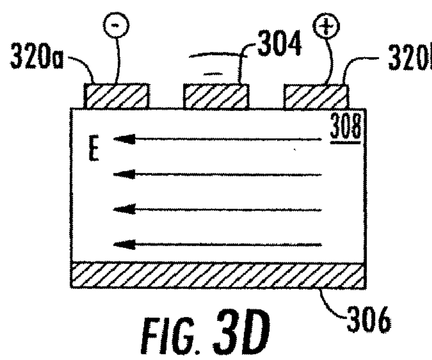


FIG. 3D

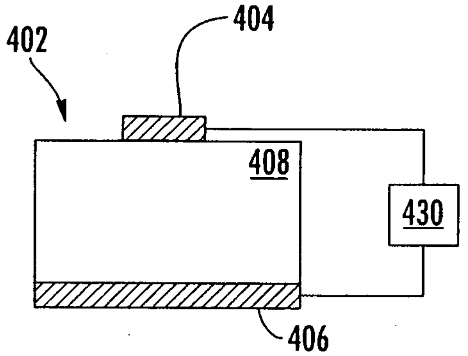
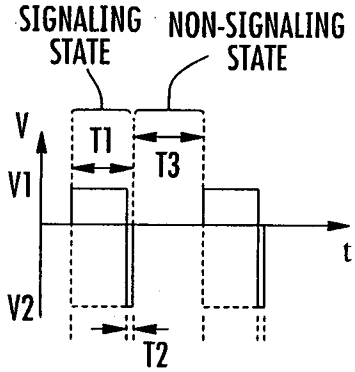


FIG. 4A



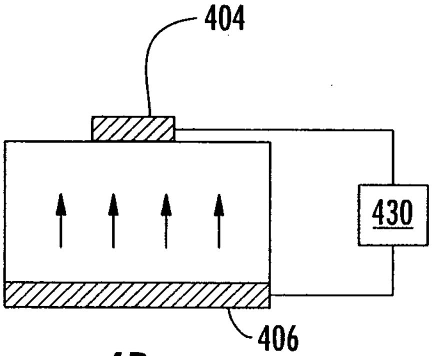


FIG. 4B

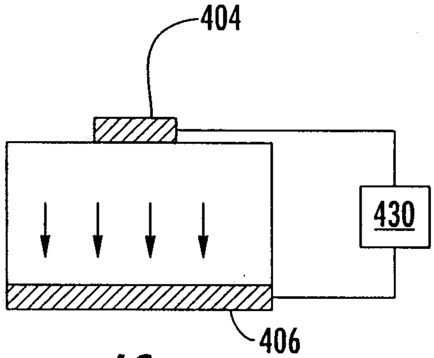


FIG. 4C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2007/001243

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G02F, H01P, H03K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6621377 B2 (OSADCHY, V ET AL), 16 Sept 2003 (16.09.2003), column 1, line 16 - column 5, line 44, figures 1-3	1,2,6,8,9, 11-13,15-17, 20
A		4,5,18
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X	FUJIKAKE,H ET AL: "Voltage-variable microwave delay line using ferroelectric liquid crystal with aligned submicron polymer fibers", Applied Physics Letters, Vol. 83, No. 9, 1 sept2003, pages 1815-1817. AN7726704	1-3,6,8-17, 19,20
A		4,5,18
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 January 2008	17 -01- 2008

Name and mailing address of the ISA/	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Bo Gustavsson/ABW Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2007/001243

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 7111407 A, MATSUSHITA ELECTRIC IND CO LTD, 19950425: (abstract) Retrieved from PAJ database.	1,2,6,8,9, 11-13,15-17, 20
A		4,5,18
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X	US 3005976 A1 (ANDERSSON, J R), 24 October 1961 (24.10.1961), column 1, line 54 - column 2, line 42; column 4, line 38 - line 59, figure 3	1,2,6,8,9, 11-13,15-17, 20
A		4,5,18
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X	EP 1221632 A1 (AGILENT TECHNOLOGIES INC.), 10 July 2002 (10.07.2002), figure 2, abstract, paragraphs [0011]-[0012]	1-3,6,8-17, 19,20
A		4,5,18
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X	NASHIMOTO, K ET AL: "High-Speed PLZT Optical Switches for Burst and Packet Switching". IEEE 2005 2nd International Conference on Broadband Networks, 3-7 Oct. 2005, Vol. 2, pages 1118-1123. AN9094724	1,2,6,8,9, 11,12,13,15, 16,17,20
A		4,5,18
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A	WEIL,C ET AL: "Nonlinear Dielectrics for Microwave Applications - Ferroelectrics and Liquid Crystals". Retrieved 2008-01-07; from the Internet <URL:http//www.hf.tu-darmstadt.de/en/research/reports/JB2001/files/AR2001_27.pdf	1-20
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A	JP 4338734 A MITSUBISHI ELECTRIC CORP, 19921126: (abstract) Retrieved from PAJ database	1-20
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International patent classification (IPC)
H01P 1/10 (2006.01)
G02F 3/02 (2006.01)
H01P 3/08 (2006.01)
H03K 17/80 (2006.01)
H01P 3/00 (2006.01)
H03K 3/45 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2007/001243

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