Title: IMPROVED WAVEFRONT SENSOR USING HYBRID OPTICAL/ELECTRONIC HETERODYNE TECHNIQUES

Abstract: A hybrid optical/electronic wavefront includes an electro-acoustical device, such as a Bragg cell, that is used to upshift an optical reference signal. An optical test signal and the frequency upshifted optical reference signal are optically heterodyned to create a signal having a frequency equivalent to the beat frequency of the two signals. The optically heterodyned signal is then converted by a detector to an electronic signal having the same phase as the optical test signal. The output of the detector is a sinusoidal signal having the same phase as the phase of the optical test signal. This signal is filtered by way of AC filter and mixed with a second clock signal. The low frequency product of the mixer is passed by way of a filter and converted to a square wave by way of a comparator. The output of the comparator is applied to a simple pulse counter and used to disable the pulse counter. An electronic reference signal formed by mixing the two RF signals, filtering the output, and squaring up the output by way of another comparator. The reference signal is used to start the pulse counter. A clock signal for the pulse counter is developed by squaring up the RF driving signal applied to the electro-acoustical device by a comparator. The pulse counter counts the clock pulses while it is enabled. The pulse count is linearly related to the difference in phase between the optical test signal and the frequency upshifted signal.
Published:
— with international search report
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Date of publication of the international search report: 30 March 2006

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INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
   IPC(8) : G01N 21/55
   US CL : 356/484
   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)
   U.S. : 356/484, 450

   Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
   NONE

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,E</td>
<td>US 6,972,887 B2 (WICKHAM et al) 06 December 2005 (06.12.2005), Figure 6.</td>
<td>1-16</td>
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   □ Further documents are listed in the continuation of Box C.  □ See patent family annex.

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   Date of the actual completion of the international search
   23 January 2006 (23.01.2006)

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   31 JAN 2006

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Form PCT/ISA/210 (second sheet) (April 2005)
Continuation of B. FIELDS SEARCHED Item 3:
EAST: US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB
search terms: heterodyne$; interfer$; wavefront or wave-front or wave front; BROSAN-STEPHEN-J or WRBER-MARK-E or WEBER-MARK; frequency shift$; phase