



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 040 923 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
08.11.2000 Bulletin 2000/45

(51) Int. Cl.⁷: **B41J 2/14, B41J 2/16**

(43) Date of publication A2:
04.10.2000 Bulletin 2000/40

(21) Application number: **00106070.6**

(22) Date of filing: **29.03.2000**

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

(30) Priority: **29.03.1999 JP 8578899**
17.03.2000 JP 2000076269

(71) Applicant:
SEIKO EPSON CORPORATION
Shinjuku-ku, Tokyo 163-0811 (JP)

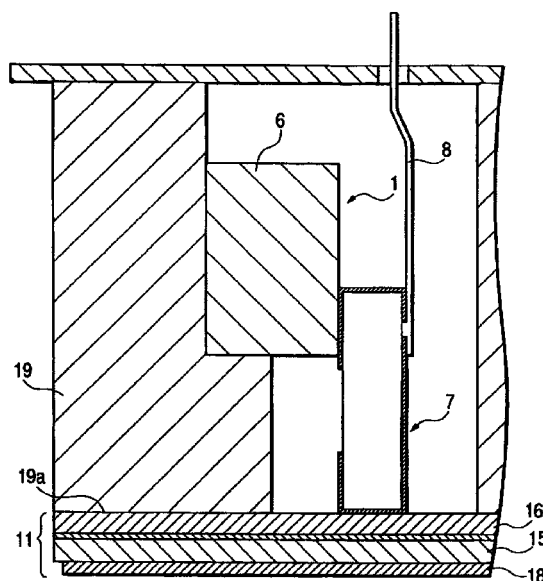
(72) Inventors:
• **Kitahara, Tsuyoshi**
Suwa-shi, Nagano 392-8502 (JP)
• **Arai, Hiroshi**
Suwa-shi, Nagano 392-8502 (JP)

(74) Representative: **HOFFMANN - EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) **Inkjet recording head, piezoelectric vibration element unit, and method of manufacturing the piezoelectric vibration element unit**

(57) A dummy piezoelectric element (7) is disposed at least at one of the ends of an array of piezoelectric vibration elements. A region not including internal electrodes is provided in the vicinity of the outer side surface of the dummy piezoelectric vibration element 7 to be formed. When the outer side surface of the dummy piezoelectric element 7 is cut, a shift of a cutting line from a correct cutting line, which is due to high hardness of the internal electrodes, is minimized.

FIG. 2



EP 1 040 923 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 10 6070

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)
A	EP 0 861 725 A (SEIKO EPSON CORP) 2 September 1998 (1998-09-02) * column 3, line 38 - column 9, line 10 * ---	1-31	B41J2/14 B41J2/16
A	EP 0 860 279 A (SEIKO EPSON CORP) 26 August 1998 (1998-08-26) * column 2, line 57 - column 7, line 2 * ---	1-31	
A	EP 0 761 447 A (SEIKO EPSON CORP) 12 March 1997 (1997-03-12) * page 4, line 27 - page 11, line 25 * ---	1-31	
X		32-41	
A	WD 96 00151 A (CITIZEN WATCH CO LTD ;NAGASHIMA MITSUYOSHI (JP)) 4 January 1996 (1996-01-04) & US 5 945 773 A (NAGASHIMA MITSUYOSHI) 31 August 1999 (1999-08-31) * abstract; figures 1-3,10 * ---	1,2,15, 16	
X	EP 0 550 030 A (SEIKO EPSON CORP) 7 July 1993 (1993-07-07) * column 3, line 4 - column 6, line 29 * ---	32-41	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X	EP 0 787 589 A (SEIKO EPSON CORP) 6 August 1997 (1997-08-06) * column 5, line 17 - column 6, line 41 * ---	32-41	B41J
A	DE 197 45 980 A (FUJITSU LTD) 1 October 1998 (1998-10-01) * column 4, line 19 - column 8, line 57 * -----	32-41	
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 14 September 2000	Examiner Widmeier, W
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 03.82 (P04C01)



European Patent
Office

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 00 10 6070

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: 1-31

Inkjet recording head and piezoelectric vibration unit with a dummy piezoelectric vibration element which does not have internal electrodes at a side surface.

2. Claims: 32-41

Actuator with a positioning member having a reference surface of homogenous material.

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

EP 00 10 6070

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.

14-09-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0861725 A	02-09-1998	JP 10264392 A	06-10-1998
		US 5992976 A	30-11-1999
EP 0860279 A	26-08-1998	JP 10291314 A	04-11-1998
EP 0761447 A	12-03-1997	JP 9085950 A	31-03-1997
		JP 9099557 A	15-04-1997
		JP 9123448 A	13-05-1997
		JP 10058683 A	03-03-1998
WO 9600151 A	04-01-1996	JP 2902786 B	07-06-1999
		US 5945773 A	31-08-1999
EP 0550030 A	07-07-1993	JP 5220955 A	31-08-1993
		JP 5220956 A	31-08-1993
		JP 5246025 A	24-09-1993
		JP 5278215 A	26-10-1993
		JP 5293961 A	09-11-1993
		JP 5169652 A	09-07-1993
		DE 69224975 D	07-05-1998
		DE 69224975 T	30-07-1998
		EP 0795404 A	17-09-1997
		HK 1010045 A	11-06-1999
		SG 49270 A	18-05-1998
		US 5764257 A	09-06-1998
		US 5630274 A	20-05-1997
		US 5517225 A	14-05-1996
		JP 6166178 A	14-06-1994
EP 0787589 A	06-08-1997	JP 9327909 A	22-12-1997
		DE 69701898 D	15-06-2000
		US 5933168 A	03-08-1999
DE 19745980 A	01-10-1998	JP 10258509 A	29-09-1998
		US 5971522 A	26-10-1999