



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
22.06.2005 Bulletin 2005/25

(51) Int Cl.⁷: **G01N 29/24**

(43) Date of publication A2:
07.11.2001 Bulletin 2001/45

(21) Application number: **01110581.4**

(22) Date of filing: **30.04.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant: **FUJI PHOTO FILM CO., LTD.**
Kanagawa-ken, 250-0193 (JP)

(72) Inventor: **Ogawa, Eiji, c/o Fuji Photo Film Co., Ltd.**
Ashigarakami-gun, Kanagawa 258-8538 (JP)

(30) Priority: **02.05.2000 JP 2000133084**

(74) Representative: **Klunker . Schmitt-Nilson . Hirsch**
Winzererstrasse 106
80797 München (DE)

(54) **Ultrasonic probe and ultrasonic diagnosis apparatus using the same**

(57) A two-dimensional ultrasonic probe has a transmitting function of an ultrasonic signal without electric interconnection of a numerous number of microcomponents and without increase in crosstalk and electric impedance. This probe includes an optical fiber array 13 having a plurality of optical fibers to which light generated from a light source 11 is made incident, a plurality

of ultrasonic detecting elements 14, formed at one ends of the respective optical fibers, for modulating incident light via the optical fibers on the basis of the ultrasonic signal to be applied, and an ultrasonic transmitting element 19 using a piezoelectric element.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 11 0581

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 339 885 A (AMERICAN TELEPHONE AND TELEGRAPH COMPANY) 2 November 1989 (1989-11-02)	1-4,6, 11-14,16	G01N29/24 G01N29/24 G01H9/00
Y	* abstract; claims 1-16; figures 1-3 * * column 2, line 6 - column 5, line 49 *	5,7-10, 15,17-20	G01S15/89 G01D5/353 G02F1/125
X	DUDDERAR T D ET AL: "FIBER OPTIC SENSING FOR ULTRASONIC NDE" JOURNAL OF NONDESTRUCTIVE EVALUATION, PLENUM PUBLISHING CORPORATION. NEW YORK, US, vol. 6, no. 3, 1 September 1987 (1987-09-01), pages 135-143, XP000000271 ISSN: 0195-9298 * abstract; figures 5a,5b * * page 139, left-hand column *	1-3, 11-13	
X	US 3 685 008 A (PRAVIN G. BHUTA ET AL) 15 August 1972 (1972-08-15)	1-3, 11-13	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
Y	* abstract; claims 1,11; figure 1 * * column 1, line 11 - column 8, line 8 *	9,19	G01N G01H G01S G01D G02F
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 285826 A (NIPPON STEEL CORP), 1 November 1996 (1996-11-01) * abstract *	1,11	
		-/--	
4 The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 April 2005	Examiner Uttenthaler, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.92 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 11 0581

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	HAMILTON J D ET AL: "HIGH FREQUENCY ULTRASOUND IMAGING USING AN ACTIVE OPTICAL DETECTOR" IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL, IEEE INC. NEW.YORK, US, vol. 45, no. 3, May 1998 (1998-05), pages 719-727, XP000776109 ISSN: 0885-3010 * abstract; figures 2,3 * * page 720, right-hand column, last paragraph - page 721, left-hand column, paragraph 1 *	7,8,17, 18	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
Y	MONCHALIN J-P: "OPTICAL DETECTION OF ULTRASOUND" IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL, IEEE INC. NEW.YORK, US, vol. UFFC-33, no. 5, September 1986 (1986-09), pages 485-499, XP001024716 ISSN: 0885-3010 * abstract; figure 10 * * page 489, right-hand column, paragraph 5 - page 491, left-hand column, paragraph 2 * * page 486, left-hand column, paragraph 3 *	9,10,19, 20	
Y	US 5 636 181 A (DUGGAL ET AL) 3 June 1997 (1997-06-03) * abstract; claim 1; figure 1 * * column 2, line 58 - line 65 * * column 4, line 33 - line 54 * ----- -/--	9,19	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 April 2005	Examiner Uttenthaler, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

4
EPO FORM 1503 03.92 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 11 0581

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 5 991 026 A (KLUTH ET AL) 23 November 1999 (1999-11-23) * abstract; figure 1 * * column 2, line 50 - column 3, line 4 * -----	5,7,15, 17	
Y	MUESSIG P R ET AL: "Total internal reflectance optoacoustic spectroscopy" JOURNAL OF APPLIED PHYSICS USA, vol. 54, no. 8, August 1983 (1983-08), pages 4251-4253, XP002324760 ISSN: 0021-8979 * the whole document * -----	10,20	
Y	THOMSEN C ET AL: "Ultrasonic experiments with picosecond time resolution" JOURNAL DE PHYSIQUE COLLOQUE FRANCE, vol. 46, no. C-10, December 1985 (1985-12), pages 765-772, XP009046417 ISSN: 0449-1947 * the whole document * -----	10,20	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
Place of search Munich		Date of completion of the search 18 April 2005	Examiner Uttenthaler, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

4
EPO FORM 1503 03 82 (P04C01)



European Patent
Office

Application Number

EP 01 11 0581

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



European Patent
Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 01 11 0581

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1 (part), 2-6,11 (part), 12-16

Ultrasonic probe with receiving means including a plurality of optical waveguide paths in which ultrasonic sensing parts for detecting ultrasonic waves are provided.

Technical problem: Arrangement of non-contact receiving means in a 2-dimensional manner

2. claims: 1(part), 7,8, 11(part), 17,18

Ultrasonic probe with receiving means including a sensor having a Bragg grating structure not larger than $3/4$ of a wavelength of an ultrasonic wave which is propagated through the ultrasonic sensing part.

Technical problem: Miniaturising of non-contact receiving means and avoiding distortion of detected waveform

3. claims: 1 (part), 9, 11(part), 19

Ultrasonic probe with receiving means including a laser resonator for receiving the ultrasonic signal to change an emission light frequency and detect it in a heterodyne interference optical system.

Technical problem: Simplifying the detection of frequency changes in the optical receiving means

4. claims: 1(part), 10, 11(part), 20

Ultrasonic probe with receiving means including a sensor for detecting the ultrasonic signal by use of change in amount of reflection/transmission light on a light reflection plane due to vibration of an object which exists in an evanescent field near the light reflection plane in response to a received ultrasonic signal.

Technical problem: Detection of the distribution of sound pressures of the ultrasonic waves.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 11 0581

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-04-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0339885	A	02-11-1989	US 4928527 A BR 8902042 A CA 1325842 C EP 0339885 A2 JP 2071147 A KR 9104225 B1	29-05-1990 05-12-1989 04-01-1994 02-11-1989 09-03-1990 24-06-1991
US 3685008	A	15-08-1972	NONE	
JP 08285826	A	01-11-1996	NONE	
US 5636181	A	03-06-1997	DE 69615491 D1 DE 69615491 T2 EP 0769136 A1 JP 10501894 T WO 9631761 A1	31-10-2001 23-05-2002 23-04-1997 17-02-1998 10-10-1996
US 5991026	A	23-11-1999	GB 2311131 A ,B GB 2340227 A ,B	17-09-1997 16-02-2000

专利名称(译)	超声波探头和使用其的超声波诊断装置		
公开(公告)号	EP1152240A3	公开(公告)日	2005-06-22
申请号	EP2001110581	申请日	2001-04-30
[标]申请(专利权)人(译)	富士摄影胶片公司		
申请(专利权)人(译)	富士胶片有限公司.		
当前申请(专利权)人(译)	富士胶片有限公司.		
[标]发明人	OGAWA EIJI C O FUJI PHOTO FILM CO LTD		
发明人	OGAWA, EIJI, C/O FUJI PHOTO FILM CO., LTD.		
IPC分类号	A61B8/00 B06B1/06 G01H9/00 G01N29/24		
CPC分类号	A61B5/0097 A61B8/00 A61B8/4483 B06B1/06 G01H9/002 G01H9/004 G01N29/2418 G01N29/449 G01N2291/044 G01N2291/102		
优先权	2000133084 2000-05-02 JP		
其他公开文献	EP1152240A2		
外部链接	Espacenet		

摘要(译)

二维超声波探头具有超声波信号的传输功能，不需要多个微组件的电互连，并且不会增加串扰和电阻抗。该探头包括：光纤阵列13，其具有多个光纤，光源11产生的光入射到该光纤阵列13；多个超声波检测元件14，形成在各个光纤的一端，用于通过光纤调制入射光。基于要施加的超声波信号的光纤和使用压电元件的超声波发送元件19。

European Patent Office		EUROPEAN SEARCH REPORT		Application Number EP 01 11 0581
DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)	
X	EP 0 339 885 A (AMERICAN TELEPHONE AND TELEGRAPH COMPANY) 2 November 1989 (1989-11-02) * abstract; claims 1-16; figures 1-3 *	1-4, 6, 11-14, 16	G01N29/24 G01N29/24 G01N29/24 G01N29/24 G01N29/24	
Y	* column 2, line 6 - column 5, line 49 *	5, 7-10, 15, 17-20		
X	DUDDERAR T D ET AL: "FIBER OPTIC SENSING FOR ULTRASONIC NON-DESTRUCTIVE EVALUATION, PLENUM PUBLISHING CORPORATION, NEW YORK, US; vol. 6, no. 3, 1 September 1987 (1987-09-01), pages 135-143, XP000000271 ISSN: 0195-9298 * abstract; figures 5a, 5b *	1-3, 11-13		
X	US 3 685 008 A (PRAVIN G. BHUTA ET AL) 15 August 1972 (1972-08-15) * abstract; claims 1, 11; figure 1 *	1-3, 11-13		
Y	* column 1, line 11 - column 8, line 8 *	9, 19		
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03 21 March 1997 (1997-03-31) * JP 08 285826 A (NIPPON STEEL CORP), 1 November 1996 (1996-11-01) * abstract *	1, 11	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G01N G01H G01S G01D G02F	
<p>The present search report has been drawn up for all claims</p> <p>4. CLASSIFICATION OF THE APPLICATION</p> <p>Class of search: Munich Date of completion of the search: 18 Apr 11 2005 Center: Uttenhaller, E</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant if known alone Y: particularly relevant if combined with another document of the same category A: document of the same category B: document of the same category C: document of the same category D: document of the same category E: document of the same category F: document of the same category G: document of the same category H: document of the same category I: document of the same category J: document of the same category K: document of the same category L: document of the same category M: document of the same category N: document of the same category O: document of the same category P: document of the same category Q: document of the same category R: document of the same category S: document of the same category T: document of the same category U: document of the same category V: document of the same category W: document of the same category X: document of the same category Y: document of the same category Z: document of the same category</p>				