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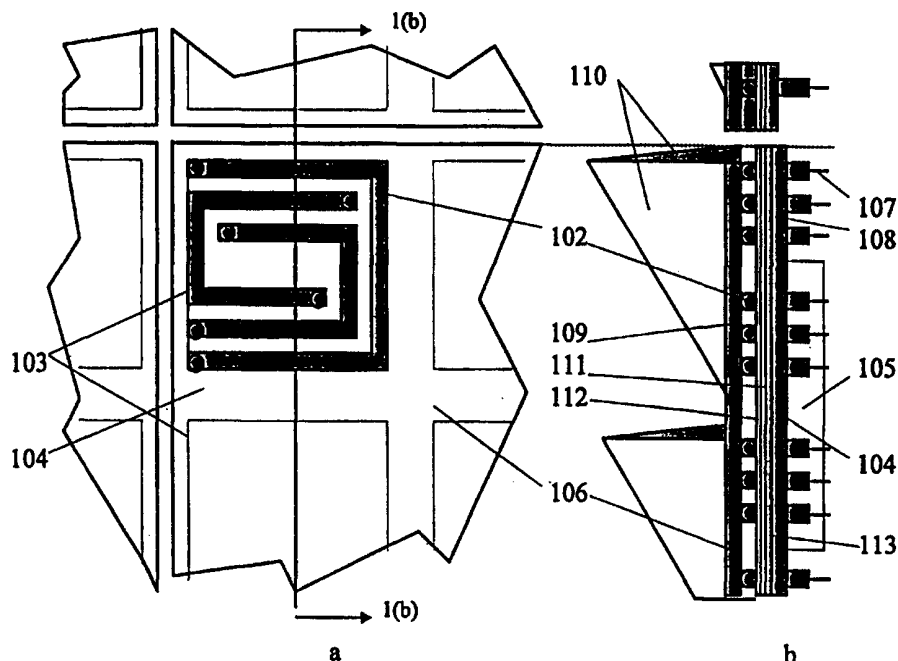
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[Continued on next page]

(54) Title: COLD CATHODE FLUORESCENT LAMP AND DISPLAY



(57) Abstract: A light transmitting container filled with gas is used to house a cold cathode fluorescent illumination apparatus (101) to reduce heat loss due to ambient temperature and to increase the luminous efficiency of the lamp (102). A display array comprising a plurality of illumination devices (102) arranged adjacent to one another can be used as a large screen display device which has high luminance, high efficiency, long lifetime, high contrast and excellent color.



WO 99/57749 A3



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INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H01J61/92 H01J61/52 H01J61/34 H01J61/78 H01J65/04
H01J61/32 H05B41/24 H01J5/48 F21V7/00

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 6 H01J G02F F21V F21Q F21M H05B G09G F21S

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

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

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 396 (E-568), 24 December 1987 (1987-12-24) & JP 62 157657 A (TOSHIBA ELECTRIC EQUIP CORP), 13 July 1987 (1987-07-13) abstract	1-4
Y	---	5-10, 45-49
X	EP 0 331 660 A (LUMALAMPAN AKTIEBOLAG) 6 September 1989 (1989-09-06) the whole document	1-4, 11, 12
Y	WO 95 22835 A (WINSOR, M.D.) 24 August 1995 (1995-08-24) page 8, line 25 -page 10, line 28 ---	5-8
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

Date of the actual completion of the international search

14 October 1999

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/09856

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 220 249 A (TSUKADA, Y.) 15 June 1993 (1993-06-15) column 8, line 9 - line 63 ---	9,10
Y	PATENT ABSTRACTS OF JAPAN vol. 014, no. 122 (P-1017), 7 March 1990 (1990-03-07) & JP 01 315787 A (MATSUSHITA ELECTRIC WORKS LTD), 20 December 1989 (1989-12-20) abstract ---	45-49
X	US 5 446 990 A (ERIKSSON BERTIL) 5 September 1995 (1995-09-05) column 10, line 20 - line 52 column 7, line 18 - line 33; figure 2 ---	23-26
Y	---	13-22, 27-32, 145-153
X	US 4 839 564 A (IDE KATSUYUKI ET AL) 13 June 1989 (1989-06-13) the whole document ---	79,80, 120,122, 123,128
Y	---	13, 15-22, 133,134, 145-153
Y	US 5 455 484 A (MAYA JAKOB ET AL) 3 October 1995 (1995-10-03) figures 1, 5, referring description ---	14, 27-32, 144
X	WO 94 29895 A (LEE OK YUN) 22 December 1994 (1994-12-22) figures 1-8 ---	143
Y	---	144
X	EP 0 348 979 A (TOSHIBA LIGHTING & TECHNOLOGY) 3 January 1990 (1990-01-03) the whole document ---	33-41
Y	---	42-44
Y	EP 0 593 311 A (FLOWIL INT LIGHTING) 20 April 1994 (1994-04-20) column 7, line 16 -column 8, line 31 ---	42-44
X	US 2 171 359 A (GERTLER S E) 29 August 1939 (1939-08-29) figure 4, referring description ---	33
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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/09856

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 213 560 A (SIEMENS AG) 11 March 1987 (1987-03-11) the whole document	51-53, 59,62,63
Y		57,58, 64-78, 99-104, 121, 136-139
X	--- PATENT ABSTRACTS OF JAPAN vol. 009, no. 169 (E-328), 13 July 1985 (1985-07-13) & JP 60 041750 A (TOUSHIBA DENZAI KK), 5 March 1985 (1985-03-05) abstract	51-53, 62,63
Y		66-78, 113-119
X	--- US 4 558 400 A (BUSER JOHANN) 10 December 1985 (1985-12-10) the whole document	51-53
X	--- PATENT ABSTRACTS OF JAPAN vol. 1995, no. 08, 29 September 1995 (1995-09-29) & JP 07 114904 A (HITACHI LTD), 2 May 1995 (1995-05-02) abstract	54,55, 60,61
Y	--- US 5 061 872 A (KULKA THOMAS S) 29 October 1991 (1991-10-29) figures 1, 10-17, referring description	57,58, 64,65
Y	--- US 4 425 608 A (HECKER GYULA ET AL) 10 January 1984 (1984-01-10) the whole document	8,96-98, 105-112
X	--- US 5 032 765 A (NILSSEN OLE K) 16 July 1991 (1991-07-16) the whole document	79-86, 122,123
X	--- GB 2 261 332 A (HORIZON FABRICATIONS LTD) 12 May 1993 (1993-05-12) the whole document	79-95, 122,123
Y		96-119, 121
X	--- US 5 337 068 A (ROACH WILLIAM R ET AL) 9 August 1994 (1994-08-09) the whole document --- -/--	79-81, 122-128

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/09856

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 016, no. 075 (P-1316), 24 February 1992 (1992-02-24) & JP 03 264990 A (MATSUSHITA ELECTRIC WORKS LTD), 26 November 1991 (1991-11-26) abstract ---	79,122
X	EP 0 151 850 A (MAXIMUM TECHNOLOGY) 21 August 1985 (1985-08-21) figures 23-27, referring description	129-132, 135, 140-142
Y	---	133,134, 136-139
X	US 4 750 096 A (LIM KENNETH) 7 June 1988 (1988-06-07) the whole document ---	129,130, 132,135
X	US 5 019 749 A (ITO NORIO) 28 May 1991 (1991-05-28) figures 8, 9, referring description ---	154-156
X	GB 1 485 166 A (GEN ELECTRIC) 8 September 1977 (1977-09-08) the whole document -----	154,157

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/09856

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet(s)

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-12, 45-50

mainly refer to illumination/modules respectively arrays
used in display devices

2. Claims: 13-32, 143-153

mainly refer to discharge lamps of bulb-type

3. Claims: 33-44

mainly refer to electrodeless discharge lamps

4. Claims: 51-78

mainly refer to traffic information displays and their
control

5. Claims: 79-128

mainly refer to a driving method of display devices

6. Claims: 129-142

mainly refer to reflector structures of discharge devices

7. Claims: 154-157

mainly refer to driving circuits of discharge devices

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/09856

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 62157657 A	13-07-1987	NONE	
EP 331660 A	06-09-1989	AT 124573 T DE 68923197 D DE 68923197 T EP 0330808 A ES 2073459 T SE 467279 B SE 8900728 A	15-07-1995 03-08-1995 09-11-1995 06-09-1989 16-08-1995 22-06-1992 03-09-1989
WO 9522835 A	24-08-1995	US 5479069 A AU 1846895 A CA 2183631 A EP 0748514 A US 5509841 A US 5850122 A	26-12-1995 04-09-1995 24-08-1995 18-12-1996 23-04-1996 15-12-1998
US 5220249 A	15-06-1993	JP 5205699 A	13-08-1993
JP 01315787 A	20-12-1989	NONE	
US 5446990 A	05-09-1995	SE 469868 B DK 563138 T EP 0563138 A SE 9004016 A WO 9210931 A DE 69118205 D DE 69118205 T	04-10-1993 05-08-1996 06-10-1993 18-06-1992 09-07-1992 25-04-1996 31-10-1996
US 4839564 A	13-06-1989	JP 61015194 A	23-01-1986
US 5455484 A	03-10-1995	JP 8171972 A	02-07-1996
WO 9429895 A	22-12-1994	KR 9408169 Y	29-11-1994
EP 0348979 A	03-01-1990	JP 2012751 A KR 9110106 B	17-01-1990 16-12-1991
EP 0593311 A	20-04-1994	US 5325024 A CA 2108435 A DE 69317500 D DE 69317500 T	28-06-1994 17-04-1994 23-04-1998 19-11-1998
US 2171359 A	29-08-1939	NONE	
EP 0213560 A	11-03-1987	DK 406286 A	28-02-1987
JP 60041750 A	05-03-1985	NONE	
US 4558400 A	10-12-1985	AT 377641 B CH 637197 A AT 13082 A AU 1042883 A WO 8302526 A EP 0099895 A	10-04-1985 15-07-1983 15-08-1984 28-07-1983 21-07-1983 08-02-1984
JP 07114904 A	02-05-1995	NONE	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/09856

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5061872	A	29-10-1991	NONE		

US 4425608	A	10-01-1984	GB	2077410 A	16-12-1981
			AT	382733 B	10-04-1987
			DD	151834 A	04-11-1981
			DE	3022737 A	24-12-1981

US 5032765	A	16-07-1991	NONE		

GB 2261332	A	12-05-1993	NONE		

US 5337068	A	09-08-1994	DE	69025341 D	21-03-1996
			DE	69025341 T	29-08-1996
			EP	0528797 A	03-03-1993
			JP	5504416 T	08-07-1993
			WO	9110223 A	11-07-1991

JP 03264990	A	26-11-1991	NONE		

EP 0151850	A	21-08-1985	US	4562517 A	31-12-1985
			AU	568674 B	07-01-1988
			AU	3251884 A	15-08-1985
			ES	533505 D	16-10-1985
			ES	8601440 A	16-02-1986
			IL	71890 A	31-10-1986
			JP	61007502 A	14-01-1986

US 4750096	A	07-06-1988	NONE		

US 5019749	A	28-05-1991	EP	0341601 A	15-11-1989
			JP	2056593 A	26-02-1990
			JP	2827243 B	25-11-1998

GB 1485166	A	08-09-1977	CA	1042498 A	14-11-1978
			DE	2451120 A	07-05-1975
			JP	50078173 A	25-06-1975
			US	3921032 A	18-11-1975
			ZA	7406373 A	29-10-1975
